

FIRST PUBLIC REVIEW DRAFT
2027 NATIONAL FUEL GAS CODE (Z223.1)

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BSR Z223.1-20xx

NFPA® 54-20xx

National Fuel Gas Code

2027 Edition

NOTE: This preprint of the 2027 National Fuel Gas Code is provided for the convenience of the reviewer. NFPA's Terra online draft is the official source for information. Please visit www.nfpa.org/54 for official drafts and reports.

The following preprint is based on the First Revision Draft of the 2027 edition of NFPA 54/Z223.1.

How to Use the Draft: The following draft shows those parts of the Code revised based on the First Draft Report. The revisions are identified as additions (underlined) and ~~deletions~~ (strikethrough).

Each revision is identified by its First Revision Number in brackets (for example, [FR No. 1-NFPA 54/Z223.1-2024]). The FR identification is typically placed at the end of each revised section(s) or specific revision. In some cases, the revision would only apply to the NFPA edition or the Z223.1 edition. These revisions are identified using the FR number within brackets as noted above but would only show the impacted document, NFPA 54 or Z223.1, within the brackets.

The draft also identifies those sections that have not been revised shown in brackets, for example "{3.9 through 3.13.5 unchanged}". These section numbers reflect the 2021 edition section numbering sequence.

Visit the NFPA website at www.nfpa.org/54 or AGA website at www.aga.org/nfgc to view the First Revisions Report which contains the committee reasons for the FRs and any Committee Inputs (CI).

Chapter 1
Administrative

{1.1 through 1.1.1.1(F) unchanged}

1.1.1.2 This code shall not apply to the following items:

- (1) Portable LP-Gas appliances and equipment of all types that are not connected to a fixed fuel piping system
- (2) Installation of appliances such as brooders, dehydrators, dryers, and irrigation equipment used for agricultural purposes.
- (3) Raw material (feedstock) applications except for piping to special atmosphere generators
- (4) Oxygen-fuel gas cutting and welding systems
- (5) Industrial gas applications under the scope of NFPA 51 or NFPA 55 using such gases as acetylene and acetylenic

~~compounds, hydrogen, ammonia, carbon monoxide, oxygen, and nitrogen~~ [FR No. 51-NFPA 54/Z223.1-2024]

- (6) Petroleum refineries, pipeline compressor or pumping stations, loading terminals, compounding plants, refinery tank farms, and natural gas processing plants
- (7) Large integrated chemical plants or portions of such plants where flammable or combustible liquids or gases are produced by chemical reactions or used in chemical reactions
- (8) LP-Gas installations at utility gas plants
- (9)* Liquefied natural gas (LNG) systems
- (10) Fuel gas piping in electric utility power plants
- ~~(11) Proprietary items of equipment, apparatus, or instruments such as gas generating sets, compressors, and calorimeters~~ [FR No. 50-NFPA 54/Z223.1-2024]
- (11) LP-Gas equipment for vaporization, gas mixing, and gas manufacturing
- (12) LP-Gas piping for buildings under construction or renovations that is not to become part of the permanent building piping system—that is, temporary fixed piping for building heat
- (13) Installation of LP-Gas systems for railroad switch heating
- (14) Installation of LP-Gas and compressed natural gas systems on vehicles
- (15) Gas piping, meters, gas pressure regulators, and other appurtenances used by the ~~servicing~~ gas supplier in distribution of gas, other than undiluted LP-Gas [FR No. 60-NFPA 54/Z223.1-2024]
- ~~(17) Building design and construction, except as specified herein~~ [FR No. 50-NFPA 54/Z223.1-2024]
- (16) Fuel gas systems on recreational vehicles manufactured in accordance with NFPA 1192
- (17) Fuel gas systems under the scope of NFPA 2 using hydrogen as a fuel [FR No. 52-NFPA 54/Z223.1-2024]
- (18) Construction of appliances

1.1.2 Other Standards. In applying this code, reference shall also be made to the manufacturers' instructions and the ~~servicing~~ gas supplier regulations. [FR No. 60-NFPA 54/Z223.1-2024]

1.2 Purpose. ~~(Reserved)~~ The purpose of this code shall be to provide for the safe installation of fuel gas pipingsystems, appliances, equipment, and related accessories. [FR No. 26-NFPA 54/Z223.1-2024]

{1.3 unchanged}

1.4 Equivalency. The provisions of this code ~~are~~ shall not be intended to prevent the use of any material, appliance, equipment, method of construction, or installation procedure, provided that any such alternatives is in accordance with the following: acceptable to the authority having jurisdiction. The authority having jurisdiction shall require that sufficient evidence be

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~~submitted to substantiate any claims made regarding the safety of such alternatives.~~

(1) It is equivalent or superior to that prescribed in this code in terms of quality, strength, fire-resistance, durability, and safety as applicable

(2) It meets the intent of this code

(3) It is approved for the intended purpose by the AHJ

1.4.2 Technical documentation satisfactory to the AHJ shall be submitted to demonstrate equivalency.

[FR No. 27-NFPA 54/Z223.1-2024]

{1.5 unchanged}

Chapter 2 Referenced Standards

{2.1 through 2.2 unchanged}

2.3 Other Publications

2.3.1 ASME International Publications. American Society of Mechanical Engineers International, Two Park Avenue, New York, NY 10016-5990, 800.843.2763, www.asme.org. [EDITORIAL-Z223.1-2024]

ANSI/ASME B1.20.1, *Pipe Threads, General Purpose, Inch*, 2013 (R2018).

ANSI/ASME B16.1, *Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250*, 2020.

ANSI/ASME B16.5, *Pipe Flanges and Flanged Fittings: NPS ½ through NFPS 24 Metric/Inch Standard*, 2020.

ANSI/ASME B16.20, *Metallic Gaskets for Pipe Flanges: Ring-Joint, Spiral-Wound and Jacketed*, 2017 2023. [FR No. 53-NFPA 54/Z223.1-2024]

ANSI/ASME B16.21, *Nonmetallic Flat Gaskets for Pipe Flanges*, 2021.

ANSI/ASME B16.24, *Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500*, 2021.

ANSI/ASME B16.33, *Manually Operated Metallic Gas Valves for Use in Gas Piping Systems up to 175 psi (Sizes NPS 1/2 through NPS 2)*, 2012 ~~(R2017)~~ 2024. [FR No. 53-NFPA 54/Z223.1-2024]

ANSI/ASME B16.42, *Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300*, 2021.

ANSI/ASME B16.44, *Manually Operated Metallic Gas Valves for Use in Above Ground Piping Systems up to 5 psi*, 2012 ~~(R2017)~~ 2023. [FR No. 53-NFPA 54/Z223.1-2024]

ANSI/ASME B16.47, *Large Diameter Steel Flanges: NPS 26 through NPS 60 Metric/Inch Standard*, 2020.

ANSI/ASME B36.10M, *Welded and Seamless Wrought Steel Pipe*, 2018.

2.3.2 ASTM International Publications. American Society for Testing and Materials International, 100 Barr Harbor Drive, West

Conshohocken, PA 19428-2959, 610.832.9500, www.astm.org. [EDITORIAL-Z223.1-2024]

ASTM A53, *Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless*, 2022 2024. [FR No. 53-NFPA 54/Z223.1-2024]

ASTM A106, *Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service*, 2019a.

ASTM A254, *Standard Specification for Copper-Brazed Steel Tubing*, 2012, reaffirmed 2019.

ASTM A268, *Standard Specification for Seamless and Welded Ferritic and Martensitic Stainless Steel Tubing for General Service*, 2022 2024. [FR No. 53-NFPA 54/Z223.1-2024]

ASTM A269, *Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service*, 2015a, reaffirmed 2019 2024. [FR No. 53-NFPA 54/Z223.1-2024]

ASTM A312, *Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes*, 2021 2024a. [FR No. 53-NFPA 54/Z223.1-2024]

ASTM B88, *Standard Specification for Seamless Copper Water Tube*, 2020 2022. [FR No. 53-NFPA 54/Z223.1-2024]

ASTM B210, *Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes*, 2019a.

ASTM B241, *Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube*, 2016 2022. [FR No. 53-NFPA 54/Z223.1-2024]

ASTM B280, *Standard Specification for Seamless Copper Tube for Air-Conditioning and Refrigeration Field Service*, 2020 2023. [FR No. 53-NFPA 54/Z223.1-2024]

ASTM D2513, *Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings*, 2020.

ASTM E136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*, 2019a 2024c. [FR No. 53-NFPA 54/Z223.1-2024]

ASTM E2652, *Standard Test Method for Behavior of Materials in a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750°C*, 2018 2022. [FR No. 53-NFPA 54/Z223.1-2024]

ASTM F1973, *Standard Specification for Factory Assembled Anodeless Risers and Transition Fittings in Polyethylene (PE) and Polyamide 11 (PA11) and Polyamide 12 (PA12) Fuel Gas Distribution Systems*, 2021.

ASTM F2509, *Standard Specification for Field-assembled Anodeless Riser Kits for Use on Outside Diameter Controlled Polyethylene Gas Distribution Pipe and Tubing*, 2015, reaffirmed 2019 2024. [FR No. 53-NFPA 54/Z223.1-2024]

ASTM F2945, *Standard Specification for Polyamide 11 Gas Pressure Pipe, Tubing, and Fittings*, 2018 reaffirmed 2023. [FR No. 53-NFPA 54/Z223.1-2024]

2.3.3 CSA Group Publications. CSA Group, Inc., 8501 East Pleasant Valley Road, Cleveland, OH 44131-5575, 216.524.4990, www.csa-group.org.

CSA/ANSI/FC 1:21/CSA 22.2 NO. 622822-3-100:21, Fuel Cell Technologies - Part 3-100: *Stationary Fuel Cell Power*

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- Systems – Safety* (adopted IEC 6228-3-100:2016, second edition, 2019-2, with Canadian and US deviations), 2021.
- ANSI/CSA NGV 5.1, *Residential Fueling Appliances*, ~~2016~~, reaffirmed 2020 2023. [FR No. 53-NFPA 54/Z223.1-2024]
- ANSI/CSA ~~NGV~~ NGV 5.2, *Vehicle Fueling Appliances (VFA)*, 2017, reaffirmed 2021. [FR No. 53-NFPA 54/Z223.1-2024]
- CSA/ANSI LC 1/CSA 6.26, *Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing*, 2019.
- CSA/ANSI LC 4/CSA 6.32, *Press-Connect Metallic Fittings for Use in Fuel Gas Distribution Systems* 2022.
- CSA/ANSI Z21.1/CSA 1.1, *Household Cooking Gas Appliances*, ~~2019~~ 2024. [FR No. 53-NFPA 54/Z223.1-2024]
- ANSI Z21.5.1/CSA 7.1, *Gas Clothes Dryers, Volume I, Type 1 Clothes Dryers*, ~~2017~~ 2022. [FR No. 53-NFPA 54/Z223.1-2024]
- ANSI Z21.5.2/CSA 7.2, *Gas Clothes Dryers, Volume II, Type 2 Clothes Dryers*, 2016, reaffirmed 2021.
- ANSI Z21.8, *Installation of Domestic Gas Conversion Burners*, 1994, reaffirmed 2017.
- CSA/ANSI Z21.10.1/CSA 4.1, *Gas Water Heaters, Volume I, Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less*, 2019.
- CSA/ANSI Z21.10.3/CSA 4.3, *Gas Water Heaters, Volume III, Storage Water Heaters with Input Ratings Above 75,000 Btu per Hour*, 2019.
- CSA/ANSI Z21.11.2, *Gas-Fired Room Heaters - Volume II, Unvented Room Heaters*, 2019.
- CSA/ANSI Z21.13/CSA 4.9, *Gas-fired Low Pressure Steam and Hot Water Boilers*, 2022.
- ANSI Z21.15/CSA 9.1, *Manually operated gas valves for appliances, appliance connector valves and hose end valves*, ~~2007~~, reaffirmed 2019 2021. [FR No. 53-NFPA 54/Z223.1-2024]
- CSA/ANSI Z21.18/CSA 6.3, *Gas Appliance Pressure Regulators*, 2019.
- CSA/ANSI Z21.19/CSA 1.4, *Refrigerators Using Gas Fuel*, 2019.
- ANSI Z21.22/CSA 4.4, *Relief Valves for Hot Water Supply Systems*, 2015, reaffirmed 2020.
- CSA/ANSI Z21.24/CSA 6.10, *Connectors for Gas Appliances*, 2022.
- ANSI Z21.40.1/CSA 2.91, *Gas-fired Heat Activated Air Conditioning and Heat Pump Appliances*, 1996, reaffirmed 2022.
- ANSI Z21.40.2/CSA 2.92, *Gas-Fired, Work-Activated Air Conditioning and Heat Pump Appliances (Internal Combustion)*, 1996, reaffirmed 2022.
- ANSI Z21.41/CSA 6.9, *Quick-Disconnect Devices for use with Gas Fuel Appliances*, ~~2014~~, reaffirmed 2019 2023. [FR No. 53-NFPA 54/Z223.1-2024]
- CSA/ANSI Z21.47/CSA 2.3, *Gas-fired Central Furnaces*, 2021.
- ANSI Z21.50/CSA 2.22, *Vented Decorative Gas Appliances*, 2019.
- CSA/ANSI Z21.54/CSA 8.4, *Gas Hose Connectors for Portable Outdoor Gas-Fired Appliances*, 2019.
- CSA/ANSI Z21.56/CSA 4.7, *Gas-fired Pool Heaters*, 2019.
- ANSI Z21.58/CSA 1.6, *Outdoor Cooking Gas Appliances*, 2022.
- ANSI Z21.60/CSA 2.26, *Decorative Gas Appliances for Installation in Solid-Fuel Burning Fireplaces*, 2017, reaffirmed 2021.
- ANSI Z21.69/CSA 6.16, *Connectors for Movable Gas Appliances*, 2015, reaffirmed 2020.
- ANSI Z21.75/CSA 6.27, *Connectors for Outdoor Gas Appliances and Manufactured Homes*, 2016, reaffirmed 2021.
- ANSI Z21.80/CSA 6.22, *Line Pressure Regulators*, 2019.
- ANSI Z21.86/CSA 2.32, *Vented Gas-fired Space Heating Appliances*, 2016, reaffirmed 2021.
- CSA/ANSI Z21.88/CSA 2.33, *Vented Gas Fireplace Heaters*, 2019,
- ANSI Z21.89/CSA 1.18, *Outdoor Cooking Specialty Gas Appliances*, ~~2017~~ 2023. [FR No. 53-NFPA 54/Z223.1-2024]
- ANSI Z21.90/CSA 6.24, *Gas Convenience Outlets and Optional Enclosures*, 2019.
- ANSI Z21.93/CSA 6.30, *Excess flow valves for natural and LP gas with pressures up to 5 psig*, 2017, reaffirmed 2022.
- ANSI Z21.97/CSA 2.41, *Outdoor Decorative Gas Appliances*, 2017.
- ANSI Z83.4/CSA 3.7, *Non-Recirculating Direct Gas-Fired Heating and Forced Ventilation Appliances for Commercial and Industrial Application*, 2017, reaffirmed 2022.
- ANSI Z83.8/CSA 2.6, *Gas Unit Heaters, as Packaged Heaters, Gas Utility Heaters, and Gas-fired Duct Furnaces*, 2016, reaffirmed 2021.
- ANSI Z83.11/CSA 1.8, *Gas Food Service Equipment*, 2016.
- ANSI Z83.18, *Recirculating Direct Gas-Fired Heating and Forced Ventilation Appliances for Commercial and Industrial Application*, 2017, reaffirmed 2021.
- ANSI Z83.19/CSA 2.35, *Gas-fired High-Intensity Infrared Heaters*, 2017, reaffirmed 2021.
- ANSI Z83.20/CSA 2.34, *Gas-fired Tubular and Low-intensity Infrared Heaters*, 2016, reaffirmed 2021.
- ANSI Z83.26/CSA 2.27, *Gas-fired Outdoor Infrared Patio Heaters*, 2020.
- {2.3.4 unchanged}
- 2.3.5 UL Publications.** Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096, 877.854.3577; ~~www.ul.com~~. [FR No. 53-NFPA 54/Z223.1-2024]
- UL 103, *Factory-Built Chimneys for Residential Type and Building Heating Appliances*, 2010, revised 2021.
- UL 353, *Limit Controls*, 1994, revised 2011. [FR No. 53-NFPA 54/Z223.1-2024]
- UL 378, *Draft Equipment*, 2006, revised 2013.
- UL 441, *Gas Vents*, ~~2019~~ 2024. [FR No. 53-NFPA 54/Z223.1-2024]

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- UL 467, *Grounding and Bonding Equipment*, 2022.
- UL 641, *Type L Low-Temperature Venting Systems*, 2010, revised 2018.
- UL 651, *Schedule 40 and 80 Type EB and A Rigid PVC Conduit and Fittings*, 2011, revised 2022. [FR No. 53-NFPA 54/Z223.1-2024]
- UL 959, *Medium Heat Appliance Factory-Built Chimneys*, 2010, revised 2019 2024. [FR No. 53-NFPA 54/Z223.1-2024]
- UL 1738, *Venting Systems for Gas Burning Appliances, Categories II, III, and IV*, 2010, revised 2021 2023. [FR No. 53-NFPA 54/Z223.1-2024]
- UL 1777, *Chimney Liners*, 2015, revised 2019 2024. [FR No. 53-NFPA 54/Z223.1-2024]
- UL 2158A, *Clothes Dryer Transition Ducts*, 2013, revised 2021 2023. [FR No. 53-NFPA 54/Z223.1-2024]
- UL 2561, *1400 Degree Fahrenheit Factory-Built Chimneys*, 2016, revised 2018 2022. [FR No. 53-NFPA 54/Z223.1-2024]
- UL 2989, *Outline of Investigation of Tracer Wire*, 2017 2022. [FR No. 53-NFPA 54/Z223.1-2024]
- UL 60730-2-6, *Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Automatic Electrical Pressure Sensing Controls Including Mechanical Requirements*, 2016, revised 2021.

{2.3.6 through 2.4 unchanged}

2.4 References for Extracts in Mandatory Sections.

- NFPA 31, *Standard for the Installation of Oil-Burning Equipment*, 2020 2024 edition. [FR No. 53-NFPA 54/Z223.1-2024]
- NFPA 70®, *National Electrical Code*®, 2023 edition.
- NFPA 88A, *Standard for Parking Structures*, 2023 edition.
- NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, 2024 edition.
-
- NFPA 5000®, *Building Construction and Safety Code*®, 2021 edition.

Chapter 3 Definitions

{3.1 through 3.3.4.4.1 unchanged}

3.3.4.4.2 Gas Deep Fat Fryer. An appliance, including a cooking vessel in which oils or fats are placed to such a depth that the cooking food is essentially supported by displacement of the cooking fluid or a perforated container immersed in the cooking fluid rather than by the bottom of the vessel, designed primarily for use in hotels, restaurants, clubs, and similar institutions. [FR No. 28-NFPA 54/Z223.1-2024]

3.3.4.4.3 Steam Cooker. An appliance that cooks, defrosts, or reconstitutes food by direct contact with steam. [FR No. 30-NFPA 54/Z223.1-2024]

~~**3.3.4.4.4 Steam Generator.** A separate appliance primarily intended to supply steam for use with food service appliances. [FR No. 31-NFPA 54/Z223.1-2024]~~

3.3.4.4.5 Kettle. An appliance with a cooking chamber that is heated either by a steam jacket in which steam is generated by gas heat or by direct gas heat applied to the cooking chamber. [FR No. 29-NFPA 54/Z223.1-2024]

{3.3.4.5 through 3.3.12 unchanged}

~~**3.3.13 Breeching.** See 3.3.100, Vent Connector. [FR No. 32-NFPA 54/Z223.1-2024]~~

{3.3.14 through 3.3.16.5 unchanged}

~~**3.3.16.5.1 Fan-Assisted Power Burner.** A burner that uses either induced or forced draft. [FR No. 33-NFPA 54/Z223.1-2024]~~

{3.3.17 through 3.3.82 unchanged}

3.3.8382 Qualified Agency. Any individual, firm, corporation, or company that either in person or through a representative is engaged in and that is responsible for: (1) the design, installation, testing, removal, or replacement of gas piping or (2) the connection, installation, testing, repair, or servicing of appliances and equipment; that is experienced in such work; that is familiar with all precautions required; and that has complied compliant with all the requirements of the authority having jurisdiction. [FR No. 34-NFPA 54/Z223.1-2024]

{3.3.84 through 3.3.85.7 unchanged}

~~**3.3.85.8–3.3.84.8 Service Regulator.** A pressure regulator installed by the servicing gas supplier to reduce and limit the service line gas pressure to delivery pressure. [FR No. 60-NFPA 54/Z223.1-2024]~~

{3.3.86 through 3.3.88 unchanged}

~~**3.3.89 3.3.88 Service Meter Assembly.** The meter, valves, piping, fittings, and equipment installed by the servicing gas supplier to connect the gas supply to the customer's house or yard piping. [FR No. 60-NFPA 54/Z223.1-2024]~~

{3.3.90 through 3.3.92 unchanged}

~~**3.3.93 Steam Cooker.** See 3.3.4.4.4, Steam Cooker. [FR No. 35-NFPA 54/Z223.1-2024]~~

{3.3.94 through 3.3.99.1 unchanged}

~~**3.3.99.2 Automatic Valve.** An automatic or semiautomatic device consisting essentially of a valve and operator that control the gas supply to the burner(s) during operation of an appliance. [FR No. 36-NFPA 54/Z223.1-2024]~~

{3.3.99.3 unchanged}

~~**3.3.99.4 Manual Reset Valve.** An automatic shutoff valve installed in the gas supply piping and set to shut off when unsafe conditions occur. The device remains closed until manually reopened. [FR No. 37-NFPA 54/Z223.1-2024]~~

{3.3.99.5 unchanged}

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~~3.3.99.6~~ **3.3.97.6 Service Shutoff Valve.** A valve, installed by the serving gas supplier between the source of supply and the customer piping system, to shut off the fuel gas to the entire piping system. [FR No. 60-NFPA 54/Z223.1-2024]

{3.3.99.7 through 3.3.105 unchanged}

Chapter 4
General

4.1 Qualified Agency. The following shall be performed only by a qualified agency:

- (1) The design, installation, testing, purging, and replacement of gas piping, appliances, equipment, and accessories.
- (2) The repair and servicing of appliances and equipment.
- (3) The removal of unpurged gas piping. [FR No. 1-NFPA 54/Z223.1-2024]

4.2 Interruption of Service.

4.2.1 Notification of Interrupted Service. When the gas supply is to be turned off, ~~it shall be the duty of the qualified agency to~~ shall notify all affected users. Where two or more users are served from the same supply system, precautions shall be exercised to ensure that service only to the proper user is turned off.

Exception: In cases of emergency, affected users shall be notified as soon as possible of the actions taken by the qualified agency. [FR No. 2-NFPA 54/Z223.1-2024]

{4.2.2 through 4.3.1 unchanged}

4.3.2 Handling of Flammable Liquids.

~~4.3.2.1* Drip Liquids.~~ Liquid that is removed from a drip in existing gas piping shall be handled to avoid spillage or ignition.

~~4.3.2.2 Other Flammable Liquids.~~ Flammable liquids used by the installer shall be handled with precaution and shall not be left within the premises from the end of one working day to the beginning of the next.

[FR No. 3-NFPA 54/Z223.1-2024]

{4.4 through 4.5 unchanged}

4.6 Hydrogen Admixtures.

4.6.1 Hydrogen added to natural gas by blending that yields greater than 5 percent hydrogen by volume shall be recognized by this code as a hydrogen admixture.

4.6.2 Hydrogen admixtures shall not exceed 20 percent hydrogen by volume.

4.6.3 Fuel gas systems conveying hydrogen admixtures shall meet all requirements found in Chapters 5, 6, 7, and 8 of this code.

[FR No. 14-NFPA 54/Z223.1-2024]

4.7 Inspection and Repairs Following a Fire, Explosion, or Other Damage. Where a gas piping system is affected by a fire, explosion, or other damage, the piping system shall be inspected in accordance with Chapter 8 and replaced or repaired using materials

and methods in accordance with this code. [FR No. 58-NFPA 54/Z223.1-2024]

Chapter 5
Gas Piping System Design, Materials, and Components

{5.1 through 5.2.2.1 unchanged}

5.2.2.2 A three-way valve that has no intermediate position flow path and that is installed to admit the standby supply and at the same time shut off the regular supply shall be permitted to be used for this purpose. [FR No. 4-NFPA 54/Z223.1-2024]

{5.3 through 5.3.2.2 unchanged}

5.3.2.3 The total connected hourly load shall be used as the basis for piping sizing, assuming all appliances are operating at full capacity simultaneously except as provided by 5.3.2.3.1 or 5.3.2.3.2.

Exception. Sizing shall be permitted to be based upon established load diversity factors.

5.3.2.3.1 Sizing shall be permitted to be based upon established load diversity factors.

5.3.2.3.2 Where appliances are interlocked to prevent simultaneous operation, sizing shall be permitted to be based on the full capacity of all those appliances that can operate simultaneously.

[FR No. 5-NFPA 54/Z223.1-2024]

{5.3.3 through 5.5.4.1.1 unchanged}

5.5.4.1.2 Polyamide mechanical fittings for use on polyethylene pipe and tubing shall comply with ASTM F1924, Standard Specification for Plastic Mechanical Fittings for Use on Outside Diameter Controlled Polyethylene Gas Distribution Pipe and Tubing. [FR No. 6-NFPA 54/Z223.1-2024]

{5.5.4.1.2 through 5.5.4.3 unchanged}

5.5.5 Workmanship and Defects. Gas pipe, tubing, and fittings at the time of installation shall meet the following requirements:

- (1) Gas pipe, tubing, and fittings shall be clear and free from cutting burrs and visible defects in structure or threading.
- (2) Gas pipe, tubing, and fittings shall be ~~thoroughly~~ cleaned to remove chip, scale, and debris.
- ~~(3) Visible defects in pipe, tubing, and fittings shall not be repaired.~~
- ~~(4)~~ (3) Pipe, tubing, and fittings with visible defects shall be replaced.

[FR No. 7-NFPA 54/Z223.1-2024]

{5.5.6 through 5.5.7.4 unchanged}

5.5.7.5 Metallic Pipe Fittings. Metallic fittings shall comply with the following:

- (1) Threaded fittings in sizes larger than 4 in. (100 mm) shall not be used.

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- (2) Fittings used with steel, stainless steel, or wrought-iron pipe shall be steel, stainless steel, copper alloy, malleable iron, or cast iron.
- (3) Fittings used with copper or copper alloy pipe shall be copper or copper alloy.
- (4) Fittings used with aluminum alloy pipe shall be aluminum alloy.
- (5) *Cast-Iron Fittings.* Cast-iron fittings shall comply with the following:
 - (a) Flanges shall be permitted.
 - (b) Bushings shall not be used.
 - (c) Fittings shall not be used in systems containing flammable gas-air mixtures.
 - (d) Fittings in sizes 4 in. (100 mm) and larger shall not be used indoors unless approved.
 - (e) Fittings in sizes 6 in. (150 mm) and larger shall not be used unless approved.
- (6) *Aluminum Alloy Fittings.* Threads shall not form the joint seal.
- (7) *Zinc-Aluminum Alloy Fittings.* Fittings shall not be used in systems containing flammable gas-air mixtures.
- (8) *Special Fittings.* Fittings such as couplings, proprietary-type joints, saddle tees, gland-type compression fittings, and flared, flareless, or compression-type tubing fittings shall be as follows:
 - (a) Used within the fitting manufacturer's pressure-temperature recommendations
 - (b) Used within the service conditions anticipated with respect to vibration, fatigue, thermal expansion, or contraction
 - (c) Acceptable to the authority having jurisdiction
- (9) *Field Drilled and Tapped Fittings.* When pipe fittings are drilled and tapped in the field, the operation shall be in accordance with the following: Section 7.5.
 - (a) ~~The operation shall be performed on systems having operating pressures of 5 psi (34 kPa) or less.~~
 - (b) ~~The operation shall be performed by the gas supplier or their designated representative.~~
 - (c) ~~The drilling and tapping operation shall be performed in accordance with written procedures prepared by the gas supplier.~~
 - (d) ~~The fittings shall be located outdoors.~~
 - (e) ~~The tapped fitting assembly shall be inspected and proven to be free of leaks.~~

[FR No. 83-NFPA 54/Z223.1-2024]

{5.5.8 through 5.5.9.4 unchanged}

5.5.10 Flange Gaskets. The material for gaskets shall be capable of withstanding the design temperature and pressure of the piping system and the chemical constituents of the gas being conducted without change to its chemical and physical properties. ~~The effects of fire exposure to the joint shall be considered in choosing the material.~~ [FR No. 8-NFPA 54/Z223.1-2024]

{5.5.10.1 through 5.7.1 unchanged}

5.7.2 Listing. ~~Line~~ Except where serving appliances rated for inlet pressures higher than ½ psi and are covered in NFPA 37, NFPA 85, NFPA 86, or NFPA 87, line pressure regulators shall be listed in accordance with ANSI Z21.80/CSA 6.22, *Line Pressure Regulators*, where the outlet pressure is set to 2 psi or less. [FR No. 9-NFPA 54/Z223.1-2024]

{5.7.3 through 5.7.7 unchanged}

5.7.8* Regulator Pressure Test Means. Means shall be provided upstream and downstream of the line pressure regulator to facilitate testing of the regulator after installation. [FR No. 10-NFPA 54/Z223.1-2024]

5.8 Overpressure Protection.

5.8.1 Where Required. Where the serving gas supplier delivers gas at a pressure greater than 2 psi (14 kPa) for piping systems serving appliances designed to operate at a gas pressure of 14 in. w.c. (3.4 kPa) or less, overpressure protection devices shall be installed. Piping systems serving equipment designed to operate at inlet pressures greater than 14 in. w.c. (3.4 kPa) shall be equipped with overpressure protection devices as required by the appliance manufacturer's installation instructions. [FR No. 60-NFPA 54/Z223.1-2024]

{5.8.2 through 5.8.3.2 unchanged}

5.8.4 Construction and Installation. All overpressure protection devices shall be designed, constructed, and installed to meet the following requirements:

- (1) ~~Be constructed of materials so that the~~ The operation of the device will not be impaired by the ambient environment, corrosion of external parts, ~~by or the atmosphere or corrosion~~ of internal parts by the gas.
- (2) ~~Be designed and installed so they can be operated to determine whether the valve is free. The devices shall also be designed and installed so they can be tested to determine the pressure at which they will operate and examined for leakage when in the closed position. The device is capable of being operated as designed.~~
- (3) The device is capable of being tested to determine the pressure at which it operates.
- (4) The device is capable of being examined for internal leakage when in the closed position.

[FR No. 11-NFPA 54/Z223.1-2024]

{5.8.5 through 5.8.6 unchanged}

5.8.7 Unauthorized Operation. Where unauthorized operation of any shutoff valve could render a pressure relieving valve or pressure limiting device inoperative, one of the following shall be accomplished:

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- (1)*The valve shall be locked in the open position. ~~Instruct authorized personnel in the importance of leaving the shutoff valve open and of being present while the shutoff valve is closed so that it can be locked in the open position before leaving the premises.~~
- (2) Duplicate relief valves shall be installed, each having ~~adequate~~ the capacity to protect the system, ~~and arrange with~~ the isolating valves or three-way valve ~~arranged~~ so that only relief valve can be rendered inoperative at a time.

[FR No. 12-NFPA 54/Z223.1-2024]

{5.8.8 through 5.11 unchanged}

Table 5.11 Manual Gas Valve Standards

[EDITORIAL-Z223.1-2024]

Shutoff Valve Application	Valve Meeting the Following Standards
Appliance shutoff valve up to ½ psi	ANSI LC-4/CSA 6.32 ANSI Z21.15/CSA 9.1 ASME B16.33 marked 125 G ASME B16.44 <u>ANSI/ASME B16.38</u>
Valve up to ½ psi	ANSI LC-4/CSA 6.32 ASME B16.33 marked 125 G ASME B16.44 <u>ANSI/ASME B16.38</u>
Valve up to 2 psi	ANSI LC-4/CSA 6.32 with ASME B16.44 labeled 2G or labeled 5G ANSI LC-4/CSA 6.32 with ASME B16.33 marked 125 G ASME B16.33 marked 125 G ASME B16.44 labeled 2G <u>ANSI/ASME B16.38</u>
Valve up to 5 psi	ANSI LC-4/CSA 6.32 with ASME B16.44 marked 5G ANSI LC-4/CSA 6.32 with ASME B16.33 marked 125 G ASME B16.33 ASME B16.44 labeled 5G <u>ANSI/ASME B16.38</u>
Valve up to 125 psi	ANSI LC-4/CSA 6.32 with ASME B16.33 marked 125 G ASME B16.33 marked 125 G <u>ANSI/ASME B16.38</u>

For SI units: 1 psi gauge = 6.895 kPa.

[FR No. 41-NFPA 54/Z223.1-2024]

{5.12 through 5.13.2 unchanged}

5.14 Pressure Regulator and Pressure Control Venting. The venting of the atmospheric side of diaphragms in line-pressure regulators and gas-pressure-limit controls shall be in accordance with all of the following:

- (1) An independent vent pipe to the outdoors, sized in accordance with the device manufacturer’s instructions, shall be provided

where the location of a device is such that a discharge of fuel gas ~~from the device~~ will cause a hazard.

- (5) Independent vents for multiple regulators shall not be required where the vents are connected to a common manifold designed in accordance with engineering methods to minimize backpressure in the event of diaphragm failure and such design is approved.
- (3) A regulator and vent limiting means combination listed in accordance with ANSI Z21.80/CSA 6.22, Line Pressure Regulators, shall not be required to be vented to the outdoors.
- (4) A listed gas appliance regulator factory equipped with a vent limiting device shall not be required to be vented to the outdoors.
- (5) A listed gas pressure limit control that is factory equipped with a vent-limiting device and in accordance with UL 353, *Limit Controls*, or UL 60730-2-6, *Automatic Electrical Controls for Household and Similar Use, Part 2*, shall not be required to be vented to the outdoors.
- (6) Materials for vent piping shall be in accordance with Section 5.5.
- (7) The vent terminus shall be designed to prevent the entry of water, insects, and other foreign matter that could cause blockage.
- (8) Vent piping shall be installed to minimize static loads and bending moments placed on the regulators and gas pressure control devices.
- (9) Vents shall terminate not less than 3 ft (0.9 m) from a possible source of ignition.
- (10) At locations where a vent termination could be submerged during floods or snow accumulations one of the following shall apply:
- (a) An antiflood-type breather vent fitting shall be installed.
 - (b) The vent terminal shall be located above the height of the expected floor waters or snow.
- (11) Vent piping from pressure regulators and gas pressure controls shall not be a connected to a common manifold that serves a bleed line from a diaphragm-type gas valve.

[FR No. 13-NFPA 54/Z223.1-2024]

Chapter 6
Pipe Sizing

{6.1 through 6.4.2 unchanged}

{Table 6.4.2 unchanged}

Table 6.2.1(a)	Schedule 40 Metallic Pipe	Gas	Natural
		Inlet pressure	Less than 2 psi
		Pressure Drop	0.3 in w.c.

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		Specific Gravity	0.60
INTENDED USE: Inlet gas pressure less than 8 in. w.c.			
Pipe Size (in.)			
{No change to rest of existing table}			

[FR No. 42-NFPA 54/Z223.1-2024]

Table 6.2.1(b)	Schedule 40 Metallic Pipe	Gas	Natural
		Inlet pressure	Less than 2 psi
		Pressure Drop	0.5 in w.c.
		Specific Gravity	0.60
INTENDED USE: Inlet gas pressure less than 8 in. w.c.			
Pipe Size (in.)			
{No change to rest of existing table}			

[FR No. 42-NFPA 54/Z223.1-2024]

{Table 6.2.1(c) through Table 6.2.1(e) unchanged}

Table 6.2.1(f)	Schedule 40 Metallic Pipe	Gas	Natural
		Inlet pressure	3.0 psi
		Pressure Drop	2.0 psi
		Specific Gravity	0.60
Pipe Size (in.)			
{Delete entire table 6.2.1(f)}			

[FR No. 43-NFPA 54/Z223.1-2024]

{Table 6.2.1(g) unchanged}

Table 6.2.1(h)	Semirigid Copper Tubing	Gas	Natural
		Inlet pressure	Less than 2 psi
		Pressure Drop	0.3 in w.c.
		Specific Gravity	0.60

INTENDED USE: Inlet gas pressure less than 8 in. w.c.			
Pipe Size (in.)			
{No change to rest of existing table}			

[FR No. 42-NFPA 54/Z223.1-2024]

Table 6.2.1(i)	Semirigid Copper Tubing	Gas	Natural
		Inlet pressure	Less than 2 psi
		Pressure Drop	0.5 in w.c.
		Specific Gravity	0.60
INTENDED USE: Inlet gas pressure less than 8 in. w.c.			
Pipe Size (in.)			
{No change to rest of existing table}			

[FR No. 42-NFPA 54/Z223.1-2024]

Table 6.2.1(j)	Semirigid Copper Tubing	Gas	Natural
		Inlet pressure	Less than 2 psi
		Pressure Drop	1.0 in w.c.
		Specific Gravity	0.60
INTENDED USE: Tube Sizing between House Line Pressure Regulator and the Appliance			
Tube Size (in.)			
{No change to rest of existing table}			

[FR No. 47-NFPA 54/Z223.1-2024]

Table 6.2.1(k)	Semirigid Copper Tubing	Gas	Natural
		Inlet pressure	Less than 2.0 psi
		Pressure Drop	17 in. w.c.

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		Specific Gravity	0.60
Pipe Size (in.)			
{Delete entire table 6.2.1(k)}			

[FR No. 44-NFPA 54/Z223.1-2024]

{Table 6.2.1(l) unchanged}

Table 6.2.1(m)	Semirigid Copper Tubing	Gas	Natural
		Inlet pressure	2.0 psi
		Pressure Drop	1.5 psi
		Specific Gravity	0.60
Pipe Size (in.)			
{Delete entire table 6.2.1(m)}			

[FR No. 45-NFPA 54/Z223.1-2024]

{Table 6.2.1(n) through Table 6.2.1(o) unchanged}

Table 6.2.1(p)	Corrugated Stainless Steel Tubing (CSST)	Gas	Natural
		Inlet pressure	Less than 2 psi
		Pressure Drop	3.0 in w.c.
		Specific Gravity	0.60
INTENDED USE: Initial Supply Pressure of 8.0 in. w.c. or Greater up to 14.0 in. w.c. without a line pressure regulator			
{Table values unchanged}			
Notes:			
1. Table includes losses for four 90-degree bends and two end fittings. Tubing runs with larger numbers of bends and/or fittings shall need to be increased by an equivalent length of tubing to the following equation: $L = 1.3n$ where L is additional length (ft) of tubing and n is the number of additional fittings and/or bends.			
2. <u>Do not use this table unless the gas supplier confirms a delivery pressure between 8 in w.c. and 14 in. w.c..</u>			
3. EHD— Equivalent Hydraulic Diameter, which is a measure of the relative hydraulic efficiency between different tubing sizes. The greater the value of EHD, the greater the gas capacity of the tubing.			

4. All table entries have been rounded to 3 significant digits.

[FR No. 48-NFPA 54/Z223.1-2024]

Table 6.2.1(q)	Corrugated Stainless Steel Tubing (CSST)	Gas	Natural
		Inlet pressure	Less than 2 psi
		Pressure Drop	6.0 in w.c.
		Specific Gravity	0.60
INTENDED USE: Initial Supply Pressure of 11.0 in. w.c. or Greater up to 14.0 in. w.c. without a line pressure regulator			
{Table values unchanged}			
Notes:			
1. Table includes losses for four 90-degree bends and two end fittings. Tubing runs with larger numbers of bends and/or fittings shall need to be increased by an equivalent length of tubing to the following equation: $L = 1.3n$ where L is additional length (ft) of tubing and n is the number of additional fittings and/or bends.			
2. <u>Do not use unless the gas supplier can supply 11 in. w.c. or greater.</u>			
3. EHD— Equivalent Hydraulic Diameter, which is a measure of the relative hydraulic efficiency between different tubing sizes. The greater the value of EHD, the greater the gas capacity of the tubing.			
4. All table entries have been rounded to 3 significant digits.			

[FR No. 46-NFPA 54/Z223.1-2024]

{Table 6.2.1(r) through 6.2.1(x) unchanged}

{Table 6.3.1(a) through 6.3.1(m) unchanged}

Chapter 7
Gas Piping Installation

{7.1 through 7.2.4 unchanged}

7.2.5* Prohibited Locations. Gas piping inside any building shall not be installed in or through a clothes chute, chimney or gas vent, dumbwaiter, elevator shaft, or air duct, ~~other than combustion air ducts.~~ [FR No. 15-NFPA 54/Z223.1-2024]

{7.2.6 through 7.4.2 unchanged}

7.5 Field Drilled and Tapped Fittings.

7.5.1 Where pipe fittings are drilled and tapped in the field, the operation shall be performed in accordance with the following:

- (1) On systems having operating pressures of 5 psi (34 kPa) or less
- (2) By the gas supplier or their designated representative
- (3) Using written procedures prepared by the gas supplier

7.5.2 The tapped fitting assembly shall be inspected and proven to be free of leaks.

7.5.3 Field drilled and tapped fittings shall be located outdoors only. [FR No. 84-NFPA 54/Z223.1-2024]

{7.5 through 7.5.3 unchanged}

7.6 Drips and Sediment Traps.

~~7.6.1~~ **7.7.1 Provide Drips Where Necessary.** For other than dry gas conditions, a drip shall be provided at any point in the line of pipe where condensate could collect. Where required by the authority having jurisdiction or the serving gas supplier, a drip shall also be provided at the outlet of the meter. This drip shall be so installed as to constitute a trap wherein an accumulation of condensate will shut off the flow of gas before it will run back into the meter. [FR No. 60-NFPA 54/Z223.1-2024]

{7.6.2 through 7.10 unchanged}

~~7.11~~ **7.12 Systems Containing Flammable Gas-Air Mixtures.**

7.12.1 Systems containing flammable gas-air mixtures shall be designed in accordance with engineering methods.

7.12.2 Equipment used in flammable gas-air mixtures shall be selected in accordance with engineering methods.

~~7.11.1~~ **Required Components.** A central premix system with a flammable mixture in the blower or compressor shall consist of the following components:

- ~~(1) Gas mixing machine in the form of an automatic gas-air proportioning device combined with a downstream blower or compressor~~
- ~~(2) Flammable mixture piping, minimum Schedule 40~~
- ~~(3) Automatic firecheck(s)~~
- ~~(4) Safety blowout(s) or backfire preventers for systems utilizing flammable mixture lines above 2½ in. (64 mm) nominal pipe size or the equivalent~~

~~7.11.2~~ **Optional Components.** The following components shall also be permitted to be utilized in any type central premix system:

- ~~(1) Flowmeter(s)~~
- ~~(2) Flame arrester(s)~~

~~7.11.3~~ **Additional Requirements.** Gas mixing machines shall have nonsparking blowers and shall be so constructed that a flashback will not rupture machine casings.

~~7.11.4*~~ **Special Requirements for Mixing Blowers.** A mixing blower system shall be limited to applications with minimum

practical lengths of mixture piping, limited to a maximum mixture pressure of 10 in. w.c. (2.5 kPa) and limited to gases containing no more than 10 percent hydrogen. The blower shall be equipped with a gas control valve at its air entrance so arranged that gas is admitted to the airstream, entering the blower in proper proportions for correct combustion by the type of burners employed, the said gas control valve being of either the zero governor or mechanical ratio valve type that controls the gas and air adjustment simultaneously. No valves or other obstructions shall be installed between the blower discharge and the burner or burners.

7.11.5 Installation of Gas-Mixing Machines.

~~7.11.5.1*~~ **Location.** The gas mixing machine shall be located in a well-ventilated area or in a detached building or cutoff room provided with room construction and explosion vents in accordance with engineering methods. Such rooms or below finished ground level installations shall have adequate positive ventilation.

~~7.11.5.2~~ **Electrical Requirements.**

~~7.11.5.2.1~~ Where gas mixing machines are installed in well-ventilated areas, the type of electrical equipment shall be in accordance with NFPA 70® for unclassified areas unless other hazards required classification of the area.

~~7.11.5.2.2~~ Where gas mixing machines are installed in small detached buildings or cutoff rooms, the small detached building or cutoff room shall be classified Class I, Division 2.

~~7.11.5.3~~ **Air Intakes.** Air intakes for gas mixing machines using compressors or blowers shall be taken from outdoors whenever practical.

~~7.11.5.4*~~ **Controls.** Controls for gas mixing machines shall include interlocks and a safety shutoff valve of the manual reset type in the gas supply connection to each machine arranged to automatically shut off the gas supply in the event of high or low gas pressure. Except for open burner installations only, the controls shall be interlocked so that the blower or compressor stops operating following a gas supply failure. Where a system employs pressurized air, means shall be provided to shut off the gas supply in the event of air failure.

~~7.11.5.5~~ **Installation in Parallel.** Centrifugal gas mixing machines in parallel shall be reviewed by the user and equipment manufacturer before installation, and means or plans for minimizing these effects of downstream pulsation and equipment overload shall be prepared and utilized as needed.

~~7.11.6~~ **Use of Automatic Firechecks, Safety Blowouts, or Backfire Preventers.** Automatic firechecks and safety blowouts or backfire preventers shall be provided in piping systems distributing flammable air gas mixtures from gas mixing machines to protect the piping and the machines in the event of flashback, in accordance with the following:

- ~~(1)*~~ Approved automatic firechecks shall be installed upstream as close as practical to the burner inlets following the firecheck manufacturers' instructions.
- ~~(2)~~ A separate manually operated gas valve shall be provided at each automatic firecheck for shutting off the flow of gas air

mixture through the firecheck after a flashback has occurred. The valve shall be located upstream as close as practical to the inlet of the automatic firecheck. ~~Caution: these valves shall not be reopened after a flashback has occurred until the firecheck has cooled sufficiently to prevent re-ignition of the flammable mixture and has been reset properly.~~

(3) ~~A safety blowout or backfiring preventer shall be provided in the mixture line near the outlet of each gas mixing machine where the size of the piping is larger than 2½ in. (64 mm) NPS, or equivalent, to protect the mixing equipment in the event of an explosion passing through an automatic firecheck. The manufacturers' instructions shall be followed when installing these devices, particularly after a disc has burst. The discharge from the safety blowout or backfire preventer shall be located or shielded so that particles from the ruptured disc cannot be directed toward personnel. Wherever there are interconnected installations of gas mixing machines with safety blowouts or backfire preventers, provision shall be made to keep the mixture from other machines from reaching any ruptured disc opening. Check valves shall not be used for this purpose.~~

(4) ~~Large capacity premix systems provided with explosion heads (rupture disc) to relieve excessive pressure in pipelines shall be located at and vented to a safe outdoor location. Provisions shall be provided for automatically shutting off the supply of the gas-air mixture in the event of rupture.~~

[FR No. 16-NFPA 54/Z223.1-2024]

{7.12 through 7.14.2 unchanged}

Chapter 8 Inspection, Testing, and Purging

{8.1 through 8.1.2 unchanged}

8.1.3 Test Preparation.

8.1.3.1* Pipe joints, including welds, shall be left exposed for examination during the test.

Exception. Covered or concealed pipe end joints that have been previously tested in accordance with this code.

8.1.3.2 Covered or concealed pipe end joints that have been previously tested in accordance with this code shall be permitted to remain covered or concealed.

[FR No. 17-NFPA 54/Z223.1-2024]

{8.1.3.3 through 8.3.4 unchanged}

Chapter 9 Appliance, Equipment and Accessory Installation

{9.1 through 9.1.2(3) unchanged}

9.1.3 Type of Gas(es). The appliance shall be connected to the fuel gas for which it was designed. No attempt shall be made to convert the appliance from the gas specified on the rating plate for use with a different gas without consulting the installation

instructions, the serving gas supplier, or the appliance manufacturer for complete instructions. Listed appliances shall not be converted unless permitted by and in accordance with the manufacturer's installation instructions. [FR No. 60-NFPA 54/Z223.1-2024]

{9.1.4 through 9.3.2.1 unchanged}

9.3.2.2* Known Air Infiltration Rate Method. Where the air infiltration rate of a structure is known, the minimum required volume shall be determined as follows:

(1) For all appliances other than fan-assisted, calculate using the following equation:

$$\text{Required volume}_{\text{other}} \geq \frac{21 \text{ft}^3}{\text{ACH}} \left(\frac{I_{\text{mer}}}{1,000 \text{ Btu/hr}} \right) \quad \text{[9.3.2.2a]}$$

$$\text{Required volume} \geq \frac{21 \text{ft}^3}{\text{ACH}} \left(\frac{I}{1,000 \text{ Btu/hr}} \right) \quad \text{[9.3.2.2]}$$

where:

I = all appliances input (Btu/hr)

ACH = air change per hour (percent of volume of space exchanged per hr, expressed as a decimal)

(2) For fan-assisted appliance, calculate using the following equation:

$$\text{Required volume}_{\text{fan}} \geq \frac{15 \text{ft}^3}{\text{ACH}} \left(\frac{I_{\text{fan}}}{1,000 \text{ Btu/hr}} \right) \quad \text{[9.3.2.2b]}$$

where:

~~I_{other} = all appliances other than fan-assisted input (Btu/hr)~~

~~I_{fan} = fan-assisted appliance input (Btu/hr)~~

~~ACH = air change per hour (percent of volume of space exchanged per hr, expressed as a decimal)~~

(3) For purposes of this calculation, an infiltration rate greater than 0.60 ACH shall not be used in Equations 9.3.2.2a and 9.3.2.2b.

9.3.2.2.1 For purposes of this calculation, an infiltration rate greater than 0.60 ACH shall not be used in Equation 9.3.2.2.

{9.3.2.3 through 9.3.6.3 unchanged}

9.3.7 Louvers, Grilles, and Screens.

9.3.7.1 Net Free Area Louvers and Grilles. The required size of openings for combustion, ventilation, and dilution air shall be based on the net free area of each opening. Where the free area through a design of louver, grille, or screen is known, it shall be used in calculating the size opening required to provide the free area specified. Where the louver or grille design and free area are not known, it shall be assumed that wood louvers will have 25 percent free area, and metal louvers and grilles will have 75 percent free area. Nonmotorized louvers and grilles shall be fixed in the open position.

9.3.7.1.1 The required size of openings for combustion, ventilation, and dilution air shall be based on the net free area of each opening.

9.3.7.1.2 Where the free area through a design of louver, grille, or screen is known, it shall be used in calculating the size opening required to provide the free area specified.

9.3.7.1.3 Where the louver or grille design and free area are not known, it shall be assumed that wood louvers will have 25 percent free area, and metal louvers and grilles will have 75 percent free area.

9.3.7.1.4 Nonmotorized louvers and grilles shall be fixed in the open position.

[FR No. 21-NFPA 54/Z223.1-2024]

{9.3.7.2 unchanged}

9.3.7.3 Motorized Louvers. Motorized louvers shall be interlocked with the appliance so they are proven in the full open position prior to main burner ignition and during main burner operation. Means shall be provided to prevent the main burner from igniting should the louver fail to open during burner startup and to shut down the main burner if the louvers close during burner operation.

9.3.7.3.1 Motorized louvers shall be interlocked with the appliance so they are proven in the full open position prior to main burner ignition and during main burner operation.

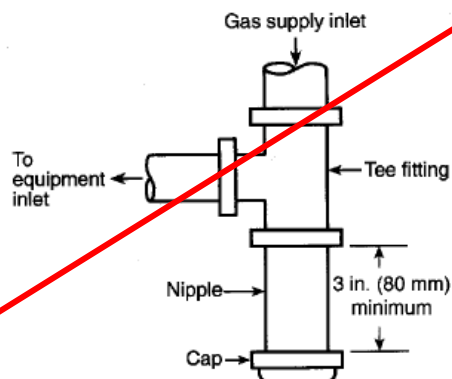
9.3.7.3.2 Means shall be provided to prevent the main burner from igniting should the louver fail to open during burner startup and to shut down the main burner if the louvers close during burner operation.

[FR No. 22-NFPA 54/Z223.1-2024]

{9.3.8 through 9.6.7 unchanged}

9.6.8 Sediment Trap. Where a sediment trap is not incorporated as a part of the appliance, a sediment trap shall be installed downstream of the appliance shutoff valve as close to the inlet of the appliance as practical at the time of appliance installation. The sediment trap shall be either a tee fitting with a capped nipple in the bottom outlet, as illustrated in Figure 9.6.8, or other device recognized as an effective sediment trap. Illuminating appliances, gas ranges, clothes dryers, decorative appliances for installation in vented fireplaces, gas fireplaces, and outdoor cooking appliances shall not be required to be so equipped.

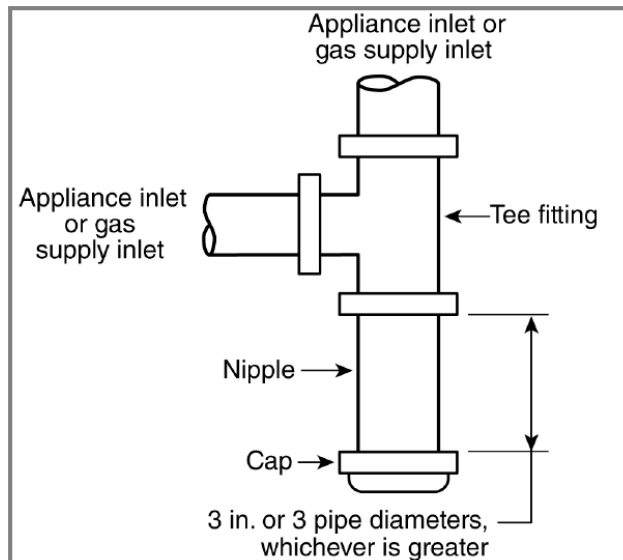
Figure 9.6.8
Method of installing a tee fitting sediment trap.



9.6.8.1 Where a sediment trap is not incorporated as a part of the appliance, a sediment trap shall be installed downstream of the appliance shutoff valve as close to the inlet of the appliance as practical at the time of appliance installation.

9.6.8.2 The sediment trap shall be either a tee fitting with a capped nipple in the bottom outlet, as illustrated in Figure 9.6.8, or other device recognized as an effective sediment trap.

Figure 9.6.8.2
Method of Installing a Tee Fitting Sediment Trap.



9.6.8.3 Illuminating appliances, gas ranges, clothes dryers, decorative appliances for installation in vented fireplaces, gas fireplaces, and outdoor cooking appliances shall not be required to be equipped with a sediment trap.

[FR No. 25-NFPA 54/Z223.1-2024]

{9.6.9 through 9.8.2 unchanged}

Chapter 10 Installation of Specific Appliances

{10.1 through 10.2 unchanged}

10.2.1 Application Listing. Gas-fired air conditioners and heat pumps shall be listed in accordance with ANSI Z21.40.1/CSA 2.91, *Gas-fired Heat Activated Air Conditioning and Heat Pump Appliances*, or ANSI Z21.40.2/CSA 2.92, *Air Conditioning and Heat Pump Appliances (Internal Combustion)*. [FR No. 40-NFPA 54/Z223.1-2024]

{10.2.2 through 10.3 unchanged}

10.3.1 Application Listing. [FR No. 40-NFPA 54/Z223.1-2024]

{10.3.1.1 through 10.4 unchanged}

10.4.1 Application Listing. Clothes dryers shall be listed in accordance with ANSI Z21.5. 1 /CSA 7.1, *Gas Clothes Dryer*,

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Volume I, Type 1 Clothes Dryers, or ANSI Z21.5.2/CSA 7.2, *Gas Clothes Dryer, Volume II, Type 2 Clothes Dryers*. [FR No. 40-NFPA 54/Z223.1-2024]

{10.4.2 through 10.6 unchanged}

10.6.1 Application Listing. Decorative appliances for installation in vented fireplaces shall be listed in accordance with ANSI Z21.60/CSA 2.26, *Decorative Gas Appliances for Installation in Solid-Fuel Burning Fireplaces*. [FR No. 40-NFPA 54/Z223.1-2024]

{10.6.2 through 10.7 unchanged}

10.7.1 Application Listing. Vented gas fireplaces shall be listed in accordance with ANSI Z21.50/CSA 2.22, *Vented Decorative Gas Appliances*. [FR No. 40-NFPA 54/Z223.1-2024]

{10.7.2 through 10.8 unchanged}

10.8.1 Application Listing. Direct gas-fired heating and forced ventilation appliances for commercial and industrial applications shall be listed in accordance with the following standards as applicable: [FR No. 40-NFPA 54/Z223.1-2024]

{10.8.1(1) through 10.12 unchanged}

10.12.1 Application Listing. Food service counter appliances shall be listed in accordance with ANSI Z83.11/CSA 1.8, *Gas Food Service Equipment*. [FR No. 40-NFPA 54/Z223.1-2024]

{10.12.2 through 10.13 unchanged}

10.13.1 Application Listing. Household cooking appliances shall be listed in accordance with ANSI Z21.1/CSA 1.1, *Household Cooking Gas Appliances*. [FR No. 40-NFPA 54/Z223.1-2024]

{10.13.2 through 10.16 unchanged}

10.16.1 Application Listing. Infrared heaters having an input rating of 400,000 Btu/hr or less shall be listed in accordance with ANSI Z83.19/CSA 2.35, *Gas-fired High Intensity Infrared Heaters*, or ANSI Z83.20/CSA 2.34, *Gas-fired Tubular and Low Intensity Infrared Heaters*. [FR No. 40-NFPA 54/Z223.1-2024]

{10.16.2 through 10.17 unchanged}

10.17.1 Application Listing. Open-top broiler units shall be listed in accordance with ANSI Z83.11/CSA 1.8, *Gas Food Service Equipment* or ANSI Z21.1/CSA 1.1, *Household Cooking Gas Appliances*, and installed in accordance with the manufacturer's installation instructions. [FR No. 40-NFPA 54/Z223.1-2024]

{10.17.2 through 10.18 unchanged}

10.18.1 Manufactureres shall construct venting in all premade cabinetry or doors utilized for permanently installed outdoor cooking equipment meeting the following:

- (1) Have a minimum of two vents.
- (2) Each vent has minimum dimensions of 4 x 4 in. (102 x 102 mm), 4.5 in. (114 mm) diameter, or equivalent with a minimum of 16 in.² (0.01 m²) of unrestricted opening.

10.18.2 Where manufacturer-designed cabinetry or doors are not purchased, the installer shall comply with all of the following:

(1) Install venting within the enclosure located based on the fuel gas utilized as follows:

- (a) For natural gas, within 3 in. (76 mm) of the top
- (b) For LP-Gas, within 3 in. (76 mm) of the bottom

(2) Have a minimum of two vents.

(3) Each vent has minimum dimensions of 4 x 4 in. (102 x 102 mm), 4.5 in. (114 mm) diameter, or equivalent with a minimum of 16 in.² (0.01 m²) of unrestricted opening.

[FR No. 18-NFPA 54/Z223.1-2024]

10.19 Pool Heaters.

10.19.1 Application Listing. Pool heaters shall be listed in accordance with ANSI Z21.56/CSA 4.7, *Gas-fired Pool Heaters*. [FR No. 40-NFPA 54/Z223.1-2024]

{10.19.2 through 10.20 unchanged}

10.20.1 Application Listing. Refrigerators shall be listed in accordance with ANSI Z21.19/CSA 1.4, *Refrigerators Using Gas Fuel*. [FR No. 40-NFPA 54/Z223.1-2024]

{10.20.2 through 10.21 unchanged}

10.21.1 Application Listing. Room heaters shall be listed in accordance with 10.21.1.1 or 10.21.1.2. [FR No. 40-NFPA 54/Z223.1-2024]

{10.21.1.1 through 10.24 unchanged}

10.24.1 Application Listing. [FR No. 40-NFPA 54/Z223.1-2024] Unit heaters shall be listed in accordance with ANSI Z83.8/CSA 2.6, *Gas Unit Heaters, Gas Packaged Heaters, Gas Utility Heaters, and Gas-fired Duct Furnaces*, ~~and installed in accordance with the manufacturer's installation instructions.~~ [FR No. 76-NFPA 54/Z223.1-2024]

10.24.2 Support. ~~Suspended Hangers~~ and brackets used to support ~~suspended-type~~ unit heaters shall be ~~safely and adequately supported with due consideration given to their weight and vibration characteristics.~~ Hangers and brackets shall be of noncombustible material. [FR No. 19-NFPA 54/Z223.1-2024]

{10.23 through 10.25 unchanged}

10.25.1 Application Listing. Wall furnaces shall be listed in accordance with ANSI Z21.86/CSA 2.32, *Vented Gas-fired Space Heating Appliances*. [FR No. 40-NFPA 54/Z223.1-2024]

{10.25.2 through 10.26 unchanged}

10.26.1 Application Listing. [FR No. 40-NFPA 54/Z223.1-2024] Water heaters shall be listed in accordance with ANSI Z21.10.1/CSA 4.1, *Gas Water Heaters, Volume I, Storage Water Haters with Input Ratings of 75,000 Btu per Hour or Less*, or ANSI Z21.10.3/CSA 4.3, *Gas Water Heaters, Volume III, Storage Water Haters with Input Ratings Above 75,000 Btu per Hour, Circulating or Instantaneous*, ~~and shall be installed in accordance with the manufacturer's installation instructions.~~ [FR No. 77-NFPA 54/Z223.1-2024]

{10.26.2 through 10.31 unchanged}

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Chapter 11
Procedures to Be Followed to Place Appliance in Operation

{11.1 through 11.7 unchanged}

Chapter 12
Venting of Appliances

{12.1 through 12.16(5) unchanged}

{Table 12.5.1 through Table 12.11.2.5 unchanged}

{Figure 12.7.3 through Figure 12.9.1 unchanged}

Chapter 13
Sizing of Category I Venting Systems

{13.1 through 13.1.18 unchanged}

{Table 13.1(a) unchanged}

	Asbestos Cement Vent	Appliance Vent Connection: Connected Directly to Pipe or Vent
{Table values unchanged}		
For SI units, 1 in. = 25.4 mm, 1 in. ² = 645 mm ² ; 1 ft = 0.305 m, 1,000 Btu/hr = 0.293 kW		
NA: Not allowed.		

[FR No. 61-NFPA 54/Z223.1-2024]

Table 13.1(a) continued	Type B Double-Wall Gas Vent	Number of Appliances: Single
		Appliance Type: Category I
		Appliance Vent Connection: Connected Directly to Vent
{Table values unchanged}		
For SI units, 1 in. = 25.4 mm, 1 in. ² = 645 mm ² ; 1 ft = 0.305 m, 1,000 Btu/hr = 0.293 kW		
NA: Not allowed.		

[EDITORIAL-Z223.1-2024]

{Table 13.1(b) and Table 13.1(c) unchanged}

Table 13.1(f)	Type B Double-Wall Gas Vent	Number of Appliances: Single
		Appliance Type: Category I
		Appliance Vent Connection: Connected Directly to Vent
{Table values unchanged}		
For SI units, 1 in. = 25.4 mm, 1 in. ² = 645 mm ² ; 1 ft = 0.305 m, 1,000 Btu/hr = 0.293 kW		
See Figure F.2.4 for a map showing local 99 percent winter design temperatures in the United States.		
NA: Not allowed.		

[FR No. 61-NFPA 54/Z223.1-2024]

{13.2 through 13.2.30 unchanged}

Table 13.1(d)	Masonry Chimney	Number of Appliances: Single
		Appliance Type: Category I
		Appliance Vent Connection: Single Wall Metal Connector
{Table values unchanged}		
For SI units, 1 in. = 25.4 mm, 1 in. ² = 645 mm ² ; 1 ft = 0.305 m, 1,000 Btu/hr = 0.293 kW		
NA: Not allowed.		

[FR No. 61-NFPA 54/Z223.1-2024]

Table 13.2(a)	Type B Double-Wall Vent	Number of Appliances: Two or More
		Appliance Type: Category I
		Appliance Vent Connection: Type B Double Wall Connector
{Table values unchanged}		
For SI units, 1 in. = 25.4 mm, 1 in. ² = 645 mm ² ; 1 ft = 0.305 m, 1,000 Btu/hr = 0.293 kW		
NA: Not allowed.		

[FR No. 62-NFPA 54/Z223.1-2024]

Table 13.1(e)	Single Wall Metal Pipe or Type B	Number of Appliances: Single
		Appliance Type: Draft Hood-Equipped

Table 13.2(a) continued		Number of Appliances: Two or More
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	Type B Double-Wall Vent	Appliance Type: Category I
		Appliance Vent Connection: Type B Double Wall Connector
{Table values unchanged}		
For SI units, 1 in. = 25.4 mm, 1 in. ² = 645 mm ² ; 1 ft = 0.305 m, 1,000 Btu/hr = 0.293 kW		
NA: Not allowed.		

[EDITORIAL-Z223.1-2024]

		Appliance Type: Category I
		Appliance Vent Connection: Single Wall Metal Connector
{Table values unchanged}		
For SI units, 1 in. = 25.4 mm, 1 in. ² = 645 mm ² ; 1 ft = 0.305 m, 1,000 Btu/hr = 0.293 kW		
NA: Not allowed.		

[FR No. 62-NFPA 54/Z223.1-2024]

Table 13.2(b)	Type B Double-Wall Vent	Number of Appliances: Two or More
		Appliance Type: Category I
		Appliance Vent Connection: Single Wall Metal Connector
{Table values unchanged}		
For SI units, 1 in. = 25.4 mm, 1 in. ² = 645 mm ² ; 1 ft = 0.305 m, 1,000 Btu/hr = 0.293 kW		
NA: Not allowed.		

[FR No. 62-NFPA 54/Z223.1-2024]

Table 13.2(e)	Single Wall Metal Pipe or Type B Asbestos Cement Vent [EDITORIAL-Z223.1-2024]	Number of Appliances: Two or More
		Appliance Type: Draft Hood-Equipped
		Appliance Vent Connection: Direct to Pipe or Vent
{Table values unchanged}		
For SI units, 1 in. = 25.4 mm, 1 in. ² = 645 mm ² ; 1 ft = 0.305 m, 1,000 Btu/hr = 0.293 kW		
See Figure F.1(f) and Section 13.2.		
NA: Not allowed.		

[FR No. 62-NFPA 54/Z223.1-2024]

Table 13.2(c)	Masonry Chimney	Number of Appliances: Two or More
		Appliance Type: Category I
		Appliance Vent Connection: Type B Double Wall Connector
{Table values unchanged}		
For SI units, 1 in. = 25.4 mm, 1 in. ² = 645 mm ² ; 1 ft = 0.305 m, 1,000 Btu/hr = 0.293 kW		
NA: Not allowed.		

[FR No. 62-NFPA 54/Z223.1-2024]

Table 13.2(f)	Exterior Masonry Chimney	Number of Appliances: Two or More
		Installation Type: NAT + NAT
		Appliance Vent Connection: Type B Double Wall Connector
{Table values unchanged}		
For SI units, 1 in. = 25.4 mm, 1 in. ² = 645 mm ² ; 1 ft = 0.305 m, 1,000 Btu/hr = 0.293 kW		
NA: Not allowed.		

[FR No. 62-NFPA 54/Z223.1-2024]

Table 13.2(d)	Masonry Chimney	Number of Appliances: Two or More
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Table 13.2(g)	Exterior Masonry Chimney	Number of Appliances: Two or More
		Installation Type: NAT + NAT
		Appliance Vent Connection: Type B Double Wall Connector
{Table values unchanged}		
For SI units, 1 in. = 25.4 mm, 1 in. ² = 645 mm ² ; 1 ft = 0.305 m, 1,000 Btu/hr = 0.293 kW Note: See Figure F.2.4 for a map showing local 99 percent winter design temperatures in the United States. NA: Not allowed.		

[FR No. 62-NFPA 54/Z223.1-2024]

Table 13.2(h)	Exterior Masonry Chimney	Number of Appliances: Two or More
		Installation Type: FAN + NAT
		Appliance Vent Connection: Type B Double Wall Connector
{Table values unchanged}		
For SI units, 1 in. = 25.4 mm, 1 in. ² = 645 mm ² ; 1 ft = 0.305 m, 1,000 Btu/hr = 0.293 kW NA: Not allowed.		

[FR No. 62-NFPA 54/Z223.1-2024]

Table 13.2(i)	Exterior Masonry Chimney	Number of Appliances: Two or More
		Installation Type: FAN + NAT
		Appliance Vent Connection: Type B Double Wall Connector
{Table values unchanged}		
For SI units, 1 in. = 25.4 mm, 1 in. ² = 645 mm ² , 1 ft = 0.305 m, 1,000 Btu/hr = 0.293 kW Note: See Figure F.2.4 for a map showing local 99 percent winter design temperatures in the United States. NA: Not allowed.		

Annex A
Explanatory Material

{A.1.1.1(A) through A.3.3.95.6 unchanged}

~~**A.4.3.2.1** Gas suppliers intend to provide gas that is free of liquids. Where liquids or condensates are removed from a drip, the gas supplier can be notified if it is determined that the liquid accumulation impedes the appliance operation or if the liquid accumulation appears to be at an unusual rate. This could mean that the gas supplier's liquid removal equipment has failed or is in need of service.~~

~~Handling and disposal of liquids may need to be done with the consideration of an industrial hygienist to avoid possible contact with trace amounts of benzene. Contact the gas supplier for a Safety Data Sheet (SDS) or consider laboratory sampling before handling or disposing of liquids. [FR No. 3-NFPA 54/Z223.1-2024]~~

{A.4.4 through A.4.5(3) unchanged}

~~**A.4.6** The distribution of hydrogen admixtures in natural gas in building systems does not change the safety or operability of fuel gas systems where reasonable limits on hydrogen percentages (by volume), such as 20 percent, are used. Pipe system components and sizing methods currently in the code can be used to size hydrogen admixtures up to 20 percent hydrogen by volume with the different natural gas sources already used in developing the sizing methods and based upon current technical justification of admixture compatibility.~~

~~Adding hydrogen to a fuel gas affects appliance function, specifically combustion behavior. The primary safety concern of increasing hydrogen percentages is burner "flashback," where burner flame front retreats into the burner itself (regression), leading to burner failure, failure of the burner system, and potential release of unburned gas in the building. Regression of flame fronts into burners occurs when hydrogen concentrations are increased and gas mixture flame speeds increase proportionally, exceeding the flow rate of the mixed fuel gas/air mixture to the flame within the combustion chamber. Hydrogen's burning velocity is approximately six times faster than that of methane. A 20 percent maximum threshold for hydrogen admixtures with natural gas represents a reasonable limit to minimize the potential of flashback behavior and associated safety risks of burner failure. This admixture maximum threshold is consistent with compatibility of piping system limit of 20 percent hydrogen. [FR No. 14-NFPA 54/Z223.1-2024]~~

{A.5.3.1 through A.5.7 unchanged}

{Table A.5.3.2.1 unchanged}

~~**A.5.7.8** A fitting with one opening capped or plugged could be installed between the regulator and its upstream shutoff valve to allow connection of a pressure-measuring instrument. Means could also be provided downstream of, and in the same room as, the regulator for the connection of a pressure measuring instrument by any of the following:~~

- ~~(1) Dedicated test port on the regulator.~~
- ~~(2) Dedicated test port on the inlet side of the appliance gas control.~~

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(3) Test port on the distribution manifold.

(4) A plugged tee fitting in the piping.

(5) A plugged manifold port.

[FR No. 10-NFPA 54/Z223.1-2024]

A.5.8.7(1) Authorized personnel should be instructed in the importance of leaving the shutoff valve open and of being present while the shutoff valve is closed so that it can be locked in the open position before leaving the premises. **[FR No. 12-NFPA 54/Z223.1-2024]**

{A.5.10 through A.7.8.4 unchanged}

{Table A.6.1 unchanged}

~~**A.7.11.4** The mixing blower is acknowledged as a special case because of its inability to tolerate control valves or comparable restrictions between mixing blower(s) and burner(s). With these limitations, mixing blower installations are not required to utilize safety blowouts, backfire preventers, explosion heads, flame arresters, or automatic firechecks that introduce pressure losses.~~

~~**A.7.11.5.1** For information on venting of deflagrations, see NFPA 68.~~

~~**A.7.11.5.4** Additional interlocks might be necessary for safe operation of appliances supplied by the gas mixing machine.~~

~~**A.7.11.6 (1)** Two basic methods are generally used. One calls for a separate firecheck at each burner, the other a firecheck at each group of burners. The second method is generally more practical if a system consists of many closely spaced burners.~~

~~An approved automatic firecheck should be installed as near as practical upstream from a flame arrester used for local protection where test burners or lighting torches are employed.~~

[FR No. 12-NFPA 54/Z223.1-2024]

{A.7.12.2 through A.8.1.1.11 unchanged}

A.8.1.3.1 Welded pipe joints should be left exposed for examination. **[FR No. 17-NFPA 54/Z223.1-2024]**

{A.8.1.4.3 through A.9.3.2.1 unchanged}

A.9.3.2.2 See Table A.9.3.2.2 (a), ~~Table A.9.3.2.2 (b), and A.9.3.2.2(e).~~

Meeting the requirements of the “known air infiltration rate method” is not a guarantee that the equipment will pass the Section 11.6 draft test with current tighter construction, remodeling, and weatherization methods. There are also factors related to building airflows and combustion air that cannot be quantified or predicted, including leakage of supply and return ducts in unconditioned spaces, multiple appliances operating at the same time, operation of exhaust fans, wind and weather conditions, and isolation of appliance areas from sources of combustion air by the closing of doors. This code is not a design manual and should not be considered as such. The formula used to determine the required indoor air volume is meant to provide you with the best guidance available at the time of publication of this edition of NFPA 54. Even tracer gas methods, for determining air infiltration rates,

which require specialized equipment, can only determine rates of flow for the time and conditions when the test is conducted.

Air changes per hour (ACH) in this formula is the number of air changes that occur within the building by natural means (ACH_{NAT}). There are several methods to measure ACH, although any factors can affect this value, such as wind velocities, wind direction, barometric pressure, and the number and type of appliances installed and operated within the building.

Tracer gas methods have been developed to determine ACH. Such methods produce the most reliable values for ACH. However, these methods can be expensive and cumbersome, making them out of reach of most contractors or installers. Other published methods for estimating ACHs include ASHRAE estimating methods and those developed by the Air Conditioning Contractors of America Manual J, Residential Load Calculations, which includes tightness categories and estimated ACH for each category. The most prevalent technology in use today for evaluating air leakage characteristics associated with structures is through the use of blower door testing. This tool, called ACH₅₀, provides a somewhat consistent and quantifiable means for arriving at the air leakage for a uniform depressurization of a building compared to atmosphere—normally 50 pascals. ~~This method has been successfully correlated to tracer gas measured natural air infiltration rates.~~ ASHRAE 62.2 provides a method for converting ACH₅₀ to an ACH value that ~~reflects~~ estimates the actual number of air changes under normal conditions, called ACH_{NAT}.

Many buildings constructed to current building and energy codes can achieve very low ACH_{NAT} values, which need a relatively large indoor volume for naturally drafted appliances. Designers, builders, installers, and inspectors should know that these kinds of values might need indoor air volumes that are greater than structures have available. In such cases, draft testing per Section 11.6 might fail. This could necessitate an alternate means of appliance venting, replacing the appliance, or other remedies for achieving the necessary combustion air other than using indoor air.

The following is intended to provide guidance on developing the ACH factor for use in the “known air infiltration rate” (see 9.3.2.2) method of providing combustion air. It supports converting commonly used ACH₅₀ blower door air change measurements to estimated natural air infiltration rates.

ASHRAE 62.2, Ventilation and Acceptable Indoor Air Quality in Residential Buildings, provides an infiltration credit formula used with single-point blower door testing for estimating natural infiltration rates. Table A.9.3.2.2(b)(c) represents one set of simplified ASHRAE method calculations for a single-story building for an ACH₅₀ of 3. The formula should be used to calculate ACH_{NAT} for buildings with ~~larger~~ other ACH₅₀ leakage rates. A design professional should be consulted to validate calculations before they are used as the basis for providing combustion air.

$$ACH_{NAT} = .052 \times Q_{50} \times wsf \times (H / Hr)^z \times 60 / \text{volume}$$

~~**A.9.3.2.3b**~~ **A.9.3.2.2a)**

where:

wsf = Weather and shielding factor (from ASHRAE 62.2)

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H = Conditioned height above grade

Hr = Reference height, 8.2 ft

z = 0.4

Q₅₀ = CFM₅₀ blower door reading or ACH₅₀ x volume / 60

~~[A.9.3.2.3a A.9.3.2.2b]~~

[FR No. 23-NFPA 54/Z223.1-2024]

{Table A.9.3.2.1 unchanged}

Table A.9.3.2.2 (a) Known Air Infiltration Rate Method: Minimum Space Volume for Appliances ~~Other Than Fan-Assisted~~, for Specified Infiltration Rates (ACH)

Appliance Input Btu/hr	Space Volume(ft ³)		
	0.25 ACH	0.30 ACH	0.35 ACH
5,000	420	350	300
10,000	840	700	600
15,000	1,260	1,050	900
20,000	1,680	1,400	1,200
25,000	2,100	1,750	1,500
30,000	2,520	2,100	1,800
35,000	2,940	2,450	2,100
40,000	3,360	2,800	2,400
45,000	3,780	3,150	2,700
50,000	4,200	3,500	3,000
55,000	4,620	3,850	3,300
60,000	5,040	4,200	3,600
65,000	5,460	4,550	3,900
70,000	5,880	4,900	4,200
75,000	6,300	5,250	4,500
80,000	6,720	5,600	4,800
85,000	7,140	5,950	5,100
90,000	7,560	6,300	5,400
95,000	7,980	6,650	5,700
100,000	8,400	7,000	6,000
105,000	8,820	7,350	6,300
110,000	9,240	7,700	6,600
115,000	9,660	8,050	6,900
120,000	10,080	8,400	7,200
125,000	10,500	8,750	7,500
130,000	10,920	9,100	7,800
135,000	11,340	9,450	8,100
140,000	11,760	9,800	8,400
145,000	12,180	10,150	8,700
150,000	12,600	10,500	9,000
160,000	13,440	11,200	9,600
170,000	14,280	11,900	10,200
180,000	15,120	12,600	10,800
190,000	15,960	13,300	11,400
200,000	16,800	14,000	12,000
210,000	17,640	14,700	12,600
220,000	18,480	15,400	13,200
230,000	19,320	16,100	13,800
240,000	20,160	16,800	14,400
250,000	21,000	17,500	15,000
260,000	21,840	18,200	15,600
270,000	22,680	18,900	16,200
280,000	23,520	19,600	16,800
290,000	24,360	20,300	17,400
300,000	25,200	21,000	18,000

For SI units, 1 ft³ = 0.028 m³; 1,000 Btu/hr = 0.293 kW

ACH = Air change per hour

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Table A.9.3.2.2 (b) Known Air Infiltration Rate Method: Minimum Space Volume for Fan-Assisted Appliance, for Specified Infiltration Rates (ACH)

Appliance Input Btu/hr	Space Volume(ft ³)		
	0.25 ACH	0.30 ACH	0.35 ACH
5,000	300	250	214
10,000	600	500	429
15,000	900	750	643
20,000	1,200	1,000	857
25,000	1,500	1,250	1,071
30,000	1,800	1,500	1,286
35,000	2,100	1,750	1,500
40,000	2,400	2,000	1,714
45,000	2,700	2,250	1,929
50,000	3,000	2,500	2,143
55,000	3,300	2,750	2,357
60,000	3,600	3,000	2,571
65,000	3,900	3,250	2,786
70,000	4,200	3,500	3,000
75,000	4,500	3,750	3,214
80,000	4,800	4,000	3,429
85,000	5,100	4,250	3,643
90,000	5,400	4,500	3,857
95,000	5,700	4,750	4,071
100,000	6,000	5,000	4,286
105,000	6,300	5,250	4,500
110,000	6,600	5,500	4,714
115,000	6,900	5,750	4,929
120,000	7,200	6,000	5,143
125,000	7,500	6,250	5,357
130,000	7,800	6,500	5,571
135,000	8,100	6,750	5,786
140,000	8,400	7,000	6,000
145,000	8,700	7,250	6,214
150,000	9,000	7,500	6,429
160,000	9,600	8,000	6,857
170,000	10,200	8,500	7,286
180,000	10,800	9,000	7,714
190,000	11,400	9,500	8,143
200,000	12,000	10,000	8,571
210,000	12,600	10,500	9,000
220,000	13,200	11,000	9,429
230,000	13,800	11,500	9,857
240,000	14,400	12,000	10,286
250,000	15,000	12,500	10,714
260,000	15,600	13,000	11,143
270,000	16,200	13,500	11,571
280,000	16,800	14,000	12,000
290,000	17,400	14,500	12,429
300,000	18,000	15,000	12,857

For SI units, 1 ft³ = 0.028 m³; 1,000 Btu/hr = 0.293 kW

ACH = Air change per hour

Table A.9.3.2.3(b) (e) ACH ₅₀ to ACH _{NAT} Sample Calculations		
ACH _{NAT} = .052 x Q ₅₀ x wsf x (H / Hr) ² x 60 / volume *		
Single Story		
ACH ₅₀	wsf †	ACH _{NAT}
3	0.30	0.05
	0.35	0.06
	0.40	0.07
	0.45	0.08
	0.50	0.08
	0.55	0.09
	0.60	0.10
	0.65	0.10
	0.70	0.10
	0.75	0.10
	0.80	0.10
	0.85	0.15
	0.90	0.15
	0.95	0.15
	1.00	0.15
	1.05	0.175
1.10	0.20	
1.15	0.20	

*H/Hr was derived from an average of 10 ft. This made for a representative factor for facilities with 8 ft to 12 ft conditioned heights.
† Created with selected weather shielding factors.

[FR No. 23-NFPA 54/Z223.1-2024]

{A.9.3.2.3(1) through A.11.1.1 unchanged}

A.11.2 Normally, the primary air adjustment should first be set to give a soft blue flame having luminous tips and then increased to a point where the yellow tips just disappear. If the burner cannot be so adjusted, the manufacturer or ~~servicing~~ gas supplier should be contacted. **[FR No. 60-NFPA 54/Z223.1-2024]**

{A.11.6 through A.13.2.20 unchanged}

{Table A.11.1.1 unchanged}

{Figure A.9.3.2.3(1) through Figure A.12.13.4 unchanged}

Annex B
Sizing and Capacities of Gas Piping

{B.1 through B.3 unchanged}

B.3.1 General. The quantity of gas to be provided at each outlet should be determined, whenever possible, directly from the manufacturer's gas input Btu/hr rating of the appliance to be installed, adjusted for altitude where appropriate. In case the ratings of the appliances to be installed are not known, Table A.5.3.2.1 shows the approximate consumption (in Btu per hour) of certain types of typical household appliances.

To obtain the cubic feet per hour of gas required, divide the total Btu/hr input of all appliances by the average Btu heating value per cubic foot of the gas. The average Btu per cubic foot of the gas in the area of the installation can be obtained from the servicing gas supplier. [FR No. 60-NFPA 54/Z223.1-2024]

{B.3.2 through B.7.6 Example 6, (6) unchanged}

{Table B.3.2 through Table B.6(b) unchanged}

{Figure B.7.1 through Figure B.7.4 unchanged}

Annex C

Suggested Method for Checking for Leakage

{C.1 unchanged}

C.2 Leak Check Using the Gas Meter. Immediately prior to the leak check, it should be determined that the meter is in operating condition and has not been bypassed.

The leak check can be done by carefully watching the test dial of the meter to determine whether gas is passing through the meter. To assist in observing any movement of the test hand, wet a small piece of paper and paste its edge directly over the centerline of the hand as soon as the gas is turned on. This observation should be made with the test hand on the upstroke. Table C.2 can be used for determining the length of observation time.

In case careful observation of the test hand for a sufficient length of time reveals no movement, the piping should be purged and a small gas burner turned on and lighted and the hand of the test dial again observed. If the dial hand moves (as it should), it will show that the meter is operating properly. If the test hand does not move or register flow of gas through the meter to the small burner, the meter is defective and the gas should be shut off and the servicing gas supplier notified. [FR No. 60-NFPA 54/Z223.1-2024]

{Table C.2 unchanged}

{C.3 through C.4 unchanged}

Annex D

Suggested Emergency Procedure for Gas Leaks

{D.1 through D.2 unchanged}

Annex E

Flow of Gas through Fixed Orifices

{E.1 through E.1.2 unchanged}

{Table E.1.1(a) through Table E.1.1(d) unchanged}

Annex F

Sizing of Venting Systems Serving Appliances Equipped with Draft Hoods, Category I Appliances, and Appliances Listed for Use with Type B Vents

{F.1 through F.2.4 Example 5(c) unchanged}

{Figure F.1(a) through Figure F.2.4 unchanged}

Annex G

Recommended Procedure for Safety Inspection of an Existing Appliance Installation

{G.1 through G.3.2 unchanged}

G.3.3 Piping Support Inspection. Inspect piping to determine that it is adequately supported, that there is no undue stress on the piping, and if that there are any no improperly capped or uncapped pipe openings. [FR No. 38-NFPA 54/Z223.1-2024]

{G.3.4 through G.6.8 unchanged}

{Table G.6 unchanged}

Annex H

Indoor Combustion Air Calculation Examples

{H.1 through H.3 unchanged}

Annex I

Example of Combination of Indoor and Outdoor Combustion and Ventilation Opening Design.

{I.1 unchanged}

Annex J

Enforcement

{J.1 unchanged}

Annex K

Informational Publications

{K.1 through K.1.2.1 unchanged}

K.1.2 Other Publications

K.1.2.2 ASHRAE Publications. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., 180 Technology Parkway, Peachtree Corners, GA 30092, 404.636.8400, www.ashrae.org.

ASHRAE 62.2, Ventilation and Acceptable Indoor Air Quality in Residential Buildings, 2022.

ASHRAE Handbook — Fundamentals, 2021.

ASHRAE Handbook — HVAC Systems and Equipment, 2020 2024.

[FR No. 56-NFPA 54/Z223.1-2024]

K.1.2.3 ASME International Publications. American Society of Mechanical Engineers International, Two Park Avenue, New York, NY 10016-5990, 800.843.2763, www.asme.org.

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Boiler and Pressure Vessel Code, Section IX and Section IV, ~~2021~~ 2023. **[FR No. 38-NFPA 54/Z223.1-2024]**

{K.1.2.4 through K.1.2.5 unchanged}

K.1.2.6 CSA Group Publications. CSA Group, 8501 East Pleasant Valley Road, Cleveland, OH 44131-5575, 216.524.4990, www.csagroup.org.

ANSI Z21.13/CSA 4.9, Gas-Fired Low Pressure Steam and Hot Water Boilers, 2017 (R2022).

ANSI Z21.50/CSA 2.22, *Vented Decorative Gas Appliances*, 2019.

ANSI Z21.60/CSA 2.26, *Decorative Gas Appliances for Installation in Solid-Fuel Burning Fireplaces*, 2017 (R2021).

[FR No. 56-NFPA 54/Z223.1-2024]

K.1.2.7 NACE Publications. NACE International, 15835 Park Ten Place, Houston, TX 77084-4906, 281.228.6200, www.nace.org.

NACE SP0169, *Control of External Corrosion on Underground or Submerged Metallic Piping Systems*, ~~2013~~ 2024.

[FR No. 56-NFPA 54/Z223.1-2024]

K.1.2.8 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096, 847.272.8800, www.ul.com.

UL 651, *Schedule 40 and 80 Type EB and A Rigid PVC Conduit and Fittings*, 2011, revised 2022.

UL 795, *Standard for Commercial-Industrial Gas Heating Equipment*, ~~2022~~ 2024.

[FR No. 56-NFPA 54/Z223.1-2024]

{K.1.2.9 through K.2.1 unchanged}

K.2.2 CSA Group Publications. CSA Group, 178 Rexdale Boulevard, Toronto, ON M9W 1R3, Canada, (216) 524-4990, www.csagroup.org.

ANSI/AGA NGV3.1/CSA 12.3, *Fuel System Components for Compressed Natural Gas Powered Vehicles*, ~~2014~~ reaffirmed 2020.

ANSI NGV1/CSA NGV 1, *Compressed Natural Gas Vehicle (NGV) Fueling Connection Devices*, 2017 (R2021).

CSA/ANSI NGV 2, *Compressed Natural Gas Vehicle Fuel Containers*, ~~2019~~ 2023.

ANSI/LC 2A, *Direct Gas-Fired Circulating Heaters for Agricultural Animal Confinement Buildings*, 1998, reaffirmed 2020.

ANSI/LC 2, *Direct Gas-Fired Circulating Heaters for Agricultural Animal Confinement Buildings*, 1996, reaffirmed 2020.

ANSI Z21.12, *Draft Hoods*, 1990, reaffirmed 2020.

ANSI Z21.17/CSA 2.7, *Domestic Gas Conversion Burners*, 1998, reaffirmed 2019.

CSA/ANSI Z21.20/CSA 22.2 – No. 60730-2-5, *Automatic Electrical Controls– Part 2-5: Particular Requirements for Automatic Electrical Burner Control*, 2014, reaffirmed 2022.

CSA/ANSI Z21.21/CSA 6.5, *Automatic Gas Valves for Gas Appliances*, ~~2019~~ 2023.

CSA/ANSI Z21.23/CSA 6.6, *Gas Appliance Thermostats*, 2022.

ANSI Z21.35/CSA 6.8, *Pilot Gas Filters*, 2005, reaffirmed 2020.

ANSI Z21.40.4/CSA 2.94, *Performance Testing and Rating of Gas-Fired, Air-Conditioning and Heat Pump Appliances*, ~~1996, reaffirmed 2022~~ 2023.

ANSI Z21.42, *Gas-Fired Illuminating Appliances*, ~~2013, reaffirmed 2018~~ 2024.

ANSI Z21.57, *Recreational Vehicle Cooking Gas Appliances*, 2010, reaffirmed 2021.

ANSI Z21.58/CSA 1.6, *Outdoor Cooking Gas Appliances*, ~~2015~~ 2018 2022.

ANSI Z21.61, *Gas-Fired Toilets*, 1993, reaffirmed 2013.

ANSI Z21.66/CSA 6.14, *Automatic Vent Damper Devices for Use with Gas-Fired Appliances*, ~~2015, reaffirmed 2020~~ 2023.

ANSI Z21.71, *Automatic Intermittent Pilot Ignition Systems for Field Installation*, 1993, reaffirmed 2021.

ANSI Z21.77/CSA 6.23, *Manually-Operated Piezo-Electric Spark Gas Ignition Systems and Components*, 2005, reaffirmed 2020.

ANSI Z21.78/CSA 6.20, *Combination Gas Controls for Gas Appliances*, 2010, reaffirmed 2020.

ANSI Z21.84, *Manually Lighted, Natural Gas Decorative Gas Appliances for Installation in Solid-Fuel Burning Fireplaces*, 2017 reaffirmed 2021.

ANSI Z21.87/CSA 4.6, *Automatic Gas Shutoff Devices for Hot Water Supply Systems*, 2007, reaffirmed 2021.

ANSI Z21.88/CSA 2.33, *Vented Gas Fireplace Heaters*, 2019.

CSA/ANSI Z21.91, *Ventless Firebox Enclosures for Gas-Fired Unvented Gas Log-Type Room Heaters*, 2020.

CSA/ANSI Z83.21/CSA C 22.2 No.168, *Commercial Dishwashers*, 2020.

{K.2.3 through K.3 unchanged}

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[FR No. 1-NFPA 54/Z223.1-2024]: A qualified agency is needed for the removal of unpurged piping as there are numerous hazards around removal of unpurged piping that a qualified agency can deal with. The removal of purged piping does not need a qualified agency as it does not present the same hazards.

[FR No. 2-NFPA 54/Z223.1-2024]: The qualified agency making the notification is the important criteria here and not the imposition of duty on the qualified agency.

[FR No. 3-NFPA 54/Z223.1-2024]: Drip liquids are not common in fuel gas any more and the text is not relevant. NFPA 30 is the correct code document for providing requirements on the storage of flammable liquids when in use.

[FR No. 4-NFPA 54/Z223.1-2024]: Two isolation valves in series does not accomplish backflow prevention and a single isolation valve with a blind is not easily understood terminology and would produce create confusion for enforcement. The intent of the section is to prevent backflow of fluid to the alternate fuel system, and a three way valve that has no intermediate position flow path prevents this.

[FR No. 5-NFPA 54/Z223.1-2024]: Pipe sizing capacity can be reduced where not all appliances are operating at the same time when interlocked and that is being added to allow for that.

[FR No. 6-NFPA 54/Z223.1-2024]: The current standard (ASTM D2513), referenced in section 5.5.4.1.1, allows for the use of mechanical fittings, but it only covers fittings made of polyethylene. ASTM F1924, "Standard Specification for Plastic Mechanical Fittings for Use on Outside Diameter Controlled Polyethylene Gas Distribution Pipe and Tubing" is written as a supplement to D2513. It defines requirements for plastic mechanical fittings specifically for use on ASTM D2513 systems and allows for the use of fittings constructed of all plastic materials, provided they are compatible with ASTM D2513 piping systems. ASTM F1924 is an established standard with over 25 years of history.

[FR No. 7-NFPA 54/Z223.1-2024]: The requirement for cleaning is sufficient without the the modifier. "Thoroughly" is not enforceable as degree of cleaning is subjective. (3) is redundant as they are required to be replaced in the next sub-paragraph.

[FR No. 8-NFPA 54/Z223.1-2024]: Fire exposure is vague terminology and is unenforceable as it does not have actionable criteria once "fire exposure" has been considered. There is also no performance requirement on how much fire exposure the gasket is to withstand.

[FR No. 9-NFPA 54/Z223.1-2024]: It is hard for large appliance installations to comply with ANSI Z21.80/CSA 6.22 as the regulators built for these appliances are custom built and fall under other combustion equipment standards and an exemption is needed to allow unlisted regulators to be engineered as a solution. There is no regulator on the market that can comply with ANSI Z21.80 listed regulators and flow 12,500 (or more) cubic feet of natural gas at pressures less than 1/2 PSI. ANSI Z21.80 fits well for residential and light commercial appliances that are listed under the Z21/83 series standards (and most of these are all less than 5,000 CFH) , but once the appliance is a larger commercial, industrial(light or heavy), or a gas engine (e.g. larger generator engine), the requirement for an ANSI Z21.80 listed regulator is overly burdensome.

[FR No. 10-NFPA 54/Z223.1-2024]: Means are needed where the line pressure regulator is installed to allow the regulator to be tested to verify that it is operating properly. Improper operation can result in lower pressure than the appliance requires to operate safely and efficiently or higher pressure which can cause overfiring of the appliance.

[FR No. 11-NFPA 54/Z223.1-2024]: The language is changing to meet the NFPA Manual of Style. The term ambient environment is more descriptive and useful as ambient atmosphere does not account for moisture or water. The final requirement was modified to speak about what kind of leakage in the closed position through the device.

[FR No. 12-NFPA 54/Z223.1-2024]: The requirement is moving text to the annex material to conform with the NFPA Manual of Style. The term critical isolation valves are undefined in the code and it is unclear as to which valves this is referring to. The additional material being proposed requires training, tagging indicating the position of the valves and developing formal written procedures without justification as to why these additional requirements are necessary. The term duplicate overpressure control equipment is also undefined and it is unclear as to what that refers to.

[FR No. 13-NFPA 54/Z223.1-2024]: The text is being added to clarify that the discharge of concern is from the device causing a hazard and not the discharge location.

[FR No. 14-NFPA 54/Z223.1-2024]: The current state of knowledge around hydrogen admixtures of natural gas has concluded that 20% hydrogen by volume represents a prudent upper bound for gas suppliers used in existing and new

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natural gas appliances and equipment from a standpoint of appliance and gas system safety. This knowledge is based upon appliance testing, combustion properties associated with interchangeability to the baseline natural gas used for admixing, uncertainties associated with non-combustion characteristics of admixtures upon natural gas piping systems and components, and known current gas supplier plans for hydrogen admixtures that do not exceed 20% for near term projects, higher heating value (HHV) limits of natural gas suppliers and the decrements of HHV associated with hydrogen fractions (hydrogen representing roughly one-third the HHV of methane). At a minimum, a 20% admixture limit serves as a reasonable limit for hydrogen admixtures for the current code cycle and as research and analysis continues to test this threshold as an upper bound. The addition of hydrogen up to 20% does not require any changes to the design of fuel gas systems under NFPA 54

This appendix text provides concise essential information for understanding the implications of hydrogen admixtures and practical limits on admixture rates as they relate to combustion behavior, the first-order limiting factor on practical use of hydrogen admixing in natural gas systems, which themselves exhibit higher tolerances for hydrogen in natural gas.

The inclusion of up to 5 percent hydrogen as delivered for sources of natural gas has been accepted by CSA Group for all current listings of appliance/accessories, and therefore it is unnecessary to revise the definition of natural gas within the definition of gases.

Hydrogen has been a component of natural gas as the natural gas delivered to fuel gas systems, therefore it is unnecessary to specify the composition of the gas in the definition.

The proposed definition is not needed as the requirement where hydrogen admixtures appears explains the term where used. The definition of admixture is sufficiently covered by the dictionary definition.

[FR No. 15-NFPA 54/Z223.1-2024]: It is not safe to allow for gas piping to be installed within combustion air ducts for the same reasons that all of the other locations are prohibited. Leaks of gas into combustion air ducts could immediately communicate flammable mixtures to ignition sources. This could burn back through the duct and make for a catastrophic explosion and fire.

[FR No. 16-NFPA 54/Z223.1-2024]: Systems containing flammable gas-air mixtures are normally designed through engineering methods or fall under the scope of other codes (e.g. NFPA 86 for larger ovens and furnaces). In the context of how NFPA 54 is commonly used, these requirements are not commonly applicable in residential and light commercial systems. The technical expertise of the committee is limited in this technical area and it is hard to revise the requirements to maintain the intent.

[FR No. 17-NFPA 54/Z223.1-2024]: A weld is a pipe joint and it is moved to the annex as it is guidance material. The exception is moving to requirement language to comply with the Manual of Style.

[FR No. 18-NFPA 54/Z223.1-2024]: Ventilation requirements are needed for cabinets below outdoor cooking appliances are needed to prevent accumulation of fuel gas under these appliances. Guides demonstrate methods for venting in stone or other installation guides, but the simplest solution to ensuring sufficient venting exists is to place the vents in the manufacturers equipment that is sold as an accessory.

[FR No. 19-NFPA 54/Z223.1-2024]: The sentence proposed to be deleted does not contain a specific requirement and is unenforceable.

[FR No. 21-NFPA 54/Z223.1-2024]: The requirement is splitting out to multiple sections to meet the NFPA Manual of Style.

[FR No. 22-NFPA 54/Z223.1-2024]: The requirement is breaking out into multiple sections to comply with the NFPA Manual of Style.

[FR No. 23-NFPA 54/Z223.1-2024]: Building construction has gotten tighter and the permissible reduction of ventilation air for fan assisted requirements is not warranted. The key aspect is that the input rating of the appliance dictates the ventilation air required rather than the appliance drafting mechanism, as the drafting can malfunction. All appliances, whether fan assisted or natural draft, require roughly the same amount of air for combustion and ventilation air. Ventilation air is a necessary safety to protect against unintended emissions. All appliances should share the same equation for air requirements.

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[FR No. 25-NFPA 54/Z223.1-2024]: The sediment trap can operate in either direction to accomplish the intended function of a sediment trap. The addition of 3 pipe lengths or whichever is greater is to accomplish the sediment trap function for larger diameter piping.

[FR No. 26-NFPA 54/Z223.1-2024]: A purpose statement is being provided per the NFPA Manual of Style and is providing information as to the purpose of this code.

[FR No. 27-NFPA 54/Z223.1-2024]: The revised text clarifies that the AHJ needs to approve the alternate methods and adds specificity as to what equivalency might be relevant.

[FR No. 28-NFPA 54/Z223.1-2024]: The dictionary definition of the term is sufficient to describe the term where used.

[FR No. 29-NFPA 54/Z223.1-2024]: The dictionary definition of the term is sufficient to describe the term where used.

[FR No. 30-NFPA 54/Z223.1-2024]: The dictionary definition of the term is sufficient to describe the term where used.

[FR No. 31-NFPA 54/Z223.1-2024]: The dictionary definition of the term is sufficient to describe the term where used.

[FR No. 32-NFPA 54/Z223.1-2024]: The term is not used in the code.

[FR No. 33-NFPA 54/Z223.1-2024]: The term is not used in the code.

[FR No. 34-NFPA 54/Z223.1-2024]: A qualified agency can be involved in removal of piping and is being added here to reflect that.

[FR No. 35-NFPA 54/Z223.1-2024]: The dictionary definition of the term is sufficient. The term is also being deleted in the cross referenced section in FR 30.

[FR No. 36-NFPA 54/Z223.1-2024]: The term is not used in the code.

[FR No. 37-NFPA 54/Z223.1-2024]: The dictionary definition of the term is sufficient for where the term is used.

[FR No. 38-NFPA 54/Z223.1-2024]: The title is changing to match the content of the section. Uncapped lines are also of concern for the inspection and are being added here.

[FR No. 40-NFPA 54/Z223.1-2024]: These paragraphs establish listing requirements, not the application of the appliance and the title is changing to reflect that. See related FR 78 and FR 79 for related changes in regards to the section content based on the proposed title changes.

[FR No. 41-NFPA 54/Z223.1-2024]: ANSI/ASME B16.38 is being added to allow for valves above 4" to be allowed for use as there are piping systems with pipe size above 4".

[FR No. 42-NFPA 54/Z223.1-2024]: There are 24 sizing tables for natural gas in the Code. It is not unusual for the wrong table to be used because the descriptions are similar. The proposed Intended Use line will make it more evident that the tables with a 0.3 in. w.c. drop are intended for systems with the minimum inlet pressure and will help to prevent under-sizing of pipe. With the present Code, and installer can see that both Tables 6.2.1 (a) and (b) appear to be applicable, and might note that Table 6.2.1 (b) provided greater capacity, allowing the use of smaller pipe.

[FR No. 43-NFPA 54/Z223.1-2024]: The table is deleted as the use of 3 psi inlet pressure systems is not common. The knowledge of the submitted, gas utilities do not normally offer 3 psi pressure for building use. The deletion of the table does not intend to prohibit 3 psi piping systems, but will require the engineer or designer to identify the proper sizing table. The table will always be available in previous editions of the Code.

[FR No. 44-NFPA 54/Z223.1-2024]: The table is no longer needed. The combination of a less than 2 psi (<55 in. w.c.) system inlet pressure and 17 in. with a pressure drop of 17 in w.c. is unlikely today.

[FR No. 45-NFPA 54/Z223.1-2024]: The table is easily misused. It is limited to a total load of 150 Cu. Ft. per hour, yet the table has entries up to 2,270 Cu. Ft per hour. Only the length rows up to 60 ft. provide capacities under 150 Cu. Ft. per hour. This table covers the inlet to a line pressure regulator. The information is being provided by manufacturers of line pressure regulators; therefore, this table is not needed.

[FR No. 46-NFPA 54/Z223.1-2024]: 1. The Intended Use is revise to be consistent with allowable practice.

2. Note (1) is revised to eliminate shall as requirements cannot be in table notes.

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3. A new Note (2) is added to remind the user that a minimum supply pressure of 11" w.c. is needed to use this table. This reiterates the Intended Use line, as the table has been misused.

4. The proposed Note stating that the table is intended for use with engineering methods is not accepted because the table can be used without engineering methods.

[FR No. 47-NFPA 54/Z223.1-2024]: The term "line pressure regulator" is substituted for "house pressure regulator". Line pressure regulator is a defined term, and its use is preferred.

[FR No. 48-NFPA 54/Z223.1-2024]: 1. The Intended Use is revised to be consistent with allowable practice.

2. Note (1) is revised to eliminate shall use "should" instead of "shall" as requirements cannot be in table notes.

3. A new note (2) is added to remind users that inlet pressure between 11 in. w.c. and 14 in. w.c. is needed to use the Table.

4. The proposed Note stating that the table is intended for use with engineering methods is not accepted because the table can be used without engineering methods.

[FR No. 50-NFPA 54/Z223.1-2024]: The code does not cover the installation of certain types of equipment and proprietary items is unclear as to what it applies to. While the code does not cover the construction of the equipment, its installation is in the scope of the code.

This code covers some building design and construction requirements (e.g. building tightness for combustion air, or floor strength when placing appliances) and it provides further clarity if this item is removed and the requirements in the code are let stand.

[FR No. 51-NFPA 54/Z223.1-2024]: The list in this requirement is not all inclusive and is intended to exclude gases under the scope of NFPA 51 or NFPA 55, as those gases are used outside the scope of NFPA 54.

[FR No. 52-NFPA 54/Z223.1-2024]: NFPA 2 is the applicable code for fuel gas systems using hydrogen as a fuel. NFPA 2 lays out what is considered to be a hydrogen system fuel gas system.

[FR No. 53-NFPA 54/Z223.1-2024]: Reference standards are being updated to their latest revision year.

[FR No. 55-NFPA 54/Z223.1-2024]: This revision updates extracted text in accordance with the Extract Policy.

[FR No. 56-NFPA 54/Z223.1-2024]: Reference standards are updating to the latest revision year.

[FR No. 57-NFPA 54/Z223.1-2024]: Reference standards are being updated to the latest editions.

[FR No. 58-NFPA 54/Z223.1-2024]: The committee was made aware that repairs to leaking piping systems post fire, explosion, or other damage are not currently addressed in the Code and this requirement specifies what must be done to place the system back in service. See related FR 59 for revisions related to this topic.

[FR No. 60-NFPA 54/Z223.1-2024]: Serving is being removed as the gas supplier is always the one serving the gas and not the customer.

[FR No. 61-NFPA 54/Z223.1-2024]: The note is changing from not applicable to not allowed because the venting conditions that are specified in the tables would create unsafe venting conditions and are therefore not allowed rather than not applicable.

[FR No. 62-NFPA 54/Z223.1-2024]: The descriptor of NA is being added per the NFPA Manual of Style to specify not allowed because the venting conditions that are specified in the tables would create unsafe venting conditions and are therefore not allowed rather than not applicable.

[FR No. 76-NFPA 54/Z223.1-2024]: The text is being deleted to match the rest of the 10.XX.1 sections. Additionally the text is redundant to 10.1.1 as all appliances have to be installed in accordance with the manufacturer's instructions. See Related FR 40 for related changes on the section titles.

[FR No. 77-NFPA 54/Z223.1-2024]: The text is being deleted to match the rest of the 10.XX.1 sections. Additionally the text is redundant to 10.1.1 as all appliances have to be installed in accordance with the manufacturer's instructions. See Related FR 40 for related changes on the section titles.

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[FR No. 83-NFPA 54/Z223.1-2024]: The revision to create a table is unnecessary as the current text is more user friendly. Field drilled and tapped fittings are moving to chapter 7 as they are installation requirements and a pointer to chapter 7 is remaining in chapter 5 to help the user navigate the requirements around these fittings appropriately. See FR 84 related move of text to chapter 7.

[FR No. 84-NFPA 54/Z223.1-2024]: Field drilled and tapped fittings are moving to chapter 7 as they are installation requirements and a pointer to chapter 7 is remaining in chapter 5 to help the user navigate the requirements around these fittings appropriately. See FR 83 for revision offield drilled and tapped fittings in chapter 5.