

## APPENDIX F

# CHAPTER 9B-52 FLORIDA STANDARD FOR PASSIVE RADON-RESISTANT NEW RESIDENTIAL BUILDING CONSTRUCTION

### 9B-52.001 Purpose and intent.

### 9B-52.002 Definitions.

### 9B-52.003 Department activities.

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### 9B-52.001 Purpose and intent.

- (1) The provisions of this rule chapter are adopted to implement the *Florida Standard for Passive Radon-Resistant New Residential Building Construction* as mandated in Part X, Chapter 553, Florida Statutes, in order to provide standards for construction of passive radon-resistant new residential buildings and to provide for the public safety, health and general welfare.
- (2) These rules and regulations prescribe standards for radon-resistant construction of new residential buildings in Florida. However, none of the provisions contained herein, or in the standards adopted, shall preclude or prohibit the owners of such buildings from exceeding these standards at their discretion.
- (3) Local jurisdictions may enact ordinances for radon-resistant new residential building construction providing that a county governing authority and the governing bodies of the municipalities representing at least a majority of the county's municipal population enter into an interlocal agreement to adopt by ordinance the department's standard as referenced in 9B-52.004(1). The standard shall apply uniformly to all jurisdictions that adopt the standard. No local jurisdiction may adopt any requirement for radon-resistant building construction other than the standard.

### Specific 553.98(1), 553.98(2) Florida Statutes.

### Law Implemented 553.98 Florida Statutes.

### History - New 9-1-96.

### 9B-52.002 Definitions.

For the purpose of this rule chapter, the following words, unless the context does not permit such meaning, shall have the meanings indicated:

- (1) Department—the Department of Community Affairs.
- (2) Exempted Buildings—
  - (a) Buildings of occupancy classifications other than one- or two-family detached houses and town house apartments with no more than three stories (as distinguished from condominiums, apartments or commercial buildings that employ different construction practices).

- (b) Residential buildings built on piers or pilings that elevate the bottom of the floor joists a minimum of 18 inches (457 mm) above grade and which comply with all requirements of Section 103.2(2) of the *Florida Standard for Passive Radon-Resistant New Residential Building Construction*.

- (3) New Residential Building—one- or two-family detached houses and town house apartments with no more than three stories (as distinguished from condominiums, apartments or commercial buildings that employ different construction practices) for which a building permit is issued on or after the effective date of these rules.
- (4) Radon—a naturally occurring, chemically inert, radioactive gas. It is part of the uranium-238 decay series, and is the direct decay product of radium-226.
- (5) Standard—the *Florida Standard for Passive Radon-Resistant New Residential Building Construction*.

### Specific 553.98(1) Florida Statutes.

### Law Implemented 553.98 Florida Statutes.

### History - New 9-1-96.

### 9B-52.003 Department activities.

- (1) The Department shall interpret and clarify various aspects of the *Florida Standard for Passive Radon-Resistant New Residential Building Construction*.
- (2) Any person may request information or interpretations regarding the application and administration of the standards adopted herein, provided that any oral request shall be confirmed by the party in writing to the Department prior to the Department's response.

### Specific 553.98(1), 120.53(1)(a) Florida Statutes.

### Law Implemented 553.98 Florida Statutes.

### History - New 9-1-96.

### 9B-52.004 Florida Standard for Passive Radon-Resistant New Residential Building Construction, Adopted.

- (1) The *Florida Standard for Passive Radon-Resistant New Residential Building Construction*, dated July 1, 1995, is herein incorporated by reference.
- (2) A copy of the above referenced standard has been filed with these regulations with the Secretary of State. The standard is also available for reference and inspection at the Department of Community Affairs, Division of Housing and Community Development, Radon Program, 2555 Shumard Oak Boulevard, Tallahassee, Florida 32399-2100.

**Specific 553.98(1) Florida Statutes.****Law Implemented 553.98 Florida Statutes.****History - New 9-1-96.**

Florida Standard for Passive Radon-resistant New Residential Building Construction

July 1, 1995

State of Florida

Florida Department of Community Affairs

Radon Program

2555 Shumard Oak Blvd

Tallahassee, FL 32399-2100

Linda Loomis Shelley, Secretary

## CHAPTER F1 GENERAL

**F101 General.** Provisions in the following chapters and sections shall constitute and be known as and may be cited as the *Florida Standard For Passive Radon-Resistant New Residential Building Construction*, hereinafter referred to as “this standard.”

**F102 Intent.**

**F102.1 General.** This standard shall apply to the design and construction of new residential buildings as determined in Section F103, Scope, to enable control of human exposure to indoor radon and its progeny.

**F102.2 Compliance.** This passive standard will provide radon protection beyond that provided by standard building code provisions. Compliance with existing local building codes and with the Energy Efficiency, Chapter 13 of the *Florida Building Code, Building*, current edition, is assumed.

**F103 Scope.**

**F103.1 Applicability.** The provisions of this standard shall apply to the construction of new residential buildings and additions to existing residential buildings. Residential buildings are defined for the purposes of this standard as one- or two-family detached houses and town house apartments with no more than three stories (distinguished from condominiums, apartments and commercial buildings that employ different construction practices).

**F103.2 Additions.** When the cost of an addition exceeds a cumulative total of 50 percent of the assessed value of the existing building, only the addition to the building must meet the requirements for new buildings in Section F104.1.

**F104 Compliance.**

**F104.1 New buildings and additions.** All new residential buildings and additions to existing residential buildings shall use passive radon protection measures, as determined in Chapter F3 of this standard.

**F104.2 Exemptions.** Exempt buildings are as follows:

- (1) Buildings of classifications not listed in Section F103.1, Applicability, and
- (2) Residential buildings built on piers or pilings that elevate the bottom of the floor joists a minimum of 18

inches (457 mm) above grade, which do not have skirting or stem walls that restrict air ventilation, and which comply with the following additional provisions:

- (a) The perimeter of the building from the ground plane to the lower surface of the floor shall be totally open for ventilation, except for the occurrence of enclosures complying with item (c) below.
- (b) All pilings, posts or other supports shall be solid, or if hollow, shall be capped by an 8-inch (203 mm) solid masonry unit or sealed by a permanent barrier that is impermeable to air flow.
- (c) Enclosures of any kind, including chases, storage rooms, elevator shafts and stairwells, etc., that connect between the soil and the structure shall be sealed at the surface of the soil to comply with the sealing provisions of Chapter F3 and shall have a soil contact area of less than 5 percent of the total building floor area.

## CHAPTER F2 DEFINITIONS

**F201 General.** For the purposes of this standard, certain abbreviations, terms, phrases, words and their derivatives shall be set forth in this chapter. Words not defined herein shall have the meanings stated in the *Standard Building Code, Standard Mechanical Code, Standard Plumbing Code, Standard Gas Code, Standard Fire Prevention Code*, or the current *Florida Building Code, Building*. Words not defined in these codes shall have the meanings in *Webster's Ninth New Collegiate Dictionary*, as revised.

**F202 Definitions.**

**ADDITION.** A building extension or increase in floor area that can be occupied or that exchanges air with the conditioned space of the building.

**AIR DISTRIBUTION SYSTEM.** For the purposes of this standard, the air distribution system components which include ducts, plenums, air handlers, furnaces, single-package air conditioners, etc.

**CAULKS AND SEALANTS.** Those materials which will significantly reduce the flow of gases through small openings in the building shell. Among those used are:

**Urethane.** A crystalline ester-amide used as a gelatinizing agent for cellulose acetate or cellulose nitrate. A component of polyurethane used in making flexible and rigid foams, elastomers, and resins for coatings and adhesives.

**Epoxy.** A thermosetting resin characterized by adhesiveness, flexibility and resistance to chemicals and used chiefly as a coating or adhesive.

**Polysulfide rubber.** A synthetic rubber characterized by impermeability to gases and used in adhesives, binders and sealing compositions and in coatings.

**CONDITIONED FLOOR AREA.** The horizontal projection (outside measurements) of that portion of space which is conditioned directly or indirectly by an energy-using system.

**CONDITIONED SPACE.** All spaces which are provided with heated and/or cooled air or which are maintained at temperatures over 50°F (10°C) during the heating season, including adjacent connected spaces separated by an uninsulated component (e.g., basements, utility rooms, garages, corridors).

**CONTRACTION JOINT.** A formed, sawed, or tooled groove in a concrete slab to create a weakened plane and control the location of cracking resulting from drying and thermal shrinkage (also sometimes called control joint).

**CRAWL SPACE.** The unconditioned space between the lowest structural member of the floor and the earth. The crawl space is created when the floor spans between structural supports rather than being directly supported by the earth beneath the floor.

**ELASTOMERIC.** That property of macromolecular material of returning rapidly to approximately the initial dimensions and shape, after substantial deformation by a weak stress and release of stress.

**HIGH RANGE WATER REDUCER.** A chemical admixture added to the concrete capable of reducing the water content at least 12 percent. This admixture shall conform to ASTM C 494 Type F or G.

**HVAC.** Heating, ventilating and air conditioning.

**INFILTRATION BARRIER.** A product or system designed to limit the free passage of air through a building envelope component (wall, ceiling or floor). Such products and systems may be continuous or noncontinuous discrete elements which are sealed together to form a continuous barrier against air infiltration.

**MANUFACTURED SANDS.** Sands resulting from the crushing of rock, gravel or slag.

**MASTIC.** A sealant with putty-like properties.

**MIDRANGE WATER REDUCER.** A water reducing admixture capable of reducing water content from 6 to 15 percent. This admixture shall conform to ASTM C 494 Type A and or F.

**MITIGATE.** Make less severe, reduce, relieve.

**NATURAL SANDS.** Sands resulting from the natural disintegration and abrasion of rock.

**OCCUPANCY.** The purpose for which a building or part thereof is used or intended to be used. For the purposes of determining changes of occupancy for this code, the occupancy shall be considered the major occupancy group designations established by the locally adopted building code.

**OUTSIDE AIR.** Air taken from the outdoors and, therefore, not previously circulated through the system.

**PASSIVE RADON PROTECTION SYSTEM.** Indoor radon reducing building design, material, or construction features that increase the barriers to radon entry and require no mechanical operation, operating costs, or user attention beyond normal home maintenance (such as recaulking floor cracks, etc.)

**PERM.** Unit of measurement of the water vapor permeance of materials. Value of one perm is equal to one grain of water vapor per square foot hour per inch of mercury vapor pressure difference.

**PICOCURIE (pCi).** A unit of measurement of radioactivity. A curie is the amount of any radionuclide that undergoes exactly  $3.7 \times 10^{10}$  radioactive disintegrations per second. A picocurie is one trillionth ( $10^{-12}$ ) of a curie, or 0.037 disintegrations per second.

**PICOCURIE PER LITER (pCi/L).** A common unit of measurement of the concentration of radioactivity in a gas. A picocurie per liter corresponds to 0.037 radioactive disintegrations per second in every liter of air.

**RADIUM (Ra).** A naturally occurring radioactive element resulting from the decay of uranium. For the purposes of this standard, radium applies to radium-226. It is the parent of radon gas.

**RADON.** A naturally occurring, chemically inert, radioactive gas. It is part of the uranium-238 decay series. For the purposes of this standard, radon applies to radon-222; thus, it is the direct decay product of radium-226.

**REMOTE SPACE.** A space isolated from the main conditioned area of a building by intermediate nonconditioned spaces.

**RESIDENTIAL BUILDING.** Residential occupancies which include single- and multiple-family buildings that are three or fewer stories above grade. Hotels, motels and other transient occupancies are considered nonresidential buildings for the purpose of this standard.

**SLUMP.** A measure of the relative consistency or stiffness of fresh concrete mix, as defined by ASTM C 143.

**SOIL GAS.** Gas which is always present underground, in the small spaces between particles of the soil or in crevices of rock. Major constituents of soil gas include air and water vapor. Since radium-226 is essentially always present in the soil or rock, trace levels of radon-222 also will exist in the soil gas.

**SUBSTRUCTURE MEMBRANE.** Flexible, nondegrading material sheet placed between the soil and the building for the purpose of reducing the flow of soil gas and moisture into the building. Examples are: polyethylene, ethylenepropylene diene terpolymer (EPDM), neoprene, and cross laminated HDPE.

**VENTILATION.** The process of supplying or removing air, by natural or mechanical means, to or from any space. Such air may or may not have been conditioned.

**WATER-REDUCING ADMIXTURE.** A chemical additive to concrete capable of increasing its flowability without increased mixing water, without set retardation, and without increased air entrainment.

### CHAPTER F3 CONSTRUCTION REQUIREMENTS FOR PASSIVE RADON CONTROL

**F301 General.** This chapter provides minimum design and construction criteria for passive control of radon entry into resi-

dential buildings. Construction to these standards will limit radon entry points through building floors and foundations and will limit mechanical depressurization of buildings which can enhance radon entry.

### F302 Sub-slab and soil cover membranes.

**F302.1 Membrane material.** A sub-slab or soil-cover membrane shall consist of a minimum 0.006 inch (0.152 mm) (6 mil) thick single layer of polyethylene. Polyvinylchloride (PVC), ethylene propylene diene terpolymer (EPDM), neoprene or other nondeteriorating nonporous material may be used instead of polyethylene, provided the installed thickness has greater or equal resistance to air flow, puncturing, cutting and tearing, and a permeance of less than 0.3 perm as determined in accordance with ASTM E 96. The membrane shall be placed to minimize seams and to cover all of the soil below the building floor.

**F302.2 Tape.** Tape used to install the membrane shall have a minimum width of 2 inches (51 mm) and shall be pressure sensitive vinyl or other nondeteriorating pressure sensitive tape compatible with the surfaces being joined. Paper tape and/or cloth shall not be used for these purposes.

**F302.3 Mastic.** Mastic used to install the membrane shall be compatible with the surfaces being joined, and shall be installed in accordance with the manufacturer's recommendations for the materials, surface conditions and temperatures involved. Mastic may be used to join sections of membrane to one another or to elements of the building foundation, or to seal penetrations in the membrane.

**F302.4 Installation.** The membrane shall be placed under the entire soil-contact area of the floor in a manner that minimizes the required number of joints and seams. Care shall be taken to prevent damage to the membrane during the construction process.

**F302.5 Seams.** Seams between portions of the membrane shall be lapped a minimum of 12 inches (305 mm) and shall be secured in place with a continuous band of tape or mastic centered over the edge of the top membrane.

**F302.6 Slab edges and joints.** The membrane shall fully cover the soil beneath the building floor. Where the slab edge is cast against a foundation wall or grade beam, the membrane shall contact the foundation element, and shall not extend vertically into the slab more than one inch.

**F302.7 Penetrations, punctures, cuts and tears.** At all points where pipes, conduits, stakes, reinforcing bars or other objects pass through the membrane, the membrane shall be fitted to within  $\frac{1}{2}$  inch (12.7 mm) of the penetration and sealed to the penetration. Penetrations may be sealed with either mastic or tape. When necessary to meet this requirement, a second layer of the membrane, cut so as to provide a minimum 12 inches (305 mm) lap on all sides, shall be placed over the object and shall be sealed to the membrane with a continuous band of tape.

**F302.8 Repairs.** Where portions of an existing slab have been removed and are about to be replaced, a membrane shall be carefully fitted to the opening and all openings between the membrane and the soil closed with tape or mastic.

### F303 Floor slab-on-grade buildings.

**F303.1 General.** All concrete slabs supported on soil and used as floors for conditioned space or enclosed spaces connected or adjacent to a conditioned space shall be constructed in accordance with the provisions of Section F302 and Section F303.

**F303.2 Slab edge detail.** Slabs and foundations shall be constructed using a slab edge detail that eliminates cracks that could connect the house interior to sub-slab soil and is consistent with other construction constraints such as terrain. Monolithic slab construction should be used where possible. Only the following slab edge detail options may be used:

- (1) Thickened edge monolithic — the sub-slab membrane shall extend beyond the outside face of the slab edge.
- (2) Slab poured into stem wall — where concrete blocks are used as slab forms, the sub-slab membrane shall extend horizontally at least 1 inch (25.4 mm) into the stem wall, but shall not extend upward along any vertical faces of the stem wall. The concrete slab shall be poured into the stem wall to completely fill its open volume to form a continuous and solid stem wall cap of minimum 8 inch (203 mm) thickness. Framed exterior walls shall be sealed or gasket to the slab.
- (3) Slab capping stem wall — where the floor slab is formed and placed to completely cover the stem wall, the sub-slab membrane shall extend horizontally beneath the slab to its outer edge. The supporting stem wall shall be capped with a solid masonry unit of at least 4 inch (102 mm) thickness beneath the membrane and the slab.

### F303.3 Sealing of joints, penetrations and cracks in slabs.

**F303.3.1 Contraction joints.** All contraction joints shall be cleaned and sealed against soil-gas entry by use of an approved sealant (see Section F303.6) applied according to the manufacturer's instructions. (Note: most sealants require the concrete to be cured and dried.) For bottom-induced joints, inverted T-split ribbed waterstops at least 6 inches (152 mm) wide made of impermeable material may be formed into the slab and shall not require top-surface sealing for radon control.

**F303.3.2 Horizontal joints.** Horizontal joints between two slabs of different elevations that are poured at different times shall provide horizontal contact between the two slabs that is at least 8 inches (203 mm) wide, or shall be sealed by an approved sealant (Section F303.6).

**F303.3.3 Vertical joints through slabs.** Vertical joints through slabs shall be formed with a recess of not less than  $\frac{1}{4}$  inch by  $\frac{1}{4}$  inch (6.4 by 6.4 mm) and sealed with an approved sealant.

**Exception:** Slab-edge vertical joints occurring in slab poured into stem wall construction [see Section F303.2(2)]. The sealant (see Section F303.6) shall be applied according to the manufacturer's instructions.

(Note: most sealants require the concrete to be cured and dried.)

#### F303.3.4 Penetrations.

**F303.3.4.1 Stake penetrations.** Any stake that extends through more than one-fourth the thickness of the slab shall be of a nonporous material resistant to decay, corrosion and rust, and shall be cast tightly against the slab, or sealed to the slab in accordance with Section F303.6. All stakes shall either be solid, or shall have the upper end tightly sealed by installation of an end cap designed to provide a gas-tight seal.

**F303.3.4.2 Work spaces.** Work spaces formed into a slab, such as beneath a shower or bath tub drain, shall be sealed gas tight. The exposed soil shall be compacted and then shall be fully covered with a solvent-based plastic roof cement or a foamed-in-place polyurethane sealant or other approved elastomeric material to a minimum depth of 1 inch (25.4 mm).

**F303.3.4.3 Pipe penetrations.** Plastic pipes shall be in contact with the slab along the slab's depth by casting the concrete tightly against the pipe. Where pipes are jacketed by sleeves they shall be sealed by one of the following methods:

- (1) Formation of a slot in the slab around the pipe and casting with asphalt or an approved sealant from the slab to a point above the sleeve, or
- (2) Seal the space between the sleeve and the pipe with an appropriate joint sealant (see Section F303.6).
- (3) Pipes and wiring penetrating the slab through chases or conduit shall be sealed by placing an approved sealant between the pipe or wiring and chase or conduit. Plastic sheath, foam or insulation material shall not be used alone around pipes or conduit for sealing purposes.
- (4) Where multiple pipes are ganged, block out a work space around the multiple pipes and seal as in Section F303.3.4.2.

**F303.3.5 Cracks.** All slab cracks greater than  $\frac{1}{32}$  inch (0.8 mm) wide; all cracks that exhibit vertical displacement; all cracks that connect weakened zones in the slab such as vertical penetrations or reentrant corners; and, all cracks that cross changes in materials or planes in the structure, shall be cleaned and sealed against radon entry, prior to applying floor covering, with a flexible field-molded elastomeric sealant installed in accordance with Section F303.6. Cracks less than  $\frac{1}{32}$  inch (0.8 mm) in width that do not meet any of the above criteria may be left unsealed.

#### F303.4 Concrete for slabs.

**F303.4.1 Mix design.** Mix designs for all concrete used in the construction of slab-on-grade floors shall specify a minimum design strength of 3,000 psi (20.7 MPa) at 28 days and a design slump not to exceed 4 inches (102 mm). On-site slumps shall not exceed 5 inches (127 mm), provided total water added to the mix including

plant, transit and site added water does not exceed the following parameters:

- (1) For mixes using natural sands — 275 pounds per cubic yard [33 gallons (125 L)].
- (2) For mixes using manufactured sands — 292 pounds per cubic yard [35 gallons (132.5 L)].

**F303.4.2 Concrete placement.** For improved workability of concrete used in the construction of slab-on-grade floors, additional water and/or water-reducing admixtures shall be used within the following constraints:

- (1) Slumps in excess of 5 inches (127 mm) shall be achieved through the use of mid-range or high-range water reducing admixtures. Water shall not be used in excess of the limitations.
- (2) Slumps of concrete containing mid-range or high range water reducing admixtures shall not exceed 8 inches (203 mm).

**F303.4.3 Curing.** Concrete slabs shall be cured continuously after pouring according to one of the following procedures:

- (1) Moist curing by means of ponding, fog spray or wet burlap for at least 7 days.
- (2) Moist curing using impermeable cover sheet materials conforming with ASTM C 171 for at least 7 days.
- (3) Curing with liquid membrane forming compound according to manufacturer's specifications and conforming with ASTM C 309.

Curing compounds shall be compatible with materials specified in Section F303.6.

**F303.4.4 Loading.** Loading or use of the slab shall be delayed for a minimum of 48 hours after concrete placement. When the slab is used for material storage after the minimum 48-hour period, caution should be used to prevent impact loading.

**F303.4.5 Slab reinforcement.** Floor slabs shall be reinforced by steel reinforcing bars at reentrant corners such as inside corners of an L-shaped slab. Reentrant corners shall have two pieces of #4 reinforcing bar 36 inches (914 mm) long placed diagonally to the corner, 12 inches (305 mm) apart, with the first bar placed 2 inches (51 mm) from the corner. All reinforcement shall be appropriately positioned in the upper third of the slab.

**F303.5 Sealing walls.** Penetrations for electrical receptacles and switches, wiring, plumbing, etc. in the interior surface of the concrete block walls shall be sealed.

**F303.6 Approved sealant material.** Acceptable polyurethane, polysulfide and epoxy caulks and sealants shall conform with ASTM C 920-87, *Standard Specifications for Elastomeric Joint Sealants*, and ASTM C 1193-91, *Standard Guide for Use of Joint Sealants*. Sealant material and the method of application shall be compatible with curing compounds, admixtures and floor finishing materials; withstand light traffic; be impermeable to soil gas; and have an allowable extension and compression of at least 25 percent with 100 percent recovery. Sealants shall be applied to dried

and cured concrete in accordance with manufacturers' instructions. Backer rods may be used to support sealants in cracks and joints.

#### **F304 Slab-below-grade construction.**

**F304.1 General.** For the purposes of this standard, slab-below-grade construction is defined as any conditioned space with the finished floor below finished grade at any point.

**F304.2 Slab construction.** Slabs shall have a sub-slab membrane, conforming with Section F302 that extends to the slab perimeter, but does not vertically separate the slab from the foundation wall. The slab and membrane shall be placed in accordance with Section F303, or may use a floating slab design with all of the following conditions:

- (1) The stem wall is solid poured concrete.
- (2) The slab-wall joint is tooled and sealed with flowable polyurethane (according to Section F303.6).
- (3) All other provisions of Section F303 are satisfied.

#### **F304.3 Sealing walls.**

**F304.3.1 Walls.** Walls surrounding slab-below-grade space shall be constructed from solid poured concrete, at least 8 inches (203 mm) thick, and shall be sealed with a continuous waterproofing coating applied to their outside surface from the top of the footing to finished grade. This coating shall completely seal any joint between the footing and the wall.

**F304.3.2 Utility penetrations.** All utility penetrations through walls in partial or full contact with the soil shall be closed and sealed with an approved sealant material (see Section F303.6) on the interior and exterior faces of the wall.

**F304.4 Sumps.** Any sump located in a habitable portion of a building, or in an enclosed space directly attached to a portion of a building, shall be covered by a lid. An air tight seal shall be formed between the sump and lid and at any wire or pipe penetrations.

#### **F305 Buildings with crawl spaces.**

**F305.1 General.** For the purposes of this standard, buildings with crawl spaces include all buildings with floor supported above grade which do not meet the requirements of Section F306.

**F305.2 Floor systems.** Reinforced concrete floors constructed over crawl spaces shall conform to all applicable provisions of Section F303. Wood-framed floors constructed over crawl spaces shall include an air infiltration barrier in compliance with Chapter 13 of the *Florida Building Code, Building*, current edition. All joints and penetrations through the floor, including plumbing pipes, conduits, chases, wiring, ductwork and floor-wall joints, shall be fully sealed with an approved caulk. Where large openings are created (such as at bathtub drains), sheet metal or other rigid materials shall be used in conjunction with sealants to close and seal the openings.

**F305.3 Crawl space ventilation.** Screened vents without closures shall be installed around the perimeter of the house to connect the crawl space with outdoor air.

**F305.3.1 Vent area.** The crawl space vents shall have a total area equal to either:

- (1) at least  $1/150$  of the area enclosed by the crawl space if the crawl space is exposed to bare soil; or
- (2) at least  $1/300$  of the area enclosed by the crawl space if the crawl space is completely covered by a sub-structure membrane.

**F305.3.2 Ventilation obstructions.** The crawl space shall not contain structures that restrict ventilation in the crawl space. If freeze protection is provided for plumbing in the crawl space, the protection shall not restrict air ventilation in the crawl space.

**F305.4 Sealing walls and doors.** Penetrations from the crawl space into wall cavities shall be fully sealed with an approved caulk or sealant. When a door is located between the crawl space and the conditioned space, it shall be fully weatherstripped or gasketed.

**F305.5 Closing and sealing other paths.** Any openings that connect a crawl space and the closed space between floor or ceiling joists, wall studs, or any other cavity adjoining conditioned space shall be closed and sealed.

**F305.6 Soil connection.** Foundation walls and piers or other intermediate supports that intersect the floor plane shall be solid across the entire horizontal section at a point above the ground plane.

#### **F306 Buildings with combination floor systems.**

**F306.1 Floor system construction.** Where slab-on-grade, slab below-grade, crawl space or elevated building construction are combined in one structure, the provisions for each construction type shall be met.

**F306.2 Walls.** A wall located between a crawl space and conditioned space shall be designed and constructed in compliance with Chapter 13 of the *Florida Building Code, Building*, current, and the provisions of the applicable Sections F303 through F305 of this standard.

#### **F307 Space conditioning systems.**

##### **F307.1 Equipment enclosures.**

**F307.1.1 Crawl spaces.** Return ducts, return plenums and air handlers shall not be located in crawl spaces. Crawl spaces shall not be used as supply or return plenums.

**F307.1.2 Condensate drains, piping and wiring chases.** Condensate drain pipe joints shall be sealed (chemical weld, soldered, etc.) gas tight and shall terminate outside the building perimeter at a height of at least 6 inches (152 mm) above the finished grade ground level. Chases through which the condensate and refrigerant lines run shall not terminate in the return sections of the air distribution system. Where chase lines terminate within the house or garage, they shall be sealed.

##### **F307.2 Air distribution systems.**

**F307.2.1 Sealing.** All ducts and plenums shall be made air tight, constructed and installed in accordance with the current edition Chapter 13 of the *Florida Building Code, Building*. Where rigid fibrous glass ductboard is used, the seal must be on the foil air barrier side of the ductboard.

**F307.2.2 Return plenums and ducts.** Return air shall be separated from any floor that is in contact with the soil or a crawl space, by a plenum or duct fabricated in compliance with Section F307.2.1 and all local codes. Construction of the return plenum or duct shall provide a continuous air barrier that completely separates the depressurized plenum or duct from adjacent building components including but not limited to floors, walls, chases, enclosures, etc. The support platform shall not be used as a return plenum. Where the support platform provides a protective enclosure for a duct, one side shall have a removable panel or door to provide access for inspection and/or repair of the duct and duct-to-air handler connection. Ducts shall carry the return air from the return grills or return plenums to the air handler and shall have a positive air-tight seal to the air handler. A closet shall not be used as a return plenum.

**F307.2.3 Return grille connection.** The return pathway from the return grille shall be a part of the return duct or plenum and shall have a continuous air barrier along its boundary. Where the return pathway passes through a wall cavity, the cavity shall be sealed around the duct in all directions to prevent the leakage of air into the return air stream.

**F307.2.4 Location of ducts and plenums.** Supply and return ducts shall not be located below concrete slab-on-grade floors, and return ducts and plenums shall not be located in crawl spaces.

### **F307.3 Exhaust fans.**

**F307.3.1 Bathroom fans.** Bathroom exhaust fans shall be controlled by an independent separate switch. Manually operated timers should be used as applicable.

**F307.3.2 Attic fans.** If used, attic exhaust fans shall be installed with unobstructed vent and intake areas in accordance with the minimum areas prescribed by their manufacturer. In no case shall effective open vent area be less than the minimum areas prescribed by the manufacturer.

