

CHAPTER 6

DUCT SYSTEMS

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.

■ **[B] 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, utilization of corridors for conveying return air is permitted.

[B] 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; or
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.

■ **[B] 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 *Florida Building Code, Building* 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 *Florida Building Code, Building* 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 *Florida Building Code, Building* 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 *Florida Building Code, Building* for enclosure wall opening protectives. Exit enclosure ventilation systems shall be independent of other building ventilation systems.

601.4 Balanced return air. Restricted return air occurs in buildings when returns are located in central zones and closed interior doors impede air flow to the return grille or when ceiling spaces are used as return plenums and fire walls restrict air movement from one portion of the return plenum to another. Provisions shall be made in both residential and commercial buildings to avoid unbalanced air flows and pressure differentials caused by restricted return air. Pressure differentials across closed doors where returns are centrally located shall be limited to 0.01 inch WC (2.5 Pa) or less. Pressure differentials across fire walls in ceiling space plenums shall be limited to 0.01 inch WC (2.5 Pa) by providing air duct pathways or air transfer pathways from the high pressure zone to the low zone.

Exceptions:

1. Transfer ducts may achieve this by increasing the return transfer 1¹/₂ times the cross sectional area (square inches) of the supply duct entering the room or space it serves and the door having at least an unrestricted 1-inch undercut to achieve proper return air balance.
2. Transfer grilles shall use 50 square inches (of grille area) to 100 cfm (of supply air) for sizing through-the-wall transfer grilles and using an unrestricted 1-inch undercutting of doors to achieve proper return air balance.

3. Habitable rooms only shall be required to meet these requirements for proper balanced return air excluding bathrooms, closets, storage rooms and laundry rooms, except that all supply air into the master suite shall be included.

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

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 and mechanical equipment rooms. Plenums shall be limited to one fire area. Fuel-fired appliances shall not be installed within a plenum.

602.2 Construction. Plenum enclosures shall be constructed of materials permitted for the type of construction classification of the building.

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. Air plenums formed by gypsum boards shall not be incorporated in air-handling systems utilizing evaporative coolers.

602.2.1 Materials exposed within plenums. Except as required by Sections 602.2.1.1 through 602.2.1.5, materials within plenums shall be noncombustible or 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 E 84.

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 enclosed in noncombustible raceways or enclosures, approved gypsum board assemblies or enclosed in materials listed and labeled for such application.
6. Condensate pump units with a total volume not exceeding 2 cubic feet.
7. Loudspeakers, loudspeaker assemblies and their accessories exposed within a plenum shall have a peak optical density not greater than 0.50, an average optical density not greater than 0.15, and a peak heat release rate not greater than 100 kW when tested in accordance with UL 2043.

602.2.1.1 Wiring. Combustible electrical or electronic wiring methods and materials, optical fiber cable, and

optical fiber raceway exposed within a plenum shall have a peak optical density not greater than 0.50, an average optical density not greater than 0.15, and a flame spread not greater than 5 feet (1524 mm) when tested in accordance with NFPA 262. Only type OFNP (plenum rated nonconductive optical fiber cable) shall be installed in plenum-rated optical fiber raceways. Wiring, cable, and raceways addressed in this section shall be listed and labeled as plenum rated and shall be installed in accordance with Chapter 27 of the *Florida Building Code, Building*.

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 have a peak optical density not greater than 0.50, an average optical density not greater than 0.15, and a flame spread of not greater than 5 feet (1524 mm) when tested in accordance with UL 1887. Piping shall be listed and labeled.

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

602.2.1.4 Combustible electrical equipment. Combustible electrical equipment exposed within a plenum shall have a peak rate of heat release not greater than 100 kilowatts, a peak optical density not greater than 0.50 and an average optical density not greater than 0.15 when tested in accordance with UL 2043. Combustible electrical equipment shall be listed and labeled.

602.2.1.5 Foam plastic insulation. Foam plastic insulation used as wall or ceiling finish in plenums 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 E 84 and shall also comply with Section 602.2.1.5.1, 602.2.1.5.2 or 602.2.1.5.3.

602.2.1.5.1 Separation required. The foam plastic insulation shall be separated from the plenum by a thermal barrier complying with Section 2603.4 of the *Florida Building Code, Building*.

602.2.1.5.2 Approval. The foam plastic insulation shall be approved based on tests conducted in accordance with Section 2603.9 of the *Florida Building Code, Building*.

602.2.1.5.3 Covering. The foam plastic insulation shall be covered by corrosion-resistant steel having a base metal thickness of not less than 0.0160 inch (0.4 mm).

602.2.1.6 Semiconductor fabrication areas. 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 shall not be subject to the provisions of Section 602.2.1.

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 *Florida Building Code, Building*.
5. Stud wall cavities and joist space plenums shall be isolated from adjacent concealed spaces by approved fireblocking as required in the *Florida Building Code, Building*.

[B] **602.4 Flood hazard.** See Section 301.13.

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 building code. Ducts shall be constructed, braced, reinforced and installed to provide structural strength and durability. All transverse joints, longitudinal seams and fitting connections shall be securely fastened and sealed in accordance with the applicable standards of this section.

All enclosures which form the primary air containment passageways for air distribution systems shall be considered ducts or plenum chambers and shall be constructed and sealed in accordance with the applicable criteria of this section.

603.1.1 Mechanical fastening. All joints between sections of air ducts and plenums, between intermediate and terminal fittings and other components of air distribution systems, and between subsections of these components shall be mechanically fastened to secure the sections independently of the closure system(s).

603.1.2 Sealing. Air distribution system components shall be sealed with approved closure systems.

603.1.3 Space provided. Sufficient space shall be provided adjacent to all mechanical components located in or forming a part of the air distribution system to assure adequate access for 1) construction and sealing in accordance with the requirements of Section 603.1 of this code; 2) inspection; and 3) cleaning and maintenance. A minimum of 4 inches (102 mm) is considered sufficient space around air handling units.

Exception: Retrofit or replacement units not part of a renovation are exempt from the minimum clearance requirement.

603.1.4 Product application. Closure products shall be applied to the air barriers of air distribution system compo-

nents being joined in order to form a continuous barrier or they may be applied in accordance with the manufacturer's instructions or appropriate industry installation standard where more restrictive.

603.1.5 Surface preparation. The surfaces upon which closure products are to be applied shall be clean and dry in accordance with the manufacturer's installation instructions.

603.1.6 Approved mechanical attachments. Approved mechanical attachments for air distribution system components include screws, rivets, welds, interlocking joints crimped and rolled, staples, twist in (screw attachment), and compression systems created by bend tabs or screw tabs and flanges or by clinching straps. Mechanical attachments shall be selected to be appropriate to the duct system.

603.1.7 Approved closure systems. Closure system materials, including adhesives when used, shall have a flame spread rating not over 25 without evidence of continued progressive combustion and a smoke-developed rating not over 50 when tested in accordance with the ASTM E 84. The following closure systems and materials are approved for air distribution construction and sealing for the applications and pressure classes prescribed in Sections 603.2 through 603.10:

1. Metal Closures.
 - a. Welds applied continuously along metal seams or joints through which air could leak.
 - b. Snaplock seams and grooved, standing, double-corner and Pittsburgh-lock seams as defined by SMACNA, as well as all other rolled mechanical seams. All seams shall be rolled or crimped.
2. Gasketing, which achieves a 25/50 flame spread, smoke density development rating under ASTM E 84 or UL 723, provided that it is used only between mated surfaces which are mechanically fastened with sufficient force to compress the gasket and to fill all voids and cracks through which air leakage would otherwise occur.
3. Mastic Closures. Mastic shall be placed over the entire joint between mated surfaces. Mastics shall not be diluted. Approved mastics include the following:
 - a. Mastic or mastic plus embedded fabric systems applied to fibrous glass ductboard that are listed and labeled in accordance with the UL 181A, Part III.
 - b. Mastic or mastic plus embedded fabric systems applied to nonmetal flexible duct that are listed and labeled in accordance with the UL 181B, Part II.
 - c. Mastic ribbons, which achieve a 25/50 flame spread, smoke density development rating under ASTM E 84 or UL 723, provided that they may be used only in flange joints and lap joints, such that the mastic resides between two parallel surfaces of the air barrier and that those surfaces are mechanically fastened.

4. Tapes. Tapes shall be applied such that they extend not less than 1 inch (25 mm) onto each of the mated surfaces and shall totally cover the joint. When used on rectangular ducts, tapes shall be used only on joints between parallel rigid surfaces and on right angle joints. Approved tapes include the following:
 - a. Pressure-sensitive tapes.
 - 1) Pressure-sensitive tapes applied to fibrous glass ductboard that are listed and labeled in accordance with the UL 181A, Part I.
 - 2) Pressure-sensitive tapes applied to nonmetal flexible duct that are listed and labeled in accordance with the UL 181B, Part I.
 - b. Heat-activated tapes applied to fibrous glass ductboard that are listed and labeled in accordance with the UL 181A, Part II.
5. Aerosol Sealant. Such sealants shall be installed by manufacturer-certified installers following manufacturer instructions and shall achieve 25/50 flame spread smoke density development ratings under ASTM E 84 or UL 723.

603.2 Duct sizing. Ducts installed within a single dwelling unit shall be sized in accordance with ACCA Manual D 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 Metallic ducts, rigid and flexible. All ducts shall be constructed of iron, steel, aluminum or other approved material. 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 603.3.

**TABLE 603.3
DUCT CONSTRUCTION MINIMUM SHEET METAL
THICKNESSES FOR SINGLE DWELLING UNITS**

DUCT SIZE	GALVANIZED		APPROXIMATE ALUMINUM B&S GAGE
	Minimum thickness (inches)	Equivalent galvanized gage no.	
Round ducts and enclosed rectangular ducts			
14" or less	0.013	30	26
Over 14"	0.016	28	24
Exposed rectangular ducts			
14" or less	0.016	28	24
Over 14"	0.019	26	22

For SI: 1 inch = 25.4 mm.

All transverse joints, longitudinal seams and duct wall penetration of ducts and joints with other air distribution systems components shall be mechanically attached and sealed using approved closure systems for that pressure class specified in Section 603.3.1 or 603.3.2.

603.3.1 Pressure less than 1 inch water gage, approved closure systems. The following closure systems are

approved for rigid metal duct designed to be operated at pressures less than 1 inch water gauge when they conform to the approved closure and mechanical attachment requirements of Section 603.1:

1. Continuous welds.
2. Snaplock seams and grooved, standing, double-corner, single-corner and Pittsburgh-lock seams and all other rolled mechanical seams.
3. Mastic, mastic-plus-embedded fabric or mastic ribbons.
4. Gaskets.
5. Pressure-sensitive tape.
6. Aerosol sealant.

603.3.2 Pressure 1 inch water gauge or greater, approved closure systems. The following closure systems are approved for rigid metal duct designed to be operated at pressures 1 inch water gauge or greater and flexible duct when they conform to the approved closure and mechanical attachment requirements of Section 603.1:

1. Continuous welds.
2. Mastic, mastic-plus-embedded fabric or mastic ribbons.
3. Gaskets.

603.3.3 High-pressure duct systems. High-pressure duct systems designed to operate at pressures greater than 3 inches water gauge (4 inches water gage pressure class), shall be tested in accordance with the SMACNA *HVAC Air Duct Leakage Test Manual*. The tested duct leakage class, at a test pressure equal to the design duct pressure class rating, shall be equal to or less than Leakage Class 6. Leakage testing may be limited to representative sections of the duct system but in no case shall such tested sections include less than 25 percent of the total installed duct area for the designated pressure class.

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

603.4.1 Gypsum. Gypsum boards that 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 dewpoint temperature. Gypsum return air ducts shall not be incorporated in air-handling systems utilizing evaporative coolers.

603.4.2 Fibrous glass duct, rigid. All joints, seams and duct wall penetrations including, but not limited to, the joints between sections of duct and the joints between duct and other distribution system components shall be mechanically attached and sealed using approved closure systems as specified in Section 603.1.

603.4.2.1 Approved closure systems. The following closure systems are approved for rigid fibrous glass ducts when they conform to the approved closure and mechanical attachment requirements of Section 603.1:

1. Heat-activated tapes.
2. Pressure-sensitive tapes.
3. Mastics or mastic-plus-embedded fabric systems.

603.4.2.2 Mechanical fastening. Attachments of ductwork to air-handling equipment shall be by mechanical fasteners. Where access is limited, two fasteners on one side shall be acceptable when installed in accordance with Section 603.1.6.

603.5 Flexible air ducts and flexible air connectors. Flexible air ducts, both metallic and nonmetallic, shall comply with Sections 603.5.1, 603.5.1.1 and 603.5.3 through 603.5.5. Flexible air connectors, both metallic and nonmetallic, shall comply with Sections 603.5.2 through 603.5.5.

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

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

603.5.2 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.

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

603.5.3 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).

603.5.4 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.

603.5.5 Penetrations prohibited. Flexible air ducts and flexible air connectors shall not pass through any fire-resistance-rated assembly. Flexible air connectors shall not pass through any wall, floor or ceiling.

603.5.6 Flexible air duct systems, nonmetal. Flexible nonmetal ducts shall be joined to all other air distribution system components by either terminal or intermediate fittings. All duct collar fittings shall have a minimum $5/8$ inch (15.9 mm) integral flange for sealing to other components and a minimum 3-inch (76 mm) shaft for insertion into the inner duct core.

Flexible ducts having porous inner cores shall not be used.

Exception: Ducts having a nonporous liner between the porous inner core and the outer jacket. Fastening and sealing requirements shall be applied to such intermediate liners.

All joints of flexible ducts to fittings and fittings to other air distribution system components shall be mechanically attached and sealed as specified in Sections 603.5.6.1 through 603.5.6.6.

603.5.6.1 Duct core to duct fitting, mechanical attachment. The reinforced core shall be mechanically attached to the duct fitting by a drawband installed directly over the wire-reinforced core and the duct fitting. The duct fitting shall extend a minimum of 2 inches (51 mm) into each section of duct core. When the flexible duct is larger than 12 inches (305 mm) in diameter or the design pressure exceeds 1 inch water gauge, the drawband shall be secured by a raised bead or indented groove on the fitting.

603.5.6.2 Duct core to duct fitting, approved closure systems. The reinforced lining shall be sealed to the duct fitting using one of the following sealing materials which conforms to the approved closure and mechanical attachment requirements of Section 603.1:

1. Gasketing.
2. Mastic, mastic-plus-embedded fabric or mastic ribbons.
3. Pressure-sensitive tape.
4. Aerosol sealants, provided that their use is consistent with UL 181.

603.5.6.3 Duct outer jacket to duct collar fitting. The outer jacket of a flexible duct section shall be secured at the juncture of the air distribution system component and intermediate or terminal fitting in such a way as to prevent excess condensation. The outer jacket of a flexible duct section shall not be interposed between the flange of the duct fitting and the flexible duct, rigid fibrous glass duct board or sheet metal to which it is mated.

603.5.6.4 Duct collar fitting to rigid duct, mechanical attachment. The duct collar fitting shall be mechanically attached to the rigid duct board or sheet metal by appropriate mechanical fasteners; either screws, spin-in flanges, or dovetail flanges.

603.5.6.5 Duct collar fitting to rigid duct, approved closure systems. The duct collar fitting's integral flange shall be sealed to the rigid duct board or sheet metal using one of the following closure systems/materials which conforms to the approved closure and mechanical attachment standards of Section 603.1:

1. Gasketing.
2. Mastic or mastic-plus-embedded fabric.
3. Mastic ribbons when used to attach a duct collar to sheet metal.
4. Pressure-sensitive tape.
5. Aerosol sealants, provided that their use is consistent with UL 181.

603.5.6.6 Flexible duct installation and support. Flexible ducts shall be configured and supported so as to prevent the use of excess duct material, prevent duct

dislocation or damage, and prevent constriction of the duct below the rated duct diameter in accordance with the following requirements:

1. Ducts shall be installed fully extended. The total extended length of duct material shall not exceed 5 percent of the minimum required length for that run.
2. Bends shall maintain a center line radius of not less than one duct diameter.
3. Terminal devices shall be supported independently of the flexible duct.
4. Horizontal duct shall be supported at intervals not greater than 5 feet (1524 mm). Duct sag between supports shall not exceed 6 inches (12.7 mm) per foot of length. Supports shall be provided within 6 inches (152 mm) of intermediate fittings and between intermediate fittings and bends. Ceiling joists and rigid duct or equipment may be considered to be supports.
5. Vertical duct shall be stabilized with support straps at intervals not greater than 6 feet (1829 mm).
6. Hangers, saddles and other supports shall meet the duct manufacturer's recommendations and shall be of sufficient width to prevent restriction of the internal duct diameter. In no case shall the material supporting flexible duct that is in direct contact with it be less than 1½ inches (38 mm) wide.

603.6 Terminal and intermediate fittings. All seams and joints in terminal and intermediate fittings, between fitting sub-sections and between fittings and other air distribution system components or building components shall be mechanically attached and sealed as specified in Section 603.6.1 or Section 603.6.2.

603.6.1 Fittings and joints between dissimilar duct types, approved closure systems. Approved closure systems shall be as designated by air distribution system component material type in Section 603.1.

Exception: When the components of a joint are fibrous glass duct board and metal duct, including collar fittings and metal equipment housings, the closure systems approved for fibrous glass duct shall be used.

603.6.2 Terminal fittings and air ducts to building envelope components, approved closure systems. Terminal fittings and air ducts which penetrate the building envelope shall be mechanically attached to the structure and sealed to the envelope component penetrated and shall use one of the following closure systems/materials which conform to the approved closure and mechanical application requirements of Section 603.1:

1. Mastics or mastic-plus-embedded fabrics.
2. Gaskets used in terminal fitting/grille assemblies which compress the gasket material between the fitting and the wall, ceiling or floor sheathing.

603.7 Air handling units. All air handling units shall be mechanically attached to other air distribution system compo-

nents. Air handling units located outside the conditioned space shall be sealed using approved closure systems conforming to the approved closure and mechanical application requirements of 603.3.

603.7.1 Approved closure systems. Systems conforming to the product and application standards of Section 603.1 may be used when sealing air handling units.

603.8 Cavities of the building structure. Cavities in framed spaces, such as dropped soffits and walls, shall not be used to deliver air from or return air to the conditioning system unless they contain an air duct insert which is insulated in accordance with Table 13-410.1.ABC.2.2 or Table 13-610.1.ABC.2.1 of Chapter 13 of the *Florida Building Code, Building* and constructed and sealed in accordance with the requirements of Section 603.1 appropriate for the duct materials used.

Exception: Return air plenums.

Cavities designed for air transport such as mechanical closets, chases, air shafts, etc. shall be lined with an air barrier and sealed in accordance with Section 603.9 and shall be insulated in accordance with Table 13-410.1.ABC.2.2 or Table 13-610.1.ABC.2.1 of Chapter 13 of the *Florida Building Code, Building*.

Building cavities which will be used as return air plenums shall be lined with a continuous air barrier made of durable nonporous materials. All penetrations of the air barrier shall be sealed with a suitable long-life mastic material.

Exception: Surfaces between the plenum and conditioned spaces from which the return/mixed air is drawn.

Building cavities beneath a roof deck that will be used as return air plenums shall have an insulated roof with the insulation having an *R*-value of at least R-19.

603.9 Mechanical closets. The interior surfaces of mechanical closets shall be sheathed with a continuous air barrier as specified in Section 603.9.1 and shall be sealed with approved closure systems as specified in Section 603.9.2. All joints shall be sealed between air barrier segments and between the air barriers of walls and those of the ceiling, floor and door framing. All penetrations of the air barrier including, but not limited to, those by air ducts, plenums, pipes, service lines, refrigerant lines, electrical wiring and condensate drain lines shall be sealed to the air barrier and approved closure systems.

Exception: Air passageways into the closet from conditioned space that are specifically designed for return air flow.

Through-wall, through-floor and through-ceiling air passageways into the closet shall be framed and sealed to form an airtight passageway using approved air duct materials and approved closure systems.

Duct penetrations through any part of the ceiling, walls or floor of a mechanical closet shall have sufficient space between surrounding ceiling, walls or floor and any duct or plenum penetration to allow for sealing of the penetration and inspection of the seal.

Clothes washers, clothes dryers, combustion water heaters and atmospheric combustion furnaces shall not be located in mechanical closets used as return air plenums.

603.9.1 Approved air barriers. The following air barriers are approved for use in mechanical closets:

1. One-half-inch-thick (12.7 mm) or greater gypsum wallboard, taped and sealed.
2. Other panelized materials having inward facing surfaces with an air porosity no greater than that of a duct product meeting Section 22 of UL 181 which are sealed on all interior surfaces to create a continuous air barrier.

603.9.2 Approved closure systems. The following closure systems are approved for use in mechanical closets:

1. Gypsum wallboard joint compound over taped joints between gypsum wallboard panels.
2. Sealants complying with the product and application standards of Section 603.4.2.1 for fibrous glass duct board.
3. A suitable long-life caulk or mastic compliant with the locally adopted mechanical code for all applications.

603.10 Enclosed support platforms. Enclosed support platforms located between the return air inlet(s) from conditioned space and the inlet of the air handling unit or furnace, shall contain a duct section constructed entirely of rigid metal, rigid fibrous glass duct board, or flexible duct which is constructed and sealed according to the respective requirements of Section 603.1 and insulated according to the requirements of Section 13-410.1.ABC.2.2 and Section 13-610.1.ABC.2.1 of Chapter 13 of the *Florida Building Code, Building*.

- The duct section shall be designed and constructed so that no portion of the building structure, including adjoining walls, floors and ceilings, shall be in contact with the return air stream or function as a component of this duct section.
- The duct section shall not be penetrated by a refrigerant line chase, refrigerant line, wiring, pipe or any object other than a component of the air distribution system.
- Through-wall, through-floor and through-ceiling penetrations into the duct section shall contain a branch duct which is fabricated of rigid fibrous glass duct board or rigid metal and which extends to and is sealed to both the duct section and the grille side wall surface. The branch duct shall be fabricated and attached to the duct insert in accordance with Section 603.3 or 603.4.2, respective to the duct type used.

603.11 Furnace connection. Reserved.

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

603.13 Flood hazard areas. Floodplain Management Construction Standards. This code specifically defers to the authority granted to local government by Title 44 CFR, sections 59 and 60. This code is not intended to supplant or supercede local ordinances adopted pursuant to that authority, nor are local floodplain management ordinances to be deemed amendments to the code.

603.14 Location. Ducts shall not be installed in or within 6 inches (152 mm) of the earth, except where such ducts comply with Section 603.7.

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. All ducts including linings, coverings and vibration isolation connectors installed on the exterior of the building shall be protected against the elements.

603.17 Registers, grilles and diffusers. Duct registers, grilles and diffusers shall be installed in accordance with the manufacturer's installation instructions and shall have a flamespread rating not over 25 without evidence of continued progressive combustion and a smoke developed rating not over 50 when tested in accordance with ASTM E 84. 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.

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

603.17.2 Prohibited locations. Diffusers, registers and grilles shall be prohibited in the floor or its upward extension within toilet and bathing room floors required by the *Florida Building Code* to have smooth, hard, nonabsorbent surfaces.

Exception: Dwelling units.

603.18 Underground ducts. Ducts shall be approved for underground installation. Metallic ducts not having an approved protective coating shall be completely encased in a minimum of 2 inches (51 mm) of concrete.

603.18.1 Slope. Ducts shall slope to allow drainage to a point provided with access.

603.18.2 Sealing. Ducts shall be sealed and secured prior to pouring the concrete encasement.

603.18.3 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 D 2412. 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).

SECTION 604 INSULATION

604.1 General. Duct insulation shall conform to the requirements of Sections 604.2 through 604.13 and *Chapter 13 of the Florida Building Code, Building*.

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. Coverings and linings, including adhesives when 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 E 84, using the specimen preparation and mounting procedures of ASTM E 2231. Duct coverings and linings shall not flame, glow, smolder or smoke when tested in accordance with ASTM C 411 at the temperature to which they are exposed in service. The test temperature shall not fall below 250°F (121°C).

604.4 Foam plastic insulation. Foam plastic used as duct coverings and linings shall conform to the requirements of Section 604.

604.5 Appliance insulation. Listed and labeled appliances that are internally insulated shall be considered as conforming to the requirements of Section 604.

604.6 Penetration of assemblies. Duct coverings shall not penetrate a wall or floor required to have a fire-resistance rating or required to be fireblocked.

[EC] 604.7 Identification. External duct insulation and factory-insulated flexible duct shall be legibly printed or identified at intervals not greater than 36 inches (914 mm) with the name of the manufacturer, the thermal resistance *R*-value at the specified installed thickness and the flame spread and smoke-developed indexes of the composite materials. All duct insulation product *R*-values shall be based on insulation only, excluding air films, vapor retarders or other duct components, and shall be based on tested *C*-values at 75°F (24°C) mean temperature at the installed thickness, in accordance with recognized industry procedures. The installed thickness of duct insulation used to determine its *R*-values shall be determined as follows:

1. For duct board, duct liner and factory-made rigid ducts not normally subjected to compression, the nominal insulation thickness shall be used.
2. For duct wrap, the installed thickness shall be assumed to be 75 percent (25-percent compression) of nominal thickness.
3. For factory-made flexible air ducts, the installed thickness shall be determined by dividing the difference between the actual outside diameter and nominal inside diameter by two.

604.8 Lining installation. Linings shall be interrupted at the area of operation of a fire damper and at a minimum of 6 inches (152 mm) upstream of and 6 inches (152 mm) downstream of electric-resistance and fuel-burning heaters in a duct system. Metal nosings or sleeves shall be installed over exposed duct liner edges that face opposite the direction of airflow.

604.9 Thermal continuity. Where a duct liner has been interrupted, a duct covering of equal thermal performance shall be installed.

604.10 Service openings. Service openings shall not be concealed by duct coverings unless the exact location of the opening is properly identified.

604.11 Vapor retarders. Where ducts used for cooling are externally insulated, the insulation shall be covered with a vapor retarder having a maximum permeance of 0.05 perm [2.87 ng/(Pa • s • m²)] or aluminum foil having a minimum thickness of 2 mils (0.051 mm). Insulations having a

permeance of 0.05 perm [2.87 ng/(Pa • s • m²)] or less shall not be required to be covered. All joints and seams shall be sealed to maintain the continuity of the vapor retarder.

604.12 Weatherproof barriers. Insulated exterior ducts shall be protected with an approved weatherproof barrier.

604.13 Internal insulation. Materials used as internal insulation and exposed to the airstream in ducts shall be shown to be durable when tested in accordance with UL 181. Exposed internal insulation that is not impermeable to water shall not be used to line ducts or plenums from the exit of a cooling coil to the downstream end of the drain pan.

SECTION 605 AIR FILTERS

605.1 General. Heating and air-conditioning systems of the central type shall be provided with approved air filters. Filters shall be installed in the return air system, upstream from any heat exchanger or coil, in an approved convenient location. Liquid adhesive coatings used on filters shall have a flash point not lower than 325°F (163°C).

605.2 Approval. Media-type and electrostatic-type air filters shall be listed and labeled. Media-type air filters shall comply with UL 900. High efficiency particulate air filters shall comply with UL 586. Electrostatic-type air filters shall comply with UL 867. Air filters utilized within dwelling units shall be designed for the intended application and shall not be required to be listed and labeled.

605.3 Airflow over the filter. Ducts shall be constructed to allow an even distribution of air over the entire filter.

SECTION 606 SMOKE DETECTION SYSTEMS CONTROL

606.1 Controls required. Air distribution systems shall be equipped with smoke detectors listed and labeled for installation in air distribution systems, as required by this section. Duct smoke detectors shall comply with UL 268A. Other smoke detectors shall comply with UL 268.

Exception: Structures classified as R-3 occupancy type.

606.2 Where required. Smoke detectors shall be installed where indicated in Sections 606.2.1 through 606.2.3 and NFPA 90A.

606.2.1 Supply air systems. Smoke detectors shall be installed in supply air systems with a design capacity greater than 2,000 cfm (0.9 m³/s), in the **supply air duct**.

Exception: Smoke detectors are not required in the **supply air system where the space served by the air distribution system is protected by a system of area smoke detectors in accordance with the Florida Fire Prevention Code**. The area smoke detector system shall comply with Section 606.4.

606.2.2 Common supply, return air and supply air systems. Where multiple air-handling systems share common supply or return air ducts or plenums with a combined

design capacity greater than 2,000 cfm (0.9 m³/s), the return air **and supply air system** shall be provided with smoke detectors in accordance with Section 606.2.1.

Exception: Reserved.

606.2.3 Return and supply risers. Where return air **and supply air** risers serve two or more stories and **are part of a return air and supply air system** having a design capacity greater than 15,000 cfm (7.1 m³/s), smoke detectors shall be installed at each story. Such smoke detectors shall be located upstream of the connection between the return air riser and any air ducts or plenums **and between the air supply source and the first branch or take-off to the areas served.**

606.3 Installation. Smoke detectors required by this section shall be installed in accordance with NFPA 72. The required smoke detectors shall be installed to monitor the entire airflow conveyed by the system including return air, **supply air** and exhaust or relief air. Access shall be provided to smoke detectors for inspection and maintenance.

606.4 Controls operation. Upon activation, the smoke detectors shall shut down all operational capabilities of the air distribution system in accordance with the listing and labeling of appliances used in the system. Air distribution systems that are part of a smoke control system shall switch to the smoke control mode upon activation of a detector.

606.4.1 Supervision. The duct smoke detectors shall be connected to a fire alarm system. The actuation of a duct smoke detector shall activate a visible and audible supervisory signal at a constantly attended location.

Exceptions:

1. The supervisory signal at a constantly attended location is not required where the duct smoke detector activates the building’s alarm-indicating appliances.
2. In occupancies not required to be equipped with a fire alarm system, actuation of a smoke detector shall activate a visible and an audible signal in an approved location. Duct smoke detector trouble conditions shall activate a visible or audible signal in an approved location and shall be identified as air duct detector trouble.

**[B] SECTION 607
DUCT AND TRANSFER OPENINGS**

[B] 607.1 General. The provisions of this section shall govern the protection of duct penetrations and air transfer openings in assemblies required to be protected.

[B] 607.1.1 Ducts without dampers. Ducts that penetrate fire-resistance-rated assemblies and are not required by this section to have dampers shall comply with the requirements of Section 712 of the *Florida Building Code, Building*.

[B] 607.2 Installation. Fire dampers, smoke dampers, combination fire/smoke dampers and ceiling radiation dampers located within air distribution and smoke control systems shall

be installed in accordance with the requirements of this section, and the manufacturer’s installation instructions and listing.

[B] 607.2.1 Smoke control system. Where the installation of a fire damper will interfere with the operation of a required smoke control system in accordance with Section 513, approved alternative protection shall be utilized.

[B] 607.2.2 Hazardous exhaust ducts. Fire dampers for hazardous exhaust duct systems shall comply with Section 510.

[B] 607.3 Damper testing and ratings. Dampers shall be listed and bear the label of an approved testing agency indicating compliance with the standards in this section. Fire dampers shall comply with the requirements of UL 555. Only fire dampers labeled for use in dynamic systems shall be installed in heating, ventilation and air-conditioning systems designed to operate with fans on during a fire. Smoke dampers shall comply with the requirements of UL 555S. Combination fire/smoke dampers shall comply with the requirements of both UL 555 and UL 555S. Ceiling radiation dampers shall comply with the requirements of UL 555C.

[B] 607.3.1 Fire protection rating. Fire dampers shall have the minimum fire protection rating specified in Table 607.3.1 for the type of penetration.

**TABLE 607.3.1
FIRE DAMPER RATING**

TYPE OF PENETRATION	MINIMUM DAMPER RATING (hour)
Less than 3-hour fire-resistance-rated assemblies	1½
3-hour or greater fire-resistance-rated assemblies	3

[B] 607.3.1.1 Fire damper actuating device. The fire damper actuating device shall meet one of the following requirements:

1. The operating temperature shall be approximately 50°F (27.8°C) above the normal temperature within the duct system, but not less than 160°F (71°C).
2. The operating temperature shall be not more than 286°F (141°C) where located in a smoke control system complying with Section 513.
3. Where a combination fire/smoke damper is located in a smoke control system complying with Section 513, the operating temperature rating shall be approximately 50°F (27.8°C) above the maximum smoke control system designed operating temperature, or a maximum temperature of 350°F (177°C). The temperature shall not exceed the UL 555S degradation test temperature rating for a combination fire/smoke damper.

[B] 607.3.2 Smoke damper ratings. Smoke damper leakage ratings shall not be less than Class II. Elevated temperature ratings shall be not less than 250°F (121°C).

[B] 607.3.2.1 Smoke damper actuation methods. The smoke damper shall close upon actuation of a listed

smoke detector or detectors installed in accordance with Section 607 of this code and Sections 907.10 and 907.11 of the *Florida Building Code, Building* and one of the following methods, as applicable:

1. Where a damper is installed within a duct, a smoke detector shall be installed in the duct within 5 feet (1524 mm) of the damper with no air outlets or inlets between the detector and the damper. The detector shall be listed for the air velocity, temperature and humidity anticipated at the point where it is installed. Other than in mechanical smoke control systems, dampers shall be closed upon fan shutdown where local smoke detectors require a minimum velocity to operate.
2. Where a damper is installed above smoke barrier doors in a smoke barrier, a spot-type detector listed for releasing service shall be installed on either side of the smoke barrier door opening.
3. Where a damper is installed within an unducted opening in a wall, a spot-type detector listed for releasing service shall be installed within 5 feet (1524 mm) horizontally of the damper.
4. Where a damper is installed in a corridor wall or ceiling, the damper shall be permitted to be controlled by a smoke detection system installed in the corridor.
5. Where a total-coverage smoke detector system is provided within areas served by an HVAC system, dampers shall be permitted to be controlled by the smoke detection system.

[B] 607.4 Access and identification. Fire and smoke dampers shall be provided with an approved means of access, large enough to permit inspection and maintenance of the damper and its operating parts. The access shall not affect the integrity of fire-resistance-rated assemblies. The access openings shall not reduce the fire-resistance rating of the assembly. Access points shall be permanently identified on the exterior by a label having letters not less than 0.5 inch (12.7 mm) in height reading: FIRE/SMOKE DAMPER, SMOKE DAMPER or FIRE DAMPER. Access doors in ducts shall be tight fitting and suitable for the required duct construction.

[B] 607.5 Where required. Fire dampers, smoke dampers, combination fire/smoke dampers and ceiling radiation dampers shall be provided at the locations prescribed in Sections 607.5.1 through 607.5.5. Where an assembly is required to have both fire dampers and smoke dampers, combination fire/smoke dampers or a fire damper and a smoke damper shall be required.

[B] 607.5.1 Fire walls. Ducts and air transfer openings permitted in fire walls in accordance with Section 705.11 of the *Florida Building Code, Building* shall be protected with listed fire dampers installed in accordance with their listing.

[B] 607.5.2 Fire barriers. Ducts and air transfer openings that penetrate fire barriers shall be protected with listed fire dampers installed in accordance with their listing. Ducts and air transfer openings shall not penetrate exit enclosures and exit passageways except as permitted by Sections

1020.1.2 and 1021.5, respectively, of the *Florida Building Code, Building*.

Exception: Fire dampers are not required at penetrations of fire barriers where any of the following apply:

1. Penetrations are tested in accordance with ASTM E 119 as part of the fire-resistance-rated assembly.
2. Ducts are used as part of an approved smoke control system in accordance with Section 513 and where the fire damper would interfere with the operation of the smoke control system.
3. Such walls are penetrated by ducted HVAC systems, have a required fire-resistance rating of 1 hour or less, are in areas of other than Group H and are in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 of the *Florida Building Code, Building*. For the purposes of this exception, a ducted HVAC system shall be a duct system for the structure's HVAC system. Such a duct system shall be constructed of sheet steel not less than 26 gage [0.0217 inch (0.55 mm)] thickness and shall be continuous from the air-handling appliance or equipment to the air outlet and inlet terminals.

[B] 607.5.3 Fire partitions. Ducts and air transfer openings that penetrate fire partitions shall be protected with listed fire dampers installed in accordance with their listing.

Exception: In occupancies other than Group H, fire dampers are not required where any of the following apply:

1. The partitions are tenant separation or corridor walls in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 of the *Florida Building Code, Building* and the duct is protected as a through penetration in accordance with Section 712 of the *Florida Building Code, Building*.
2. The partitions are tenant partitions in covered mall buildings where the walls are not required by provisions elsewhere in the *Florida Building Code, Building* to extend to the underside of the floor or roof deck above.
3. The duct system is constructed of approved materials in accordance with Section 603 and the duct penetrating the wall complies with all of the following requirements:
 - 3.1. The duct shall not exceed 100 square inches (0.06 m²).
 - 3.2. The duct shall be constructed of steel a minimum of 0.0217-inch (0.55 mm) in thickness.
 - 3.3. The duct shall not have openings that communicate the corridor with adjacent spaces or rooms.
 - 3.4. The duct shall be installed above a ceiling.
 - 3.5. The duct shall not terminate at a wall register in the fire-resistance-rated wall.

- 3.6. A minimum 12-inch-long (305 mm) by 0.060-inch-thick (1.52 mm) steel sleeve shall be centered in each duct opening. The sleeve shall be secured to both sides of the wall and all four sides of the sleeve with minimum 1½-inch by 1½-inch by 0.060-inch (38 mm by 38 mm by 1.52 mm) steel retaining angles. The retaining angles shall be secured to the sleeve and the wall with No. 10 (M5) screws. The annular space between the steel sleeve and the wall opening shall be filled with rock (mineral) wool batting on all sides.

[B] 607.5.4 Corridors/smoke barriers. A listed smoke damper designed to resist the passage of smoke shall be provided at each point a duct or air transfer opening penetrates a smoke barrier wall or a corridor enclosure required to have smoke and draft control doors in accordance with the *Florida Building Code, Building*. Smoke dampers and smoke damper actuation methods shall comply with Section 607.5.4.1.

Exceptions:

1. Smoke dampers are not required in corridor penetrations where the building is equipped throughout with an approved smoke control system in accordance with Section 513 and smoke dampers are not necessary for the operation and control of the system.
2. Smoke dampers are not required in smoke barrier penetrations where the openings in ducts are limited to a single smoke compartment and the ducts are constructed of steel.
3. Smoke dampers are not required in corridor penetrations where the duct is constructed of steel not less than 0.019 inch (0.48 mm) in thickness and there are no openings serving the corridor.

[B] 607.5.4.1 Smoke damper. The smoke damper shall close upon actuation of a listed smoke detector or detectors installed in accordance with the *Florida Building Code, Building* and one of the following methods, as applicable:

1. Where a damper is installed within a duct, a smoke detector shall be installed in the duct within 5 feet (1524 mm) of the damper with no air outlets or inlets between the detector and the damper. The detector shall be listed for the air velocity, temperature and humidity anticipated at the point where it is installed.
2. Where a damper is installed above smoke barrier doors in a smoke barrier, a spot-type detector listed for releasing service shall be installed on either side of the smoke barrier door opening.
3. Where a damper is installed within an unducted opening in a wall, a spot-type detector listed for releasing service shall be installed within 5 feet (1524 mm) horizontally of the damper.

4. Where a damper is installed in a corridor wall, the damper shall be permitted to be controlled by a smoke detection system installed in the corridor.
5. Where a total-coverage smoke detector system is provided within all areas served by an HVAC system, dampers shall be permitted to be controlled by the smoke detection system.

[B] 607.5.5 Shaft enclosures. Shaft enclosures that are permitted to be penetrated by ducts and air transfer openings shall be protected with listed fire and smoke dampers installed in accordance with their listing.

Exceptions:

1. Fire dampers are not required at penetrations of shafts where:
 - 1.1. Steel exhaust subducts extend at least 22 inches (559 mm) vertically in exhaust shafts provided that there is a continuous airflow upward to the outdoors;
 - 1.2. Penetrations are tested in accordance with ASTM E 119 as part of the fire-resistance-rated assembly;
 - 1.3. Ducts are used as part of an approved smoke control system in accordance with Section 909 of the *Florida Building Code, Building*, and where the fire damper will interfere with the operation of the smoke control system; or
 - 1.4. The penetrations are in parking garage exhaust or supply shafts that are separated from other building shafts by not less than 2-hour fire-resistance-rated construction.
2. In Group B and R occupancies equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 of the *Florida Building Code, Building*, smoke dampers are not required at penetrations of shafts where kitchen, clothes dryer, bathroom and toilet room exhaust openings with steel exhaust subducts, having a wall thickness of at least 0.019 inch (0.48 mm) extend at least 22 inches (559 mm) vertically and the exhaust fan at the upper terminus is powered continuously in accordance with the provisions of Section 909.11 of the *Florida Building Code, Building*, and maintains airflow upward to the outdoors.
3. Smoke dampers are not required at penetration of exhaust or supply shafts in parking garages that are separated from other building shafts by not less than 2-hour fire-resistance-rated construction.
4. Smoke dampers are not required at penetrations of shafts where ducts are used as part of an approved mechanical smoke control system designed in accordance with Section 909 of the *Florida Building Code, Building* and where the

smoke damper will interfere with the operation of the smoke control system.

[B] 607.6 Horizontal assemblies. Penetrations by air ducts of a floor, floor/ceiling assembly or the ceiling membrane of a roof/ceiling assembly shall be protected by a shaft enclosure that complies with Section 707 and Sections 716.6.1 through 716.6.3 the *Florida Building Code, Building* or shall comply with Sections 607.6.1 through 607.6.3.

[B] 607.6.1 Through penetrations. In occupancies other than Groups I-2 and I-3, a duct constructed of approved materials in accordance with Section 603 that penetrates a fire-resistance-rated floor/ceiling assembly that connects not more than two stories is permitted without shaft enclosure protection provided that a listed fire damper is installed at the floor line or the duct is protected in accordance with Section 712.4 of the *Florida Building Code, Building*. For air transfer openings, see Exception 7 to Section 707.2 of the *Florida Building Code, Building*.

Exception: A duct is permitted to penetrate three floors or less without a fire damper at each floor provided it meets all of the following requirements:

1. The duct shall be contained and located within the cavity of a wall and shall be constructed of steel not less than 0.019 inch (0.48 mm) (26 gage) in thickness.
2. The duct shall open into only one dwelling unit or sleeping unit and the duct system shall be continuous from the unit to the exterior of the building.
3. The duct shall not exceed 4-inch (102 mm) nominal diameter and the total area of such ducts shall not exceed 100 square inches (0.065 m²) for any 100 square feet (9.3 m²) of the floor area.
4. The annular space around the duct is protected with materials that prevent the passage of flame and hot gases sufficient to ignite cotton waste where subjected to ASTM E 119 time-temperature conditions under a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water at the location of the penetration for the time period equivalent to the fire-resistance rating of the construction penetrated.
5. Grille openings located in a ceiling of a fire-resistance-rated floor/ceiling or roof/ceiling assembly shall be protected with a listed ceiling radiation damper installed in accordance with Section 607.6.2.

[B] 607.6.2 Membrane penetrations. Ducts and air transfer openings constructed of approved materials, in accordance with Section 603, that penetrate the ceiling membrane of a fire-resistance-rated floor/ceiling or roof/ceiling assembly shall be protected with one of the following:

1. A shaft enclosure in accordance with Sections 707 of the *Florida Building Code, Building*.
2. A listed ceiling radiation damper installed at the ceiling line where a duct penetrates the ceiling of a

fire-resistance-rated floor/ceiling or roof/ceiling assembly.

3. A listed ceiling radiation damper installed at the ceiling line where a diffuser with no duct attached penetrates the ceiling of a fire-resistance-rated floor/ceiling or roof/ceiling assembly.

[B] 607.6.2.1 Ceiling radiation dampers. Ceiling radiation dampers shall be tested in accordance with UL 555C and installed in accordance with the manufacturer's installation instructions and listing. Ceiling radiation dampers are not required where either of the following apply:

1. Tests in accordance with ASTM E 119 have shown that ceiling radiation dampers are not necessary in order to maintain the fire-resistance rating of the assembly.
2. Where exhaust duct penetrations are protected in accordance with Section 712.4.1.2 of the *Florida Building Code, Building* and the exhaust ducts are located within the cavity of a wall and do not pass through another dwelling unit or tenant space.

[B] 607.6.3 Nonfire-resistance-rated floor assemblies. Duct systems constructed of approved materials in accordance with Section 603 that penetrate nonfire-resistance-rated floor assemblies shall be protected by any of the following methods:

1. A shaft enclosure in accordance with Section 707 of the *Florida Building Code, Building*.
2. The duct connects not more than two stories, and the annular space around the penetrating duct is protected with an approved noncombustible material that resists the free passage of flame and the products of combustion.
3. The duct connects not more than three stories, and the annular space around the penetrating duct is protected with an approved noncombustible material that resists the free passage of flame and the products of combustion, and a listed fire damper is installed at each floor line.

Exception: Fire dampers are not required in ducts within individual residential dwelling units.

[B] 607.7 Flexible ducts and air connectors. Flexible ducts and air connectors shall not pass through any fire-resistance-rated assembly.

607.8 Location and installation details. The specific location and installation details of each fire door, fire damper, ceiling damper and smoke damper shall be shown and properly identified on the building plans by the designer.