NFPA® 90A

Standard for the Installation of Air-Conditioning and Ventilating Systems

2024 Edition

NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471
An International Codes and Standards Organization

IMPORTANT NOTICES AND DISCLAIMERS CONCERNING NFPA® STANDARDS

NFPA® codes, standards, recommended practices, and guides ("NFPA Standards"), of which the document contained herein is one, are developed through a consensus standards development process approved by the American National Standards Institute. This process brings together volunteers representing varied viewpoints and interests to achieve consensus on fire and other safety issues. While the NFPA administers the process and establishes rules to promote fairness in the development of consensus, it does not independently test, evaluate, or verify the accuracy of any information or the soundness of any judgments contained in NFPA Standards.

The NFPA disclaims liability for any personal injury, property, or other damages of any nature whatsoever, whether special, indirect, consequential or compensatory, directly or indirectly resulting from the publication, use of, or reliance on NFPA Standards. The NFPA also makes no guaranty or warranty as to the accuracy or completeness of any information published herein.

In issuing and making NFPA Standards available, the NFPA is not undertaking to render professional or other services for or on behalf of any person or entity. Nor is the NFPA undertaking to perform any duty owed by any person or entity to someone else. Anyone using this document should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances.

The NFPA has no power, nor does it undertake, to police or enforce compliance with the contents of NFPA Standards. Nor does the NFPA list, certify, test, or inspect products, designs, or installations for compliance with this document. Any certification or other statement of compliance with the requirements of this document shall not be attributable to the NFPA and is solely the responsibility of the certifier or maker of the statement.

REVISION SYMBOLS IDENTIFYING CHANGES FROM THE PREVIOUS EDITION

Text revisions are shaded. A Δ before a section number indicates that words within that section were deleted and a Δ to the left of a table or figure number indicates a revision to an existing table or figure. When a chapter was heavily revised, the entire chapter is marked throughout with the Δ symbol. Where one or more sections were deleted, a • is placed between the remaining sections. Chapters, annexes, sections, figures, and tables that are new are indicated with an ***N***.

Note that these indicators are a guide. Rearrangement of sections may not be captured in the markup, but users can view complete revision details in the First and Second Draft Reports located in the archived revision information section of each code at www.nfpa.org/docinfo. Any subsequent changes from the NFPA Technical Meeting, Tentative Interim Amendments, and Errata are also located there.

REMINDER: UPDATING OF NFPA STANDARDS

Users of NFPA codes, standards, recommended practices, and guides ("NFPA Standards") should be aware that these documents may be superseded at any time by the issuance of a new edition, may be amended with the issuance of Tentative Interim Amendments (TIAs), or be corrected by Errata. It is intended that through regular revisions and amendments, participants in the NFPA standards development process consider the then-current and available information on incidents, materials, technologies, innovations, and methods as these develop over time and that NFPA Standards reflect this consideration. Therefore, any previous edition of this document no longer represents the current NFPA Standard on the subject matter addressed. NFPA encourages the use of the most current edition of any NFPA Standard [as it may be amended by TIA(s) or Errata] to take advantage of current experience and understanding. An official NFPA Standard at any point in time consists of the current edition of the document, including any issued TIAs and Errata then in effect.

To determine whether an NFPA Standard has been amended through the issuance of TIAs or corrected by Errata, visit the "Codes & Standards" section at www.nfpa.org.

ISBN: 978-145593051-7 (Print)

ADDITIONAL IMPORTANT NOTICES AND DISCLAIMERS CONCERNING NFPA® STANDARDS

Updating of NFPA Standards

Users of NFPA codes, standards, recommended practices, and guides ("NFPA Standards") should be aware that these documents may be superseded at any time by the issuance of a new edition, may be amended with the issuance of Tentative Interim Amendments (TIAs), or be corrected by Errata. It is intended that through regular revisions and amendments, participants in the NFPA standards development process consider the then-current and available information on incidents, materials, technologies, innovations, and methods as these develop over time and that NFPA Standards reflect this consideration. Therefore, any previous edition of this document no longer represents the current NFPA Standard on the subject matter addressed. NFPA encourages the use of the most current edition of any NFPA Standard [as it may be amended by TIA(s) or Errata] to take advantage of current experience and understanding. An official NFPA Standard at any point in time consists of the current edition of the document, including any issued TIAs and Errata then in effect.

To determine whether an NFPA Standard has been amended through the issuance of TIAs or corrected by Errata, visit the "Codes & Standards" section at www.nfpa.org.

Interpretations of NFPA Standards

A statement, written or oral, that is not processed in accordance with Section 6 of the Regulations Governing the Development of NFPA Standards shall not be considered the official position of NFPA or any of its Committees and shall not be considered to be, nor be relied upon as, a Formal Interpretation.

Patents

The NFPA does not take any position with respect to the validity of any patent rights referenced in, related to, or asserted in connection with an NFPA Standard. The users of NFPA Standards bear the sole responsibility for determining the validity of any such patent rights, as well as the risk of infringement of such rights, and the NFPA disclaims liability for the infringement of any patent resulting from the use of or reliance on NFPA Standards.

NFPA adheres to the policy of the American National Standards Institute (ANSI) regarding the inclusion of patents in American National Standards ("the ANSI Patent Policy"), and hereby gives the following notice pursuant to that policy:

NOTICE: The user's attention is called to the possibility that compliance with an NFPA Standard may require use of an invention covered by patent rights. NFPA takes no position as to the validity of any such patent rights or as to whether such patent rights constitute or include essential patent claims under the ANSI Patent Policy. If, in connection with the ANSI Patent Policy, a patent holder has filed a statement of willingness to grant licenses under these rights on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license, copies of such filed statements can be obtained, on request, from NFPA. For further information, contact the NFPA at the address listed below.

Law and Regulations

Users of NFPA Standards should consult applicable federal, state, and local laws and regulations. NFPA does not, by the publication of its codes, standards, recommended practices, and guides, intend to urge action that is not in compliance with applicable laws, and these documents may not be construed as doing so.

Copyrights

NFPA Standards are copyrighted. They are made available for a wide variety of both public and private uses. These include both use, by reference, in laws and regulations, and use in private self-regulation, standardization, and the promotion of safe practices and methods. By making these documents available for use and adoption by public authorities and private users, the NFPA does not waive any rights in copyright to these documents.

Use of NFPA Standards for regulatory purposes should be accomplished through adoption by reference. The term "adoption by reference" means the citing of title, edition, and publishing information only. Any deletions, additions, and changes desired by the adopting authority should be noted separately in the adopting instrument. In order to assist NFPA in following the uses made of its documents, adopting authorities are requested to notify the NFPA (Attention: Secretary, Standards Council) in writing of such use. For technical assistance and questions concerning adoption of NFPA Standards, contact NFPA at the address below.

For Further Information

All questions or other communications relating to NFPA Standards and all requests for information on NFPA procedures governing its codes and standards development process, including information on the procedures for requesting Formal Interpretations, for proposing Tentative Interim Amendments, and for proposing revisions to NFPA standards during regular revision cycles, should be sent to NFPA headquarters, addressed to the attention of the Secretary, Standards Council, NFPA, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101; email: stds_admin@nfpa.org.

For more information about NFPA, visit the NFPA website at www.nfpa.org. All NFPA codes and standards can be viewed at no cost at www.nfpa.org/docinfo.

NFPA® 90A

Standard for the

Installation of Air-Conditioning and Ventilating Systems

2024 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. It was issued by the Standards Council on April 23, 2023, with an effective date of May 13, 2023, and supersedes all previous editions.

This edition of NFPA 90A was approved as an American National Standard on May 13, 2023.

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 standards on blower systems. In 1937, it was decided to prepare a separate standard on air-conditioning, warm air heating, and ventilating systems. This standard was initially adopted in 1937 with subsequent amendments in 1938, 1939, 1940, 1942, 1950, 1952, 1955, 1956, 1960, 1961, 1963, 1964, 1965, 1968, 1971, 1973, 1976, 1980, 1984, and 1989. The 1993 and 1996 editions were reconfirmations of the 1989 edition. The 1999 edition contained changes that were mainly editorial in nature.

The 2002 edition incorporated format changes to comply with the *Manual of Style for NFPA Technical Committee Documents* and new provisions for the removal of accessible abandoned materials in concealed spaces and plenums.

The only changes to the 2006 edition were to update "flame spread rating" to "flame spread index."

The major change in the 2009 edition was to replace the references to NFPA 255 with ANSI/UL 723 and ASTM E84, because NFPA 255 was withdrawn. All three test standards were quite similar.

The changes in the 2012 edition were edition updates of the referenced standards.

For the 2015 edition, the changes were primarily editorial alterations, reference updates, and clarifications of existing language. Also, a section and test method for air dispersion systems was added.

For the 2018 edition, the changes were primarily editorial alterations, reference updates, clarifications of existing language, and corrections for changes of terminology. Also, an option for testing flame spread of plastic pipe for use in plenums was added.

For the 2021 edition, the changes primarily consisted of editorial alterations, reference updates, and updates to existing language. In the referenced publications, all UL publications were updated to remove the term *ANSI* for clarification.

The 2024 edition provides substantial changes to the standard as a result of a comprehensive review by the committee. First, the document has been reorganized to provide ease-of-use to the reader. The requirements previously found within Chapter 4, *HVAC Systems*, and Chapter 5, *Integration of Ventilation and Air-Conditioning System(s) with Building Construction*, have been separated and provided in new chapters (Chapters 4-10). Next, several technical changes have been incorporated. These include, but are not limited to, new requirements for the use of UL 586 regarding air filters (Chapter 4); for ultraviolet (UV-C) germicidal lamp systems (Chapter 5); for mechanical, electrical, and plumbing controls (Chapter 6); and for requirements and definitions for combination fire-smoke dampers and corridor dampers (Chapter 3, as well as other chapters). Finally, editorial changes and updates to referenced publications have been provided.

Technical Committee on Air Conditioning

Dwayne Sloan, *Chair*
UL LLC, NC [RT]

Kevin Carr, *Administrative Secretary*
National Fire Protection Association, MA

Joseph F. Andre, Steel Tube Institute, WA [M]
Rep. Steel Tube Institute of North America

Justin B. Biller, Emerson Graham + Associates, VA [SE]

Alberto Cusimano, Dupont International SA, Switzerland [U]

Dennis Dawe, CBRE, IN [U]

Brian Deacy, Atkore International, IL [M]
Rep. National Electrical Manufacturers Association

Jonathan Flannery, AHA - ASHE, UT [U]

Ralph D. Gerdes, Ralph Gerdes Consultants, LLC, IN [SE]

Jonathan Hartsell, Rodgers, NC [IM]

Marcelo M. Hirschler, GBH International, CA [M]
Rep. North American Flame Retardant Alliance/Plenum Cable Assn.

Eli P. Howard, III, Sheet Metal & Air Conditioning Contractors Natl. Assn., VA [IM]

Anthony Hurst, Mason & Hanger, KY [SE]

Kevin D. Kalakay, State Of Michigan, MI [E]

Ralph A. Koerber, ATCO Rubber Products, Inc., TX [M]
Rep. Air Duct Council

William E. Koffel, Koffel Associates, Inc., MD [M]
Rep. Plastics Industry Association (Plastics)

Nanette Lockwood, Trane Technologies, CO [IM]
Rep. American Society of Heating, Refrigeration & Air Conditioning Engineers Inc.

Ajay V. Prasad, JENSEN HUGHES, MD [SE]

Rodger Reiswig, Johnson Controls, VA [M]
Rep. Automatic Fire Alarm Association, Inc.

Michael L. Savage, Sr., Marion County Building Safety, FL [E]

Michael Schmeida, Gypsum Association, OH [M]

John M. Wright, SMART 20, IN [L]

Alternates

Matthew Buehrer, Buehrer Alarm Systems Consulting LLC, AZ [M]
(Alt. to Rodger Reiswig)

Jay Burris, Wheatland Tube (Div. of Zekelman Industries), OH [M]
(Alt. to Joseph F. Andre)

Charles C. Cottrell, North American Insulation Manufacturers Assn., VA [M]
(Voting Alt.)

Timothy Earl, GBH International, MI [M]
(Alt. to Marcelo M. Hirschler

Juan Carlos Hernandez, JENSEN HUGHES, FL [SE]
(Alt. to Ajay V. Prasad)

Amando Lyndyll Hisole, ccrd partners, TX [SE]
(Voting Alt.)

Harold C. Ohde, IBEW 134/Electrical Joint Apprenticeship Training & Trust, IL [L]
(Voting Alt.)

Michelle Sluga, UL LLC, IL [RT]
(Alt. to Dwayne Sloan)

Mark Terzigni, Sheet Metal & Air Conditioning Contractors Natl. Assn., VA [IM]
(Alt. to Eli P. Howard, III)

Kevin Carr, NFPA Staff Liaison

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.

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.

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.

Contents

NFPA 90A

Standard for the

Installation of Air-Conditioning and Ventilating Systems

2024 Edition

IMPORTANT NOTE: This NFPA document is made available for use subject to important notices and legal disclaimers. These notices and disclaimers appear in all publications containing this document and may be found under the heading "Important Notices and Disclaimers Concerning NFPA Standards." They can also be viewed at www.nfpa.org/disclaimers or obtained on request from NFPA.

UPDATES, ALERTS, AND FUTURE EDITIONS: New editions of NFPA codes, standards, recommended practices, and guides (i.e., NFPA Standards) are released on scheduled revision cycles. This edition may be superseded by a later one, or it may be amended outside of its scheduled revision cycle through the issuance of Tentative Interim Amendments (TIAs). An official NFPA Standard at any point in time consists of the current edition of the document, together with all TIAs and Errata in effect. To verify that this document is the current edition or to determine if it has been amended by TIAs or Errata, please consult the National Fire Codes® Subscription Service or the "List of NFPA Codes & Standards" at www.nfpa.org/docinfo. In addition to TIAs and Errata, the document information pages also include the option to sign up for alerts for individual documents and to be involved in the development of the next 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.

A reference in brackets [ ] following a section or paragraph indicates material that has been extracted from another NFPA document. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

Information on referenced and extracted 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–ceiling 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 over 708 m^3 (25,000 ft^3) 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, Quincy, MA 02169-7471.

NFPA 30, *Flammable and Combustible Liquids Code,* 2024 edition.

NFPA 31, *Standard for the Installation of Oil-Burning Equipment,* 2020 edition.

NFPA 54, *National Fuel Gas Code,* 2024 edition.

NFPA 70®, National Electrical Code®, 2023 edition.

NFPA 72®, National Fire Alarm and Signaling Code®, 2022 edition.

NFPA 75, *Standard for the Fire Protection of Information Technology Equipment,* 2020 edition.

NFPA 80, *Standard for Fire Doors and Other Opening Protectives,* 2022 edition.

NFPA *101®, Life Safety Code®,* 2024 edition.

NFPA 105, *Standard for Smoke Door Assemblies and Other Opening Protectives,* 2022 edition.

NFPA 259, *Standard Test Method for Potential Heat of Building Materials,* 2023 edition.

NFPA 262, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces,* 2023 edition.

NFPA 275, *Standard Method of Fire Tests for the Evaluation of Thermal Barriers,* 2022 edition.

NFPA 286, *Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth,* 2024 edition.

NFPA 5000®, Building Construction and Safety Code®, 2024 edition.

2.3 Other Publications.

2.3.1 ASHRAE Publications. ASHRAE, 180 Technology Parkway, Peachtree Corners, GA 30092.

ASHRAE 15 (packaged with ASHRAE 34), *Safety Standard for Refrigeration Systems and Designation and Safety Classification of Refrigerants* (ANSI Approved), 2019.

ASHRAE Handbook — HVAC Systems and Equipment, 2020.

2.3.2 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM C411, *Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation*, 2019.

ASTM D93, *Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester*, 2020.

ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, 2022.

ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, 2020.

ASTM E136, *Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C*, 2022.

ASTM E2231, *Standard Practice for Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics*, 2021.

ASTM E2652, *Standard Test Method for Assessing Combustibility of Materials Using a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750°C*, 2018.

ASTM E2965, *Standard Test Method for Determination of Low Levels of Heat Release Rate for Materials and Products Using an Oxygen Consumption Calorimeter*, 2022.

2.3.3 GA Publications. Gypsum Association, 962 Wayne Avenue, Suite 620, Silver Spring, MD 20910.

GA-600, *Fire Resistance and Sound Control Design Manual*, 2021.

2.3.4 NAIMA Publications. North American Insulation Manufacturers Association, P.O. Box 1906, Alexandria, VA 22313.

Fibrous Glass Duct Construction Standards, 5th edition, 2002.

2.3.5 SMACNA Publications. Sheet Metal and Air Conditioning Contractors' National Association, 4201 Lafayette Center Drive, Chantilly, VA 20151-1219.

ANSI/SMACNA 016, *HVAC Air Duct Leakage Test Manual*, 2nd edition, 2012.

Fibrous Glass Duct Construction Standards, 8th edition, 2021.

HVAC Duct Construction Standards — Metal and Flexible, 4th edition, 2020.

2.3.6 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

UL 181, *Factory-Made Air Ducts and Air Connectors*, 2013, revised 2021.

UL 181A, *Closure Systems for Use with Rigid Air Ducts*, 2013, revised 2021.

UL 181B, *Closure Systems for Use with Flexible Air Ducts and Air Connectors*, 2013, revised 2021.

UL 263, *Fire Tests of Building Construction and Materials*, 2011, revised 2022.

UL 555, *Fire Dampers*, 2006, revised 2020.

UL 555C, *Ceiling Dampers*, 2014, revised 2021.

UL 555S, *Smoke Dampers*, 2014, revised 2020.

UL 586, *Safety for High-Efficiency, Particulate, Air Filter Units*, 2009, revised 2017.

UL 723, *Test for Surface Burning Characteristics of Building Materials*, 2018.

UL 867, *Electrostatic Air Cleaners*, 2011, revised 2021.

UL 900, *Air Filter Units*, 2015, revised 2022.

UL 1598, *Luminaires*, 2021.

UL 1820, *Fire Test of Pneumatic Tubing for Flame and Smoke Characteristics*, 2004, revised 2021.

UL 1887, *Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics*, 2004, revised 2021.

UL 1995, *Heating and Cooling Equipment*, 2015, revised 2022.

UL 2024, *Cable Routing Assemblies and Communications Raceways*, 2014, revised 2021.

UL 2043, *Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces*, 2013, revised 2018.

UL 2518, *Air Dispersion Systems*, 2016, revised 2021.

UL 2846, *Fire Test of Plastic Water Distribution Plumbing Pipe for Visible Flame and Smoke Characteristics*, 2014, revised 2021.

UL 60335-2-40, *Household and Similar Electrical Appliances — Safety — Part 2-40: Particular Requirements for Electrical Heat Pumps, Air-Conditioners and Dehumidifiers*, 2019.

2.3.7 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2020.

Δ 2.4 References for Extracts in Mandatory Sections.

NFPA 80, *Standard for Fire Doors and Other Opening Protectives*, 2022 edition.

NFPA 90B, *Standard for the Installation of Warm Air Heating and Air-Conditioning Systems*, 2024 edition.

NFPA *101®*, *Life Safety Code®*, 2024 edition.

NFPA 211, *Standard for Chimneys, Fireplaces, Vents, and Solid Fuel–Burning Appliances*, 2024 edition.

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 defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary,* 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or 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 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.

3.2.6 Standard. An NFPA standard, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA manuals of style. When used in a generic sense, such as in the phrase "standards development process" or "standards development activities," the term "standards" includes all NFPA standards, including codes, standards, recommended practices, and guides.

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.

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 systems. [**90B,** 2024]

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 Continued Progressive Combustion. A flame front progressing more than 3.2 m (10.5 ft) beyond the centerline of the burners during a test in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for Surface Burning Characteristics of Building Materials*.

3.3.14 Damper.

3.3.14.1* *Ceiling Radiation Damper.* A listed device installed in a ceiling membrane of a fire-resistance-rated floor–ceiling or roof–ceiling assembly to automatically limit the radiative heat transfer through an air inlet/outlet opening.

3.3.14.2 *Combination Fire-Smoke Damper.* A listed device installed in the ducts or air transfer openings of fire-resistance-rated walls, barriers, partitions, or floors that meets both fire damper and smoke damper requirements.

N **3.3.14.3 *Corridor Damper.*** A listed device intended for use where air ducts penetrate or terminate at horizontal openings in the ceilings of fire-resistance-rated corridors and where the corridor ceiling is constructed as required for the corridor walls.

3.3.14.4* *Fire Damper.* A listed device installed in an air distribution system and designed to close automatically upon detection of heat, to interrupt migratory airflow, and to restrict the passage of flame.

Δ **3.3.14.5* *Smoke Damper.*** A listed device within an air distribution system to control the movement of smoke.

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

3.3.16 Fan. A blower or exhauster assembly comprising blades or runners and housings or casings. [**211,** 2024]

3.3.17* 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 ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, or UL 263, *Fire Tests of Building Construction and Materials*.

3.3.18 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.

3.3.19* Flame Spread Index. A comparative measure, expressed as a dimensionless number, derived from visual measurements of the spread of flame versus time for a material tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for Surface Burning Characteristics of Building Materials*. [***101,*** 2024]

Δ **3.3.20 Foam Plastic Insulation.** A cellular plastic, used for thermal insulating or acoustical applications, having a density of 20 lb/ft^3 (320 kg/m^3) or less, containing open or closed cells, and formed by a foaming agent. [***101,*** 2024]

N **3.3.21 Fusible Link.** A device consisting of two strips of metal soldered together with a fusible alloy that is designed to melt at a specific temperature and is the triggering device for fire dampers, ceiling radiation dampers, and mechanical automatic door release mechanisms, among others.

N **3.3.22 Heat-Responsive Device.** A mechanical or electrical device that actuates the closing mechanism of a damper or other device at a predetermined temperature.

3.3.23* Limited-Combustible (Material). See 4.3.2.

3.3.24* Noncombustible Material. See 4.3.1.

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

3.3.25.1 ***Air-Handling Unit Room Plenum.*** An individual room containing an air-handling unit(s) used to gather air from various sources and combine the air within the room before returning it to the air-handling unit.

3.3.25.2 ***Apparatus Casing Plenum.*** A sheet metal construction attached directly to a fan enclosure, fan coil unit, air-handling unit, or furnace bonnet for the purpose of connecting distribution ducts.

3.3.25.3 ***Ceiling Cavity Plenum.*** The space between the top of the finished ceiling and the underside of the floor above or the roof and used to supply air to the occupied area or to return air to or exhaust air from the occupied area.

3.3.25.4 ***Raised Floor Plenum.*** The space between the top of the finished floor and the underside of a raised floor and used to supply air to the occupied area or to return air to or exhaust air from the occupied area.

3.3.26 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.

Δ **3.3.27* Smoke Barrier.** A continuous membrane, or a membrane with discontinuities created by protected openings, where such membrane is designed and constructed to restrict the movement of smoke. [***101,*** 2024]

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

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

3.3.30* Smoke Developed Index. A comparative measure expressed as a dimensionless number, derived from measurements of smoke obstruction versus time in ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for 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*.

4.1.5 Air-handling equipment rooms shall meet the requirements of Section 5.11.

4.2 System Components.

4.2.1 Outside Air Intakes.

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

4.2.1.2* Outside air intakes shall be located so as to minimize the introduction of fire or smoke into the building.

4.2.1.2.1 Outside air intakes shall be equipped with an approved fire and/or smoke damper where not located to meet the requirements of 4.2.1.2. *(See Section 11.3 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, *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 comply with UL 900, *Air Filter Units*, or UL 586, *Safety for High-Efficiency, Particulate, Air Filter Units*, where applicable.

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 D93, *Standard Test Methods for Flash Point 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.

N **4.2.2.6** High-efficiency particulate air filters shall be installed in accordance with the manufacturer's written instructions.

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.

•

4.3 Materials.

4.3.1* Noncombustible Material.

Δ **4.3.1.1** A material that complies with any one of the following shall be considered a noncombustible material:

(1) The material, 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.
(2) The material is reported as passing ASTM E136, *Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C.*
(3) The material is reported as complying with the pass/fail criteria of ASTM E136 when tested in accordance with the test method and procedure in ASTM E2652, *Standard Test Method for Assessing Combustibility of Materials Using a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750°C.*

[***101:***4.6.13.1]

4.3.1.2 Where the term *limited-combustible* is used in this standard, it shall also include the term *noncombustible*. [***101:***4.6.13.2]

4.3.2 Limited-Combustible Material. A material shall be considered a limited-combustible material where one of the following is met:

(1) The conditions of 4.3.2.1 and 4.3.2.2, and the conditions of either 4.3.2.3 or 4.3.2.4, shall be met.
(2) The conditions of 4.3.2.5 shall be met.

[***101:***4.6.14]

4.3.2.1 The material shall not comply with the requirements for noncombustible material in accordance with 4.3.1. [***101:***4.6.14.1]

Δ **4.3.2.2** The material, in the form in which it is used, shall exhibit a potential heat value not exceeding 8141 kJ/kg (3500 Btu/lb) where tested in accordance with NFPA 259. [***101:***4.6.14.2]

Δ **4.3.2.3** The material shall have a structural base of noncombustible material with a surfacing not exceeding a thickness of 3.2 mm (⅛ in.) where the surfacing exhibits a flame spread index not greater than 50 when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for Surface Burning Characteristics of Building Materials.* [***101:***4.6.14.3]

Δ **4.3.2.4** The material shall be composed of materials that, in the form and thickness used, neither exhibit a flame spread index greater than 25 nor exhibit evidence of continued progressive combustion when tested in accordance with ASTM E84 or UL 723, and are of such composition that all surfaces that would be exposed by cutting through the material on any plane would neither exhibit a flame spread index greater than 25 nor exhibit evidence of continued progressive combustion when tested in accordance with ASTM E84 or UL 723. [***101:***4.6.14.4]

4.3.2.5 Materials shall be considered limited-combustible materials where tested in accordance with ASTM E2965, *Standard Test Method for Determination of Low Levels of Heat Release Rate for Materials and Products Using an Oxygen Consumption Calorimeter*, at an incident heat flux of 75 kW/m^2 for a 20-minute exposure and both of the following conditions are met:

(1) The peak heat release rate shall not exceed 150 kW/m^2 for longer than 10 seconds.
(2) The total heat released shall not exceed 8 MJ/m^2.

[***101:***4.6.14.5]

4.3.2.6 Where the term *limited-combustible* is used in this standard, it shall also include the term *noncombustible*. [***101:***4.6.14.6]

•

N Chapter 5 Equipment, Systems, and Rooms

N 5.1 Air-Cooling and Heating Equipment.

N 5.1.1 Installation.

N 5.1.1.1 Heating and cooling equipment shall be installed in accordance with the applicable NFPA standards and the manufacturer's instructions.

N 5.1.1.2 The equipment shall be approved for the specific installation. *(See 6.4.1.)*

N 5.2 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 6.4.1 and 6.4.2 unless otherwise specified in 5.2.1 or 5.2.2.

N 5.2.1 The requirements of 6.4.1 and 6.4.2 shall not apply to equipment tested and listed in accordance with UL 1995, *Heating and Cooling Equipment*, or UL 60335-2-40, *Household and Similar Electrical Appliances — Safety — Part 2-40: Particular Requirements for Electrical Heat Pumps, Air-Conditioners and Dehumidifiers.*

N 5.2.2 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.

N 5.3 Mechanical Cooling.

N 5.3.1 Mechanical refrigeration used with air duct systems shall be installed in accordance with recognized safety practices.

N 5.3.2 Installations conforming to ASHRAE 15 (packaged with ASHRAE 34), *Safety Standard for Refrigeration Systems and Designa-*

tion and Safety Classification of Refrigerants, shall be considered to be in compliance with the requirement in 5.3.1.

N **5.4 Furnaces.**

N **5.4.1** Oil-burning heating furnaces combined with cooling units in the same air duct system shall be installed in accordance with NFPA 31.

N **5.4.2** Gas-burning heating furnaces combined with cooling units in the same air duct system shall be installed in accordance with NFPA 54.

N **5.5 Duct Heaters.**

N **5.5.1** 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 6.5.3.

N **5.5.2** The installation of electrical duct heaters shall comply with the provisions of Part VI, "Duct Heaters," of Article 424 of *NFPA 70*.

N **5.6 Evaporative Coolers.** Combustible evaporation media shall not be used unless they meet the requirements of 4.2.2.2.

N **5.7 Applicable Ultraviolet (UV-C) Germicidal Lamp Systems.** Where applicable, ultraviolet (UV-C) germicidal lamp systems used within plenums shall be listed in accordance with UL 60335-2-40, *Household and Similar Electrical Appliances — Safety — Part 2-40: Particular Requirements for Electrical Heat Pumps, Air-Conditioners and Dehumidifiers*.

N **5.7.1** UV-C germicidal lamp systems shall be installed in accordance with the manufacturer's listing.

N **5.8 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.

N **5.9 Materials for Operation and Control of the Air Distribution System.**

N **5.9.1*** Wiring shall not be installed in air ducts, except as permitted in 5.9.2 or in Chapter 10.

N **5.9.2** Wiring shall not be installed through any openings protected by a fire damper, smoke damper, or combination fire-smoke damper.

N **5.9.3** Nonmetallic pneumatic tubing for control systems shall be permitted to have up to 457.2 mm (18 in.) of tubing that meets the requirements of 8.2.6.2 to connect to equipment.

N **5.10 Corridor Air Systems.**

N **5.10.1 Egress Corridors.**

N **5.10.1.1*** Egress corridors in health care, detention and correctional, and residential occupancies shall not be used as a portion of a supply, return, or exhaust air system serving adjoining areas unless otherwise permitted by 5.10.1.3.1 through 5.10.1.3.4.

N **5.10.1.2** Air movement between rooms and egress corridors in hospitals, nursing facilities, and ambulatory care facilities shall be permitted where the transfer of air is required for clinical purposes by other standards.

N **5.10.1.3** An air transfer opening(s) shall not be permitted in walls or in doors separating egress corridors from adjoining areas.

N **5.10.1.3.1** An air transfer opening(s) shall be permitted in walls or doors from toilet rooms, bathrooms, shower rooms, sink closets, and similar auxiliary spaces opening directly onto the egress corridor.

N **5.10.1.3.2** Where door clearances do not exceed those specified for fire doors in NFPA 80 air transfer caused by pressure differentials shall be permitted.

N **5.10.1.3.3** Use of egress corridors shall be permitted as part of an engineered smoke-control system.

N **5.10.1.3.4** Air transfer opening(s) shall be permitted in walls or in doors separating egress corridors from adjoining areas in detention and correctional occupancies with corridor separations of open construction (e.g., grating doors or grating partitions).

N **5.10.2 Exits.** Exit passageways, stairs, ramps, and other exits shall not be used as a part of a supply, return, or exhaust air system serving other areas of the building.

N **5.10.3* Smoke Control.** Where a smoke-control or exhaust system is required, it shall conform to the requirements of the building code of the authority having jurisdiction.

N **5.11 Air-Handling Equipment Rooms.**

N **5.11.1 General.** Air-handling equipment rooms shall be classified into the following three categories:

(1) Those used as air plenums (usually return air)
(2) Those with air ducts that open directly into a shaft
(3) Other air-handling unit rooms

N **5.11.2 Air-Handling Equipment Rooms Used as Plenum Space.** Air-handling equipment rooms used as plenums for supply or return air shall comply with Section 8.4.

N **5.11.3 Air-Handling Equipment Rooms That Have Air Ducts That Open Directly into a Shaft.**

N **5.11.3.1** Air-handling equipment rooms, including the protection of openings, shall be separated from shafts by construction having a fire resistance rating not less than that required for the shaft by Section 6.8.

N **5.11.3.2** Fire-resistant separation shall not be required for air-handling equipment rooms that are enclosed by construction having a fire resistance rating not less than that required for the shaft.

N **5.11.4 Other Spaces Housing Air-Handling Units.** Other spaces housing air-handling units shall meet the requirements of the building code of the authority having jurisdiction.

N Chapter 6 Air Ducts and Air Connectors

N 6.1* Air Distribution.

N 6.1.1 Air Ducts.

N 6.1.1.1 Air ducts shall be constructed of iron, steel, aluminum, copper, concrete, masonry, or clay tile, except as otherwise permitted in 6.1.1.2 or 6.1.1.3.

N 6.1.1.2 Class 0 or Class 1 rigid or flexible air ducts tested in accordance with UL 181, *Factory-Made Air Ducts and Air Connectors*, and installed in conformance with the conditions of listing shall be permitted to be used for ducts where air temperature in the ducts does not exceed 121°C (250°F) or where used as vertical ducts serving not more than two adjacent stories in height.

N 6.1.1.3 Gypsum Board Air Ducts.

N 6.1.1.3.1 Gypsum board having a flame spread index not exceeding 25 without evidence of continued progressive combustion and a smoke developed index not exceeding 50 when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for 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.

N 6.1.1.3.2 The air temperature limits of 6.1.1.3 shall not apply where gypsum board material is used for emergency smoke exhaust air ducts.

N 6.1.1.4 All air duct materials shall be suitable for continuous exposure to the temperature and humidity conditions of the environmental air in the air duct.

N 6.1.1.5 The materials, thickness, construction, and installation of ducts shall provide structural strength and durability.

N 6.1.1.5.1 Air ducts shall be considered to be in compliance with 6.1.1.5 where constructed and installed in accordance with the *ASHRAE Handbook — HVAC Systems and Equipment* and with one of the following as applicable:

(1) NAIMA *Fibrous Glass Duct Construction Standards*
(2) SMACNA *Fibrous Glass Duct Construction Standards*
(3) SMACNA *HVAC Duct Construction Standards — Metal and Flexible*
(4) ANSI/SMACNA 016, *HVAC Air Duct Leakage Test Manual*

N 6.1.1.6 Where no standard exists for the construction of air ducts, the ducts shall be constructed to withstand both the maximum positive and the maximum negative pressures of the system at fan shutoff.

N 6.1.1.7 A duct enclosure used for the multiple distribution or gathering of ducts or connectors shall be constructed of materials and methods specified in 6.1.1.

N 6.1.1.7.1 Electrical wires and cables and optical fiber cables within a duct enclosure shall comply with Section 5.9.

N 6.1.1.8 Air Dispersion Systems. Air dispersion systems shall meet the following criteria:

(1) They shall only be installed in entirely exposed locations.
(2) They shall always operate under positive pressure.
(3) They shall not penetrate fire-resistance-rated construction.
(4) They shall not pass through fire-resistance-rated construction.
(5) They shall be listed and labeled in accordance with UL 2518, *Air Dispersion Systems*.

N 6.2 Mechanical, Electrical, and Plumbing Controls.

N 6.2.1 Mechanical, electrical, and plumbing controls shall not be installed in air duct systems unless the controls are directly associated with the air distribution system and comply with 10.3.4.

N 6.2.2 Mechanical, electrical, and plumbing controls shall not be installed through fire dampers, smoke dampers, combination fire-smoke dampers, corridor dampers, or ceiling radiation dampers unless otherwise permitted by the manufacturer's installation instructions and the manufacturer's listing.

N 6.3 Air Connectors.

N 6.3.1 Air connectors shall be permitted to be used as limited-use, flexible air ducts that shall not be required to conform to the provisions for air ducts where they meet the requirements of 6.3.1.1 through 6.3.1.7.

N 6.3.1.1 Air connectors shall conform to the requirements for Class 0 or Class 1 air connectors when tested in accordance with UL 181, *Factory-Made Air Ducts and Air Connectors*.

N 6.3.1.2 Class 0 or Class 1 air connectors shall not be used for ducts containing air at temperatures in excess of 121°C (250°F).

N 6.3.1.3 Air connector runs shall not exceed 4.27 m (14 ft) in length.

N 6.3.1.4 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.

N 6.3.1.5 Air connectors shall not pass through floors.

N 6.3.1.6 An air connector shall not be interrupted by a short collar or any other fitting on one side and then connected to another air connector on the other side where penetrating a floor or a wall, partition, or enclosure of a vertical shaft that is required to have a fire resistance rating of 1 hour.

N 6.3.1.7 Multiple air connector runs shall not be spliced together to exceed the length limitation in 6.3.1.3.

N 6.3.1.8 Wiring shall not be installed in air connectors.

N 6.4 Supplementary Materials for Air Distribution Systems.

N 6.4.1* Pipe and duct insulation and 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 6.4.1.2 or 6.4.1.3, 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 ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or with UL 723, *Test for Surface Burning Characteristics of Building Materials*. Pipe and duct insulation and coverings, duct linings and their adhesives, and tapes shall use the specimen preparation and mounting procedures of ASTM E2231, *Standard Practice for Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics*.

N **6.4.1.1** Pipe and duct insulation shall be listed and labeled.

N **6.4.1.2** The flame spread index and smoke developed index requirements of 6.4.1 shall not apply to air duct weatherproof coverings where they are located entirely outside a building, do not penetrate a wall or roof, and do not create an exposure hazard.

N **6.4.1.3** Smoke detectors required by 11.4.4 shall not be required to meet flame spread index or smoke developed index requirements.

N **6.4.2** Closure systems for use with rigid and flexible air ducts tested in accordance with UL 181, *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, *Closure Systems for Use with Rigid Air Ducts*
(2) UL 181B, *Closure Systems for Use with Flexible Air Ducts and Air Connectors*

N **6.4.3** Coverings and linings for air ducts, pipes, plenums, and panels, including all pipe and duct insulation materials, shall not flame, glow, smolder, or smoke when tested in accordance with ASTM C411, *Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation*, at the temperature to which they are exposed in service. In no case shall the test temperature be below 121°C (250°F).

N **6.4.4** 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 NFPA 80.

N **6.4.5*** Air duct linings shall be interrupted at fire dampers to prevent interference with the operation of devices.

N **6.4.6** Air duct coverings shall not be installed so as to conceal or prevent the use of any service opening.

N **6.4.7*** Wall or ceiling finish in plenums shall comply with Section 8.6.

N **6.5 Air Duct Access and Inspection.**

N **6.5.1** A service opening shall be provided in air ducts adjacent to each fire damper, smoke damper, combination fire-smoke damper, and any smoke detectors that need access for installation, cleaning, maintenance, inspection, and testing.

N **6.5.1.1** The opening shall be large enough to permit maintenance and resetting of the device.

N **6.5.2** Service openings shall be identified with letters having a minimum height of 12.7 mm (½ in.) to indicate the location of the fire protection device(s) within.

N **6.5.3** Horizontal air ducts and plenums shall be provided with service openings to facilitate the removal of accumulations of dust and combustible materials.

N **6.5.3.1** 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 permitted in 6.5.3.2 through 6.5.3.4.

N **6.5.3.2** Removable air outlet or air inlet devices of adequate size shall be permitted in lieu of service openings.

N **6.5.3.3** 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.

N **6.5.3.4** 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 [1.8 mm (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).

N **6.5.4** Inspection windows shall be permitted in air ducts, provided they are glazed with wired or fire protection–rated glass.

N **6.5.5** Openings in walls or ceilings shall be provided so that service openings in air ducts are accessible for maintenance and inspection needs.

N **6.5.6** Where a service opening is necessary in an air duct located above the ceiling of a floor–ceiling or a roof–ceiling assembly that has been tested and assigned a fire resistance rating in accordance with ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, or UL 263, *Fire Tests of Building Construction and Materials*, access shall be provided in the ceiling.

N **6.5.7** The service opening shall be designed and installed so that it does not reduce the fire resistance rating of the assembly.

N **6.6 Air Duct Integrity.**

N **6.6.1** Air ducts shall be located where they are not subject to damage or rupture, or they shall be protected to maintain their integrity.

N **6.6.2** Where an air duct is located outdoors, the air duct, together with its covering or lining, shall be protected from harmful elements.

N **6.6.3** 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.

N **6.6.3.1** For air ducts rated as Class 1 in accordance with UL 181, *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 6.5.3 in order to meet the clearances specified as a condition of the equipment listing, unless otherwise permitted in 6.5.3.2 or 6.5.3.3.

N **6.6.3.2** Appliances listed for zero clearance from combustibles shall be permitted to be installed in accordance with the conditions of their listings.

N **6.6.3.3** 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.

N 6.7 Building Construction.

N 6.7.1 Air Duct Clearance.

N 6.7.1.1 The clearance from metal air ducts used for heating to assemblies constructed of combustible materials, including plaster on wood lath, shall be not less than 12.7 mm (½ in.), or the combustible material shall be protected with minimum 6.35 mm (¼ in.) thick approved insulating material.

N 6.7.1.2 The integrity of the firestopping and smokestopping shall be maintained.

N 6.7.1.3 The clearances provided in 6.7.1.1 shall not apply to systems used solely for ventilation, air cooling, or air conditioning without heating.

N 6.7.2 Structural Members. The installation of air ducts, including the hangers, shall not reduce the fire resistance rating of structural members.

N 6.7.3 Ceiling Assemblies. Where the installation of the hangers for the components of an air duct system penetrates an existing ceiling of a fire-resistive floor–ceiling or roof–ceiling assembly and necessitates removal of a portion of that ceiling, the replacement material shall be identical to that which was removed or shall be approved as equivalent to that which was removed.

N 6.7.4 As an alternative to repairing the existing ceiling, a new ceiling shall be permitted to be installed below the air duct system, provided the fire resistance rating of the floor–ceiling or roof–ceiling design is not reduced.

N 6.8 Shafts.

N 6.8.1 Air ducts that pass through the floors of buildings that require the protection of vertical openings shall be enclosed with partitions or walls constructed of materials as permitted by the building code of the authority having jurisdiction, as indicated in 6.8.2 or 6.8.3, unless otherwise permitted by 6.8.3.1.

N 6.8.2 The shaft enclosure shall have a minimum fire resistance rating (based on possible fire exposure from either side of the partition or wall) of 1 hour where such air ducts are located in a building less than four stories in height.

N 6.8.3 The shaft enclosure shall have a minimum fire resistance rating (based on possible fire exposure from either side of the partition or wall) of 2 hours where such air ducts are located in a building four stories or more in height.

N 6.8.3.1 Where an air duct penetrates only one floor or one floor and an air-handling equipment penthouse floor, and the air duct contains a fire damper located where the duct penetrates the floor, an air duct enclosure shall not be required.

N 6.8.4 A fire-resistive enclosure used as an air duct shall conform with 6.1.1 and with 6.8.2 through 6.8.3.1.

N 6.8.4.1 Gypsum board systems shall be constructed in accordance with GA-600, *Fire Resistance and Sound Control Design Manual*.

N 6.8.5 Shafts that constitute air ducts or that enclose air ducts used for the movement of environmental air shall not enclose the following:

(1) Exhaust ducts used for the removal of smoke- and grease-laden vapors from cooking equipment
(2) Ducts used for the removal of flammable vapors
(3) Ducts used for moving, conveying, or transporting stock, vapor, or dust
(4) Ducts used for the removal of nonflammable corrosive fumes and vapors
(5) Refuse and linen chutes
(6) Piping, except for noncombustible piping conveying water or other nonhazardous or nontoxic materials
(7) Combustible storage

N Chapter 7 Vibration Isolation Connectors, Air Outlets, and Air Inlets

N 7.1 Vibration Isolation Connectors.

N 7.1.1 Vibration isolation connectors in duct systems shall be made of materials having a maximum flame spread index of 25 and a maximum smoke developed index of 50.

N 7.2 Air Outlets.

N 7.2.1 General. Air supplied to any space shall not contain flammable vapors, flyings, or dust in quantities and concentrations that would introduce a hazardous condition.

N 7.2.2 Construction of Air Outlets. Air outlets shall be constructed of noncombustible material or of a material that has a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for Surface Burning Characteristics of Building Materials*.

N 7.2.3 Location of Air Outlets.

N 7.2.3.1 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.

N 7.2.3.2 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.

N 7.3 Air Inlets — Return or Exhaust or Return and Exhaust.

N 7.3.1 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.

N 7.3.2 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 when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for Surface Burning Characteristics of Building Materials*.

N 7.3.3 Location of Air Inlets.

N 7.3.3.1 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.

N 7.3.3.2 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.

N Chapter 8 Plenums

N 8.1 Plenums.

N 8.1.1 Storage.

N 8.1.1.1 Plenums shall not be used for occupancy or storage.

N 8.1.1.2 Accessible abandoned material shall be deemed to be in storage and shall be removed. Where cables are identified for future use with a tag, the tag shall be of sufficient durability to withstand the environment involved.

N 8.2 Ceiling Cavity Plenum. The space between the top of the finished ceiling and the underside of the floor or roof above shall be permitted to be used to supply air to the occupied area or to return or exhaust air from the occupied area, provided that the conditions in 8.2.1 through 8.2.7 are met.

N 8.2.1 The integrity of the fire and smoke stopping for penetrations shall be maintained.

N 8.2.2 Light diffusers, other than those made of metal or glass, used in air-handling luminaires shall be listed in accordance with UL 1598, *Luminaires*, and marked "Light Diffusers for Air-Handling Luminaires."

N 8.2.3 The temperature of air delivered to these plenums shall not exceed 121°C (250°F).

N 8.2.4 Materials used in the construction of a ceiling plenum shall be noncombustible or shall be limited combustible having a maximum smoke developed index of 50, except as permitted in 8.2.4.1 through 8.2.4.3, and shall be suitable for continuous exposure to the temperature and humidity conditions of the environmental air in the plenum.

N 8.2.4.1 Materials used in the construction of a plenum space between the ceiling and roof (or floor) of other than the fire-resistive assemblies covered in 9.2.3 shall be permitted as specified in 8.2.4.2 and 8.2.4.3.

N 8.2.4.2 The ceiling material shall have a flame spread index of not more than 25 and a smoke developed index not greater than 50. All surfaces, including those that would be exposed by cutting through the material in any way, shall meet these requirements.

N 8.2.4.3 The ceiling materials shall be supported by noncombustible material.

N 8.2.5 Where the plenum is a part of a floor–ceiling or roof–ceiling assembly that has been tested or investigated and assigned a fire resistance rating of 1 hour or more, the assembly shall meet the requirements of 9.2.3.

N 8.2.6 Materials within a ceiling cavity plenum exposed to the airflow shall meet one of the following conditions:

(1) Be noncombustible
(2) Be limited combustible in accordance with 4.3.2
(3) Exhibit a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for Surface Burning Characteristics of Building Materials*
(4) Comply with 8.2.6.1 through 8.2.6.10, as applicable

N 8.2.6.1 Electrical wires and cables and optical fiber cables shall be listed as having a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with NFPA 262 or shall be installed in metal raceways without an overall nonmetallic covering, metal sheathed cable without an overall nonmetallic covering, or totally enclosed nonventilated metallic busway without an overall nonmetallic covering.

N 8.2.6.2 Pneumatic tubing for control systems shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL 1820, *Fire Test of Pneumatic Tubing for Flame and Smoke Characteristics*.

N 8.2.6.3 Nonmetallic fire sprinkler piping shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL 1887, *Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics*.

N 8.2.6.4 Communications raceways shall be listed as having a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL 2024, *Cable Routing Assemblies and Communications Raceways*.

N 8.2.6.5* Loudspeakers, recessed lighting fixtures, and other electrical equipment with combustible enclosures, including their assemblies and accessories, nonmetallic cable ties, wraps, nonmetallic cable supports, and other discrete products, shall be permitted in the ceiling cavity plenum where listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a peak heat release rate of 100 kW or less when tested in accordance with UL 2043, *Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces*.

N 8.2.6.6 Plastic piping and tubing used in plumbing systems shall be permitted to be used within a ceiling cavity plenum if it exhibits a flame spread index of 25 or less and a smoke developed index of 50 or less when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for Surface Burning Characteristics of Building Materials*, at full width of the tunnel and with no water or any other liquid in the pipe during the test, unless permitted by 8.2.6.7.

N 8.2.6.7 Plastic water distribution piping and tubing listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL 2846, *Fire Test of Plastic Water Distribution Plumbing Pipe for Visible Flame and Smoke Characteristics*, and installed in accordance with its listing, shall be permitted to be used within a ceiling cavity plenum.

N 8.2.6.8 Supplementary materials for air distribution systems shall be permitted provided they comply with the provisions of Section 6.4.

N 8.2.6.9 Smoke detectors shall not be required to meet the provisions of Section 6.1.

N 8.2.6.10 Air ducts complying with 6.1.1.2 and air connectors complying with 6.3 shall be permitted.

N 8.2.7 The accessible portion of abandoned materials exposed to airflow shall be removed.

N 8.3 Apparatus Casing Plenum.

N 8.3.1 A fabricated plenum and apparatus casing shall be permitted to be used for supply, return, or exhaust air service.

N 8.3.2 Fabricated plenum and apparatus casing shall be constructed of materials and by methods specified in 6.1.1 and in accordance with the following:

(1) The casing and plenum construction standards in SMACNA *HVAC Duct Construction Standards — Metal and Flexible*
(2) *ASHRAE Handbook — HVAC Systems and Equipment*
(3) Subsection 6.4 for all air duct coverings, duct lining, acoustical liner/cells, and miscellaneous materials

N 8.3.3 Electrical wires and cables and optical fiber cables shall comply with Section 5.9.

N 8.4 Air-Handling Unit Room Plenum.

N 8.4.1* Individual rooms containing an air-handling unit(s) shall gather air from various sources and combine the air within the room before returning it to the air-handling unit.

N 8.4.2 Duct covering, duct lining, acoustical liner/cells, and miscellaneous materials shall comply with Section 6.4.

N 8.4.3 Air-handling unit room plenums shall not be used for storage or occupancy other than during equipment servicing.

N 8.4.4 Accessible abandoned material shall be deemed to be in storage and shall be removed. Where cables are identified for future use with a tag, the tag shall be of sufficient durability to withstand the environment involved.

N 8.4.5 Materials used in the construction of an air-handling unit room plenum shall be noncombustible or shall be limited combustible having a maximum smoke developed index of 50 and shall be suitable for continuous exposure to the temperature and humidity conditions of the environmental air in the plenum.

N 8.4.6* Electrical wires and cables and optical fiber cables shall be listed as having a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with NFPA 262 or shall be installed in metal raceways, metal sheathed cable, or totally enclosed nonventilated busway.

N 8.5 Raised Floor Plenum.

N 8.5.1 The space between the top of the finished floor and the underside of a raised floor shall be permitted to be used to supply air to the occupied area or return or exhaust air from or return and exhaust air from the occupied area, provided that the conditions in 8.5.2 through 8.5.6 are met.

N 8.5.2 The integrity of the firestopping for penetrations shall be maintained.

N 8.5.3 The temperature of air delivered to these plenums shall not exceed 121°C (250°F).

N 8.5.4 Materials used in the construction of a raised floor plenum shall be noncombustible or limited-combustible materials, shall have a maximum peak smoke developed index of 50, and shall be suitable for continuous exposure to the temperature and humidity conditions of the environmental air in the plenum.

N 8.5.5 Materials within a raised floor plenum exposed to the airflow shall meet one of the following conditions:

(1) Be noncombustible
(2) Be limited combustible in accordance with 4.3.2
(3) Exhibit a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for Surface Burning Characteristics of Building Materials*
(4) Comply with 8.5.5.1 through 8.5.5.10, as applicable

N 8.5.5.1 Electrical wires and cables and optical fiber cables shall be listed as having a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with NFPA 262 or shall be installed in metal raceways, metal sheathed cable, or totally enclosed nonventilated busway.

N 8.5.5.2 Pneumatic tubing for control systems shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL 1820, *Fire Test of Pneumatic Tubing for Flame and Smoke Characteristics*.

N 8.5.5.3 Nonmetallic fire sprinkler piping shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL 1887, *Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics*.

N 8.5.5.4 Communications raceways shall be listed as having a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL 2024, *Cable Routing Assemblies and Communications Raceways*. Cables installed within these raceways shall be listed as plenum cable in accordance with the requirements in 8.5.5.1.

N 8.5.5.5 Raised floors, intermachine cables, electrical wires, listed plenum communications raceways, and optical-fiber cables in computer/data processing rooms where these rooms are designed and installed in accordance with NFPA 75 shall be permitted.

N 8.5.5.6 Loudspeakers, recessed lighting fixtures, and other electrical equipment with combustible enclosures, including their assemblies and accessories, nonmetallic cable ties, wraps, nonmetallic cable supports, and other discrete products, shall be permitted in the raised floor plenum where listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a peak heat release rate of 100 kW or less when tested in accordance with UL 2043, *Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces*.

N 8.5.5.7 Plastic piping and tubing used in plumbing systems shall be permitted to be used within a raised floor plenum if it exhibits a flame spread index of 25 or less and a smoke developed index of 50 or less when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of*

Building Materials, or UL 723, *Test for Surface Burning Characteristics of Building Materials*, at full width of the tunnel and with no water or any other liquid in the pipe during the test, unless otherwise permitted by 8.5.5.8.

N **8.5.5.8** Plastic water distribution piping and tubing listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL 2846, *Fire Test of Plastic Water Distribution Plumbing Pipe for Visible Flame and Smoke Characteristics*, and installed in accordance with its listing, shall be permitted to be used within a raised floor plenum.

N **8.5.5.9** Air ducts complying with 6.1.1.2 and air connectors complying with 6.3 shall be permitted.

N **8.5.5.10** Smoke detectors shall not be required to meet the requirements of 8.5.1.

N **8.5.6** The accessible portion of abandoned materials exposed to airflow shall be removed. Where cables are identified for future use with a tag, the tag shall be of sufficient durability to withstand the environment involved.

N 8.6 Wall or Ceiling Finish in Plenums.

N **8.6.1** Wall or ceiling finish in plenums, except as indicated in 8.6.2, shall be noncombustible or shall exhibit a flame spread index of 25 or less and a smoke developed index of 50 or less, when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials,* or UL 723, *Test for Surface Burning Characteristics of Building Materials*, at the maximum thickness intended for use.

N **8.6.2** Foam plastic insulation shall not be used as wall or ceiling finish in plenums unless the insulation meets any one of the criteria shown in 8.6.2.1 through 8.6.2.4.

N **8.6.2.1** The foam plastic insulation material shall exhibit a flame spread index of 25 or less and a smoke developed index of 50 or less when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials,* or UL 723, *Test for Surface Burning Characteristics of Building Materials*, at the maximum thickness intended for use, and shall comply with the following criteria, when tested in accordance with NFPA 286 (where the testing shall be performed on the finished foam plastic assembly related to the actual end-use configuration and on the maximum thickness intended for use):

(1) Flame does not spread to the ceiling during the 40 kW exposure.
(2) Flame does not spread to the outer extremities of the sample.
(3) Flashover, based on the criteria from NFPA 286, does not occur.
(4) The peak heat release rate does not exceed 800 kW.
(5) The total smoke release does not exceed 1000 m^2 (1196 yd^2).

N **8.6.2.2** The foam plastic insulation material shall be covered by corrosion-resistant steel having a base metal thickness of not less than 0.4 mm (0.0160 in.) and shall exhibit a flame spread index of 75 or less and a smoke developed index of 450 or less when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for Surface Burning Characteristics of Building Materials*, at the maximum thickness intended for use.

N **8.6.2.3** The foam plastic insulation material shall be separated from the plenum by an approved thermal barrier consisting of 12.7 mm (0.5 in.) gypsum wallboard or a material that is tested in accordance with and meets the acceptance criteria of both the temperature transmission fire test and the integrity fire test of NFPA 275 and shall exhibit a flame spread index of 75 or less and a smoke developed index of 450 or less when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for Surface Burning Characteristics of Building Materials*, at the maximum thickness intended for use.

N **8.6.2.4** The foam plastic insulation material shall be separated from the plenum by not less than 25.4 mm (1.0 in.) of masonry or concrete and shall exhibit a flame spread index of 75 or less and a smoke developed index of 450 or less when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for Surface Burning Characteristics of Building Materials*, at the maximum thickness intended for use.

N Chapter 9 Dampers

N 9.1 Fire Dampers.

N **9.1.1** Approved fire dampers shall be provided as required in Chapter 9.

N **9.1.2** Approved fire dampers shall be installed in conformance with the conditions of their listings.

N **9.1.3** Fire dampers shall be installed at each direct or ducted opening into and out of enclosures required by 6.8.1, unless otherwise permitted by 9.1.3.1 or 9.1.3.2.

N **9.1.3.1** A fire damper shall not be required where an air duct system serving only one story is used only for exhaust of air to the outside and is contained within its own dedicated shaft.

N **9.1.3.2** A fire damper shall not be required where the following conditions exist:

(1) Branch ducts connect to enclosed exhaust risers meeting the requirements of 6.8.1 or 6.8.4.
(2) The airflow moves upward.
(3) Steel subducts at least 560 mm (22 in.) in length are carried up inside the riser from each inlet.
(4) The riser is appropriately sized to accommodate the flow restriction created by the subduct.

N 9.2* Penetrations — Protection of Openings.

N 9.2.1 Fire-Rated Walls and Partitions.

N **9.2.1.1*** Approved fire dampers shall be provided where air ducts penetrate or terminate at openings in walls or partitions required to have a fire resistance rating of 2 hours or more.

N **9.2.1.1.1*** Fire dampers shall not be required where other openings through the wall are not required to be protected.

N **9.2.1.1.2** Approved fire dampers shall be provided in all air transfer openings in partitions that are required to have a fire resistance rating and in which other openings are required to be protected.

N 9.2.2 Floors Required to Have a Fire Resistance Rating.

N **9.2.2.1** Where air ducts extend through only one floor and serve only two adjacent stories, the air ducts shall be enclosed

(see 6.8.1), or fire dampers shall be installed at each point where the floor is penetrated.

***N* 9.2.3* Floor–Ceiling or Roof–Ceiling Assemblies Having a Fire Resistance Rating.**

***N* 9.2.3.1** Where air ducts and openings for air ducts are used in a floor–ceiling or roof–ceiling assembly that is required to have a fire resistance rating, all the materials and the construction of the assembly, including the air duct materials and the size and protection of the openings, shall conform with the design of the fire-resistive assembly, as tested in accordance with ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, or UL 263, *Fire Tests of Building Construction and Materials*.

***N* 9.2.3.2** Where dampers are required, they shall be located in accordance with 9.4.3.

***N* 9.3 Smoke Dampers.**

***N* 9.3.1** Approved smoke dampers shall be provided as required in Chapter 9.

***N* 9.3.1.1** Approved smoke dampers shall be installed in conformance with the conditions of their listings.

***N* 9.3.1.2** Smoke dampers shall be installed in systems with a capacity greater than 7080 L/sec (15,000 ft^3/min) to isolate the air-handling equipment, including filters, from the remainder of the system on both the building supply side and the return side, in order to restrict the circulation of smoke, unless specifically exempted by 9.3.1.2.1 or 9.3.1.2.2.

***N* 9.3.1.2.1** Air-handling units located on the floor they serve and serving only that floor shall be exempt from the requirements of 9.3.1.2.

***N* 9.3.1.2.2** Air-handling units located on the roof and serving only the floor immediately below the roof shall be exempt from the requirements of 9.3.1.2.

***N* 9.4 Fire Dampers, Smoke Dampers, Combination Fire-Smoke Dampers, and Ceiling Dampers.**

***N* 9.4.1 Fire Dampers.**

***N* 9.4.1.1** Fire dampers used for the protection of openings in walls, partitions, or floors with fire resistance ratings of less than 3 hours shall have a 1½-hour fire protection rating in accordance with UL 555, *Fire Dampers*.

***N* 9.4.1.2** Fire dampers used for the protection of openings in walls, partitions, or floors having a fire resistance rating of 3 hours or more shall have a 3-hour fire protection rating in accordance with UL 555, *Fire Dampers*.

***N* 9.4.2* Smoke Dampers.** Smoke dampers used for the protection of openings in smoke barriers or in engineered smoke-control systems shall be classified in accordance with UL 555S, *Smoke Dampers*.

***N* 9.4.2.1** Smoke damper leakage ratings shall meet, as a minimum, Class II, and elevated temperature ratings shall be not less than 121°C (250°F).

***N* 9.4.3 Ceiling Dampers.**

N* 9.4.3.1 Ceiling dampers or other methods of protecting openings in rated floor–ceiling or roof–ceiling assemblies shall comply with the construction details of the tested floor–ceiling or roof–ceiling assembly or with listed ceiling air diffusers or listed ceiling dampers.

***N* 9.4.3.2** Ceiling dampers shall be tested in accordance with UL 555C, *Ceiling Dampers*.

***N* 9.4.4 Combination Fire-Smoke Dampers.**

***N* 9.4.4.1** Combination fire-smoke dampers used for the protection of openings in walls, partitions, or floors with fire resistance ratings of less than 3 hours shall have a 1½-hour fire protection rating in accordance with UL 555, *Fire Dampers*.

***N* 9.4.4.2** Combination fire-smoke dampers used for the protection of openings in walls, partitions, or floors with fire resistance ratings of 3 hours or more shall have a 3-hour fire protection rating in accordance with UL 555, *Fire Dampers*.

***N* 9.4.4.3** Combination fire-smoke dampers used for the protection of openings in smoke barriers or in engineered smoke-control systems shall be classified in accordance with UL 555S, *Smoke Dampers*.

***N* 9.4.4.4** Combination fire-smoke dampers shall meet the following requirements:

(1) Class II leakage ratings, as a minimum
(2) Elevated temperature ratings not less than 121°C (250°F)

***N* 9.4.5 Corridor Dampers.**

***N* 9.4.5.1** Corridor dampers shall comply with the requirements of UL 555, *Fire Dampers*, and UL 555S, *Smoke Dampers*.

***N* 9.4.5.2** Corridor dampers shall demonstrate acceptable closure performance when subjected to 0.76 m/s (150 ft/min) velocity across the face of the damper using the fire exposure test in accordance with UL 555, *Fire Dampers*.

***N* 9.4.5.3** Corridor dampers shall meet all of the following requirements:

(1) Have a 1-hour fire protection rating
(2) Meet Class II leakage ratings, as a minimum
(3) Have elevated temperature ratings not less than 121°C (250°F)

***N* 9.4.6 Damper Closure.**

***N* 9.4.6.1** All fire dampers and ceiling dampers shall close automatically.

***N* 9.4.6.2** All fire dampers and ceiling dampers shall remain closed upon the operation of a listed fusible link or other approved heat-actuated device located where it will be readily affected by an abnormal rise of temperature.

***N* 9.5 Fusible Links and Heat-Responsive Devices.**

***N* 9.5.1** Fusible links and all other approved heat-responsive devices shall have a temperature rating approximately 28°C (50°F) above the maximum temperature that normally is encountered when the system is in operation or shut down.

***N* 9.5.2** Fusible links and all other approved heat-responsive devices shall have a temperature rating not less than 71°C (160°F).

N* 9.5.2.1 Where combination fire-smoke dampers are located within air ducts that are part of an engineered smoke-control system, fusible links and all other approved heat-responsive devices shall have a temperature rating approximately 28°C

(50°F) above the maximum smoke-control system designed operating temperature.

N **9.5.2.2** Combination fire-smoke dampers shall not exceed the degradation test temperature rating conducted in accordance with UL 555S, *Smoke Dampers*.

N **9.5.2.3** Combination fire-smoke dampers shall not exceed a maximum temperature rating of 177°C (350°F).

N **9.5.3** A provision for remote opening of combination fire-smoke dampers, where necessary for smoke removal, shall be permitted.

N **9.5.3.1** Combination fire-smoke dampers permitted in 9.5.3 shall have provisions that allow them to reclose automatically upon reaching the damper's maximum degradation test temperature in accordance with UL 555S, *Smoke Dampers*.

N **9.5.4*** Dampers shall close against the maximum calculated airflow of that portion of the air duct system in which they are installed.

N **9.5.4.1** Fire dampers shall be tested for closure in accordance with UL 555, *Fire Dampers*.

N **9.5.4.2** Smoke dampers shall be tested for closure in accordance with UL 555S, *Smoke Dampers*.

N **9.5.4.3** Fire dampers, smoke dampers, and combination fire-smoke dampers shall not be required in ducts used for kitchen or clothes dryer exhaust systems.

N **9.6 Damper Location Information.**

N **9.6.1** The locations and mounting arrangement of all fire dampers, smoke dampers, ceiling dampers, and fire protection means of a similar nature required by this standard shall be shown on the drawings of the air duct systems.

N **9.6.2** Dampers required to close in airflow shall have the calculated airflow at their location shown on the drawings of the air duct system.

N **9.7 Installation.**

N **9.7.1*** Fire dampers, including their sleeves; smoke dampers; and ceiling dampers shall be installed in accordance with the conditions of their listings and the manufacturer's installation instructions and the requirements of NFPA 80.

N **9.7.2** Smoke dampers shall be installed in accordance with the conditions of their listings, the manufacturer's installation instructions, and the requirements of NFPA 105.

N **9.8 Maintenance.**

N **9.8.1** Fire dampers and ceiling dampers shall be maintained in accordance with NFPA 80.

N **9.8.2** Smoke dampers shall be maintained in accordance with NFPA 105.

N **9.9 Smoke Barriers.**

N **9.9.1** Smoke dampers shall be installed at or adjacent to the point where air ducts pass through required smoke barriers, but in no case shall a smoke damper be installed more than 0.6 m (2 ft) from the barrier or after the first air duct inlet or outlet, whichever is closer to the smoke barrier, unless otherwise permitted by 9.9.1.1 through 9.9.1.5.

N **9.9.1.1** Smoke dampers shall not be required on air systems other than where necessary for the proper functioning of that system where the system is designed specifically to accomplish the following:

(1) Function as an engineered smoke-control system, including the provision of continuous air movement with the air-handling system
(2) Provide air to other areas of the building during a fire emergency
(3) Provide pressure differentials during a fire emergency

N **9.9.1.2** Smoke dampers shall not be required to be located within a prescribed distance of a smoke barrier where isolation smoke dampers complying with 9.1.2 are used in air-handling equipment.

N **9.9.1.3** Smoke dampers shall not be required where the air inlet or outlet openings in ducts are limited to a single smoke compartment.

N **9.9.1.4** Smoke dampers shall not be required in ducts where the air continues to move and the air-handling system installed is arranged to prevent recirculation of exhaust or return air under fire emergency conditions.

N **9.9.1.5*** Smoke dampers shall not be required in occupancies where exempted by NFPA *101* or *NFPA 5000*.

N **9.9.2** Where penetration of a smoke barrier is required to be provided with a fire damper, a combination fire-smoke damper equipped and arranged to be both smoke responsive and heat responsive shall be permitted.

N Chapter 10 Electrical and Optical Fiber Wiring and Equipment in Plenums and Ducts

N **10.1 General.** The requirements of this chapter shall apply to the installation and use of electrical wiring and equipment in ducts used for dust, loose stock, or vapor removal; ducts specifically fabricated for environmental air; and other spaces used for environmental air (i.e., plenums).

N **10.2 Ducts Used for Dust, Loose Stock, or Vapor Removal.**

N **10.2.1** No wiring system of any type shall be installed in ducts used to transport dust, loose stock, or flammable vapors.

N **10.2.2** No wiring system of any type shall be installed in any duct or any shaft containing only such ducts used for vapor removal or for ventilation of commercial-type cooking equipment.

N **10.3 Ducts Specifically Fabricated for Environmental Air.**

N **10.3.1** This section shall apply to electrical and optical fiber wires and cables and equipment in ducts specifically fabricated for environmental air *(see Section 5.8)* and in apparatus casing plenums *(see Section 8.3)*.

N **10.3.2** The equipment, devices, and wiring methods specified in this section shall be permitted within the ducts specified in 10.3.1 only if necessary for the direct action upon or sensing of the contained air.

N **10.3.3** Where equipment or devices are installed and illumination is necessary to facilitate maintenance and repair, enclosed gasketed-type luminaires shall be permitted.

N **10.3.4** The following wiring methods shall be permitted in ducts specifically fabricated for environmental air:

(1) Type MI cable without an overall nonmetallic covering
(2) Type MC cable employing a smooth or corrugated impervious metal sheath without an overall nonmetallic covering
(3) Wiring in electrical metallic tubing, flexible metallic tubing, intermediate metal conduit, or rigid metal conduit without an overall nonmetallic covering
(4) Wiring methods and cabling systems, approved for use in other spaces used for environmental air (i.e., plenums) in accordance with 10.4.6, where the following conditions are met:
    (a) The wiring methods or cabling systems are necessary to connect to equipment or devices associated with the direct action upon or sensing of the contained air
    (b) The total length of such wiring methods or cabling systems does not exceed 1.2 m (4 ft)

N **10.4 Other Spaces Used for Environmental Air (i.e., Plenums).**

N **10.4.1 Applicability.**

N **10.4.1.1** This section shall apply to spaces used for air-handling purposes as a plenum but not specifically fabricated for environmental air-handling purposes.

N **10.4.1.2** This section shall apply to electrical and optical fiber wires and cables and equipment in ceiling cavity plenums, raised floor plenums, and apparatus casing plenums.

N **10.4.1.3** This section shall not apply to habitable rooms or areas of buildings for which the prime purpose is not air handling.

N **10.4.1.4** This section shall not apply to the joist or stud spaces of dwelling units where the wiring passes through perpendicular to the long dimension of such spaces.

N **10.4.2 Wiring Methods.** The wiring methods for other spaces used for environmental air (i.e., plenums) shall be limited to the following:

(1) Totally enclosed, nonventilated, insulated busway having no provisions for plug-in connections
(2) Type MI cable without an overall nonmetallic covering
(3) Type MC cable without an overall nonmetallic covering
(4) Listed prefabricated cable assemblies of metallic manufactured wiring systems without a nonmetallic sheath
(5) Wires and cables installed in electrical metallic tubing, flexible metallic tubing; intermediate metal conduit; rigid metal conduit without an overall nonmetallic covering; flexible metal conduit; or, where accessible, surface metal raceway or metal wireway with metal covers
(6) Type AC cable or other electrical or optical fiber cable approved for use within an air-handling space in accordance with 10.4.6

N **10.4.3 Cable Supports.**

N **10.4.3.1** Any of the wiring methods listed in 10.4.2 shall be permitted to be supported by being fully enclosed in metal cable tray systems or in solid side and bottom metal cable tray systems with solid metal covers.

N **10.4.3.2** Wires and cables approved for use within an air-handling space in accordance with 10.4.6 shall be permitted to be additionally supported by one of the following:

(1) Communications raceways approved for use within an air-handling space, in accordance with 10.4.7
(2) Cable routing assemblies approved for use within an air-handling space, in accordance with 10.4.7
(3) Open metal cable tray systems

N **10.4.4 Cable Accessories.** Nonmetallic cable ties and other nonmetallic cable accessories shall be permitted to be used to secure and support cables in other spaces used for environmental air (i.e., plenums) if they are listed as having low smoke and heat release properties in accordance with 10.4.8.

N **10.4.5 Equipment.** Electrical equipment with a metal enclosure, or electrical equipment with a nonmetallic enclosure other than integral fan systems specifically identified for use within an air-handling space, shall be permitted for use in other spaces used for environmental air (i.e., plenums) if they are listed in accordance with 10.4.8.

N **10.4.6 Electrical or Optical Fiber Wire and Cable Systems.** Electrical or optical fiber wire and cable systems approved for use in other spaces used for environmental air (i.e., plenums) shall be constructed of noncombustible material, constructed of limited-combustible material in accordance with 4.3.2, or listed in accordance with either of the following:

(1) Having a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for Surface Burning Characteristics of Building Material*
(2)* Having a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) when tested in accordance with NFPA 262

N **10.4.7 Listing of Communications Raceways or Cable Routing Assemblies.** Communications raceways or cable routing assemblies shall be approved for use in other spaces used for environmental air (i.e., plenums) when listed as having a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL 2024, *Cable Routing Assemblies and Communications Raceways*.

N **10.4.8 Listing of Plenum Equipment.** Nonmetallic cable ties and accessories and electrical equipment with a nonmetallic enclosure shall be approved for use in other spaces used for environmental air (i.e., plenums) when listed as having a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a peak heat release rate of 100 kW or less when listed in accordance with UL 2043, *Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces*.

Chapter 11 Controls

11.1 Wiring. The installation of electrical wiring and equipment associated with the operation and control of air-conditioning and ventilating systems shall be in accordance with *NFPA 70*.

11.2 Manual Control.

11.2.1 Each air distribution system shall be provided with at least one manually operable means for stopping the operation of the supply, return, and exhaust fan(s) in an emergency.

11.2.2 The means of manual operation shall be located at an approved location.

11.3* Smoke Dampers.

11.3.1 Smoke dampers shall be controlled by an automatic alarm-initiated device.

11.3.2* Smoke dampers shall be permitted to be positioned manually from a command station.

11.3.3 Smoke dampers installed to isolate the air-handling system in accordance with 9.3.1.2 shall be arranged to close automatically when the system is not in operation.

11.3.4* Smoke dampers shall be permitted to remain open when their associated fan is off, provided their associated controlling damper actuators and automatic alarm-initiating devices remain operational.

11.4* Smoke Detection for Automatic Control.

11.4.1 Testing. All automatic shutdown devices shall be tested at least annually.

11.4.2* Location.

11.4.2.1 Smoke detectors listed for use in air distribution systems shall be located as follows:

(1) Downstream of the air filters and ahead of any branch connections in air supply systems having a capacity greater than 944 L/sec (2000 ft^3/min)
(2) At each story prior to the connection to a common return and prior to any recirculation or fresh air inlet connection in air return systems having a capacity greater than 7080 L/sec (15,000 ft^3/min) and serving more than one story

11.4.2.2 Return system smoke detectors shall not be required where the entire space served by the air distribution system is protected by a system of area smoke detectors.

11.4.2.3 Smoke detectors shall not be required for fan units whose sole function is to remove air from the inside of the building to the outside of the building.

11.4.3* Function.

11.4.3.1 Smoke detectors provided as required by 11.4.2 shall automatically de-energize their respective fans upon detecting the presence of smoke.

11.4.3.2 Where the return air fan is functioning as part of an engineered smoke-control system and a different mode is required, the smoke detectors shall not be required to automatically stop their respective fans.

11.4.4 Installation.

11.4.4.1 Smoke detectors shall be installed, tested, and maintained in accordance with *NFPA 72*.

11.4.4.2 In addition to the requirements of 11.4.3, where an approved fire alarm system is installed in a building, the smoke detectors required by the provisions of Section 11.4 shall be connected to the fire alarm system in accordance with the requirements of *NFPA 72*.

11.4.4.2.1 Smoke detectors used solely for closing dampers or for heating, ventilating, and air-conditioning system shutdown shall not be required to activate the building evacuation alarm.

11.4.4.3 Where smoke detectors required by Section 11.4 are installed in a building not equipped with an approved fire alarm system as specified by 11.4.4.2, the following shall occur:

(1) Smoke detector activation required by Section 11.4 shall cause a visual signal and an audible signal in a normally occupied area.
(2) Smoke detector trouble conditions shall be indicated visually or audibly in a normally occupied area and shall be identified as air duct detector trouble.

11.4.4.4 Smoke detectors powered separately from the fire alarm system for the sole function of stopping fans shall not require standby power.

Chapter 12 Acceptance Testing

12.1 General.

12.1.1* An acceptance test shall be performed to determine that the protective measures required in this standard function when needed in order to restrict the spread of fire and smoke.

12.1.2 Records shall be maintained on acceptance test results.

12.1.2.1 Records shall be available for inspection.

12.2* Fire Dampers, Smoke Dampers, Combination Fire-Smoke Dampers, Corridor Dampers, and Ceiling Radiation Dampers. All fire dampers, smoke dampers, combination fire-smoke dampers, corridor dampers, and ceiling radiation dampers shall be operated prior to the occupancy of a building to determine that they function in accordance with the requirements of this standard.

Δ **12.2.1 Access.**

N **12.2.1.1** Dampers equipped with fusible links, internal operators, or both shall be provided with an access door that is not less than 305 mm (12 in.) square or that is provided with a removable duct section.

N **12.2.1.2** Access shall not be obstructed.

Δ **12.2.2 Testing.**

12.2.2.1 All fire dampers, smoke dampers, combination fire-smoke dampers, corridor dampers, and ceiling radiation dampers shall be tested to determine their proper functioning in accordance with the requirements of this standard prior to the occupancy of the building.

Δ **12.2.2.2** The operational test shall verify that there is full and unobstructed access to the damper and all listed components in accordance with NFPA 80.

•

12.3 Controls and Operating Systems.

12.3.1* Controls required by Chapter 11 shall be tested for compliance with the requirements of this standard.

12.3.2 Acceptance tests of fire protection devices in air-conditioning and ventilating systems shall, as far as practicable, be performed under normal operating conditions.

12.3.3 Portions of control or alarm systems are permitted to have standby power or other emergency modes of operation.

12.3.4 The tests shall be performed to determine that the system operates under the standby power or emergency operation mode conditions as well as under normal conditions.

Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.1.1 An air duct system has the potential to convey smoke, hot gases, and flame from area to area and to supply air to aid combustion in the fire area. For these reasons, fire protection of an air duct system is essential to safety to life and the protection of property. However, an air duct system's fire integrity also enables it to be used as part of a building's fire protection system.

Guidance for the design of smoke-control systems is provided in NFPA 92.

Pertinent information on maintenance is provided in Annex B.

Maintenance of fire dampers, ceiling dampers, smoke dampers, and combination fire-smoke dampers requirements can be found in NFPA 80 and NFPA 105.

A.1.3(1) For the purposes of this standard, a space is considered as an entire building or a portion thereof separated from all other portions of the building by fire-resistance-rated construction and whose environmental air does not mix with that of any other space. *[For spaces not exceeding 708 m^3 (25,000 ft^3) in volume, see NFPA 90B.]*

A.1.3(2) For construction types, see NFPA 220.

A.1.3(3) Such applicable standards include, but are not limited to, *NFPA 70 (see Ventilation in index)* and NFPA 90B.

A.1.3(4) Such applicable standards include, but are not limited to, NFPA 31, NFPA 33, NFPA 34, NFPA 45, *NFPA 70 (see Ventilation in index)*, NFPA 75, NFPA 91, and NFPA 96.

Δ **A.3.2.1 Approved.** The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials nor does it approve or evaluate testing laboratories. In determining the acceptability of installations or procedures, equipment, or materials, the "authority having jurisdiction" may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The "authority having jurisdiction" may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase "authority having jurisdiction," or its acronym AHJ, is used in NFPA standards in a broad manner because jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.3.2.3 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A.3.3.3 Air Connector. Some such devices are listed in the UL Online Certifications Directory, Product iQ, www.UL.com/PiQ, under the category "Connectors (ALNR)." Because these devices do not meet all the requirements for air ducts, they have limitations on their use, length, and location. *(For limitations on the use of air connectors, see 6.3.1.)*

Δ **A.3.3.9 Air Inlet.** For further discussion of various types of air inlet devices, see Chapter 20, "Space Air Diffusion," of *ASHRAE Handbook — Fundamentals*.

Δ **A.3.3.10 Air Outlet.** For further discussion of various types of air outlet devices, see Chapter 20, "Space Air Diffusion," of *ASHRAE Handbook — Fundamentals*.

A.3.3.14.1 Ceiling Radiation Damper. Some such devices are listed in the UL Online Certifications Directory, Product iQ, www.UL.com/PiQ, under the category "Ceiling Damper (CABS)."

Δ **A.3.3.14.4 Fire Damper.** Some such devices are listed in the UL Online Certifications Directory, Product iQ, www.UL.com/PiQ, under the category "Fire Dampers for Fire Barrier and Smoke Applications (EMME)." Fire dampers are classified for use in static systems or for use in dynamic systems, where the dampers are rated for closure under airflow.

A.3.3.14.5 Smoke Damper. Smoke dampers are subjected to various pressure differentials and exposed to elevated temperatures, and they can be required to open or close against mechanically induced airflow. Some such devices are listed in the UL Online Certifications Directory, Product iQ, www.UL.com/PiQ, under the category "Dampers for Fire Barrier and Smoke Applications (EMME)."

A.3.3.17 Fire Resistance Rating. Some such assemblies are listed in the UL Online Certifications Directory, Product iQ, www.UL.com/PiQ, under the categories "Floors," "Roofs," and "Walls and Partitions."

A.3.3.19 Flame Spread Index. Flame spread indexes for some materials are listed in the UL Online Certifications Directory, Product iQ, www.UL.com/PiQ. Classifications have been developed using flame spread index values.

A.3.3.23 Limited-Combustible (Material). Material subject to increase in combustibility or flame spread index beyond the limits herein established through the effects of age, moisture, or other atmospheric condition is considered combustible. *(See NFPA 259 and NFPA 220.)* [***101***:A.4.6.14]

A.3.3.24 Noncombustible Material. A material that is reported as complying with the pass/fail criteria of ASTM E136, *Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C*, when tested in accordance with the test method and procedure in ASTM E2652, *Standard Test Method for Assessing Combustibility of Materials Using a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750°C*, is considered a noncombustible material.

A.3.3.25 Plenum. A plenum can be one of the following five described types of unoccupied chambers through which air flows at low velocity and with little change in static pressure:

(1) *Supply air plenum.* Any plenum at any point on the discharge side of a fan through which air is intentionally conveyed to a space or spaces within a building.
(2) *Return air plenum.* Any plenum at any point on the intake side of a fan through which air is intentionally conveyed from a space or spaces within the building to the fan for eventual complete or partial return to the same space or spaces.
(3) *Exhaust air plenum.* Any plenum at any point on the intake side of a fan through which air is intentionally removed from a space or spaces within the building for discharge to the exterior of the building.
(4) *Outside air plenum.* Any plenum at any point on the intake side of a fan through which air from the exterior of the building is intentionally introduced into the building or its ventilation system(s).
(5) *Mixed-air plenum.* Any plenum at any point on the intake side of a fan through which air is intentionally conveyed from a space or spaces within the building and from the exterior of the building to the fan for eventual complete or partial return to the same space or spaces.

A.3.3.27 Smoke Barrier. A smoke barrier might be vertically or horizontally aligned, such as a wall, floor, or ceiling assembly. A smoke barrier might or might not have a fire resistance rating. *(See Chapter 8 of NFPA 101 for additional guidance.)*

A.3.3.29 Smoke Detector. See *NFPA 72*.

A.3.3.30 Smoke Developed Index. Smoke developed indexes for some materials are listed in the UL Online Certifications Directory, Product iQ, www.UL.com/PiQ. Classifications have been developed using smoke developed index values.

A.4.2.1.2 The location of outside air intakes, including intakes located on roofs, needs to be carefully selected to avoid drawing in objectionable materials, including, but not limited to, combustible materials and toxic or hazardous vapors. The location should consider proximity to emergency smoke exhaust, garage exhaust, discharge of kitchen hood vents, and other objectionable discharges from the building or adjacent structures.

A.4.2.2.2 For care and maintenance, see Annex B.

A.4.3.1 The provisions of 4.3.1 do not require inherently noncombustible materials to be tested in order to be classified as noncombustible materials. [***101***:A.4.6.13]

A.5.9.1 Access doors for fire dampers should be located so that the spring catch and fusible links are accessible when the damper is closed. Where the size of the duct permits, the minimum access door size should be 457 mm × 406 mm (18 in. × 16 in.). For dampers that are too large for an ordinary person's arms to reach from outside the duct to reset the damper and replace the fusible link, the minimum size for the access door should be increased to 610 mm × 406 mm (24 in. × 16 in.) to allow the entrance of an individual.

Access doors should be located as close as practicable to fire dampers and smoke dampers. If feasible, the underside of the duct should be used rather than a side door.

Many fire dampers and smoke dampers are preloaded with powerful springs that force the damper to shut. These dampers need to be opened against these springs, which could necessitate the ability to get two arms into the duct.

•

A.5.10.1.1 See ASHRAE 170, *Ventilation of Health Care Facilities*.

A.5.10.3 For further information, see NFPA 92.

A.6.1 Abandoned wires, cables, and other building service materials exposed to airflow result in an unnecessary increase in fuel load. Where practical, installation locations and methods that anticipate and facilitate the removal of such materials should be selected.

A.6.4.1 ASTM E2231, *Standard Practice for Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics*, is a practice that describes, in mandatory language, standard methods for specimen preparation and mounting of pipe and duct insulation systems using the Steiner tunnel test method (contained in ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*). It requires that the entire system that is used in the field be tested, including the insulation itself, any adhesive, and/or any jacket used. The practice recognizes that pipe or duct insulation systems can comprise a single product or of a combination of products, and that these systems have a variety of physical characteristics, including that they might or might not be self-supporting.

A.6.4.5 See NAIMA *Fibrous Glass Duct Liner Standard* and NAIMA *Fibrous Glass Duct Construction Standards* for additional information.

A.6.4.7 It is the intent of the committee that wall and ceiling finish in ceiling plenums comply with 6.4.7 and not 6.4.1.

A.8.2.6.5 Nonmetallic cable ties listed to UL 62275, *Cable Management Systems — Cable Ties for Electrical Installations*, and nonmetallic cable supports listed to UL 1565, *Positioning Devices*, and marked for use in plenums are considered suitable for use wherever nonmetallic cable ties or nonmetallic cable supports tested in accordance with UL 2043, *Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces*, are required.

A.8.4.1 It is not the intent of this section to apply to a room containing an air handler with a single source of return into the room, where the air from various sources is combined outside of the air-handling unit's room (e.g., as in apartment units).

Δ **A.8.4.6** Electrical wires and cables and optical fiber cables installed in metal raceways without an overall nonmetallic covering, metal sheathed cable without an overall nonmetallic

covering, or totally enclosed nonventilated busway without an overall nonmetallic covering are not considered to be exposed to the airflow and need not meet the requirements of 8.4.6.

•

A.9.2 For examples of the application of the penetration protection requirements, see Figure A.9.2.

A.9.2.1.1 Duct penetrations of fire walls should be avoided.

A.9.2.1.1.1 Fire dampers are recommended in order to isolate specific hazards.

Δ **A.9.2.3** For information on fire-resistive assembly designs incorporating air-handling components, see the UL Online Certifications Directory, Product iQ, www.UL.com/PiQ, under the categories "Floor-Ceiling Designs" or "Roof-Ceiling Designs."

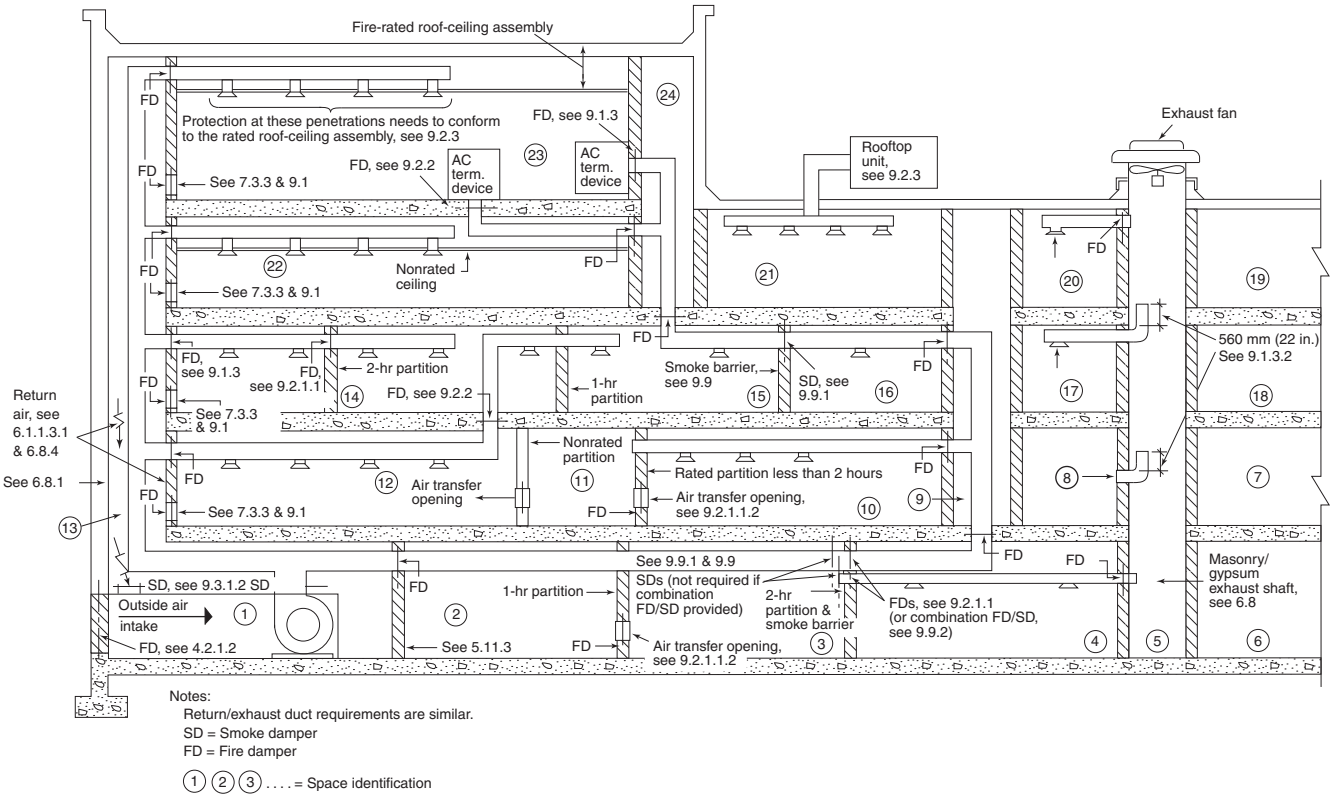
A.9.4.2 The designer should specify the leakage class, maximum pressure, maximum velocity, installation mode (horizontal or vertical), and degradation test temperature of the damper.

Δ **A.9.4.3.1** For information on other methods of protecting openings in rated floor–ceiling or roof–ceiling assemblies, see the the UL Online Certifications Directory, Product iQ, www.UL.com/PiQ, under the category "Design Information for Duct Outlet Protection." System A can be used only when it is specified in the individual design. System B can be used in any design that contains a steel duct with the duct outlet protected by a hinged door damper for an equal or smaller outlet size. The systems have been investigated for their effectiveness in retarding the transfer of heat into the ceiling space, but their ability to retard smoke and other combustion products has not been investigated.

A.9.5.2.1 The exception to this paragraph in earlier editions applied to fire dampers, due to the fact that UL 555S, *Smoke Dampers*, which tested combination dampers, was not available. Fire dampers in accordance with UL 555, *Fire Dampers*, are listed with maximum 141°C (286°F) links. It is recognized that, in some unusual cases, an engineered smoke-control system can make higher temperature links desirable for proper operation. This arrangement necessitates a case-by-case consideration and concurrence by the authority having jurisdiction.

A.9.5.4 On closure of certain smoke dampers in smoke-control systems, the total system flow decreases, but the duct velocity at open fire dampers can be as high as roughly 600 percent of the initial duct design velocity. The dynamic airflow and pressure rating of the damper must be adequate for the damper to close under airflow at the damper's closure pressure. The damper face velocity and closure pressure can be approximated by calculation. The calculated values must be specified because UL labels dynamic fire dampers at 5 m/sec (1000 ft/min) increments, starting at 10 m/sec (2000 ft/min).

Δ **A.9.7.1** Fire dampers have no fire protection value unless they remain in place in the protected opening in the event that the ductwork collapses during a fire. To accomplish this, ductwork should not be continuous through a partition opening; instead, it should connect on each side of the partition to a damper installed in a sleeve or frame secured by perimeter-mounting



Δ **FIGURE A.9.2 Application of Penetration Requirements.**