

NFPA 90A
Installation of
Air Conditioning
and Ventilating
Systems
1993 Edition



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There is a concern that the growing use of synthetic materials may produce more or additional toxic products of combustion in a fire environment. The Board has, therefore, asked all NFPA technical committees to review the documents for which they are responsible to be sure that the documents respond to this current concern. To assist the committees in meeting this request, the Board has appointed an advisory committee to provide specific guidance to the technical committees on questions relating to assessing the hazards of the products of combustion.

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NFPA 90A

**Standard for the
Installation of Air Conditioning and
Ventilating Systems**

1993 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, released by the Correlating Committee on Building Construction, and acted on by the National Fire Protection Association, Inc. at its Fall Meeting held November 16-18, 1992, in Dallas, TX. It was issued by the Standards Council on January 15, 1993, with an effective date of February 12, 1993, and supersedes all previous editions.

The 1993 edition of this document has been approved by the American National Standards Institute.

Changes other than editorial are indicated by a vertical rule in the margin of the pages on which they appear. These lines are included as an aid to the user in identifying changes from the previous edition.

Origin and Development of NFPA 90A

This standard dates from 1899, when committee attention was first given to blower and exhaust systems. Prior to 1936, the subject of air conditioning was covered in NFPA 91, *Standard on Blower Systems*. In 1937 it was decided to prepare a separate *Standard on Air Conditioning, Warm Air Heating, Air Cooling and Ventilating Systems*. This standard was initially adopted in 1937 with many subsequent amendments, up to the 1978 edition. The 1985 edition amends the 1981 edition, which was a complete revision. The 1989 edition was a complete rewrite, which was drafted using the "clean sheet" approach. For 1989 the protection methods specified as well as the chapter organization differ from earlier editions. The 1993 edition institutes changes in plenum cavity materials use, fire damper testing-acceptance criteria, and testing and maintenance of systems.

Prior to 1955, the subject of the present standard was Part I of NFPA 90, *Standard on Air Conditioning*. Since 1955 the two parts of NFPA 90 have been published separately as (this) NFPA 90A and as NFPA 90B, *Standard for the Installation of Warm Air Heating and Air Conditioning Systems*.

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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: 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.

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

1993 Edition

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

Information on referenced publications can be found in Chapter 6 and Appendix C.

Chapter 1 General

1-1 Introduction. 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 may also enable it to be used as part of a building's fire protection system. (*See Section 1-4.*)

1-2 Scope. This standard applies to all systems for the movement of environmental air in structures that:

- (a)* Serve spaces of over 25,000 cu ft (707.9 m³) in volume, or
- (b)* Serve buildings of Types III, IV, and V construction over three stories in height, regardless of volume, or
- (c)* Serve buildings and spaces not covered by other applicable NFPA standards, or
- (d)* Serve occupants or processes not covered by other applicable NFPA standards.

1-3 Purpose.

1-3.1 This standard is intended to prescribe minimum requirements for safety to life and property from fire. These requirements are intended to:

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

1-3.2 Nothing in this standard is intended to prevent the use of new methods or devices, provided that sufficient technical data is 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.

1-3.3 Provisions of this standard are not intended to be applied retroactively. Where the system is being altered, extended, or renovated, the requirements of this standard apply only to the work being undertaken.

1-4 Smoke Control. Guidance for the design of smoke control systems is provided in NFPA 92A, *Recommended Practice for Smoke Control Systems*.

1-5 Maintenance. Pertinent areas of concern are provided in Appendix B.

1-6 Definitions.

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

Air Connector.* A conduit for transferring air between an air duct or plenum and an air terminal unit or an air inlet or an air outlet. (*For limitations on use of air connectors, see 2-3.2.1.*)

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

Air Duct. A conduit for conveying air.

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

Air Duct Lining. Includes materials such as adhesive, insulation, coating, and film used to line the inside surface of an air duct, fan casing, or duct plenum.

Air Filter. A device used to reduce or remove airborne solids from heating, ventilating, and air conditioning systems by mechanical means.

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

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

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

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

Approved. Acceptable to the "authority having jurisdiction."

NOTE: 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 concerned with product evaluations which is in a position to determine compliance with appropriate standards for the current production of listed items.

Authority Having Jurisdiction. The "authority having jurisdiction" is the organization, office or individual responsible for "approving" equipment, an installation or a procedure.

NOTE: The phrase "authority having jurisdiction" is used in NFPA documents in a broad manner since 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, 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 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."

Blower. A fan used to force air under pressure through an air duct system.

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

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

Fan. An assembly comprising blades or runners and housing or casing and being either a blower or exhaust fan.

Fire Damper.* A device, installed in an air distribution system, designed to close automatically upon detection of heat, to interrupt migratory airflow, and to restrict the passage of flame. A combination fire and smoke damper meets the requirements of both.

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

Fire Wall. A wall subdividing a building to restrict the spread of fire and having fire resistance and structural stability.

Flame Spread Index.* The flame spread index of a material refers to a number or classification of a material obtained according to NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*.

Limited Combustible Material. A building construction material not complying with the definition of noncombustible material, which, in the form in which it is used, has a potential heat value not exceeding 3500 Btu/lb (8141 kJ/kg) (see NFPA 259, *Standard Test Method for Potential Heat of Building Materials*) and complies with one of the following paragraphs (a) or (b). Materials subject to increase in combustibility or flame spread index beyond the limits herein established through the effects of age, moisture, or other atmospheric condition shall be considered combustible.

(a) Materials having a structural base of noncombustible material, with a surfacing not exceeding a thickness of $\frac{1}{8}$ in. (0.32 cm), that has a flame spread index not greater than 50.

(b) Materials, in the form and thickness used, other than as described in (a), having neither a flame spread index greater than 25 nor evidence of continued combustion, and of such composition that surfaces that would be exposed by cutting through the material on any plane would have neither a flame spread index greater than 25 nor evidence of continued progressive combustion.

Listed. Equipment or materials included in a list published by an organization acceptable to the "authority having jurisdiction" and concerned with product evaluation, that maintains periodic inspection of production of listed equipment or materials and whose listing states either that the equipment or material meets appropriate standards or has been tested and found suitable for use in a specified manner.

NOTE: The means for identifying listed equipment may vary for each organization concerned with product evaluation, some of which 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.

Noncombustible Material. A material that, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat. When tested in accordance with ASTM E136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*, materials that successfully pass the test shall be considered noncombustible.

Plenum. A compartment or chamber to which one or more air ducts are connected, that forms part of the air distribution system, and that is not used for occupancy or storage. (See 2-3.10, *Plenums, for specific types*.)

Shall. Indicates a mandatory requirement.

Smoke. The airborne solid and liquid particulates and gases evolved when a material undergoes pyrolysis or combustion.

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

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

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

A smoke damper may also be a fire damper if its location lends itself to the multiple functions and it meets the requirements of both.

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

Smoke Developed Index.* The smoke developed index for a material refers to a number or classification of a material obtained according to NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*, which measures visible smoke.

Chapter 2 HVAC Systems

2-1 General Requirements—Equipment.

2-1.1 Equipment shall be arranged to afford access for inspection, maintenance, and repair.

2-1.2 Equipment shall be selected and installed based on its proper application with respect to the manufacturer's installation instructions and listing as applicable.

2-1.3 Equipment shall be guarded for personnel protection and against intake of foreign matter into the system.

2-1.4 Electrical wiring and equipment shall be installed in accordance with NFPA 70, *National Electrical Code*.®

2-1.5 Equipment Location. See Section 3-1.

2-2 System Components.

2-2.1 Outside Air Intakes.

2-2.1.1 Outside air intakes shall be located to avoid drawing in combustible material or flammable vapor and to minimize hazard from fires in other structures.

2-2.1.2 Outside air intakes shall be protected by screens of corrosion-resistant material not larger than 1/2-in. (1.27-cm) mesh.

2-2.1.3 Outside air intakes shall be located so as to minimize the introduction of fire into the building from combustible buildings and hazardous facilities, or the intake shall be equipped with an approved fire damper.

2-2.1.4 Outside air intakes shall be located so as to minimize the introduction of smoke into the building, or the intake shall be equipped with an approved smoke damper. (See Section 4-3 for smoke damper operation to restrict the intake of smoke.)

2-2.2 Air Cleaners and Air Filters.

2-2.2.1 Electrostatic air cleaners shall be listed in accordance with UL 867, *Standard for Electrostatic Air Cleaners*, and shall be installed in conformance with the conditions of listing.

2-2.2.2 Air filters shall have either a Class 1 or Class 2 rating in accordance with UL 900, *Standard for Test Performance of Air Filter Units*. (For care and maintenance, see Appendix B.)

2-2.2.3 Liquid adhesive coatings used on air filters shall have a flash point not lower than 325°F (163°C) as determined by ASTM D93, *Pensky-Martens Closed Tester*.

2-2.2.4 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.

2-2.2.5 Combustible adhesive coatings shall be stored in accordance with NFPA 30, *Flammable and Combustible Liquids Code*.

2-2.3 Fans.

2-2.3.1 Installation. Fans shall be installed in accordance with applicable NFPA standards and manufacturer's instructions. Fans shall be approved for the specific installation.

2-2.3.2 Access. Fans shall be located, arranged, and installed to afford access for inspection and maintenance.

2-2.3.3 Exposed Inlets. Exposed fan inlets shall be protected with metal screens to prevent the entry of paper, trash, and similar foreign materials.

2-2.4 Air Cooling and Heating Equipment.

2-2.4.1 Installation. Heating and cooling equipment shall be installed in accordance with applicable NFPA standards and the manufacturer's instructions. The equipment shall be approved for the specific installation. (See 2-3.3.1.)

2-2.4.2 Appliances. Materials used in the manufacturing of fan coil units, self-contained air conditioning units, furnaces, heat pumps, humidifiers, and all similar appliances shall meet the requirements of 2-3.3.1 and 2-3.3.2. Listing by a testing laboratory shall be sufficient evidence of compliance with this requirement. Unlisted solar energy air distribution system components shall be accompanied by supportive information showing they have flame spread and smoke developed indices not exceeding those of the air duct system permitted by this standard.

2-2.4.3 Mechanical Cooling. Mechanical refrigeration used with air duct systems shall be installed in accordance with recognized safety practices. Installations conforming to ANSI/ASHRAE 15, *Safety Code for Mechanical Refrigeration*, shall be considered as meeting these requirements.

2-2.4.4 Furnaces. Heating furnaces, combined with cooling units in the same air duct system shall be installed in accordance with NFPA 54 (ANSI Z223.1), *National Fuel Gas Code*, if gas fired, and NFPA 31, *Standard for the Installation of Oil-Burning Equipment*, if oil fired.

2-2.4.5 Duct Heaters. 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 2-3.5.3. The installation of electrical duct heaters shall comply with the provisions of Part F, Duct Heaters, of Article 424 of NFPA 70, *National Electrical Code*.

2-2.4.6 Evaporative Coolers. Combustible evaporation media shall not be used, but this does not preclude the use of evaporation media meeting the requirements of 2-2.2.2.

2-2.4.7 Heat Recovery Equipment. Equipment not covered by other provisions of this standard and used for heat transfer or air movement shall be constructed so that all material in the air path shall meet the requirements of Section 2-2.

2-3 Air Distribution.

2-3.1 Air Ducts.

2-3.1.1 Air ducts may be rigid or flexible and shall be constructed of materials that are reinforced and sealed to satisfy the requirements of use of the air duct system such as supply air systems, return or exhaust air systems, and variable volume/pressure air systems.

2-3.1.2 Air ducts shall be constructed of the following materials:

(a) Iron, steel, aluminum, copper, concrete, masonry, or clay tile.

(b) Class 0 or Class 1 rigid or flexible air ducts tested in accordance with UL 181, *Standard for Factory-Made Air Ducts and Connectors*, and installed in conformance with conditions of listing.

Exception No. 1: Class 0 or Class 1 rigid or flexible air ducts shall not be used as a vertical air duct that is more than two stories in height.

Exception No. 2: Class 0 or Class 1 rigid or flexible air ducts shall not be used in air ducts containing air at temperatures in excess of 250°F (121°C).

(c) Negative pressure exhaust or return air ducts, where the temperature of the conveyed air does not exceed 125°F in normal service, may be constructed of gypsum board having a flame spread rating not over 25 without evidence of continued progressive combustion and a smoke developed rating no higher than 50.

Exception: The maximum conveyed air temperature of 125°F shall not apply to gypsum board material used for emergency smoke exhaust air ducts.

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

2-3.1.3 The materials, thickness, construction, and installation of ducts shall provide structural strength and durability in conformance with recognized good practice. Air ducts shall be deemed as meeting the intent of this paragraph if constructed and installed in accordance with:

(a) The *Fibrous Glass Duct Construction Manual* published by NAIMA or the *Fibrous Glass Duct Construction Standard*, 5th Edition; *HVAC Duct Construction Standards*, 1st Edition (1985); *HVAC Air Duct Leakage Manual* (1985); whichever is applicable, or

(b) The *ASHRAE Handbook, 1988 Equipment*, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

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

2-3.2 Air Connectors.

2-3.2.1 Air connectors are limited-use, flexible air ducts that need not conform to the requirements for air ducts if they conform to the following provisions:

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

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

(c) Air connector run shall not exceed 14 ft (4.27 m) in length.

(d) 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.

(e) Air connectors shall not pass through floors.

2-3.2.2 Vibration isolation connectors in duct systems shall be made of an approved flame retardant fabric or shall consist of sleeve joints with packing of approved material, each having a flame spread rating of not over 25 and a smoke developed rating of not higher than 50. The fabric shall not exceed 10 in. (25.4 cm) in length in direction of airflow.

2-3.3 Supplementary Materials for Air Distribution Systems.

2-3.3.1 Supplementary materials such as duct coverings, duct linings, vapor barrier facings, adhesives, fasteners, tapes, and core materials added to air ducts, plenums, panels, and duct silencers used in duct systems shall have a flame spread rating not over 25 without evidence of continued progressive combustion and a smoke developed rating no higher than 50. If air duct coverings and linings are to be applied with adhesives, they shall be tested as applied with such adhesives, or the adhesives used shall have a flame spread rating not over 25 and a smoke developed rating no higher than 50 when in the final dry state. (See 2-2.4.2.)

Closure systems for use with rigid air ducts tested in accordance with UL 181, *Standard for Factory-Made Ducts and Air Connectors*, shall have been tested and listed in accordance with UL 181A, *Standard for Closure Systems for Use with Rigid Air Ducts and Air Connectors*, and used in conformance with conditions of listing.

Exception: Air duct weatherproof coverings shall not be required to meet these requirements where they are located entirely outside of a building, do not penetrate a wall or roof, and do not create an exposure hazard.

2-3.3.2 Air duct, panel, and plenum coverings and linings shall not flame, glow, smolder, or smoke when tested in accordance with similar test for pipe covering, 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 250°F (121°C).

2-3.3.3 Air duct coverings shall not extend through walls or floors required to be firestopped or required to have a fire resistance rating unless such coverings meet the requirements of 3-4.6.4.

2-3.3.4 Air duct linings shall be interrupted at fire dampers so as not to interfere with the operation of devices.

2-3.3.5 Air duct coverings shall not be installed so as to conceal or prevent use of any service opening.

2-3.3.6 Pipe insulation and coverings shall meet the requirements of 2-3.3.1 and 2-3.3.2 where installed in ducts, plenums, or concealed spaces used as part of the air distribution system.

2-3.4 Air Duct Access and Inspection.

2-3.4.1* A service opening shall be provided in air ducts adjacent to each fire damper, smoke damper, and smoke detector. The opening shall be large enough to permit maintenance and resetting of the device.

2-3.4.2 Service openings shall be identified with letters no less than 1/2 in. (1.27 cm) in height to indicate the location of the fire protection device(s) within.

2-3.4.3 Horizontal air ducts and plenums shall be provided with service openings (*see* 2-3.4.1) to facilitate removal of accumulations of dust and combustible materials. Service openings shall be placed at approximately 20-ft (6.1-m) intervals along the air duct and at the base of each vertical riser.

Exception No. 1: Removable air outlet or air inlet devices of adequate size may be accepted in lieu of service openings.

Exception No. 2: Service openings may be omitted in supply ducts when the supply air has previously passed through air filter, air cleaner, or water spray.

Exception No. 3: Service openings are not required where all of the following conditions prevail:

(a) *The occupancy has no process producing 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).*

(b) *The air inlets are at least 7 ft (2.13 m) above the floor or are protected by corrosion-resistant metal screens of at least 14 mesh (0.07 in.), installed at the inlets so that they will not draw papers, refuse, or other combustible solids into the return air duct.*

(c) *The minimum design velocity in the return duct from the particular occupancy is 1,000 ft/min (508 m/sec).*

2-3.4.4 Inspection windows are permitted in air ducts provided they are glazed with wired glass. However, service openings shall be provided as required in 2-3.4.1.

2-3.4.5 Openings in walls or ceilings shall be provided so that service openings in air ducts are accessible for maintenance and inspection needs.

2-3.4.6 Where a service opening is necessary in an air duct located above the ceiling of a floor/roof-ceiling assembly that has been tested and assigned a fire resistance rating in accordance with NFPA 251, *Standard Methods of Fire Tests of Building Construction and Materials*, access shall be provided in the ceiling and shall be designed and installed so as not to reduce the fire resistance rating of the assembly.

2-3.5 Air Duct Integrity.

2-3.5.1 Air ducts shall be located where they are not subject to damage or rupture, or they shall be protected to maintain their integrity.

2-3.5.2 Where air ducts are located outdoors, the air duct, together with its covering or lining, shall be protected from harmful elements.

2-3.5.3 Air Duct at Heat Sources. Where electric, fossil fuel, or solar energy collection heat sources are installed in air ducts, the installation shall be made so as to avoid creating a fire hazard. Air ducts rated Class 1, UL 181, air duct coverings, and linings shall be interrupted at the immediate area of operation of such heat sources in order to meet clearances specified as a condition of the equipment listing.

Exception No. 1: Appliances listed for zero clearance from combustibles when installed in accordance with their conditions of listing.

Exception No. 2: Insulation specifically suitable for the maximum temperature that can reasonably be anticipated on the duct surface may be installed at the immediate area of operation of such appliances.

2-3.6 Air Outlets.

2-3.6.1 General. Air supplied to any space shall not contain flammable vapors, flyings, or dust in quantities and concentrations that would introduce a hazardous condition.

2-3.6.2 Construction of Air Outlets. Air outlets shall be constructed of noncombustible material or a material that has a smoke developed rating no higher than 50 and a flame spread rating not over 25.

2-3.6.3 Location of Air Outlets.

(a) Air outlets shall be located at least 3 in. (7.6 cm) above the floor.

Exception: Where provisions have been made to prevent dirt and dust accumulations from entering the system.

(b) When located less than 7 ft (2.13 m) above the floor, outlet openings shall be protected by a grille or screen having openings through which a 1/2-in. (1.27-cm) sphere will not pass.

2-3.7 Air Inlets (Return and/or Exhaust).

2-3.7.1 General. Air shall not be recirculated from any space in which flammable vapors, flyings, or dust are present in quantities and concentrations that would introduce a hazardous condition into the return air system.

2-3.7.2 Construction of Air Inlets. Air inlets shall be constructed of noncombustible material or a material that has a flame spread rating not over 25 and smoke developed rating no higher than 50.

2-3.7.3 Location of Air Inlets.

(a) Air inlets shall be located at least 3 in. (7.6 cm) above the floor.

Exception: Where provisions have been made to prevent dirt and dust accumulations from entering the system.

(b) When located less than 7 ft (2.13 m) above the floor, inlet openings shall be protected by a grille or screens having openings through which a 1/2-in. (1.27-cm) sphere will not pass.

2-3.8 Fire Dampers. Approved fire dampers shall be provided as required in Chapter 3 and installed in conformance with conditions of listing.

2-3.9 Smoke Dampers.

2-3.9.1 Approved smoke dampers shall be provided as required in Chapter 3 and installed in conformance with conditions of listing.

2-3.9.2 Smoke dampers shall be installed in systems over 15,000 cfm (7080 L/sec) capacity to isolate the air handling equipment, including filters, from the remainder of the system so as to restrict circulation of smoke.

Exception No. 1: Where the air handling unit is located on the floor that it serves and serves only that floor.

Exception No. 2: Where the air handling unit is located on the roof and serves only the floor immediately below it.

2-3.10 Plenums.

2-3.10.1 Ceiling Cavity Plenum. The space between the top of the finished ceiling and the underside of the floor or roof above may be used to supply air into or return and/or exhaust air from the occupied area, provided that:

(a) All materials exposed to the airflow shall be noncombustible or limited combustible and have a smoke developed index no higher than 50.

Exception No. 1: The materials listed hereinafter are permitted in the ceiling cavity plenum if listed as having a maximum peak optical density of 0.5 or less, average optical density of 0.15 or less, and maximum flame spread distance of 5 ft (1.5 m) or less when tested in accordance with the specified test method:

- (1) Electrical wires and cables — NFPA 262
- (2) Pneumatic tubing for control systems — UL 1820
- (3) Optical-fiber cables — NFPA 262
- (4) Fire sprinkler piping — UL 1887

Exception No. 2: Smoke detectors required by 4-4.1.

Exception No. 3: The products listed hereinafter shall be permitted in the ceiling cavity plenum if listed as having a maximum peak optical density of 0.5 or less, average optical density of 0.15 or less, and a peak heat release rate of 100 kilowatts or less when tested in accordance with the specified test method or standard:

(1) Loudspeakers, loudspeaker assemblies, and their accessories — UL 2043.

(b) The integrity of firestopping of penetrations shall be maintained.

(c) Light diffusers, other than metal or glass, used in air handling light fixtures shall be listed and marked "Fixture Light Diffusers for Air Handling Fixtures."

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

(e) Materials used in the construction of a ceiling plenum shall be suitable for continuous exposure to the temperature and humidity conditions of the environmental air in the plenum.

(f) 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 3-3.3.

2-3.10.2 Duct Distribution Plenum. A duct enclosure used for multiple distribution or gathering of ducts or connectors shall be constructed of materials and methods as set forth in 2-3.1, Air Ducts.

2-3.10.3 Apparatus Casing Plenum. A fabricated plenum and apparatus casing may be used for supply, return, or exhaust air service and shall be constructed of materials and methods set forth in 2-3.1, Air Ducts, and in accordance with the following:

(a) Casing and Plenum Construction Standards in *HVAC Duct Construction Standards*, 1st Edition (1985) published by the Sheet Metal and Air Conditioning Contractors' National Association.

(b) The *ASHRAE Handbook, 1988 Equipment*. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

(c) All air duct coverings, duct lining acoustical liner/cells, and miscellaneous materials shall comply with 2-3.3, Supplementary Materials for Air Distribution Systems.

2-3.10.4 Air Handling Unit Room Plenum.

(a) Individual rooms containing air handling unit(s) gather return air from various sources and combine the return air within the room for returning to the air handling unit. Duct covering, duct lining, acoustical liner/cells, and miscellaneous materials shall comply with 2-3.3, Supplementary Materials for Air Distribution Systems.

(b) Air handling unit room plenums shall not be used for storage or occupied other than during equipment servicing.

2-3.10.5 Raised Floor Plenum. The space between the top of the finished floor and the underside of a raised floor may be used to supply air into or return and/or exhaust air from the occupied area, provided that:

(a) All materials exposed to the airflow shall be noncombustible or limited combustible and shall have a smoke developed index no higher than 50.

Exception No. 1: The materials listed hereinafter are permitted in the raised floor plenum if listed as having a maximum peak optical density of 0.5 or less, average optical density of 0.15 or

less, and maximum flame spread distance of 5 ft (1.5 m) or less when tested in accordance with the specified test method:

- (1) Electrical wires and cables — NFPA 262
- (2) Pneumatic tubing for control systems — UL 1820
- (3) Optical-fiber cables — NFPA 262
- (4) Fire sprinkler piping — UL 1887

Exception No. 2: Raised floors, intermachine cables, electrical wires, and optical fiber cables in computer/data processing rooms when these rooms are designed and installed in accordance with NFPA 75, Standard for the Protection of Electronic Computer/Data Processing Equipment.

Exception No. 3: Smoke detectors required by 4-4.1.

(b) The integrity of firestopping of penetrations shall be maintained.

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

(d) Materials used in the construction of a raised floor plenum shall be suitable for continuous exposure to the temperature and humidity conditions of the environmental air in the plenum.

2-3.11 Corridor Air Systems.

2-3.11.1 Egress Corridors. Egress corridors in health care, detention and correctional, and residential occupancies shall not be used as a portion of a supply return, exhaust air system serving adjoining areas. Air transfer opening(s) are not be permitted in walls or in doors separating egress corridors from adjoining areas.

Exception No. 1: Toilet rooms, bathrooms, shower rooms, sink closets, and similar auxiliary spaces opening directly on the egress corridor.

Exception No. 2: Provided door clearances do not exceed those specified for fire doors in NFPA 80, Standard for Fire Doors and Fire Windows, air transfer because of pressure differentials shall be permitted.

Exception No. 3: Use of egress corridors as part of an engineered smoke control system.

Exception No. 4: In detention and correctional occupancies with corridor separations of open construction (grating doors or grating partitions).

2-3.11.2 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.

2-3.12 Smoke Control. Where provisions are required for a smoke control or exhaust system, it shall conform to the requirements of the building code of the authority having jurisdiction. (See NFPA 92A, Recommended Practice for Smoke Control Systems, or NFPA 92B, Guide for Smoke Management Systems in Malls, Atria, and Large Areas.)

Chapter 3 Integration of Ventilation and Air Conditioning System with Building Construction

3-1 Air Handling Equipment Rooms.

3-1.1 General. Air handling equipment rooms generally fall into three categories:

- (a) Those used as air plenums (usually return air);
- (b) Those with air duct openings directly into a shaft;
- (c) Other air handling unit rooms.

3-1.2 Air Handling Equipment Rooms Used as Plenum Space. Air handling unit rooms used as plenums for supply or return air shall comply with 2-3.10.4.

3-1.3 Air Handling Equipment Rooms that Have Air Duct Openings Directly into a Shaft. 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 3-3.4.

Exception: 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.

3-1.4 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.

3-2 Building Construction.

3-2.1 Air Duct Clearance. The clearance from metal air ducts to assemblies constructed of combustible materials, including plaster on wood lath, shall be not less than 1/2 in. (1.27 cm), or the combustible material shall be protected with minimum 1/4 in. (0.635 cm) approved insulating material. The integrity of the firestopping and smokestopping shall be maintained.

Exception: This clearance may be disregarded for systems used solely for ventilation, air cooling, or air conditioning without heating.

3-2.2 Structural Members. The installation of air ducts including the hangers shall not reduce the fire resistance rating of structural members.

3-2.3 Where the installation of the hangers for the components of an air duct system penetrates an existing ceiling of a fire-resistive floor/roof-ceiling assembly and requires removal of a portion of that ceiling, the replacement material shall be the same as or approved equal to that which was removed.

Exception: Instead of repairing the existing ceiling, a new ceiling may be installed below the air duct system provided the fire resistance rating of the floor/roof-ceiling design is not reduced.

3-3 Penetrations—Protection of Openings. (For examples of application of the penetration protection requirements, see Figure 3-3.)

3-3.1 Fire Rated Walls and Partitions.

3-3.1.1* 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. (See Figure 3-3.)

Exception: Fire dampers shall not be required if other openings through the wall are not required to be protected.*

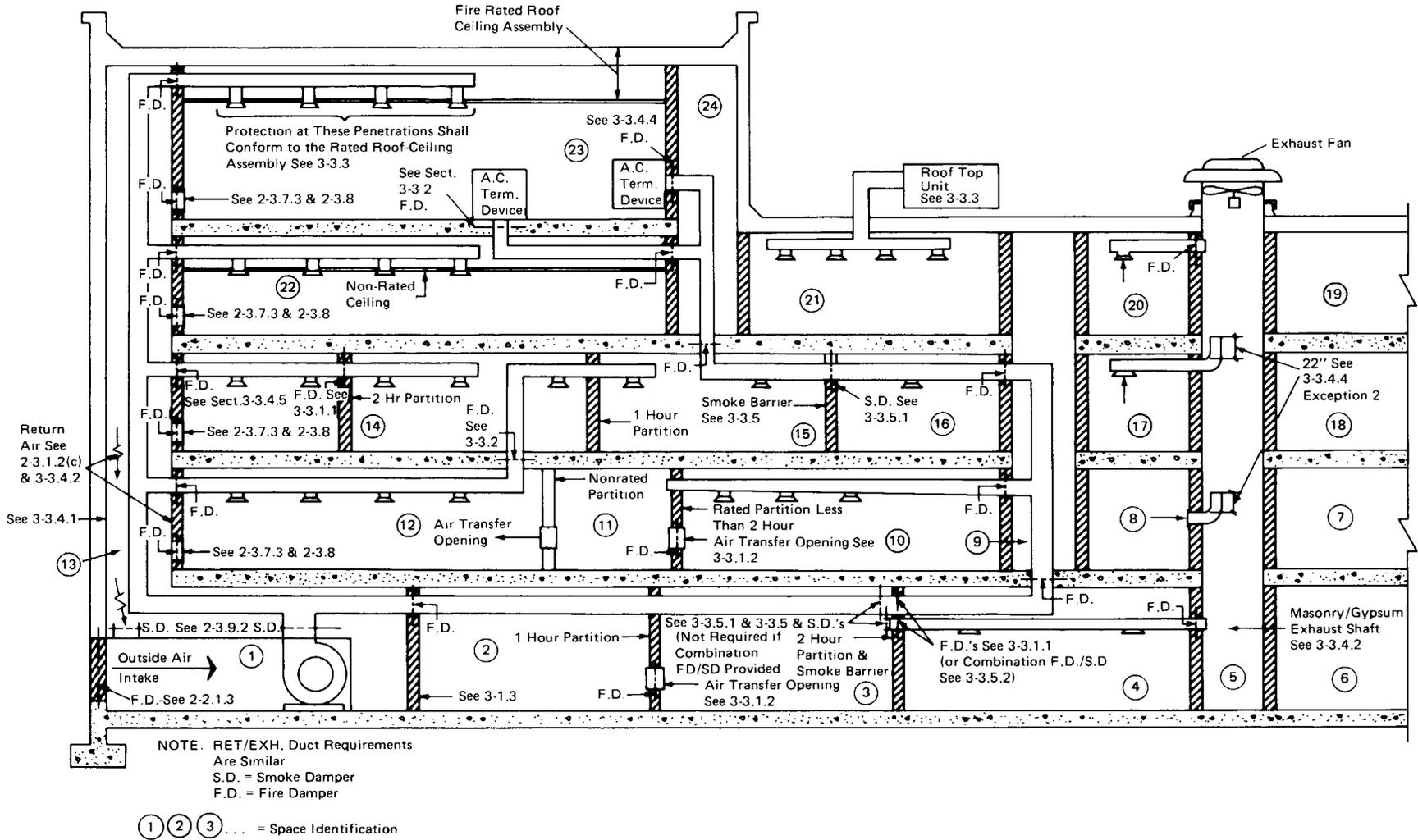


Figure 3-3.

3-3.1.2 Approved fire dampers shall be provided in all air transfer openings in partitions required to have a fire resistance rating and in which other openings are required to be protected.

3-3.2 Floors Required to Have a Fire Resistance Rating. Where air ducts extend through only one floor and serve only two adjacent stories, the air ducts shall be enclosed (see 3-3.4.1) or fire dampers shall be installed at each point where the floor is penetrated.

3-3.3* Floor/Roof-Ceiling Assemblies Having a Fire Resistance Rating. Where air ducts and openings for air ducts are used in a floor/roof-ceiling assembly required to have a fire resistance rating, all of the materials and construction of the assembly, including the air duct materials and size of openings, and the protection of the openings, shall conform with the design of the fire-resistive assembly, as tested in accordance with NFPA 251, *Standard Methods of Fire Tests of Building Construction and Materials*. (If dampers are required, see 3-4.4.)

3-3.4 Shafts.

3-3.4.1 Air ducts that pass through floors of buildings requiring 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. The enclosure shall have a fire resistance rating (based on possible fire exposure from either side of the partition or wall) of no less than 1 hour where such air ducts are located in a building less than four stories in height, and of no less than 2 hours where such air ducts are located in a building four stories or more in height.

Exception: Where an air duct penetrates through only one floor, and the air duct contains a fire damper located where the duct penetrates the floor, an air duct enclosure is not required.

3-3.4.2 A fire-resistive enclosure used as an air duct shall conform with 3-3.4.1 and 2-3.1. Gypsum board systems shall be constructed in accordance with the *Fire Resistance Design Manual*.

3-3.4.3 Shafts that constitute air ducts or that enclosed air ducts used for the movement of environmental air shall not enclose:

- (a) Exhaust ducts used for the removal of smoke- and grease-laden vapors from cooking equipment;
- (b) Ducts used for the removal of flammable vapors;
- (c) Ducts used for moving, conveying, or transporting stock, vapor, or dust;
- (d) Ducts used for the removal of nonflammable corrosive fumes and vapors;
- (e) Refuse and linen chutes; or
- (f) Piping.

Exception: Noncombustible piping conveying water or other non-hazardous or nontoxic materials.

3-3.4.4 Fire dampers shall be installed at each direct or ducted opening into or out of enclosures required under 3-3.4.1.

Exception No. 1: In an air duct system serving only one story when used only for exhaust of air to the outside and contained within its own dedicated shaft.

Exception No. 2: Where branch ducts connect to enclosed exhaust risers meeting the requirements of 3-3.4.1 or 3-3.4.2 in which the airflow is upward and steel subducts at least 22 in. (56 cm) in length are carried up inside the riser from each inlet and the riser is appropriately sized to accommodate the flow restriction created by the subduct. (See Figure 3-3.)

3-3.5 Smoke Barriers.

3-3.5.1 Smoke dampers shall be installed at or adjacent to the point where air ducts pass through required smoke barriers, but in no case shall the smoke damper be installed more than 2 ft (0.6 m) from the barrier or after the first air duct inlet or outlet.

Exception No. 1: Smoke dampers shall not be required on air systems other than those smoke dampers necessary for the proper function of that system when the system is specifically designed to:

- (a) Function as an engineered smoke control system, including continuous air movement with the air handling system, or
- (b) Provide air to other areas of the building during a fire emergency, or
- (c) Provide pressure differentials during a fire emergency.

Exception No. 2: The requirement for locating a smoke damper within a prescribed distance of a smoke barrier shall not apply to isolation smoke dampers in air handling equipment. (See 2-3.9.2.)

Exception No. 3: Smoke dampers shall not be required where the air inlet or outlet openings in ducts are limited to a single smoke compartment.

Exception No. 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.

3-3.5.2 Where penetration of a smoke barrier is required to be provided with a fire damper, a combination fire and smoke damper equipped and arranged to be both smoke and heat responsive shall be permitted.

3-4 Fire Dampers, Smoke Dampers, and Ceiling Dampers.

3-4.1 Fire dampers used for the protection of openings in walls, partitions, or floors with fire resistance ratings of less than 3 hours shall have 1½-hour fire protection rating in accordance with UL 555, *Standard for Fire Dampers*, Fourth Edition.

3-4.2 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, *Standard for Fire Dampers*, Fourth Edition.

3-4.3* Smoke dampers used for protection of openings in smoke barriers or in engineered smoke control systems shall be classified in accordance with UL 555S, *Standard for Leakage Rated Dampers for Use in Smoke Control Systems*.

3-4.4 Ceiling dampers or other methods of protecting openings in rated floor/roof-ceiling assemblies shall comply with the construction details of the tested floor/roof-ceiling assembly or with listed ceiling air diffusers and/or with listed ceiling dampers. Ceiling dampers shall be tested in accordance with UL 555, Third Edition.

3-4.5 Damper Closure.

3-4.5.1 Closing of all fire dampers and ceiling dampers shall be automatic, and they shall remain closed upon the operation of a listed fusible link or other approved heat actuated device located where readily affected by an abnormal rise of temperature in the air duct.

3-4.5.2 Fusible links shall have a temperature rating approximately 50°F (28°C) above the maximum temperature that normally is encountered when the system is in operation or shut down, but not less than 160°F (71°C).

Exception: Where fire dampers are within air ducts that are a part of an engineered smoke control system, fusible links shall have a temperature rating approximately 50°F (28°C) above the operating temperature for which the smoke control system is designed, but not to exceed 286°F (141°C).

3-4.5.3 Provision for remote opening of combination fire and smoke dampers, when necessary for smoke removal, shall be permitted. Such dampers shall have provisions to reclose automatically upon reaching the damper's maximum degradation test temperature per UL 555S, *Standard for Leakage Rated Dampers for Use in Smoke Control Systems*.

3-4.5.4 Dampers shall close against the maximum calculated airflow of that portion of the air duct system in which they are installed. Fire dampers shall be tested in accordance with UL 555, Fourth Edition. Smoke dampers shall be tested in accordance with UL 555S, First Edition.

Exception No. 1: Ceiling dampers.

Exception No. 2: Where provisions for fan or airflow shutdown are provided.

3-4.6 Installation. (See 2-3.4 for access.)

3-4.6.1 The locations and mounting arrangement of all fire dampers, smoke dampers, ceiling dampers, and fire protection means of similar nature required by this standard shall be shown on the drawings of the air duct systems.

3-4.6.2* Fire dampers, including their sleeves, smoke dampers, and ceiling dampers, shall be installed in accordance with the conditions of their listing and the manufacturer's installation instructions.

3-4.6.3 Thickness of sleeves for fire dampers shall not be less than that associated with the conditions of rating under Section 3-4.

Exception: Where UL 555 permits sleeve thickness to be the same as duct gage, such thickness shall mean not less than the following:

Air Duct Diameter or Maximum Width	Minimum Sleeve Thickness
12 in. or less	0.018 in. (26 ga.)
13 in. — 30 in.	0.024 in. (24 ga.)
31 in. — 54 in.	0.030 in. (22 ga.)
55 in. — 84 in.	0.036 in. (20 ga.)
85 in. or more	0.047 in. (18 ga.)

For SI units: 1 in. = 2.54 cm, 25.4 mm.

3-4.6.4 Patching, Filling, and Repairing. Where air ducts pass through walls, floors, or partitions required to have a fire resistance rating and where fire dampers are not required, the opening in the construction around the air duct shall not exceed 1-in. (2.54-cm) average clearance on all sides and shall be filled solid with an approved material capable of preventing the passage of flame and hot gases sufficient to ignite cotton waste when subjected to the same NFPA 251 time-temperature fire conditions required for fire barrier penetration.

Exception: Where fire dampers are installed, proper clearance for expansion shall be maintained. (See 3-4.6.)

3-4.7 Maintenance. At least every four years remove fusible links (where applicable), operate all dampers to verify that they fully close, check latch, if provided, and lubricate moving parts as necessary.

Chapter 4* Controls

4-1 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, *National Electrical Code*.

4-2 Manual Control. Each air distribution system shall be provided with not less than one manually operable means to stop the operation of supply, return, and exhaust fan(s) in an emergency. The means of manual operation shall be located at an approved location.

4-3* Smoke Dampers.

4-3.1 Smoke dampers shall be controlled by an automatic alarm initiating device. Smoke dampers shall be permitted to be positioned manually from a command station.

4-3.2 Smoke dampers installed to isolate the air handling system in accordance with 2-3.9.2 shall be arranged to close automatically when the system is not in operation.

4-3.3 Smoke dampers installed in smoke barriers may remain open during fan shutdown if their associated controlling damper actuators and smoke detectors remain operational.

4-4* Smoke Detection for Automatic Control.

4-4.1 All automatic shutdown devices shall be tested at least once a year. Special care shall be given to smoke sensing devices and fittings to assure that they are clean and properly calibrated in accordance with manufacturer's instructions.

4-4.2 Location. Smoke detectors listed for use in air distribution systems shall be located:

(a) Downstream of the air filters and ahead of any branch connections in air supply systems of greater than 2,000 cfm (944 L/sec) capacity.

(b) 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 over 15,000 cfm (7080 L/sec) capacity, and serving more than one story.

Exception No. 1: Return system smoke detectors are not required when the entire space served by the air distribution system is protected by a system of area smoke detectors.

Exception No. 2: Fan units whose sole function is to remove air from inside the building to outside the building.

4-4.3* Function. Smoke detectors provided as required by 4-4.2 shall automatically stop their respective fan(s) upon detecting the presence of smoke.

Exception: Where the return air fan is functioning as part of an engineered smoke control system and a different mode is required.

4-4.4 Installation.

4-4.4.1 Smoke detectors shall be installed in accordance with NFPA 72E, *Standard on Automatic Fire Detectors*.

4-4.4.2 In addition to the requirements of 4-4.3, when an approved protective signaling system is installed in the building, the smoke detectors required by the provisions of Section 4-4 shall be connected to the protective signaling system in accordance with the requirements of the appropriate signaling system standard (NFPA 71 or 72) so that the activation of any air distribution system smoke detector will cause a supervisory signal to be indicated at a constantly attended location, or will cause an alarm signal.

4-4.4.3 When smoke detectors required by Section 4-4 are installed in a building not equipped with an approved protective signaling system as addressed by 4-4.4.2:

(a) The smoke detector activation required by Section 4-4 shall cause a visual and an audible signal in a normally occupied area, and

(b) Smoke detector trouble conditions shall be indicated visually or audibly in a normally occupied area and shall be identified as air duct detector trouble.

4-4.4.4 Smoke detectors having power supplied separately from the signaling system for the sole function of stopping fans do not require standby power.

Chapter 5 Acceptance Testing

5-1 General.

5-1.1* An acceptance test shall be performed to determine that the protective measures required in this standard will function when needed to restrict fire and smoke spread. Maintenance, including cleaning, repair, and periodic test, is discussed in Appendix B.

5-1.2 Records shall be maintained on acceptance test results and shall be available for inspection.

5-2 Fire Dampers, Smoke Dampers, and Ceiling Dampers. All fire dampers, smoke dampers, and ceiling dampers shall be operated, prior to building occupancy, to determine that they function in accordance with the requirements of this standard.

5-3 Controls and Operating Systems.

5-3.1 Controls relating to fan shutdown and automatic damper operation shall be tested for compliance with the requirements of this standard. Generally, tests can be included with acceptance testing of the air conditioning controls or fire alarm systems.

5-3.2 Acceptance of fire protection devices in air conditioning and ventilating systems shall, as far as practical, be done under normal operating conditions. Some portions of control or alarm systems may have standby power or other emergency modes of operation and tests shall be run to determine that the system shall operate under these conditions as well as normal conditions.

Chapter 6 Referenced Publications

6-1 The following documents or portions thereof are referenced within this standard and shall be considered part of the requirements of this document. The edition indicated for each reference is the current edition as of the date of the NFPA issuance of this document.

6-1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 30, *Flammable and Combustible Liquids Code*, 1990 edition

NFPA 31, *Standard for the Installation of Oil-Burning Equipment*, 1992 edition

NFPA 54, *National Fuel Gas Code*, 1992 edition

NFPA 70, *National Electrical Code*, 1993 edition

NFPA 71, *Standard for the Installation, Maintenance, and Use of Signaling Systems for Central Station Service*, 1989 edition

NFPA 72, *Standard for the Installation, Maintenance, and Use of Protective Signaling Systems*, 1990 edition

NFPA 72E, *Standard on Automatic Fire Detectors*, 1990 edition

NFPA 75, *Standard for the Protection of Electronic Computer/Data Processing Equipment*, 1992 edition

NFPA 80, *Standard for Fire Doors and Fire Windows*, 1992 edition

NFPA 251, *Standard Methods of Fire Tests of Building Construction and Materials*, 1990 edition

NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*, 1990 edition

NFPA 259, *Standard Test Method for Potential Heat of Building Materials*, 1993 edition

NFPA 262, *Standard Method of Test for Fire and Smoke Characteristics of Wires and Cables*, 1990 edition

6-1.2 Other Publications.

6-1.2.1 ASHRAE Publications. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., 1791 Tullie Circle, NE, Atlanta, GA 30329.

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

ASHRAE Handbook, 1988 Equipment

6-1.2.2 ASTM Publications. American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM C411-1982, *Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation*

ASTM D93-1980, *Test for Flashpoint by Pensky-Martens Closed Tester*

ASTM E136-1982, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*

6-1.2.3 Gypsum Association Publication. Gypsum Association, 1603 Orrington Ave, Evanston, IL 60201.

Fire Resistance Design Manual, Twelfth Edition — 1988

6-1.2.4 SMACNA Publications. Sheet Metal and Air Conditioning Contractors' National Assn., Inc., 4201 Lafayette Center Drive, Chantilly, VA 22021-1209.

SMACNA Fibrous Glass Duct Construction Standard, Fifth Edition — 1979

SMACNA HVAC Air Duct Leakage Manual — 1985

SMACNA HVAC Duct Construction Standards, First Edition — 1985

6-1.2.5 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062.

UL 181-1990, *Standard for Factory-Made Air Ducts and Connectors*

UL 181A-1990, *Standard for Closure Systems for Use with Rigid Air Ducts and Air Connectors*

UL 555-1990, *Standard for Fire Dampers, Fourth Edition*

UL 555-1986, *Standard for Fire Dampers and Ceiling Dampers, Third Edition*

UL 555S-1983, *Standard for Leakage Rated Dampers for Use in Smoke Control Systems*

UL 867-1987, *Standard for Electrostatic Air Cleaners*

UL 900-1987, *Standard for Test Performance of Air Filter Units*

UL 1820-1989, *Fire Test of Pneumatic Tubing for Flame and Smoke Characteristics Only*

UL 1887-1989, *Fire Test of Plastic Sprinkler Pipe for Flame and Smoke Characteristics*

UL 2043-1992, *Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces*

6-1.2.6 NAIMA Publication. North American Insulation Manufacturers Association, 44 Canal Center Plaza, Suite 310, Alexandria, VA 22314.

Fibrous Glass Duct Construction Manual, First Edition, 1989

Appendix A

This Appendix is not a part of the requirements of this NFPA document, but is included for information purposes only.

A-1-2 (a) For the purpose 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 25,000 cu ft (707.9 m³) in volume, see NFPA 90B, *Standard for the Installation of Warm Air Heating and Air Conditioning Systems*.

A-1-2 (b) For construction types, see NFPA 220, *Standard on Types of Building Construction*.

A-1-2 (c) Such applicable standards include, but are not limited to: NFPA 90B, *Standard for the Installation of Warm Air Heating and Air Conditioning Systems*, and NFPA 70, *National Electrical Code*, Article 450.

A-1-2 (d) Such applicable standards include, but are not limited to: NFPA 31, *Standard for the Installation of Oil-Burning Equipment*; NFPA 33, *Standard for Spray Application Using Flammable and Combustible Materials*; NFPA 34, *Standard for Dipping and Coating Processes Using Flammable or Combustible Liquids*; NFPA 45, *Standard on Fire Protection for Laboratories Using Chemicals*; NFPA 70, *National Electrical Code*, Article 450; NFPA 75, *Standard for the Protection of Electronic Computer/Data Processing Equipment*; NFPA 91, *Standard for Exhaust Systems for Air Conveying of Materials*; and NFPA 96, *Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment*.

A-1-6 Air Connector. Some such devices are listed in the Underwriters Laboratories Inc. *Gas and Oil Equipment Directory* under the category "Connectors (ALNR)." These devices, since they do not meet all the requirements for air ducts, have limitations on use, length, and location.

A-1-6 Air Inlet and Air Outlet. For further discussion of various types of air inlet and air outlet devices, see Chapter 32, "Space Air Diffusion," in the *Handbook-1985 Fundamentals*, published by the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

A-1-6 Ceiling Damper. Some such devices are listed in the Underwriters Laboratories Inc. *Fire Resistance Directory* under the category of "Ceiling Damper (CABS)."

A-1-6 Fire Damper. Some such devices are listed in the Underwriters Laboratories Inc. *Building Materials Directory* under the category of "Fire Dampers (ALBR)."

A-1-6 Fire Resistance Rating. Some such assemblies are listed in the Underwriters Laboratories Inc. *Fire Resistance Directory* under the categories of "Floors," "Roofs," "Walls and Partitions."

A-1-6 Flame Spread Index. Flame spread indexes for some materials are listed in the Underwriters Laboratories Inc. *Building Materials Directory*.

A-1-6 Smoke Barrier. See also Chapter 6, NFPA 101,[®] *Life Safety Code*,[®] for additional guidance.

A-1-6 Smoke Damper. Smoke dampers may be subjected to various pressure differentials, may be exposed to elevated temperatures, and may be required to open or close against mechanically induced airflow. Some such devices are listed in the Underwriters Laboratories Inc. *Building Materials Directory* under the category "Leakage Rated Dampers (OOYZ)."

A-1-6 Smoke Detector. See NFPA 72E, *Standard on Automatic Fire Detectors*.

A-1-6 Smoke Developed Index. Smoke developed indexes for some materials are listed in Underwriters Laboratories Inc. *Building Materials Directory*.

A-2-3.4.1 Access doors for fire dampers should be located such that the spring catch and fusible links are accessible when the damper is closed. Where the size of the duct permits, the minimum size access door should be 18 in. × 16 in. (45.7 cm × 40.6 cm). For dampers too large for a normal 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 24 in. × 16 in. (61 cm × 40.6 cm), to permit body entry.

Access doors should be located as close as possible to fire dampers and smoke dampers. If feasible, the underside of the duct is preferable to a side door.

Many fire dampers and smoke dampers are preloaded with powerful springs which drive the damper shut. These dampers need to be opened against these springs, which may require getting both arms into the duct.

A-3-3.1.1 Duct penetrations of fire walls should be avoided.

A-3-3.1.1 Exception Fire dampers may be desirable to isolate specific hazards.

A-3-3.3 For information on designs of fire-resistive assemblies incorporating air handling components, see UL *Fire Resistance Directory* under "Floor-Ceiling Designs" or "Roof-Ceiling Designs."

A-3-4.3 The designer should specify the leakage class, maximum pressure, maximum velocity, installation mode (horizontal or vertical), and degradation test temperature of the damper.

A-3-4.6.2 Fire dampers are of 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, but should connect on each side of the partition to a damper installed in a sleeve or frame secured by perimeter mounting angles on both sides of the opening, or as listed. For specific details regarding sleeve thickness, perimeter angle dimensions, size and frequency of fasteners, clearance for expansion, duct-sleeve connections, and fire damper access doors, refer to the manufacturer's installation instructions and Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) *Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems*.

A-4 The summation of the capacities of individual supply air fans should be made if such fans are connected to a common supply air duct system, i.e., all fans connected to a common air duct supply system should be considered as constituting a single system with respect to the applicability of the Chapter 4 provisions that are dependent on system capacity.

A-4-3 The dampers should close as quickly as possible, subject to requirements of system fan and air duct characteristics. The designer should evaluate whether the smoke dampers should be normally open or normally closed and should consider the fail-safe position of the dampers such as during power failure.

A-4-4 The use of smoke detectors in relationship to HVAC systems and high air movement areas, and details as to optimum installation, are covered in NFPA 72E, specifically under "Smoke Sensing Fire Detectors," "HVAC and High Air Movement Areas," as well as under "Smoke Detectors for Control of Smoke Spread."

Protection provided by the installation of smoke detectors and related requirements is intended to prevent the distribution of smoke through the supply air duct system and, preferably, to exhaust a significant quantity of smoke to the outside. Neither function, however, will guarantee either early detection of fire or the detection of smoke concentrations prior to dangerous smoke conditions if smoke movement is other than through the supply air system.

Where facility smoke control protection is determined to be needed, see NFPA 92A, *Recommended Practice for Smoke Control Systems*.

A-4-4.3 Water Flow for Automatic Control. Where automatic water sprinklers are provided and zoned to coordinate with the HVAC zones, their water flow switches should initiate devices for the functions described in this chapter.

Sprinklers are often tested on a weekly basis. When desirable to prevent the accompanying automatic shutdown of fan system(s) referred to in 4-4.2, a means may be used to temporarily avoid such shutdown, provided:

(a) A trouble signal is sustained in the sprinkler supervisory system until the automatic shutdown provision is restored, or

(b) The automatic shutdown provision is restored at the end of the time period necessary to test the sprinkler system, its alarms, and related elements.

A-5-1.1 Many of the fire protection measures required in this standard are passive and only function in emergencies. Therefore, acceptance testing needs to be performed so that all parts of air conditioning systems will be ready for a fire emergency. The access openings, required in 2-3.4, should be checked for proper location, function, and size while conducting acceptance tests.

Appendix B Maintenance

This Appendix is not a part of the requirements of this NFPA document, but is included for information purposes only.

B-1 General.

B-1.1 Owners should develop a greater awareness of the life and property protecting abilities of these systems and establish a planned maintenance schedule. Failure to maintain proper conditions of cleanliness in air duct systems and carelessness in connection with repair operations have been important contributing causes of several fires that have involved air conditioning systems. The following recommendations apply, in general, to the period of operation of the system; systems operating only part of the year should be given a thorough general checkup before starting operation and again after shutting down.

B-1.2 The interval of testing and maintenance will vary widely depending on duration of system operation, condition of fresh air, amount of dust in return air, and other factors. The intervals given in this standard are intended to be maximum and should be shortened if system conditions warrant.

B-1.3 Inspection Form. The use of an inspection form to assist in obtaining a thorough inspection is recommended. The form should be made up to fit the system or systems involved, listing the items needing attention. However, it is suggested that provision be made on the form for equipment location, inspection frequency, due date, inspection date, inspector, and record of discrepancies found.

B-2 Fire Dampers, Smoke Dampers, and Ceiling Dampers. Each damper should be examined every two years to see that it is not rusted or blocked, giving attention to hinges and other moving parts. It is desirable to operate dampers with normal system airflow to assure that they will close and are not held open by the air stream. Care should be exercised to be certain that such tests are run safely and do not cause system damage.

B-3 Filters.

B-3.1 All air filters should be kept free of excess dust and combustible material. Unit filters should be renewed or cleaned when the resistance to airflow has increased to two

times the original resistance or when the resistance has reached a value of recommended replacement by the manufacturer. Provide a suitable draft gage for the purpose. If the filters are of the automatic liquid adhesive type, sludge should be regularly removed from the liquid adhesive reservoir.

B-3.2 When renewing filters, care must be taken to use proper type and size and to avoid gaps between filter sections, mounting frames, or hardware. Damaged filter sections or media should not be used.

B-3.3 Filters designed and manufactured to be thrown away after use should never be cleaned and reused.

B-3.4 Care should be exercised in the use of liquid adhesives. Use of an adhesive of low flash point would create a serious hazard.

B-3.5 Electrical equipment of automatic filters should be inspected semiannually, observing the operation cycle to see that the motor, relays, and other controls function as intended. Drive motors and gear reductions should also be inspected at least semiannually, and lubricated when necessary.

B-4 Inspection and Cleaning of Ducts.

B-4.1 Inspections to determine the amount of dust and waste material in the ducts (both discharge and return) should be made quarterly, except that if after several inspections such frequent inspection is found unnecessary, the interval between inspections may be adjusted to suit the conditions.

B-4.2 Cleaning should be undertaken whenever inspection indicates the need.

B-4.3 Cooling and heating coils should be cleaned, if necessary, at the time of cleaning the ducts. Thorough cleaning of ducts may require scraping, brushing, or other positive means. Vacuum cleaning may not remove dust of an oily or sticky nature, or heavy accumulations in the elbows or seams. The amount and kind of dust and dirt will depend greatly on the occupancy and the arrangement of the duct system. Additional access doors or panels may be required for complete cleaning of duct systems.

B-5 Inspection and Cleaning of Plenums.

B-5.1 Apparatus casing and air handling unit plenums should be inspected monthly, except that if after several inspections such frequent inspection is found unnecessary, the interval between inspections may be adjusted to suit the conditions.

B-5.2 Ceiling cavity, raised floor, and duct distribution plenums should be inspected similar to ducts, beginning with quarterly inspections and adjusting frequency to suit dirt buildup conditions.

B-5.3 Cleaning should be undertaken whenever inspection indicates the need, especially in common plenums serving more than one fan or system. Where plenum chambers being used for storage are found, arrangements, such as keeping the doors locked, should be made to prevent such usage. (See 2-3.10.)

B-5.4 Repair Work. Great caution should be exercised in the use of open flames or spark emitting devices inside of ducts or plenum chambers, or near air intakes.

B-6 Outside Air Intakes.

B-6.1 Conditions outside the outside air intake should be examined at the time of inspection of the ducts. Items to be noted are: (a) accumulations of combustible material near the intake, (b) presence of buildings or structures which may present an exposure to the intake allowing smoke and fire to be drawn in, and (c) operating condition of any automatic damper designed to protect the opening against exposure fire.

B-6.2 If accumulations of combustible material are noted, they should be immediately removed and arrangements made to avoid such accumulations. Inspections should thereafter be made more frequently. If newly erected exposures are noticed, consideration should be given to the protection at the intake to see that it is adequate. (See 2-2.1.)

B-7 Fans and Fan Motors.

B-7.1 Fans and fan motors should be inspected at least quarterly, and cleaned and lubricated when necessary. Care should be exercised in lubricating fans to avoid allowing lubricant to run onto the fan blades. Fans should also be checked for alignment, and to see that they are running freely.

B-7.2 The alignment of fan belt drives should be checked since improper alignment can cause motor overheating as well as premature belt failure.

B-8 Controls. Fan controls should be examined and activated at least once a year to assure that they are in operable condition.

Appendix C Referenced Publications

C-1 The following documents or portions thereof are referenced within this standard for informational purposes only and thus are not considered part of the requirements of this document. The edition indicated for each reference is the current edition as of the date of the NFPA issuance of this document.

C-1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 31, *Standard for the Installation of Oil-Burning Equipment*, 1992 edition

NFPA 33, *Standard for Spray Application Using Flammable and Combustible Materials*, 1989 edition

NFPA 34, *Standard for Dipping and Coating Processes Using Flammable or Combustible Liquids*, 1989 edition

NFPA 45, *Standard on Fire Protection for Laboratories Using Chemicals*, 1991 edition

NFPA 70, *National Electrical Code*, 1993 edition

NFPA 72E, *Standard on Automatic Fire Detectors*, 1900 edition

NFPA 75, *Standard for the Protection of Electronic Computer/ Data Processing Equipment*, 1992 edition

NFPA 90B, *Standard for the Installation of Warm Air Heating and Air Conditioning Systems*, 1993 edition

NFPA 91, *Standard for Exhaust Systems Air Conveying of Materials*, 1992 edition

NFPA 92A, *Recommended Practice for Smoke Control Systems*, 1988 edition

NFPA 92B, *Guide for Smoke Management Systems in Malls, Atria, and Large Areas*, 1991 edition

NFPA 96, *Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment*, 1991 edition

NFPA 101, *Life Safety Code*, 1991 edition

NFPA 220, *Standard on Types of Building Construction*, 1992 edition

C-1.2 Other Publications.

C-1.2.1 ASHRAE Publication. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., 1791 Tullie Circle NE, Atlanta, GA 30329.

ASHRAE *Handbook Fundamentals*, 1989

C-1.2.2 SMACNA Publication. Sheet Metal and Air Conditioning Contractors' National Assn., Inc., 4201 Lafayette Drive, Chantilly, VA 22021-1209.

SMACNA *Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems*

C-1.2.3 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Rd., Northbrook, IL 60062.

UL *Building Materials Directory*, 1992

UL *Fire Resistance Directory*, 1992

UL *Gas and Oil Equipment Directory*, 1992

Index

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