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ANSI Z223.1-2009

National Fuel Gas Code

2009 Edition

This edition of ANSI Z223.1/NFPA 54, *National Fuel Gas Code*, was prepared by the Technical Committee on National Fuel Gas Code and acted on by NFPA at its June Association Technical Meeting held June 2-5, 2008, in Las Vegas, NV. It was issued by the Standards Council on July 24, 2008, with an effective date of September 5, 2008, and supersedes all previous editions.

Two tentative interim amendments (TIAs) were issued on July 24, 2008. The first TIA deletes a new paragraph 12.2.4 proposed in the ROP and ROC. As a result, Paragraph 12.2.4 does not appear in this edition. The second TIA revises Table A.5.6. For further information on tentative interim amendments, see Section 5 of the NFPA Regulations Governing Committee Projects available at:

<http://www.nfpa.org/assets/files/PDF/CodesStandards/TIAErrataFI/TIAREgs.pdf>

This edition of ANSI Z223.1/NFPA 54 was approved as an American National Standard on September 5, 2008. The ANSI designation is Z223.1-2009. The NFPA designation is NFPA 54-2009.

Origin and Development of ANSI Z223.1/NFPA 54

This code offers criteria for the installation and operation of gas piping and gas equipment on consumers' premises. It is the cumulative result of years of experience of many individuals and many organizations acquainted with the installation of gas piping and equipment designed for utilization of gaseous fuels. It is intended to promote public safety by providing requirements for the safe and satisfactory utilization of gas.

Changes in this code can become necessary from time to time. When any revision is deemed advisable, recommendations should be forwarded to the Secretary, Accredited Standards Committee Z223, 400 N. Capitol St. NW, Washington, DC 20001, and the Secretary, Standards Council, National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

Prior to 1974, the following three codes covered the installation of gas piping and appliances:

- (1) American National Standard Installation of Gas Appliances and Gas Piping, ANSI Z21.30 (NFPA 54)
- (2) Installation of Gas Piping and Gas Equipment on Industrial Premises and Certain Other Premises, ANSI Z83.1 (NFPA 54A)
- (3) Fuel Gas Piping, ASME B31.2

The first edition of the code was issued in 1974. It combined the requirements of the three predecessor documents. The American Gas Association and the National Fire Protection Association have continued co-sponsorship of the code following the first edition.

The second edition of the code, incorporating pertinent portions of B31.2, was issued in 1980, and reorganized the code to the current format. The third, fourth, fifth, sixth, and seventh editions were issued in 1984, 1988, 1992, 1996, and 1999, respectively. The scope of the code was expanded in 1988 to include piping systems up to and including 125 psi (862 kPa).

The 2002 edition revised the requirements for air for combustion and ventilation to recognize changes in building construction practices. Also, coverage of sizing of gas piping systems was updated.

The 2006 edition incorporated expanded steel, copper, and polyethylene pipe sizing tables. Requirements for appliance shutoff valves were revised to allow manifold systems with all shutoff valves in one location up to 50 ft from the most remote appliance, and the chapters were reorganized by application.

Changes to the 2009 edition include allowing press-connect fittings for gas piping systems, new requirements for bonding of CSST piping systems, expanded CSST sizing tables to recognize additional available sizes, new coverage of outdoor decorative appliances, and a new requirement to seal the annular space around the side wall vent penetrations.

Prior editions of this document have been translated into languages other than English, including Spanish.

Table 10.6.2.3 Free Opening Area of Chimney Damper for Venting Flue Gases from Unlisted Decorative Appliances for Installation in Vented Fireplaces

Chimney Height (ft)	Minimum Permanent Free Opening (in. ²)*						
	8	13	20	29	39	51	64
	Appliance Input Rating (Btu/hr)						
6	7,800	14,000	23,200	34,000	46,400	62,400	80,000
8	8,400	15,200	25,200	37,000	50,400	68,000	86,000
10	9,000	16,800	27,600	40,400	55,800	74,400	96,400
15	9,800	18,200	30,200	44,600	62,400	84,000	108,800
20	10,600	20,200	32,600	50,400	68,400	94,000	122,200
30	11,200	21,600	36,600	55,200	76,800	105,800	138,600

For SI units, 1 ft = 0.305 m, 1 in.² = 645 mm², 1000 Btu/hr = 0.293 kW.

* The first six minimum permanent free openings (8 in.² to 51 in.²) correspond approximately to the cross-sectional areas of chimneys having diameters of 3 in. through 8 in., respectively. The 64 in.² opening corresponds to the cross-sectional area of standard 8 in. × 8 in. chimney tile.

- (3) Panels, grilles, and access doors that are required to be removed for normal servicing operations shall not be attached to the building.
- (4) Direct vent gas fireplaces shall be installed with the vent air intake terminal in the outdoors and in accordance with the manufacturers' instructions.

10.7.3 Combustion and Circulating Air. Combustion and circulating air shall be provided in accordance with Section 9.3.

10.8 Non-Recirculating Direct Gas-Fired Industrial Air Heaters.

10.8.1 Application. Direct gas-fired industrial air heaters of the non-recirculating type shall be listed in accordance with ANSI Z83.4/CSA 3.7, *Non-Recirculating Direct Gas-Fired Industrial Air Heaters*.

10.8.2 Prohibited Installations.

10.8.2.1 Non-recirculating direct gas-fired industrial air heaters shall not serve any area containing sleeping quarters.

10.8.2.2 Non-recirculating direct gas-fired industrial air heaters shall not recirculate room air.

10.8.3 Installation.

10.8.3.1 Non-recirculating direct gas-fired industrial air heaters shall be installed in accordance with the manufacturer's instructions.

10.8.3.2 Non-recirculating direct gas-fired industrial air heaters shall be installed only in industrial or commercial occupancies.

10.8.3.3 Non-recirculating direct gas-fired industrial air heaters shall be permitted to provide fresh air ventilation.

10.8.3.4 Non-recirculating direct gas-fired industrial air heaters shall be provided with access for removal of burners; for replacement of motors, controls, filters, and other working parts; and for adjustment and lubrication of parts requiring maintenance.

10.8.4 Clearance from Combustible Materials. Non-recirculating direct gas-fired industrial air heaters shall be installed with a clearance from combustible materials of not less than that shown on the rating plate and the manufacturer's instructions.

10.8.5 Air Supply. All air to the non-recirculating direct gas-fired industrial air heater shall be ducted directly from outdoors. Where outdoor air dampers or closing louvers are used, they shall be verified to be in the open position prior to main burner operation.

10.8.6 Atmospheric Vents or Gas Reliefs or Bleeds. Non-recirculating direct gas-fired industrial air heaters with valve train components equipped with atmospheric vents, gas reliefs, or bleeds shall have their vent lines, gas reliefs, or bleeds lead to a safe point outdoors. Means shall be employed on these lines to prevent water from entering and to prevent blockage from insects and foreign matter. An atmospheric vent line shall not be required to be provided on a valve train component equipped with a listed vent limiter.

10.8.7 Relief Openings. The design of the installation shall include adequate provisions to permit the non-recirculating direct gas-fired industrial air heater to operate at its rated airflow without overpressurizing the space served by the heater by taking into account the structure's designed infiltration rate, properly designed relief openings, or an interlocked powered exhaust system, or a combination of these methods.

10.8.7.1 The structure's designed infiltration rate and the size of relief opening(s) shall be determined by approved engineering methods.

10.8.7.2 Louver or counterbalanced gravity damper relief openings shall be permitted. Where motorized dampers or closable louvers are used, they shall be proved to be in their open position prior to main burner operation.

10.8.8 Purging. Inlet ducting, when used, shall be purged with at least four air changes prior to an ignition attempt.

10.9 Recirculating Direct Gas-Fired Industrial Air Heaters.

10.9.1 Application. Direct gas-fired industrial air heaters of the recirculating type shall be listed in accordance with ANSI Z83.18, *Recirculating Direct Gas-Fired Industrial Air Heaters*.

10.9.2 Prohibited Installations.

10.9.2.1 Recirculating direct gas-fired industrial air heaters shall not serve any area containing sleeping quarters.

10.9.2.2* Recirculating direct gas-fired industrial air heaters shall not recirculate room air in buildings that contain flammable solids, liquids, or gases; explosive materials; or substances that can become toxic when exposed to flame or heat.

10.9.3 Installation. Installation of direct gas-fired industrial air heaters shall comply with the following requirements:

- (1) Recirculating direct gas-fired industrial air heaters shall be installed in accordance with the manufacturer's instructions.
- (2) Recirculating direct gas-fired industrial air heaters shall be installed only in industrial or commercial occupancies.

10.9.4 Clearance from Combustible Materials. Recirculating direct gas-fired industrial air heaters shall be installed with a clearance from combustible materials of not less than that shown on the rating plate and the manufacturer's instructions.

10.9.5 Air Supply. Ventilation air to the recirculating direct gas-fired industrial air heater shall be ducted directly from outdoors. Air to the recirculating direct gas-fired industrial air heater in excess of the minimum ventilation air specified on the heater's rating plate shall be taken from the building, ducted directly from outdoors, or a combination of both. Where outdoor air dampers or closing louvers are used, they shall be verified to be in the open position prior to main burner operation.

10.9.6 Atmospheric Vents, Gas Reliefs, or Bleeds. Recirculating direct gas-fired industrial air heaters with valve train components equipped with atmospheric vents, gas reliefs, or bleeds shall have their vent lines, gas reliefs, or bleeds lead to a safe point outdoors. Means shall be employed on these lines to prevent water from entering and to prevent blockage from insects and foreign matter. An atmospheric vent line shall not be required to be provided on a valve train component equipped with a listed vent limiter.

10.9.7 Relief Openings. The design of the installation shall include adequate provisions to permit the recirculating direct gas-fired industrial air heater to operate at its rated airflow without overpressurizing the space served by the heater, by taking into account the structure's designed infiltration rate, properly designed relief openings, an interlocked powered exhaust system, or a combination of these methods.

10.9.7.1 The structure's designed infiltration rate and the size of relief opening(s) shall be determined by approved engineering methods.

10.9.7.2 Louver or counterbalanced gravity damper relief openings shall be permitted. Where motorized dampers or closable louvers are used, they shall be proved to be in their open position prior to main burner operation.

10.9.8 Purging. Inlet ducting, when used, shall be purged with at least four air changes prior to an ignition attempt.

10.10 Duct Furnaces.

10.10.1 Clearances. The installation of duct furnaces shall comply with the following clearance requirements:

- (1) Listed duct furnaces shall be installed with clearances of at least 6 in. (150 mm) between adjacent walls, ceilings, and floors of combustible material and the furnace draft hood and shall comply with the following:
 - (a) Furnaces listed for installation at lesser clearances shall be installed in accordance with the manufacturer's installation instructions.

(b) In no case shall the clearance be such as to interfere with combustion air and accessibility. (See 9.2.1 and Section 9.3.)

- (2) Unlisted duct furnaces shall be installed with clearances to combustible material in accordance with the clearances specified for unlisted furnaces and boilers in Table 10.2.3(a). Combustible floors under unlisted duct furnaces shall be protected in an approved manner.

10.10.2 Installation of Duct Furnaces. Duct furnaces shall be installed in accordance with the manufacturers' instructions.

10.10.3 Access Panels. The ducts connected to duct furnaces shall have removable access panels on both the upstream and downstream sides of the furnace.

10.10.4 Location of Draft Hood and Controls. The controls, combustion air inlet, and draft hoods for duct furnaces shall be located outside the ducts. The draft hood shall be located in the same enclosure from which combustion air is taken.

10.10.5 Circulating Air. Where a duct furnace is installed so that supply ducts carry air circulated by the furnace to areas outside the space containing the furnace, the return air shall also be handled by a duct(s) sealed to the furnace casing and terminating outside the space containing the furnace. The duct furnace shall be installed on the positive-pressure side of the circulating air blower.

10.10.6 Duct Furnaces Used with Refrigeration Systems.

10.10.6.1 A duct furnace shall not be installed in conjunction with a refrigeration coil where circulation of cooled air is provided by the blower.

Exception: Where the blower has sufficient capacity to overcome the external static resistance imposed by the duct system, furnace, and the cooling coil and the air throughput necessary for heating or cooling, whichever is greater.

10.10.6.2 Duct furnaces used in conjunction with cooling appliances shall be installed in parallel with or on the upstream side of cooling coils to avoid condensation within heating elements. With a parallel flow arrangement, the dampers or other means used to control the flow of air shall be sufficiently tight to prevent any circulation of cooled air through the unit.

Exception: Where the duct furnace has been specifically listed for downstream installation.

10.10.6.3 Where duct furnaces are to be located upstream from cooling units, the cooling unit shall be so designed or equipped as to not develop excessive temperatures or pressures.

10.10.6.4 Where a duct furnace is installed downstream of an evaporative cooler or air washer, the heat exchanger shall be constructed of corrosion-resistant materials. Stainless steel, ceramic-coated steel, and an aluminum-coated steel in which the bond between the steel and the aluminum is an iron-aluminum alloy are considered to be corrosion resistant. Air washers operating with chilled water that deliver air below the dew point of the ambient air at the duct furnace are considered as refrigeration systems.

10.10.7 Installation in Commercial Garages and Aircraft Hangars. Duct furnaces installed in garages for more than three motor vehicles or in aircraft hangars shall be of a listed type and shall be installed in accordance with 9.1.11 and 9.1.12.

10.11 Floor Furnaces.

10.11.1 Installation. The installation of floor furnaces shall comply with the following requirements: