HOUSE OF REPRESENTATIVES STAFF ANALYSIS

BILL #: HB 1185 Thermal Efficiency Standards for Unvented Attic and Unvented Enclosed Rafter Assemblies
SPONSOR(S): Griffitts
TIED BILLS: **IDEN./SIM. BILLS:** SB 1130

REFERENCE	ACTION	ANALYST	STAFF DIRECTOR or BUDGET/POLICY CHIEF
1) Regulatory Reform & Economic Development Subcommittee	12 Y, 1 N	Wright	Anstead
2) Commerce Committee			

SUMMARY ANALYSIS

The Florida Building Code (Building Code), Energy Conservation (EC Code), regulates the design and construction of buildings for the effective use and conservation of energy over the useful life of each building. The EC Code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective.

The Building Code and EC code requires that unvented attics and unvented enclosed roof framing assemblies in residential homes must meet the following requirements:

- The unvented attic space is completely within the building thermal envelope.
- Where only air-impermeable insulation is provided, the insulation must be applied in direct contact with the underside of the structural roof sheathing.
- The attic is built using **R-30 insulation** in Climate Zone 1, and **R-38 insulation** in Climate Zone 2.
- The home is verified as having an air leakage rate not exceeding seven air changes per hour (**7 ACH50**) in Climate Zones 1 and 2.
- If the home has an air leakage rate less than three air changes per hour (**3 ACH50**), the home must have whole-house mechanical ventilation.

The bill provides that unvented attic and unvented enclosed rafter assemblies that are insulated and air sealed with a minimum of **R-20 air-impermeable insulation** meet the requirements of the EC Code, if all of the following apply:

- The building has a blower door test result of less than **3 ACH50**.
- The building has a positive input ventilation system or a balanced or hybrid **whole-house mechanical ventilation system**.
- If the insulation is installed below the roof deck and the exposed portion of roof rafters is not already covered by the R-20 air-impermeable insulation, the exposed portion of the roof rafters is insulated by a minimum of **R-3 air-impermeable insulation** unless directly covered by a finished ceiling. Roof rafters are not required to be covered by a minimum of R-3 air-impermeable insulation if continuous insulation is installed above the roof deck.
- All indoor heating, cooling, and ventilation equipment and ductwork is inside the building thermal envelope.

The bill provides an effective date of July 1, 2024.

FULL ANALYSIS

I. SUBSTANTIVE ANALYSIS

A. EFFECT OF PROPOSED CHANGES:

Current Situation

The Florida Building Code

In 1974, Florida adopted legislation requiring all local governments to adopt and enforce a minimum building code that would ensure that Florida's minimum building standards were met. Local governments could choose from four separate model codes. The state's role was limited to adopting all or relevant parts of new editions of the four model codes. Local governments could amend and enforce their local codes, as they desired.[1]

In 1992, Hurricane Andrew demonstrated that Florida's system of local codes did not work. Hurricane Andrew easily destroyed those structures that were allegedly built according to the strongest code. The Governor eventually appointed a study commission to review the system of local codes and make recommendations for modernizing the system. The 1998 Legislature adopted the commission's recommendations for a single state building code and enhanced the oversight role of the state over local code enforcement. The 2000 Legislature authorized implementation of the Florida Building Code (Building Code), and that first edition replaced all local codes on March 1, 2002.[2] The current edition of the Building Code is the seventh edition, which is referred to as the 2020 Florida Building Code.[3]

Chapter 553, part IV, F.S., is known as the "Florida Building Codes Act" (Act). The purpose and intent of the Act is to provide a mechanism for the uniform adoption, updating, interpretation, and enforcement of a single, unified state building code. The Building Code must be applied, administered, and enforced uniformly and consistently from jurisdiction to jurisdiction.[4]

The Florida Building Commission (Commission) was statutorily created to implement the Building Code. The Commission, which is housed within the Department of Business and Professional Regulation (DBPR), is a 19-member technical body made up of design professionals, contractors, and government experts in various disciplines covered by the Building Code. The Commission reviews several International Codes published by the International Code Council,[5] the National Electric Code, and other nationally adopted model codes to determine if the Building Code needs to be updated and adopts an updated Building Code every three years.[6] The current edition of the Building Code is the eighth edition, which is referred to as the 2023 Florida Building Code.[7]

Building Thermal Envelope

The Florida Building Code, Energy Conservation (EC Code), regulates the design and construction of buildings for the effective use and conservation of energy over the useful life of each building. The EC Code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective.[8]

The EC Code defines:[9]

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[1] The Florida Building Commission Report to the 2006 Legislature, *Florida Department of Community Affairs,* p. 4, http://www.floridabuilding.org/fbc/publications/2006_Legislature_Rpt_rev2.pdf (last visited Feb. 2, 2024).
[2] *Id.*
[3] Florida Building Commission Homepage, https://floridabuilding.org/c/default.aspx (last visited Feb. 2, 2024).
[4] *See* s. 553.72(1), F.S.
[5] The International Code Council (ICC) is an association that develops model codes and standards used in the design, building, and compliance process to "construct safe, sustainable, affordable and resilient structures." International Code Council, *About the ICC*, https://www.iccsafe.org/about/who-we-are/ (last visited Feb. 2, 2024).
[6] S. 553.73(7)(a), F.S.
[7] Florida Building Commission, Homepage, https://floridabuilding.org/c/default.aspx (last visited Feb. 2, 2024).
[8] S. R101.1-101.3. FBC, Energy Conservation (8th Ed. 2023).
[9] S. R202, FBC, Energy Conservation (8th Ed. 2023).

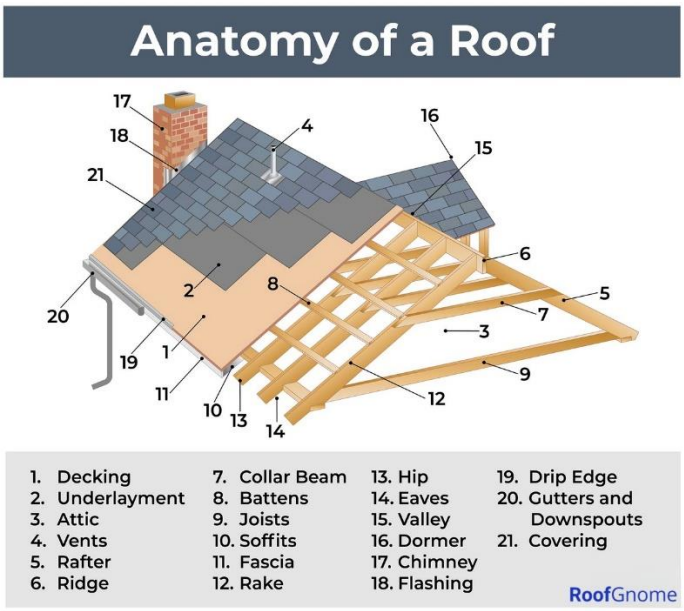
- "Building thermal envelope" as the basement walls, exterior walls, floors, ceilings, roofs and any other building element assemblies that enclose conditioned space or provide a boundary between conditioned space and exempt or unconditioned space.
- "Conditioned space" as an area, room or space that is enclosed within the building thermal envelope and that is directly or indirectly heated or cooled. Spaces are indirectly heated or cooled where they communicate through openings with conditioned spaces; where they are separated from conditioned spaces by uninsulated walls, floors or ceilings; or where they contain uninsulated ducts, piping or other sources of heating or cooling.

The building thermal envelope for residential buildings must meet the requirements of ss. R402.1.1 through R402.1.5 of the EC Code, except the following low-energy buildings, or portions thereof, separated from the remainder of the building by EC Code-compliant building thermal envelope assemblies:[10]

- Those with a peak design rate of energy usage less than 3.4 Btu/h · ft2 (10.7 W/m2) or 1.0 watt/ft2 of floor area for space-conditioning purposes.
- Those that do not contain conditioned space.
- Log homes designed in accordance with ICC-400.

Parts of a Roof

In general, a roof is composed of the following structures:[11]



Roof sheathing, also called roof decking, are the wooden boards that make up the framing of a roof system. These boards are what shingles and other roofing components are installed directly on.[12]

Roof rafters are structural components of a roof on a building. Traditional rafters frame out the roof and connect to the exterior walls, and land on a ridge board, which runs across the length of the building. The result is a vaulted ceiling that can be filled with insulation and drywall to finish the space or be left as open space in an attic.[13]

Unvented Attics

[10] S. R402.1, FBC, Energy Conservation (8th Ed. 2023).
[11] Kimberly Magerl, *21 Different Parts of a Roof,* Roof Gnome, Oct. 9, 2023, https://roofgnome.com/blog/roofing/different-parts-of-a-roof/ (last visited Feb. 4, 2024).
[12] Bill Ragan, What is Roof Sheathing? (What You Need to Know About It), Bill Ragan Roofing Company, Aug. 31, 2022, https://www.billraganroofing.com/blog/what-roof-sheathing (last visited Feb. 4, 2024).
[13] MT Copeland, *What Are Rafters?*, Dec. 22, 2021, https://mtcopeland.com/blog/what-are-rafters/ (last visited Feb. 4, 2024).

Residences may be constructed with either a:[14]

- Vented attic: With openings for outside air to ventilate the space underneath the roof with insulation above the ceiling finish.
- Unvented attic: Without any opening underneath the roof–creating an unvented attic space with insulation at the roof deck. The unvented attic is completely within the building thermal envelope.

Unvented roof assemblies, such as conditioned attics and unvented cathedral ceilings, are created by eliminating ventilation openings and moving the thermal (or insulation), moisture, and air control boundaries to the plane of the roof deck.[15] Unvented attics are also typically built with the HVAC system completely within the building thermal envelope. Insulation is usually a spray foam product that also provides air sealing to create a semi-conditioned space.[16]

Although the rationale for attic ventilation is for moisture control, this was historically based on needs in cold climates and to prevent ice dams. However, vented attics can introduce additional moisture loads into Florida homes by allowing moisture laden air in the attic that may come indoors. Unvented attics can help to reduce moisture condensation on attic mounted ducts and air handlers by reducing the moisture level of the air around the ducts and on the back side of ceiling drywall when low thermostat set points are used.

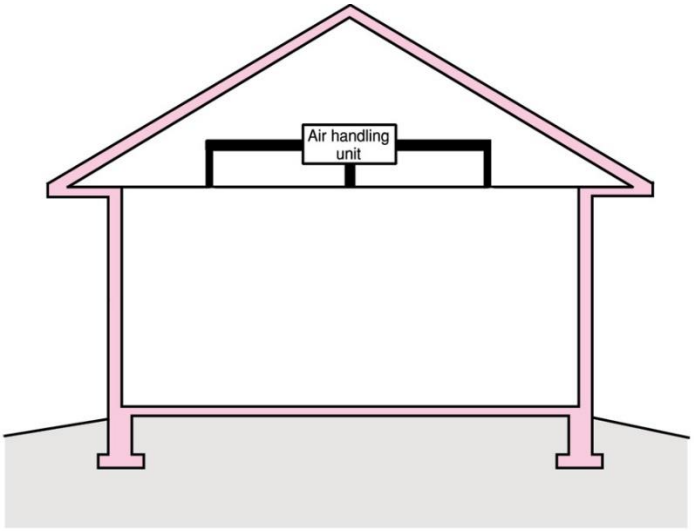
Unvented attics offer the following potential advantages over vented attics:[17]

- Energy Savings - An unvented attic is warmer in winter and cooler in summer, reducing the HVAC load. The equipment will be more durable and more efficient, especially if ductwork is in the attic.
- Moisture Resistance - The attic will stay dry, avoiding problems with mold and wood rot, and thus can serve as living or storage space.
- Disaster Resistance - Roofs over unvented attics are less likely to be blown off in high winds because the wind cannot readily enter the attic. In addition, a house in wildfire zones is less likely to catch fire from floating embers since there are no soffit vents for the embers to enter. In coastal areas, an unvented roof keeps out wind-driven rain and better protects metal connectors in the roof assembly against salt spray and corrosion.

However, an unvented attic system can be more expensive than a vented attic, as it requires more spray foam insulation, which means more cost.[18]

An example of an unvented attic is pictured below:[19]

[14] University of Central Florida, Florida Solar Energy Center, *Attic Insulation and Ventilation*, https://energyresearch.ucf.edu/research/buildings-research/roof-assembly/attic-insulation-ventilation/ (last visited Feb. 4, 2024).
[15] U.S. Department of Energy, *Unvented, Conditioned Attics*, https://www.energy.gov/eere/buildings/articles/unvented-conditioned-attics-building-america-top-innovation#:~:text=Insulating%20and%20air%20sealing%20along,insulating%20along%20the%20ceiling%20deck%3A&text=Energy%20Savings%20%2D%20An%20unvented%20attic,the%20attic%20(Rudd%202005). (last visited Feb. 4, 2024
[16] UCF, *supra* note 14.
[17] US Dept. of Energy, *supra* note 15.
[18] Amanda Ringler, *Vented vs. Unvented Attic: Which is Better?*, RetroFoam of Michigan Inc., July 13, 2020, https://www.retrofoamofmichigan.com/blog/vented-vs-unvented-attic-which-is-better (last visited Feb. 4, 2024).
[19] U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, *Unvented Attic Insulation*, https://basc.pnnl.gov/resource-guides/unvented-attic-insulation#edit-group-description (last visited Feb. 4, 2024).



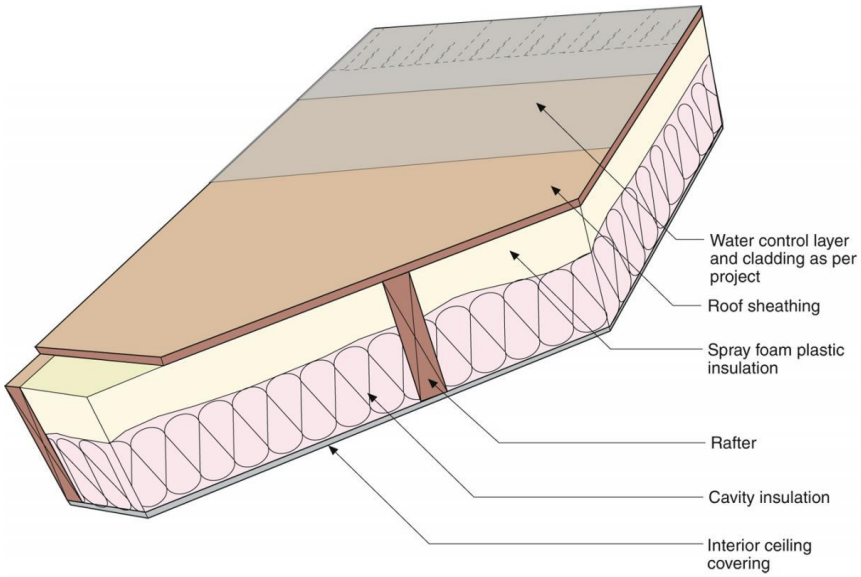
Note: Colored shading depicts the building's thermal barrier and pressure boundary. The thermal barrier and pressure boundary enclose the conditioned space.

Air-impermeable Insulation

Permeable and impermeable air barrier membranes differ in their ability to block moisture:[20]

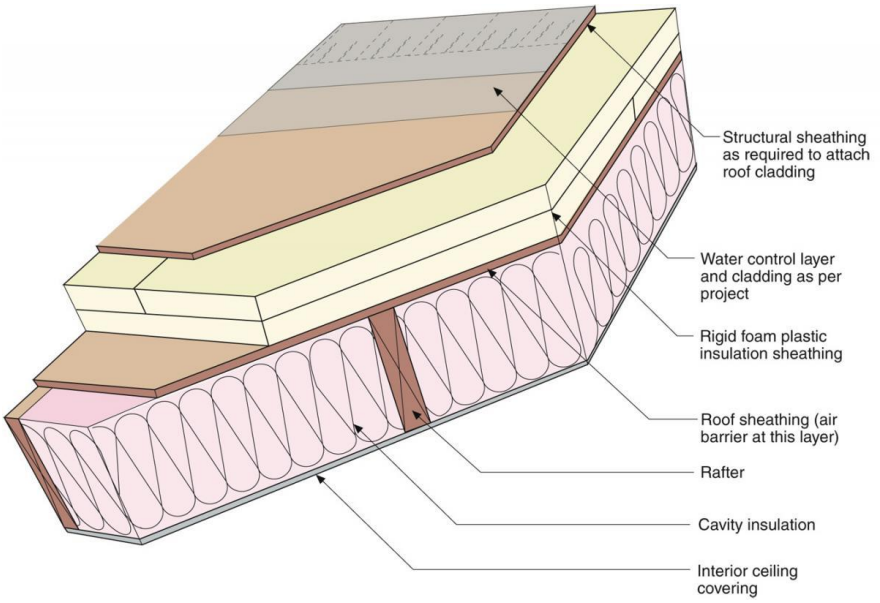
- Impermeable air barriers block water vapor and air.
- Permeable air barriers block air but allow water vapor to move through the membrane, promoting diffusion out of the wall system. Permeable air barriers offer varying permeability rates and come as either sheet or fluid-applied membranes.

Air-impermeable insulation that is installed to the underside of the roof sheathing of an unvented roof is typically spray foam. Air-impermeable spray foam insulation for unvented attics applied under the sheathing is typically installed as follows:[21]



Florida generally requires insulation to be installed under the roof sheathing,[22] but elsewhere, air-impermeable insulating sheathing applied over the roof deck may be used for unvented attics, and is typically installed as follows:[23]

[20] Cory Bendokas, *Impermeable vs. Permeable Air Barriers: Main Differences*, Build Meets World by Tremco CPG Inc., https://blog.buildmeetsworld.com/impermeable-vs-permeable-air-barriers (last visited Feb. 4, 2024).
[21] US Dept. of Energy, *supra* note 19.
[22] S. R806.5, FBC, Residential (8th Ed. 2023).



R-Value

R-value is a measure of how much resistance insulation has to heat flow. The higher the R-value, the more the resistance and the better the material is at insulating a home. Generally, insulation materials with higher R-values cost more when compared to those with lower R-values.[24]

Blower Door Tests

Blower door tests determine to what degree a home is airtight. A temporary "blower door" equipped with a powerful fan is fitted into the frame of an existing front or back door, and when the fan is turned on, it sucks the air out of the house and blows it outside. Digital gauges compare the difference in air pressure between the inside air and the outside air to determine how much air is leaking into the house.[25]

The standard way to determine air tightness of a building is to measure air leakage at 50 Pascals (ACH50) to the conditioned volume of the building. Air Change per Hour at 50 Pa (ACH50) is calculated by dividing air flow per hour by the volume of the building. ACH50 tells us how many times per hour the entire volume of air in the building is replaced when the building envelope is subjected to a 50 Pascal pressure. The airtightness of existing homes can vary dramatically based on the construction style, age and region.[26]

Proper, tight air sealing of unvented attics is important for proper function.[27] Whole-house mechanical ventilation is required for homes with a high air-tightness.[28]

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[23] To meet durability goals in most applications, the airtightness must be provided by a continuous membrane—preferably adhered to the top surface of the structural roof deck and under rigid insulation that provides condensation control. *Id.*
[24] Emily Glover and Samantha Allen, *What Is Insulation R Value? Everything You Need To Know*, Forbes, Jan, 20, 2022, https://www.forbes.com/home-improvement/home/what-is-insulation-r-value/ (last visited Feb. 4, 2024).
[25] Glenda Taylor and Bob Vila, *All You Need to Know About Blower Door Tests*, BobVila.com, Oct. 23, 2020, https://www.bobvila.com/articles/blower-door-tests/ (last visited Feb. 4, 2024); Tyler Vanzo, *Air Changes Per Hour (ACH): What is it & How to Calculate it*, SmartAir, Jan. 16, 2024, https://smartairfilters.com/en/blog/what-is-air-changes-per-hour-ach-how-to-calculate/ (last visited Feb. 4, 2024).
[26] The Energy Conservatory, TEST RESULTS AND SAMPLE TEST FORMS, https://energyconservatory.com/wp-content/uploads/2017/08/Test-Results-and-Sample-Test-Forms-Guide-.pdf (last visited Feb. 4, 2024).
[27] UCF, *supra* note 14.
[28] Eric Martin and Charles Withers, Jr., *Survey of Unvented Attics in Climate Zone 2A*, University of Central Florida, Florida Solar Energy Center, Mar. 17, 2021, https://publications.energyresearch.ucf.edu/wp-content/uploads/2021/02/FSEC-CR-2106-21.pdf (last visited Feb. 4, 2024).

The chart below shows the relative tightness of homes based on the ACH50:[29]

0 - 1.5 ACH	Very tight
1.5 - 3 ACH	Tight
3 - 5 ACH	Moderately tight
5 - 7 ACH	Loose
7 - 10 ACH	Very loose
10 + ACH	Extremely loose

Unvented Attics and Unvented Enclosed Roof Framing Assemblies

Section 806.5, Florida Building Code, Residential, for residential buildings, requires that unvented attics and unvented enclosed roof framing assemblies created by ceilings that are applied directly to the underside of the roof framing members and structural roof sheathing applied directly to the top of the roof framing members or rafters, must be allowed if certain conditions are met, including:[30]

- The unvented attic space is completely within the building thermal envelope.
- No interior Class I vapor retarders are installed on the ceiling side (attic floor) of the unvented attic assembly or on the ceiling side of the unvented enclosed roof framing assembly.
- Insulation must comply with Item 5.1 and Item 5.3. As an alternative, where air-permeable insulation is located on top of the attic floor or on top of the attic ceiling, insulation must comply with Item 5.3 and Item 5.2.

Item 5.1. provides requirements insulation depending on the air permeability of the insulation directly under the structural roof sheathing. The following requirements are applicable to air-impermeable insulation:

- Where only **air-impermeable insulation** is provided, it must be applied in direct contact with the **underside** of the structural roof sheathing.
- Alternatively, sufficient rigid board or sheet insulation must be installed directly above the structural roof sheathing to maintain the monthly average temperature of the underside of the structural roof sheathing above 45°F (7°C). For calculation purposes, an interior air temperature of 68°F (20°C) is assumed and the exterior air temperature is assumed to be the monthly average outside air temperature of the three coldest months.

Item 5.2. provides requirements for air-permeable insulation, and Item 5.3.requires, where preformed insulation board is used as the air-impermeable insulation layer, it must be sealed at the perimeter of each individual sheet interior surface to form a continuous layer.

Section R402 of the EC Code

Insulation Requirements

In general, the EC Code requires residential ceilings, including ceilings with attics, to be built using **R-30 insulation** in Climate Zone 1, and **R-38 insulation** in Climate Zone 2.[31]

However, s. R402.1.2 of the EC Code, where R-38 insulation is required in the ceiling or attic, allows installing R-30 over 100 percent of the ceiling or attic area requiring insulation to satisfy the requirement for R-38 insulation wherever the full height of uncompressed R-30 insulation extends over the wall top plate at the eaves.

Mechanical Requirements

Section R402 requires that a mechanical system of a residential building or dwelling unit must be blower door tested in accordance with ANSI/RESNET/ICC 380, reported at a pressure of 50 pascals,

[29] UCF, *supra* note 14.
[30] S. R806.5, FBC, Residential (8th Ed. 2023).
[31] Table R402.1.2, FBC, Energy Conservation (8th Ed. 2023).

and verified as having an air leakage rate not exceeding seven air changes per hour (**7 ACH50**) in Climate Zones 1 and 2.

Homes with an air leakage rate less than three air changes per hour (**3 ACH50**) must be provided with **whole-house mechanical ventilation**.[32] All counties In Florida are either Climate Zone 1 or 2.[33]

Types of Whole-house Ventilation Systems

Whole-house mechanical ventilation is the intentional exchange of indoor air with fresh outdoor air at a controlled rate using fans. The purpose of whole-house mechanical ventilation is to improve indoor air quality. Historically, mechanical ventilation was limited to local-exhaust (kitchen and bath exhaust fans) for spot control of moisture and odors. Houses commonly had enough natural ventilation, through leaky building enclosures, that whole-house mechanical ventilation was not necessary. Houses have become significantly tighter during the past 15-20 years as a result of changing codes, energy efficiency programs, and an overall desire to reduce energy use. Above-code programs and more recently the building codes have generally made controlled whole-house mechanical ventilation a requirement.[34]

Balanced

The exhaust-only ventilation method is when a fan, commonly an efficient bath fan, exhausts indoor air, and outdoor makeup air is drawn into the house through leaks in the building enclosure. The supply-only ventilation method is when a fan draws outdoor air into the house, and indoor air escapes through the building enclosure and exhaust fan ducts.[35]

A balanced whole-house mechanical ventilation system is a combination of exhaust and supply methods providing approximately equal indoor exhaust and outdoor supply air flows, e.g., an exhaust fan combined with a supply fan or passive inlet vents. A balanced system may include a heat recovery ventilator (HRV) or an energy recovery ventilator (ERV).[36]

Hybrid

A hybrid ventilation whole-house mechanical ventilation system is a recent concept that consists in using the components and sizing of natural ventilation ducts coupled with non-constant low-pressure mechanical assistance. Mechanical assistance is only used to supplement natural forces when necessary. Natural forces means three different kinds of natural phenomena that cause air to move:[37]

- Wind that can penetrate the dwelling through entrances and exists.
- Thermal draught where the airflow is produced by the density difference between the hot air and the cold air, where the less dense hot air tends to rise and the denser cold air tends to go down.
- Aeraulic draught caused by the pressure difference linked to height, where the lower upright pression creates a depression that enables the air to circulate in the dwelling.

The hybrid ventilation start is automatic; it can be activated by a temperature sensor, a wind vane or a pressure switch. Fresh air is admitted through the humidity-controlled air inlets located in the dry rooms (e.g., bedrooms and living room), and stale air is evacuated through the wet rooms (e.g., bathrooms and kitchen) by humidity-controlled extraction grilles linked to the ventilation duct connected to the fan.[38]

Positive Input

[32] S. R402.4.1.2, FBC, Energy Conservation (8th Ed. 2023).
[33] Table R301.1, FBC, Energy Conservation (8th Ed. 2023).
[34] Home Innovation Research Labs, *Whole-House Mechanical Ventilation Code: Safety and Performance Considerations*, International Code Council and National Association of Home Builders, October 2013, https://www.iccsafe.org/wp-content/uploads/proclamations/TN01-Whole-House-Ventilation_pdf.pdf (last visited Feb. 3, 2024).
[35] *Id*.
[36] *Id*.
[37] Aereco, *How does hybrid ventilation work?*, https://www.aereco.com/ventilation/ventilation-systems/hybrid-ventilation/ (last visited Feb. 3, 2024).
[38] *Id*.

A positive input ventilation system generally addresses ventilation issues in existing properties, such as condensation, damp and mold. Positive input ventilation pumps and circulates fresh filtered air into a house, forcing stale air out of the gaps and cracks in the fabric of the building. The unit is installed in the loft area, and a distribution diffuser is mounted in the ceiling in the room below. The continual supply and slight positive pressure result in the air in the property being continually diluted, displaced and replaced to create a healthier indoor air quality.[39]

Effect of the Bill

The bill provides thermal efficiency standards for unvented attic and unvented enclosed rafter assemblies.

The bill provides that unvented attic and unvented enclosed rafter assemblies that are insulated and air sealed with a minimum of **R-20 air-impermeable insulation**[40] meet the requirements of sections R402 of the Florida Building Code, 8th Edition (2023), Energy Conservation, if all of the following apply:

- The building has a blower door test result of less than **3 ACH50**.
- The building has a positive input ventilation system or a balanced or hybrid **whole-house mechanical ventilation system**.
- If the insulation is installed **below the roof deck** and the exposed portion of roof rafters is not already covered by the **R-20 air-impermeable insulation**, the exposed portion of the roof rafters is insulated by a minimum of **R-3 air-impermeable insulation** unless directly covered by a finished ceiling. Roof rafters are not required to be covered by a minimum of **R-3 air-impermeable insulation** if continuous insulation is installed **above the roof deck**.
- All indoor heating, cooling, and ventilation equipment and ductwork is inside the building thermal envelope.

The bill provides an effective date of July 1, 2024.

B. SECTION DIRECTORY:

Section 1: Creates s. 553.9065, F.S.; related to certain thermal efficiency standards.
Section 2: Provides an effective date.

II. FISCAL ANALYSIS & ECONOMIC IMPACT STATEMENT

A. FISCAL IMPACT ON STATE GOVERNMENT:

1. Revenues:

   None.

2. Expenditures:

   None.

B. FISCAL IMPACT ON LOCAL GOVERNMENTS:

1. Revenues:

   None.

2. Expenditures:

   None.

[39] Hugh Metcalf, *Positive Input Ventilation Explained: Pros, Cons, Costs and More*, Homebuilding & Renovating, Sep. 9, 2021, https://www.homebuilding.co.uk/advice/positive-input-ventilation (last visited Feb. 3, 2024).
[40] Current law requires R-30 or R-38, depending on Climate Zone.

C. DIRECT ECONOMIC IMPACT ON PRIVATE SECTOR:

The bill may allow unvented attics and unvented enclosed rafter assemblies to be constructed cheaper by reducing insulation requirements.

D. FISCAL COMMENTS:

None.

III. COMMENTS

A. CONSTITUTIONAL ISSUES:

1. Applicability of Municipality/County Mandates Provision:

Not applicable. The bill does not appear to affect county or municipal governments.

2. Other:

None.

B. RULE-MAKING AUTHORITY:

The bill requires updates to the Florida Building Code.

C. DRAFTING ISSUES OR OTHER COMMENTS:

None.

IV. AMENDMENTS/COMMITTEE SUBSTITUTE CHANGES