

NFPA 90A

Standard for the Installation of Air-Conditioning and Ventilating Systems

2002 Edition



NFPA, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101
An International Codes and Standards Organization

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NFPA 90A
Standard for the
Installation of Air-Conditioning and Ventilating Systems
2002 Edition

This edition of NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, was prepared by the Technical Committee on Air Conditioning and acted on by NFPA at its May Association Technical Meeting held May 19–23, 2002, in Minneapolis, MN. It was issued by the Standards Council on July 19, 2002, with an effective date of August 8, 2002, and supersedes all previous editions.

This edition of NFPA 90A was approved as an American National Standard on July 19, 2002.

Origin and Development of NFPA 90A

This standard dates from 1899, when committee attention was first given to blower and exhaust systems. Prior to 1936, the subject of air conditioning was covered in NFPA 91, *Standard on Blower Systems*. In 1937, a separate document, NFPA 90, *Standard on Air Conditioning, Warm Air Heating, Air Cooling and Ventilating Systems*, was developed. This standard was initially adopted in 1937, with many subsequent amendments through the 1978 edition. Since 1955, the two parts of NFPA 90 have been published separately as NFPA 90A and NFPA 90B, *Standard for the Installation of Warm Air Heating and Air-Conditioning Systems*.

The 1985 edition amended the 1981 edition, which was a complete revision. The 1989 edition was a complete rewrite, which was drafted using the “clean sheet” approach. In 1989, the protection methods specified as well as the chapter organization differed from earlier editions.

The 1993 edition instituted changes in plenum cavity materials use, fire damper testing–acceptance criteria, and testing and maintenance of systems.

The 1996 edition contained revisions that were minor in nature. Some of these revisions were to be consistent with NFPA 101[®], *Life Safety Code*[®], to update reference documents, and to provide editorial clarification.

The 1999 edition clarified requirements for fire properties of supplementary materials in plenums. Figure 3.3 was relocated to Appendix A, as it depicted examples of requirements in the standard. Other changes were minor or editorial in nature.

The 2002 edition incorporated format changes required by the NFPA *Manual of Style*. Significant changes consisted of new requirements for removal of accessible abandoned materials in concealed and plenum spaces and requirement for cables and wires to meet limited combustibility requirements.

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Committee Scope: This Committee shall have primary responsibility for documents on the construction, installation, operation, and maintenance of systems for air conditioning, warm air heating, and ventilating including filters, ducts, and related equipment to protect life and property from fire, smoke, and gases resulting from fire or from conditions having manifestations similar to fire.

NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

This list represents the membership at the time the Committee was balloted on the final text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of the document.

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NFPA 90A**Standard for the****Installation of Air-Conditioning
and Ventilating Systems****2002 Edition**

NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

Changes other than editorial are indicated by a vertical rule beside the paragraph, table, or figure in which the change occurred. These rules are included as an aid to the user in identifying changes from the previous edition. Where one or more complete paragraphs have been deleted, the deletion is indicated by a bullet between the paragraphs that remain.

A reference in brackets [] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, Annex C lists the complete title and edition of the source documents for both mandatory and nonmandatory extracts. Editorial changes to extracted material consist of revising references to an appropriate division in this document or the inclusion of the document number with the division number when the reference is to the original document. Requests for interpretations or revisions of extracted text shall be sent to the appropriate technical committee.

Information on referenced publications can be found in Chapter 2 and Annex C.

Chapter 1 Administration

1.1* Scope. This standard shall cover construction, installation, operation, and maintenance of systems for air conditioning and ventilating, including filters, ducts, and related equipment, to protect life and property from fire, smoke, and gases resulting from fire or from conditions having manifestations similar to fire.

1.2 Purpose. This standard shall prescribe minimum requirements for safety to life and property from fire. These requirements shall be intended to accomplish the following:

- (1) Restrict the spread of smoke through air duct systems within a building or into a building from the outside
- (2) Restrict the spread of fire through air duct systems from the area of fire origin, whether located within the building or outside
- (3) Maintain the fire-resistive integrity of building components and elements such as floors, partitions, roofs, walls, and floor- or roof-ceiling assemblies affected by the installation of air duct systems
- (4) Minimize the ignition sources and combustibility of the elements of the air duct systems
- (5) Permit the air duct systems in a building to be used for the additional purpose of emergency smoke control

1.3 Application. This standard shall apply to all systems for the movement of environmental air in structures that serve the following:

- (1)*Spaces of over 708 m³ (25,000 ft³) in volume

- (2)*Buildings of Types III, IV, and V construction over three stories in height, regardless of volume
- (3)*Buildings and spaces not covered by other applicable NFPA standards
- (4)*Occupants or processes not covered by other applicable NFPA standards

1.4 Retroactivity. The provisions of this standard shall not be intended to be applied retroactively. Where a system is being altered, extended, or renovated, the requirements of this standard shall apply only to the work being undertaken.

1.5 Equivalency. Nothing in this standard shall be intended to prevent the use of new methods or devices, provided that sufficient technical data are submitted to the authority having jurisdiction to demonstrate that the proposed method or device is equivalent in quality, strength, durability, and safety to that prescribed by this standard.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 30, *Flammable and Combustible Liquids Code*, 2000 edition.

NFPA 31, *Standard for the Installation of Oil-Burning Equipment*, 2001 edition.

NFPA 54, *National Fuel Gas Code*, 2002 edition.

NFPA 70, *National Electrical Code*®, 2002 edition.

NFPA 72®, *National Fire Alarm Code*®, 2002 edition.

NFPA 75, *Standard for the Protection of Electronic Computer/Data Processing Equipment*, 1999 edition.

NFPA 80, *Standard for Fire Doors and Fire Windows*, 1999 edition.

NFPA 101®, *Life Safety Code*®, 2000 edition.

NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials*, 1999 edition.

NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*, 2000 edition.

NFPA 259, *Standard Test Method for Potential Heat of Building Materials*, 1998 edition.

NFPA 262, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces*, 2002 edition.

2.3 Other Publications.

2.3.1 ASHRAE Publications. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., 1791 Tulie Circle NE, Atlanta, GA 30329-2305.

ANSI/ASHRAE 15, *Safety Code for Mechanical Refrigeration*, 1998.

ASHRAE Handbook — *HVAC Systems and Equipment*, 2000.

2.3.2 ASTM Publications. American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM C 411, *Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation*, 1997.

ASTM D 93, *Standard Test Methods for Flashpoint by Pensky-Martens Closed Cup Tester*, 2000.

ASTM E 136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*, 1999.

2.3.3 GA Publication. Gypsum Association, 810 First Street NE, Suite 510, Washington, DC 20002.

Fire Resistance Design Manual, 16th edition, 2000.

2.3.4 SMACNA Publications. Sheet Metal and Air-Conditioning Contractors' National Assn., Inc., 4201 Lafayette Center Drive, Chantilly, VA 22021-1209.

Fibrous Glass Duct Construction Standard, 6th edition, 1992.

HVAC Air Duct Leakage Test Manual, 1st edition, 1985.

HVAC Duct Construction Standards — Metal and Flexible, 2nd edition, 1995.

2.3.5 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062.

UL 181, *Standard for Safety Factory-Made Air Ducts and Air Connectors*, 1996.

UL 181A, *Standard for Safety Closure Systems for Use with Rigid Air Ducts and Air Connectors*, 1994.

UL 181B, *Standard for Safety Closure Systems for Use with Flexible Air Ducts and Air Connectors*, 1995.

UL 555, *Standard for Safety Fire Dampers*, 1999.

UL 555C, *Standard for Safety Ceiling Dampers*, 1996.

UL 555S, *Standard for Safety Smoke Dampers*, 1999.

UL 867, *Standard for Safety Electrostatic Air Cleaners*, 2000.

UL 900, *Standard for Safety Air Filter Units*, 1994.

UL 1820, *Standard for Safety Fire Test of Pneumatic Tubing for Flame and Smoke Characteristics*, 1997.

UL 1887, *Standard for Safety Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics*, 1996.

UL 1995, *Standard for Safety Heating and Cooling Equipment*, 1995.

UL 2024, *Standard for Safety Optical-Fiber Cable Raceway*, 1995.

UL 2043, *Standard for Safety Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces*, 1996.

UL *Fire Resistance Directory*, 2002.

products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

3.2.4 Shall. Indicates a mandatory requirement.

3.2.5 Should. Indicates a recommendation or that which is advised but not required.

3.3 General Definitions.

3.3.1 Accessible. Capable of being removed or exposed without damaging the building structure or finish, or not permanently closed in by the structure or finish of the building.

3.3.2 Air Cleaner. A device used to reduce or remove airborne solids from heating, ventilating, and air-conditioning systems by electrostatic means.

3.3.3* Air Connector. A conduit for transferring air between an air duct or plenum and an air terminal unit or an air inlet or air outlet.

3.3.4 Air Distribution System. A continuous passageway for the transmission of air that, in addition to air ducts, can include air connectors, air duct fittings, dampers, plenums, fans, and accessory air-handling equipment but that does not include conditioned spaces.

3.3.5 Air Duct. A conduit or passageway for conveying air to or from heating, cooling, air conditioning, or ventilating equipment, but not including the plenum. [97:1.2]

3.3.6 Air Duct Covering. A material such as an adhesive, insulation, banding, a coating(s), film, or a jacket used to cover the outside surface of an air duct, fan casing, or duct plenum.

3.3.7 Air Duct Lining. A material such as an adhesive, insulation, a coating(s), or film used to line the inside surface of an air duct, fan casing, or duct plenum.

3.3.8 Air Filter. A device used to reduce or remove airborne solids from heating, ventilating, and air conditioning.

3.3.9* Air Inlet. Any opening through which air is removed from a space and returned to an air distribution system.

3.3.10* Air Outlet. Any opening through which air is delivered to a space from an air distribution system.

3.3.11 Air Terminal Unit. An appliance receiving, conditioning, and delivering air supplied through an air distribution system.

3.3.12 Air Transfer Opening. An opening designed to allow the movement of environmental air between two contiguous spaces.

3.3.13 Damper.

3.3.13.1* Ceiling Radiation Damper. A device installed to limit radiant heat transfer through an air outlet or air inlet opening in the ceiling of a floor- or roof-ceiling assembly having not less than a 1-hour fire resistance rating. Such a device is described in the construction details for some tested floor- or roof-ceiling assemblies.

3.3.13.2 Combination Fire and Smoke Damper. A device that meets both the fire damper and smoke damper requirements.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not included, common usage of the terms shall apply.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). The organization, office, or individual responsible for approving equipment, materials, an installation, or a procedure.

3.2.3* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of

3.3.13.3* Fire Damper. A device, installed in an air distribution system, designed to close automatically upon detection of heat, to interrupt migratory airflow, and to restrict the passage of flame. [221:1.5]

3.3.13.4* Smoke Damper. A device within the air distribution system to control the movement of smoke.

3.3.14 Environmental Air. Air that is supplied, returned, recirculated, or exhausted from spaces for the purpose of modifying the existing atmosphere within the building.

3.3.15 Fan. An assembly comprising blades or runners and housings or casings and being either a blower or exhauster. [211:1.5]

3.3.16* Fire Resistance Rating. The time, in minutes or hours, that materials or assemblies have withstood a fire exposure as established in accordance with the test procedures of NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials*.

3.3.17 Fire Wall. A wall separating buildings or subdividing a building to prevent the spread of fire and having a fire resistance rating and structural stability.

3.3.18* Flame Spread Index. A comparative measure expressed as a dimensionless number derived from visual measurements or the spread of flame versus time in NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*.

3.3.19 Limited-Combustible Material. A building construction material that does not comply with the definition of non-combustible material, that, in the form in which it is used, has a potential heat value not exceeding 8141 kJ/kg (3500 Btu/lb) (see NFPA 259, *Standard Test Method for Potential Heat of Building Materials*), and that complies with either of the following (a) or (b). Materials subject to increase in combustibility or flame-spread rating beyond the limits herein established through the effects of age, moisture, or other atmospheric condition shall be considered combustible. (a) Materials having a structural base of non-combustible material, with a surfacing not exceeding a thickness of 3.2 mm (1/8 in.), and with a flame-spread rating not greater than 50; (b) Materials in the form and thickness used, other than as described in (a), having neither a flame-spread rating greater than 25 nor evidence of continued progressive combustion and of such composition that surfaces that would be exposed by cutting through the material on any plane would have neither a flame-spread rating greater than 25 nor evidence of continued progressive combustion. [96:1.2]

3.3.20 Noncombustible Material. A material that, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat. Materials that are reported as passing ASTM E 136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*, shall be considered noncombustible materials. [220:2.1]

3.3.21 Plenum. A compartment or chamber to which one or more air ducts are connected and that forms part of the air distribution system.

3.3.22 Smoke. The airborne solid and liquid particulates and gases evolved when a material undergoes pyrolysis or combustion, together with the quantity of air that is entrained or otherwise mixed into the mass.

3.3.23* Smoke Barrier. A continuous membrane, either vertical or horizontal, such as a wall, floor, or ceiling assembly, that is designed and constructed to restrict the movement of smoke.

3.3.24 Smoke Control. A system that utilizes fans to produce pressure differences so as to manage smoke movement.

3.3.25* Smoke Detector. A device that senses visible or invisible particles of combustion.

3.3.26* Smoke Developed Index. A comparative measure expressed as a dimensionless number, derived from measurements of smoke obstruction versus time in NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*.

Chapter 4 HVAC Systems

4.1 General Requirements for Equipment.

4.1.1 Access. Equipment shall be arranged to afford access for inspection, maintenance, and repair.

4.1.2 Equipment shall be selected and installed based on its application with respect to the manufacturer's installation instructions and listing as applicable.

4.1.3 Protection.

4.1.3.1 Equipment shall be guarded for personnel protection.

4.1.3.2 Equipment shall be guarded against the intake of foreign matter into the system.

4.1.4 Electrical wiring and equipment shall be installed in accordance with NFPA 70, *National Electrical Code*®.

4.1.5 Air-handling equipment rooms shall meet the requirements of Section 5.1.

4.2 System Components.

4.2.1 Outside Air Intakes.

4.2.1.1 Outside air intakes shall be located to avoid drawing in combustible material or flammable vapor.

4.2.1.1.1 Outside air intakes shall be located to minimize the hazard from fires in other structures.

4.2.1.2 Outside air intakes shall be protected by screens of corrosion-resistant material not larger than 12.7 mm (0.5 in.) mesh.

4.2.1.3 Outside air intakes shall be located so as to minimize the introduction of fire into the building from combustible buildings and hazardous facilities.

4.2.1.3.1 Outside intakes shall be equipped with an approved fire damper when not located to meet the requirements of 4.2.1.3.

4.2.1.4 Outside air intakes shall be located so as to minimize the introduction of smoke into the building.

4.2.1.4.1 Outside intakes shall be equipped with an approved smoke damper when not located to meet the requirements of 4.2.1.4. (See Section 6.3 for smoke damper operation to restrict the intake of smoke.)

4.2.2 Air Cleaners and Air Filters.

4.2.2.1 Electrostatic air cleaners shall be listed in accordance with UL 867, *Standard for Safety Electrostatic Air Cleaners*.

4.2.2.1.1 Electrostatic air cleaners shall be installed in conformance with the conditions of the manufacturer's listing.

4.2.2.2* Air filters shall be rated either as Class 1 or Class 2 in accordance with UL 900, *Standard for Safety Air Filter Units*.

4.2.2.3 Liquid adhesive coatings used on air filters shall have a minimum flash point of 163°C (325°F) as determined by ASTM D 93, *Standard Test Methods for Flashpoint by Pensky-Martens Closed Cup Tester*.

4.2.2.4 Where air filters are flushed with liquid adhesives, the system shall be arranged so that the air cleaner cannot be flushed while the fan is in operation.

4.2.2.5 Combustible adhesive coatings shall be stored in accordance with NFPA 30, *Flammable and Combustible Liquids Code*.

4.2.3 Fans.

4.2.3.1 Installation.

4.2.3.1.1 Fans shall be installed in accordance with the applicable NFPA standards and the manufacturer's instructions.

4.2.3.1.2 Fans shall be approved for the specific installation.

4.2.3.2 Access. Fans shall be located, arranged, and installed to afford access for inspection and maintenance.

4.2.3.3 Exposed Inlets. Exposed fan inlets shall be protected with metal screens to prevent the entry of paper, trash, and foreign materials.

4.2.4 Air-Cooling and Heating Equipment.

4.2.4.1 Installation.

4.2.4.1.1 Heating and cooling equipment shall be installed in accordance with the applicable NFPA standards and the manufacturer's instructions.

4.2.4.1.2 The equipment shall be approved for the specific installation. (See 4.3.3.1.)

4.2.4.2 Materials. Materials used in the manufacturing of fan coil units, self-contained air-conditioning units, furnaces, heat pumps, humidifiers, and all similar equipment shall meet the requirements of 4.3.3.1 and 4.3.3.2 unless otherwise provided in 4.2.4.2.1 or 4.2.4.2.2.

4.2.4.2.1 The requirements of 4.3.3.1 and 4.3.3.2 shall not apply to equipment tested and listed in accordance with UL 1995, *Standard for Safety Heating and Cooling Equipment*.

4.2.4.2.2 Unlisted solar energy air distribution system components shall be accompanied by supportive information demonstrating that the components have flame spread and smoke developed indexes that are not in excess of those of the air duct system permitted by this standard.

4.2.4.3 Mechanical Cooling.

4.2.4.3.1 Mechanical refrigeration used with air duct systems shall be installed in accordance with recognized safety practices.

4.2.4.3.2 Installations conforming to ANSI/ASHRAE 15, *Safety Code for Mechanical Refrigeration*, shall be considered to be in compliance with these requirements.

4.2.4.4 Furnaces.

4.2.4.4.1 Heating furnaces combined with cooling units in the same air duct system shall be installed in accordance with NFPA 31, *Standard for the Installation of Oil-Burning Equipment*, where oil fired.

4.2.4.4.2 Heating furnaces combined with cooling units in the same air duct system shall be installed in accordance with NFPA 54, *National Fuel Gas Code*, where gas fired.

4.2.4.5 Duct Heaters.

4.2.4.5.1 Where electrical resistance or fuel-burning heaters are installed in air ducts, the air duct coverings and their installation shall comply with the provisions of 4.3.5.3.

4.2.4.5.2 The installation of electrical duct heaters shall comply with the provisions of NFPA 70, *National Electrical Code*, Article 424, Part F, "Duct Heaters."

4.2.4.6 Evaporative Coolers. Combustible evaporation media shall not be used, unless they meet the requirements of 4.2.2.2.

4.2.4.7 Heat Recovery Equipment. Equipment not covered by other provisions of this standard and used for heat transfer or air movement shall be constructed so that all material in the air path meets the requirements of Section 4.2.

4.3 Air Distribution.

4.3.1 Air Ducts.

4.3.1.1 Air ducts shall be constructed of iron, steel, aluminum, copper, concrete, masonry, or clay tile. Air ducts constructed of gypsum board shall be permitted when in compliance with 4.3.1.3.

4.3.1.2 Class 0 or Class 1 rigid or flexible air ducts tested in accordance with UL 181, *Standard for Safety Factory-Made Air Ducts and Air Connectors*, and installed in conformance with the conditions of listing shall be permitted to be used for ducts when air temperature in the ducts does not exceed 121°C (250°F) or when used as vertical ducts up to two stories in height.

4.3.1.3 Gypsum Board Air Ducts.

4.3.1.3.1 Gypsum board having a maximum flame spread index of 25 without evidence of continued progressive combustion and a maximum smoke developed index of 50 when tested in accordance with NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*, shall be permitted to be used for negative pressure exhaust and return ducts where the temperature of the conveyed air does not exceed 52°C (125°F) in normal service.

4.3.1.3.2 The air temperature limits of 4.3.1.3.1 shall not apply when gypsum board material is used for emergency smoke exhaust air ducts.

4.3.1.4 All air duct materials shall be suitable for continuous exposure to the temperature and humidity conditions of the environmental air in the air duct.

4.3.1.5 The materials, thickness, construction, and installation of ducts shall provide structural strength and durability in conformance with recognized good practice.

4.3.1.5.1 Air ducts shall be considered to be in compliance with this requirement where constructed and installed in accordance with the ASHRAE Handbook — *HVAC Systems and Equipment* and with one of the following as applicable:

- (1) *SMACNA *Fibrous Glass Duct Construction Standard*
- (2) SMACNA *HVAC Duct Construction Standards — Metal and Flexible*
- (3) SMACNA *HVAC Air Duct Leakage Test Manual*

4.3.1.6 Where no standard exists for the construction of air ducts, the ducts shall be constructed to withstand both the positive and negative pressures of the system.

4.3.2 Air Connectors.

4.3.2.1 Air connectors are limited-use, flexible air ducts that shall not be required to conform to the provisions for air ducts where they meet the requirements of 4.3.2.1.1 through 4.3.2.1.5.

4.3.2.1.1 Air connectors shall conform to the requirements for Class 0 or Class 1 connectors when tested in accordance with UL 181, *Standard for Safety Factory-Made Air Ducts and Air Connectors*.

4.3.2.1.2 Class 0 or Class 1 air connectors shall not be used for ducts containing air at temperatures in excess of 121°C (250°F).

4.3.2.1.3 Air connector runs shall not exceed 4.27 m (14 ft) in length.

4.3.2.1.4 Air connectors shall not pass through any wall, partition, or enclosure of a vertical shaft that is required to have a fire resistance rating of 1 hour or more.

4.3.2.1.5 Air connectors shall not pass through floors.

4.3.2.2 Vibration isolation connectors in duct systems shall be made of an approved flame-retardant fabric or shall consist of sleeve joints with packing of approved material, each having a maximum flame spread index of 25 and a maximum smoke developed index of 50.

4.3.2.3 Approved flame-retardant fabric having a maximum length of 254 mm (10 in.) in the direction of airflow shall be permitted to be used.

4.3.3 Supplementary Materials for Air Distribution Systems.

4.3.3.1 Pipe insulation and coverings, duct coverings, duct linings, vapor retarder facings, adhesives, fasteners, tapes, and supplementary materials added to air ducts, plenums, panels, and duct silencers used in duct systems, unless otherwise provided for in 4.3.3.1.2 or 4.3.3.1.3, shall have, in the form in which they are used, a maximum flame spread index of 25 without evidence of continued progressive combustion and a maximum smoke developed index of 50 when tested in accordance with NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*.

4.3.3.1.1 Where these products are to be applied with adhesives, they shall be tested with such adhesives applied, or the adhesives used shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when in the final dry state. (See 4.2.4.2.)

4.3.3.1.2 The flame spread and smoke developed index requirements of 4.3.3.1.1 shall not apply to air duct weather-proof coverings where they are located entirely outside of a

building, do not penetrate a wall or roof, and do not create an exposure hazard.

4.3.3.1.3 Smoke detectors required by 6.4.4 shall not be required to meet flame spread index or smoke developed index requirements.

4.3.3.2 Closure systems for use with rigid and flexible air ducts tested in accordance with UL 181, *Standard for Safety Factory-Made Air Ducts and Air Connectors*, shall have been tested, listed, and used in accordance with the conditions of their listings, in accordance with one of the following:

- (1) UL 181A, *Standard for Safety Closure Systems for Use with Rigid Air Ducts and Air Connectors*
- (2) UL 181B, *Standard for Safety Closure Systems for Use with Flexible Air Ducts and Air Connectors*

4.3.3.3 Air duct, panel, and plenum coverings and linings, and pipe insulation and coverings shall not flame, glow, smolder, or smoke when tested in accordance with a similar test for pipe covering, ASTM C 411, *Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation*, at the temperature to which they are exposed in service.

4.3.3.3.1 In no case shall the test temperature be below 121°C (250°F).

4.3.3.4 Air duct coverings shall not extend through walls or floors that are required to be fire stopped or required to have a fire resistance rating, unless such coverings meet the requirements of 5.4.6.4.

4.3.3.5* Air duct linings shall be interrupted at fire dampers to prevent interference with the operation of devices.

4.3.3.6 Air duct coverings shall not be installed so as to conceal or prevent the use of any service opening.

4.3.4 Air Duct Access and Inspection.

4.3.4.1* A service opening shall be provided in air ducts adjacent to each fire damper, smoke damper, and smoke detector.

4.3.4.1.1 The opening shall be large enough to permit maintenance and resetting of the device.

4.3.4.2 Service openings shall be identified with letters having a minimum height of 1.27 cm (½ in.) to indicate the location of the fire protection device(s) within.

4.3.4.3 Horizontal air ducts and plenums shall be provided with service openings to facilitate the removal of accumulations of dust and combustible materials.

4.3.4.3.1 Service openings shall be located at approximately 6.1 m (20 ft) intervals along the air duct and at the base of each vertical riser, unless otherwise provided in 4.3.4.3.2 through 4.3.4.3.4.

4.3.4.3.2 Removable air outlet or air inlet devices of adequate size shall be permitted in lieu of service openings.

4.3.4.3.3 Service openings shall not be required in supply ducts where the supply air has previously passed through an air filter, an air cleaner, or a water spray.

4.3.4.3.4 Service openings shall not be required where all the following conditions exist:

- (1) The occupancy has no process that produces combustible material such as dust, lint, or greasy vapors. Such occupancies include banks, office buildings, churches, hotels,

and health care facilities (but not kitchens, laundries, and manufacturing portions of such facilities).

- (2) The air inlets are at least 2.13 m (7 ft) above the floor or are protected by corrosion-resistant metal screens of at least 14 mesh (0.07 in.) that are installed at the inlets so that they cannot draw papers, refuse, or other combustible solids into the return air duct.
- (3) The minimum design velocity in the return duct for the particular occupancy is 5.08 m/sec (1000 ft/min).

4.3.4.4 Inspection windows shall be permitted in air ducts provided they are glazed with wired glass.

4.3.4.5 Service openings shall be provided as required in 4.3.4.1.

4.3.4.6 Openings in walls or ceilings shall be provided so that service openings in air ducts are accessible for maintenance and inspection needs.

4.3.4.7 Where a service opening is necessary in an air duct located above the ceiling of a floor- or roof-ceiling assembly that has been tested and assigned a fire resistance rating in accordance with NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials*, access shall be provided in the ceiling.

4.3.4.8 The service opening shall be designed and installed so that it does not reduce the fire resistance rating of the assembly.

4.3.5 Air Duct Integrity.

4.3.5.1 Air ducts shall be located where they are not subject to damage or rupture, or they shall be protected to maintain their integrity.

4.3.5.2 Where an air duct is located outdoors, the air duct, together with its covering or lining, shall be protected from harmful elements.

4.3.5.3 Where electrical, fossil fuel, or solar energy collection heat sources are installed in air ducts, the installation shall avoid the creation of a fire hazard.

4.3.5.3.1 For air ducts rated as Class 1 in accordance with UL 181, *Standard for Safety Factory-Made Air Ducts and Air Connectors*, air duct coverings and linings shall be interrupted at the immediate area of operation of such heat sources in 4.3.5.3 in order to meet the clearances specified as a condition of the equipment listing, unless otherwise permitted in 4.3.5.3.2 or 4.3.5.3.3.

4.3.5.3.2 Appliances listed for zero clearance from combustibles shall be permitted to be installed in accordance with the conditions of their listings.

4.3.5.3.3 Insulation specifically suited for the maximum temperature that reasonably can be anticipated on the duct surface shall be permitted to be installed at the immediate area of operation of such appliances.

4.3.6 Air Outlets.

4.3.6.1 General. Air supplied to any space shall not contain flammable vapors, flyings, or dust in quantities and concentrations that would introduce a hazardous condition.

4.3.6.2 Construction of Air Outlets.

4.3.6.2.1 Air outlets shall be constructed of noncombustible material, except under the conditions of 4.3.6.2.2.

4.3.6.2.2 Air outlets shall be permitted to be constructed of a material that has a maximum flame spread index of 25 and a maximum smoke developed index of 50.

4.3.6.3 Location of Air Outlets.

4.3.6.3.1 Air outlets shall be located at least 76 mm (3 in.) above the floor, unless provisions have been made to prevent dirt and dust accumulations from entering the system.

4.3.6.3.2 Where located less than 2.13 m (7 ft) above the floor, outlet openings shall be protected by a grille or screen having openings through which a 12.7 mm (½ in.) sphere cannot pass.

4.3.7 Air Inlets — Return or Exhaust or Return and Exhaust.

4.3.7.1 General. Air shall not be recirculated from any space in which flammable vapors, flyings, or dust are present in quantities and concentrations that would introduce a hazardous condition into the return air system.

4.3.7.2 Construction of Air Inlets. Air inlets shall be constructed of noncombustible material or a material that has a maximum flame spread index of 25 and a maximum smoke developed index of 50.

4.3.7.3 Location of Air Inlets.

4.3.7.3.1 Air inlets shall be located at least 76 mm (3 in.) above the floor, unless provisions have been made to prevent dirt and dust accumulations from entering the system.

4.3.7.3.2 Where located less than 2.13 m (7 ft) above the floor, inlet openings shall be protected by a grille or screen having openings through which a 12.7 mm (½ in.) sphere cannot pass.

4.3.8 Fire Dampers.

4.3.8.1 Approved fire dampers shall be provided as required in Chapter 5.

4.3.8.2 Approved fire dampers shall be installed in conformance with the conditions of their listings.

4.3.9 Smoke Dampers.

4.3.9.1 Approved smoke dampers shall be provided as required in Chapter 5.

4.3.9.1.1 Approved smoke dampers shall be installed in conformance with the conditions of their listings.

4.3.9.2 Smoke dampers shall be installed in systems with a capacity greater than 7080 L/sec (15,000 ft³/min) to isolate the air-handling equipment, including filters, from the remainder of the system in order to restrict the circulation of smoke, unless specifically exempted by 4.3.9.2.1 or 4.3.9.2.2.

4.3.9.2.1 Air-handling units located on the floor they serve and serving only that floor shall be exempt from the requirements of 4.3.9.2.

4.3.9.2.2 Air-handling units located on the roof and serving only the floor immediately below the roof shall be exempt from the requirements of 4.3.9.2.

4.3.10 Plenums.

4.3.10.1 Storage.

4.3.10.1.1 Plenums shall not be used for occupancy or storage.

4.3.10.1.2 Accessible abandoned material shall be deemed to be storage and shall not be permitted to remain.