

CHAPTER 6

DUCT SYSTEMS

User note:

About this chapter: Chapter 6 addresses duct systems used in HVAC systems and some exhaust systems. Some exhaust system ducts are addressed in Chapter 5, such as kitchen exhaust ducts and clothes dryer exhaust ducts. This chapter addresses air plenums such as above-ceiling and below-floor plenums. Section 607 covers fire and smoke dampers, consistent with the requirements of the International Building Code®.

SECTION 601 GENERAL

601.1 Scope. Duct systems used for the movement of air in air-conditioning, heating, ventilating and exhaust systems shall conform to the provisions of this chapter except as otherwise specified in Chapters 5 and 7.

Exception: Ducts discharging combustible material directly into any *combustion* chamber shall conform to the requirements of NFPA 82.

[BE] 601.2 Air movement in egress elements. Corridors shall not serve as supply, return, exhaust, relief or *ventilation air* ducts.

Exceptions:

1. Use of a corridor as a source of *makeup air* for exhaust systems in rooms that open directly onto such corridors, including toilet rooms, bathrooms, dressing rooms, smoking lounges and janitor closets, shall be permitted, provided that each such corridor is directly supplied with outdoor air at a rate greater than the rate of *makeup air* taken from the corridor.
2. Where located within a *dwelling unit*, the use of corridors for conveying return air shall not be prohibited.
3. Where located within tenant spaces of 1,000 square feet (93 m²) or less in area, use of corridors for conveying return air is permitted.
4. Transfer air movement required to maintain pressurization difference within health care facilities in accordance with ASHRAE 170.

[BE] 601.2.1 Corridor ceiling. Use of the space between the corridor ceiling and the floor or roof structure above as a return air *plenum* is permitted for one or more of the following conditions:

1. The corridor is not required to be of fire-resistance-rated construction.
2. The corridor is separated from the *plenum* by fire-resistance-rated construction.
3. The air-handling system serving the corridor is shut down upon activation of the air-handling unit smoke detectors required by this code.
4. The air-handling system serving the corridor is shut down upon detection of sprinkler waterflow

where the building is equipped throughout with an automatic sprinkler system.

5. The space between the corridor ceiling and the floor or roof structure above the corridor is used as a component of an *approved* engineered smoke control system.

[BE] 601.3 Exits. *Equipment* and ductwork for exit enclosure ventilation shall comply with one of the following items:

1. Such *equipment* and ductwork shall be located exterior to the building and shall be directly connected to the exit enclosure by ductwork enclosed in construction as required by the *International Building Code* for shafts.
2. Where such *equipment* and ductwork is located within the exit enclosure, the intake air shall be taken directly from the outdoors and the *exhaust air* shall be discharged directly to the outdoors, or such air shall be conveyed through ducts enclosed in construction as required by the *International Building Code* for shafts.
3. Where located within the building, such *equipment* and ductwork shall be separated from the remainder of the building, including other mechanical *equipment*, with construction as required by the *International Building Code* for shafts.

In each case, openings into fire-resistance-rated construction shall be limited to those needed for maintenance and operation and shall be protected by self-closing fire-resistance-rated devices in accordance with the *International Building Code* for enclosure wall opening protectives. Exit enclosure ventilation systems shall be independent of other building ventilation systems.

601.4 Contamination prevention. Exhaust ducts under positive pressure, *chimneys* and vents shall not extend into or pass through ducts or *plenums*.

Exceptions:

1. Exhaust systems located in ceiling return air *plenums* over spaces that are permitted to have 10 percent recirculation in accordance with Section 403.2.1, Item 4. The exhaust duct joints, seams and connections shall comply with Section 603.9.
2. This section shall not apply to *chimneys* and vents that pass through *plenums* where such venting

DUCT SYSTEMS

systems comply with one of the following requirements:

- 2.1. The venting system shall be listed for positive pressure applications and shall be sealed in accordance with the vent manufacturer's instructions.
- 2.2. The venting system shall be installed such that fittings and joints between sections are not installed in the above ceiling space.
- 2.3. The venting system shall be installed in a conduit or enclosure with sealed joints separating the interior of the conduit or enclosure from the ceiling space.

601.5 Return air openings. Return air openings for heating, ventilation and air-conditioning systems shall comply with all of the following:

1. Openings shall not be located less than 10 feet (3048 mm) measured in any direction from an open combustion chamber or draft hood of another *appliance* located in the same room or space.
2. Return air shall not be taken from a hazardous or insanitary location or a refrigeration room as defined in this code.
3. The amount of return air taken from any room or space shall be not greater than the flow rate of supply air delivered to such room or space.
4. Return and transfer openings shall be sized in accordance with the *appliance* or *equipment* manufacturer's installation instructions, ACCA Manual D or the design of the registered design professional.
5. Return air taken from one *dwelling unit* shall not be discharged into another *dwelling unit*.
6. Taking return air from a crawl space shall not be accomplished through a direct connection to the return side of a forced air furnace. Transfer openings in the crawl space enclosure shall not be prohibited.
7. Return air shall not be taken from a closet, bathroom, toilet room, kitchen, garage, boiler room, furnace room or unconditioned attic.
8. Return air shall not be taken from indoor swimming pool enclosures and associated deck areas.

Exceptions:

1. Where the air from such spaces is dehumidified in accordance with Section 403.2.1, Item 2.
2. Dedicated HVAC systems serving only such spaces.

Exceptions:

1. Taking return air from a kitchen is not prohibited where such return air openings serve the kitchen and are located not less than 10 feet (3048 mm) from the cooking *appliances*.

2. Taking return air from a kitchen is not prohibited in a *dwelling unit* where the kitchen and living spaces are in a single room and the cooking *appliance* is electric and located not less than 5 feet (1524 mm) in any direction from the return air intake opening.
3. Dedicated forced air systems serving only the garage shall not be prohibited from obtaining return air from the garage.

SECTION 602 PLENUMS

602.1 General. Supply, return, exhaust, relief and ventilation air *plenums* shall be limited to uninhabited crawl spaces, areas above a ceiling or below the floor, attic spaces, mechanical *equipment* rooms and the framing cavities addressed in Section 602.3. *Plenums* shall be limited to one fire area. Air systems shall be ducted from the boundary of the fire area served directly to the air-handling *equipment*. Fuel-fired *appliances* shall not be installed within a *plenum*.

602.2 Construction. *Plenum* enclosure construction materials that are exposed to the airflow shall comply with the requirements of Section 703.5 of the *International Building Code* or such materials shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E84 or UL 723.

The use of gypsum boards to form *plenums* shall be limited to systems where the air temperatures do not exceed 125°F (52°C) and the building and mechanical system design conditions are such that the gypsum board surface temperature will be maintained above the airstream dew-point temperature. Supply air *plenums* formed by gypsum boards shall not be incorporated in air-handling systems utilizing *direct evaporative cooling* systems.

602.2.1 Materials within plenums. Except as required by Sections 602.2.1.1 through 602.2.1.8, materials within *plenums* shall be noncombustible or shall be *listed* and *labeled* as having a flame spread index of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E84 or UL 723.

Exceptions:

1. Rigid and flexible ducts and connectors shall conform to Section 603.
2. Duct coverings, linings, tape and connectors shall conform to Sections 603 and 604.
3. This section shall not apply to materials exposed within *plenums* in one- and two-family dwellings.
4. This section shall not apply to smoke detectors.
5. Combustible materials fully enclosed within one of the following:
 - 5.1. Continuous noncombustible raceways or enclosures.
 - 5.2. Approved gypsum board assemblies.

- 5.3. Materials *listed* and *labeled* for installation within a *plenum* and listed for the application.
6. Materials in Group H, Division 5 fabrication areas and the areas above and below the fabrication area that share a common air recirculation path with the fabrication area.

602.2.1.1 Wiring. Combustible electrical wires and cables and optical fiber cables exposed within a *plenum* shall be *listed* and *labeled* as having a peak optical density not greater than 0.50, an average optical density not greater than 0.15, and a flame spread distance not greater than 5 feet (1524 mm) when tested in accordance with NFPA 262, or shall be installed in metal raceways or metal sheathed cable. Combustible optical fiber and communication raceways exposed within a *plenum* shall be *listed* and *labeled* as having a peak optical density not greater than 0.5, an average optical density not greater than 0.15, and a flame spread distance not greater than 5 feet (1524 mm) when tested in accordance with UL 2024. Only plenum-rated wires and cables shall be installed in plenum-rated raceways.

602.2.1.2 Fire sprinkler piping. Plastic fire sprinkler piping exposed within a *plenum* shall be used only in wet pipe systems and shall be *listed* and *labeled* as having a peak optical density not greater than 0.50, an average optical density not greater than 0.15, and a flame spread distance not greater than 5 feet (1524 mm) when tested in accordance with UL 1887.

602.2.1.3 Pneumatic tubing. Combustible pneumatic tubing exposed within a *plenum* shall be *listed* and *labeled* as having a peak optical density not greater than 0.50, an average optical density not greater than 0.15, and a flame spread distance not greater than 5 feet (1524 mm) when tested in accordance with UL 1820.

602.2.1.4 Electrical equipment in plenums. Electrical *equipment* exposed within a *plenum* shall comply with Sections 602.2.1.4.1 and 602.2.1.4.2.

602.2.1.4.1 Equipment in metallic enclosures. Electrical *equipment* with metallic enclosures exposed within a *plenum* shall be permitted.

602.2.1.4.2 Equipment in combustible enclosures. Electrical *equipment* with combustible enclosures exposed within a *plenum* shall be *listed* and *labeled* for such use in accordance with UL 2043.

602.2.1.5 Discrete plumbing and mechanical products in plenums. Where discrete plumbing and mechanical products and appurtenances are located in a *plenum* and have exposed combustible material, they shall be *listed* and *labeled* for such use in accordance with UL 2043.

602.2.1.6 Foam plastic in plenums as interior finish or interior trim. Foam plastic in *plenums* used as interior wall or ceiling finish or interior trim shall exhibit a flame spread index of 25 or less and a smoke-devel-

oped index of 50 or less when tested in accordance with ASTM E84 or UL 723 at the maximum thickness and density intended for use, and shall be tested in accordance with NFPA 286 and meet the acceptance criteria of Section 803.1.2 of the *International Building Code*. As an alternative to testing to NFPA 286, the foam plastic shall be approved based on tests conducted in accordance with Section 2603.9 of the *International Building Code*.

Exceptions:

1. Foam plastic in *plenums* used as interior wall or ceiling finish or interior trim 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 or UL 723 at the maximum thickness and density intended for use, where it is separated from the airflow in the *plenum* by a thermal barrier complying with Section 2603.4 of the *International Building Code*.
2. Foam plastic in *plenums* used as interior wall or ceiling finish or interior trim, 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 or UL 723 at the maximum thickness and density intended for use, where it is separated from the airflow in the *plenum* by corrosion-resistant steel having a base metal thickness of not less than 0.0160 inch (0.4 mm).
3. Foam plastic in *plenums* used as interior wall or ceiling finish or interior trim, 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 or UL 723 at the maximum thickness and density intended for use, where it is separated from the airflow in the *plenum* by not less than a 1-inch (25 mm) thickness of masonry or concrete.

602.2.1.7 Plastic plumbing piping and tubing. Plastic piping and tubing used in plumbing systems shall be *listed* and *labeled* as having a flame spread index not greater than 25 and a smoke-developed index not greater than 50 when tested in accordance with ASTM E84 or UL 723.

Exception: Plastic water distribution piping and tubing *listed* and *labeled* in accordance with UL 2846 as having a peak optical density not greater than 0.50, an average optical density not greater than 0.15, and a flame spread distance not greater than 5 feet (1524 mm), and installed in accordance with its listing.

602.2.1.8 Pipe and duct insulation within plenums. Pipe and duct insulation contained within *plenums*, including insulation adhesives, shall have a flame spread index of not more than 25 and a smoke-devel-

oped index of not more than 50 when tested in accordance with ASTM E84 or UL 723, using the specimen preparation and mounting procedures of ASTM E2231. Pipe and duct insulation shall not flame, glow, smolder or smoke when tested in accordance with ASTM C411 at the temperature to which they are exposed in service. The test temperature shall not fall below 250°F (121°C). Pipe and duct insulation shall be *listed* and *labeled*. Pipe and duct insulation shall not be used to reduce the maximum flame spread and smoke-developed indices except where the pipe or duct and its related insulation, coatings, and adhesives are tested as a composite assembly in accordance with Section 602.2.1.7.

602.3 Stud cavity and joist space plenums. Stud wall cavities and the spaces between solid floor joists to be utilized as air *plenums* shall comply with the following conditions:

1. Such cavities or spaces shall not be utilized as a *plenum* for supply air.
2. Such cavities or spaces shall not be part of a required fire-resistance-rated assembly.
3. Stud wall cavities shall not convey air from more than one floor level.
4. Stud wall cavities and joist space *plenums* shall comply with the floor penetration protection requirements of the *International Building Code*.
5. Stud wall cavities and joist space *plenums* shall be isolated from adjacent concealed spaces by *approved* fireblocking as required in the *International Building Code*.
6. Stud wall cavities in the outside walls of building envelope assemblies shall not be utilized as air *plenums*.

[BS] **602.4 Flood hazard.** For structures located in flood hazard areas, *plenum* spaces shall be located above the elevation required by Section 1612 of the *International Building Code* for utilities and attendant equipment or shall be designed and constructed to prevent water from entering or accumulating within the *plenum* spaces during floods up to such elevation. If the *plenum* spaces are located below the elevation required by Section 1612 of the *International Building Code* for utilities and attendant equipment, they shall be capable of resisting hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding up to such elevation.

SECTION 603 DUCT CONSTRUCTION AND INSTALLATION

603.1 General. An air distribution system shall be designed and installed to supply the required distribution of air. The installation of an air distribution system shall not affect the fire protection requirements specified in the *International Building Code*. Ducts shall be constructed, braced, reinforced and installed to provide structural strength and durability.

603.2 Duct sizing. Ducts installed within a single *dwelling unit* shall be sized in accordance with ACCA Manual D, the *appliance* manufacturer's installation instructions or other approved methods. Ducts installed within all other buildings shall be sized in accordance with the ASHRAE *Handbook of Fundamentals* or other equivalent computation procedure.

603.3 Duct classification. Ducts shall be classified based on the maximum operating pressure of the duct at pressures of positive or negative 0.5, 1.0, 2.0, 3.0, 4.0, 6.0 or 10.0 inches (1 inch w.c. = 248.7 Pa) of water column. The pressure classification of ducts shall equal or exceed the design pressure of the air distribution in which the ducts are utilized.

603.4 Metallic ducts. Metallic ducts shall be constructed as specified in the SMACNA *HVAC Duct Construction Standards—Metal and Flexible*.

Exception: Ducts installed within single *dwelling units* shall have a minimum thickness as specified in Table 603.4.

603.4.1 Minimum fasteners. Round metallic ducts shall be mechanically fastened by means of not less than three sheet metal screws or rivets spaced equally around the joint.

Exception: Where a duct connection is made that is partially inaccessible, three screws or rivets shall be equally spaced on the exposed portion so as to prevent a hinge effect.

603.4.2 Duct lap. Crimp joints for round and oval metal ducts shall be lapped not less than 1 inch (25 mm) and the male end of the duct shall extend into the adjoining duct in the direction of airflow.

603.5 Nonmetallic ducts. Nonmetallic ducts shall be constructed with Class 0 or Class 1 duct material and shall comply with UL 181. Fibrous duct construction shall conform to the SMACNA *Fibrous Glass Duct Construction Standards* or NAIMA *Fibrous Glass Duct Construction Standards*. The air temperature within nonmetallic ducts shall not exceed 250°F (121°C).

603.5.1 Gypsum ducts. The use of gypsum boards to form air shafts (ducts) shall be limited to return air systems where the air temperatures do not exceed 125°F (52°C) and the gypsum board surface temperature is maintained above the airstream dew-point temperature. Supply air ducts formed by gypsum boards shall not be incorporated in air-handling systems utilizing *direct evaporative cooling* systems.

603.5.2 Phenolic ducts. Nonmetallic phenolic ducts shall be constructed and installed in accordance with the SMACNA *Phenolic Duct Construction Standards*.

603.6 Flexible air ducts and flexible air connectors. Flexible air ducts, both metallic and nonmetallic, shall comply with Sections 603.6.1, 603.6.1.1, 603.6.3 and 603.6.4. Flexible air connectors, both metallic and nonmetallic, shall comply with Sections 603.6.2 through 603.6.4.

603.6.1 Flexible air ducts. Flexible air ducts, both metallic and nonmetallic, shall be tested in accordance with UL 181. Such ducts shall be *listed* and *labeled* as Class 0 or

**TABLE 603.4
DUCT CONSTRUCTION MINIMUM SHEET METAL THICKNESS FOR SINGLE DWELLING UNITS^a**

ROUND DUCT DIAMETER (inches)	STATIC PRESSURE			
	¹ / ₂ -inch water gauge		1-inch water gauge	
	Thickness (inches)		Thickness (inches)	
	Galvanized	Aluminum	Galvanized	Aluminum
< 12	0.013	0.018	0.013	0.018
12 to 14	0.013	0.018	0.016	0.023
15 to 17	0.016	0.023	0.019	0.027
18	0.016	0.023	0.024	0.034
19 to 20	0.019	0.027	0.024	0.034
RECTANGULAR DUCT DIMENSION (inches)	STATIC PRESSURE			
	¹ / ₂ -inch water gauge		1-inch water gauge	
	Thickness (inches)		Thickness (inches)	
	Galvanized	Aluminum	Galvanized	Aluminum
≤ 8	0.013	0.018	0.013	0.018
9 to 10	0.013	0.018	0.016	0.023
11 to 12	0.016	0.023	0.019	0.027
13 to 16	0.019	0.027	0.019	0.027
17 to 18	0.019	0.027	0.024	0.034
19 to 20	0.024	0.034	0.024	0.034

For SI: 1 inch = 25.4 mm, 1-inch water gauge = 249 Pa.

a. Ductwork that exceeds 20 inches by dimension or exceeds a pressure of 1-inch water gauge shall be constructed in accordance with SMACNA *HVAC Duct Construction Standards—Metal and Flexible*.

Class 1 flexible air ducts and shall be installed in accordance with Section 304.1.

603.6.1.1 Duct length. Flexible air ducts shall not be limited in length.

603.6.2 Flexible air connectors. Flexible air connectors, both metallic and nonmetallic, shall be tested in accordance with UL 181. Such connectors shall be *listed* and *labeled* as Class 0 or Class 1 flexible air connectors and shall be installed in accordance with Section 304.1.

603.6.2.1 Connector length. Flexible air connectors shall be limited in length to 14 feet (4267 mm).

603.6.2.2 Connector penetration limitations. Flexible air connectors shall not pass through any wall, floor or ceiling.

603.6.3 Air temperature. The design temperature of air to be conveyed in flexible air ducts and flexible air connectors shall be less than 250°F (121°C).

603.6.4 Flexible air duct and air connector clearance. Flexible air ducts and air connectors shall be installed with a minimum *clearance* to an *appliance* as specified in the *appliance* manufacturer’s installation instructions.

603.7 Rigid duct penetrations. Duct system penetrations of walls, floors, ceilings and roofs and air transfer openings in such building components shall be protected as required by Section 607. Ducts in a private garage that penetrate a wall or ceiling that separates a dwelling from a private garage shall be continuous, shall be constructed of sheet steel having a thickness of not less than 0.0187 inch (0.4712 mm) (No. 26 gage) and shall not have openings into the garage.

Fire and smoke dampers are not required in such ducts passing through the wall or ceiling separating a dwelling from a private garage except where required by Chapter 7 of the *International Building Code*.

603.8 Underground ducts. Ducts shall be *approved* for underground installation. Metallic ducts not having an *approved* protective coating shall be completely encased in not less than 2 inches (51 mm) of concrete.

603.8.1 Slope. Ducts shall have a minimum slope of ¹/₈ inch per foot (10.4 mm/m) to allow drainage to a point provided with access.

603.8.2 Sealing. Ducts shall be sealed, secured and tested prior to concrete encasement or direct burial. Ducts shall be leak tested as required by Section C403 of the *International Energy Conservation Code*.

603.8.3 Plastic ducts and fittings. Plastic ducts shall be constructed of PVC having a minimum pipe stiffness of 8 psi (55 kPa) at 5-percent deflection when tested in accordance with ASTM D2412. Plastic duct fittings shall be constructed of either PVC or high-density polyethylene. Plastic duct and fittings shall be utilized in underground installations only. The maximum design temperature for systems utilizing plastic duct and fittings shall be 150°F (66°C).

603.9 Joints, seams and connections. Longitudinal and transverse joints, seams and connections in metallic and nonmetallic ducts shall be constructed as specified in SMACNA *HVAC Duct Construction Standards—Metal and Flexible* and NAIMA *Fibrous Glass Duct Construction*

DUCT SYSTEMS

Standards. Joints, longitudinal and transverse seams and connections in ductwork shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems, liquid sealants or tapes. Tapes and mastics used to seal fibrous glass ductwork shall be *listed* and *labeled* in accordance with UL 181A and shall be marked “181 A-P” for pressure-sensitive tape, “181 A-M” for mastic or “181 A-H” for heat-sensitive tape. Tapes and mastics used to seal metallic and flexible air ducts and flexible air connectors shall comply with UL 181B and shall be marked “181 B-FX” for pressure-sensitive tape or “181 B-M” for mastic. Duct connections to flanges of air distribution system *equipment* shall be sealed and mechanically fastened. Mechanical fasteners for use with flexible nonmetallic air ducts shall comply with UL 181B and shall be marked “181 B-C.” Closure systems used to seal all ductwork shall be installed in accordance with the manufacturer’s instructions.

Exception: For ducts having a static pressure classification of less than 2 inches of water column (500 Pa), additional closure systems shall not be required for continuously welded joints and seams and locking-type joints and seams. This exception shall not apply to snap-lock and button-lock type joints and seams located outside of conditioned spaces.

603.10 Supports. Ducts shall be supported in accordance with SMACNA *HVAC Duct Construction Standards—Metal and Flexible*. Flexible and other factory-made ducts shall be supported in accordance with the manufacturer’s instructions.

603.11 Furnace connections. Ducts connecting to a furnace shall have a *clearance* to combustibles in accordance with the furnace manufacturer’s installation instructions.

603.12 Condensation. Provisions shall be made to prevent the formation of condensation on the exterior of any duct.

[BS] 603.13 Flood hazard areas. For structures in flood hazard areas, ducts shall be located above the elevation required by Section 1612 of the *International Building Code* for utilities and attendant equipment or shall be designed and constructed to prevent water from entering or accumulating within the ducts during floods up to such elevation. If the ducts are located below the elevation required by Section 1612 of the *International Building Code* for utilities and attendant equipment, the ducts shall be capable of resisting hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding up to such elevation.

603.14 Location. Ducts shall not be installed in or within 4 inches (102 mm) of the earth, except where such ducts comply with Section 603.8.

603.15 Mechanical protection. Ducts installed in locations where they are exposed to mechanical damage by vehicles or from other causes shall be protected by *approved* barriers.

603.16 Weather protection. Ducts including linings, coverings and vibration isolation connectors installed on the exterior of the building shall be protected against the elements.

603.17 Air dispersion systems. Air dispersion systems shall:

1. Be installed entirely in exposed locations.
2. Be utilized in systems under positive pressure.
3. Not pass through or penetrate fire-resistant-rated construction.
4. Be *listed* and *labeled* in compliance with UL 2518.

603.18 Registers, grilles and diffusers. Duct registers, grilles and diffusers shall be installed in accordance with the manufacturer’s instructions. Volume dampers or other means of supply air adjustment shall be provided in the branch ducts or at each individual duct register, grille or diffuser. Each volume damper or other means of supply air adjustment used in balancing shall be provided with access.

603.18.1 Floor registers. Floor registers shall resist, without structural failure, a 200-pound (90.8 kg) concentrated load on a 2-inch-diameter (51 mm) disc applied to the most critical area of the exposed face.

603.18.2 Prohibited locations. Diffusers, registers and grilles shall be prohibited in the floor or its upward extension within toilet and bathing rooms required by the *International Building Code* to have smooth, hard, non-absorbent surfaces.

Exception: *Dwelling units.*

SECTION 604 INSULATION

604.1 General. Duct insulation shall conform to the requirements of Sections 604.2 through 604.13 and the *International Energy Conservation Code*.

604.2 Surface temperature. Ducts that operate at temperatures exceeding 120°F (49°C) shall have sufficient thermal insulation to limit the exposed surface temperature to 120°F (49°C).

604.3 Coverings and linings. Duct coverings and linings, including adhesives where used, shall have a flame spread index not more than 25 and a smoke-developed index not more than 50, when tested in accordance with ASTM E84 or UL 723, using the specimen preparation and mounting procedures of ASTM E2231. Duct coverings and linings shall not flame, glow, smolder or smoke when tested in accordance with ASTM C411 at the temperature to which they are exposed in service. The test temperature shall not fall below 250°F (121°C). Coverings and linings shall be *listed* and *labeled*.

Exception: Polyurethane foam insulation that is spray applied to the exterior of ducts in attics and crawl spaces shall be subject to all of the following requirements:

1. The foam plastic insulation shall have a flame spread index not greater than 25 and a smoke-developed index not greater than 450, when tested in accordance with ASTM E84 or UL 723, using the specimen preparation and mounting procedures of ASTM E2231.