Q&A Explore the Top Topics

Residential Envelope

Air sealing/barriers

Are both thermal and air barrier required to be shown on drawings or just thermal?

R105.2.1 (Building thermal envelope depiction) states only that, "The building's thermal envelope shall be represented in the construction drawings." The code does not provide any specifics as to how the thermal envelope must represented; however, the building thermal envelope consists of both insulation and air barrier layers, so it is safe to say that both layers should be included on the drawings. It is recommended that plans contain whole building cross sections showing insulated thermal envelope assemblies and a continuous air barrier. Additional insulation and air barrier design information should be provided in cross section details.

Can you use housewrap as an air barrier?

Yes, housewrap may be installed as an air barrier, but first you should verify that a specific product has been demonstrated to be an air barrier material through third-party testing, such as an ICC Evaluation Services (ES) Report Next, it is important to follow manufacturer's instructions for installing housewrap as an air barrier.

Wouldn't putting an air barrier on the exterior side of an assembly cause condensation? It would technically be on the cold side of the wall.

Most air barrier systems have at least some level of vapor permeability, meaning that water vapor can dry to the outside, even as air movement is stopped. Different products have different levels of permeability, so check the manufacturer's specifications for the perm rating. For air barriers, generally a higher perm rating is considered better because it allows drying to the outside.

In the code there is a distinction between an air barrier and a vapor barrier. Can a vapor barrier serve as an air barrier?

In general, vapor barriers, or more accurately vapor retarders, are separate systems from air barriers. Examples of exceptions are sheet polyethylene (6 mil poly) and at least one "smart" membrane product. Sheet poly is NOT recommended outside of very cold climates because it traps moisture inside building assemblies during the cooling season. Smart membranes serve as air barriers while their permeability characteristics change depending on humidity levels. See sidebar for more information.

More on barriers

There are three types of "barriers" commonly found in building assemblies: air barriers, vapor barriers, and water-resistive barriers. The purpose of an air barrier is to prevent wasteful air leakage to the outside. Many air barrier products are vapor permeable and allow drying to the outside as discussed in the previous question. The purpose of a vapor retarder is to slow the transfer of water vapor (the gas form of water) from the inside of a building toward the outside and minimize condensation risk. The most common vapor retarder is the Kraft facing on fiberglass batts. Note that vapor retarders are NOT required in Climate Zone 4 (see IRC Section R702.7), which includes Delaware, because of its significant cooling season where the direction of the vapor drive is from the exterior to the interior. Water-resistive barriers are installed to prevent bulk water intrusion into building assemblies. It is common for water-resistive barrier materials to serve double-duty as air barriers (e.g., housewraps, laminated sheathing, foam sheathing). Felt paper is an example of a product that is a water-resistive barrier but NOT and air barrier.

How do you suggest air sealing chimney pipes for HVAC and fireplace chimneys?

IECC Section R402.4.1.1 requires air sealing around all duct shafts and flues installed through ceilings, walls, and floors so conditioned air does not escape into unconditioned space. When sealing around vents and chimneys that are subject to high temperatures, it is important to follow the requirements for clearances from combustibles in IRC Chapter 18 (Chimneys and Vents) or in accordance with the product's listing. This may include using sheet metal and fire caulk to seal around openings. Also note that IECC Section R402.4.2 requires new wood-burning fireplaces to have tight-fitting flue dampers or doors, and outdoor combustion air. More details can be found at Building America Solution Center basc.pnnl.gov

Does the new code require the back side of knee walls that touch the attic areas to have an air barrier? If yes, what is a required air barrier?s

Yes, the back side of the knee wall needs to have an air barrier to prevent air movement through air permeable insulation into unconditioned space behind the knee wall. The IECC is not very specific on this point stating only that "knee walls shall be sealed" in Table R402.4.1.1, but insulation manufacturers are clear that proper installation of insulation in a knee wall includes installing an air barrier on the attic side of the knee wall prior to the installation of air permeable insulation. See page 24 of the North American Insulation Manufacturers Association (NAIMA) guide to proper insulation installation.

If the exterior sheathing is sealed why is electrical receptacle box also sealed?

Table R402.4.1.1 state that "The air barrier shall be installed behind electrical and communication boxes. Alternatively, air-sealed boxes shall be installed." The air barrier is a system which can be designed on the exterior or interior of the building envelope. An electrical receptacle, although on the interior of the wall assembly, would still be a conduit for air movement into the wall assembly and therefore needs to be sealed. That said, if both the sheathing and interior gypsum board are sealed to the wall top plate, this could be considered as having the air barrier extending behind the electrical box.

We have been seeing more sweating ductwork recently. Is this due to building leakage?

This is a summertime problem. Condensation forms when warm, moist air comes into contact with a cool surface. The condition you describe can be a combination of factors and poor air sealing may be part of the problem. The two factors in this case are the surface temperature of the duct and the relative humidity in the surrounding air. So, either the air inside the ducts is excessively cold, leading to cold duct surface temperatures or the surrounding air is too humid. If the ducts are inside the thermal envelope, but the space containing the ducts is not well air sealed from the exterior, warm, moist are may enter from the outside leading to high humidity around the ducts. While the energy code only requires duct insulation for ducts located outside the thermal envelope, it is best practice to insulate ducts regardless of their location.

Sweating of ducts associated with mechanical ventilation systems is also a risk when running uninsulated ducts into vented attics. Duct insulation will mitigate this risk.

Can mineral wool be used for air sealing?

Table R402.4.1.1 states that "Air-permeable insulation shall not be used as a sealing material." Mineral wool, or rockwool, is air permeable and is therefore not acceptable for use in air sealing the thermal envelope. Mineral wool is permissible to be used for fireblocking purposes, per IRC R302.11, in openings that do not penetrate the thermal envelope.

Insulation

Can Kraft paper insulation facing be left exposed?

IRC Section R302.10.1 states that "insulation materials, including facings, such as vapor retarder and vapor permeable membranes installed within floor-ceiling assemblies, roof-ceiling assemblies, wall assemblies, crawl spaces and attics shall have a flame spread index not to exceed 25 with an accompanying smoke-developed index not to exceed 450." Kraft facing does not meet the flame spread and smoke-developed index limits and therefore may not be left exposed, including in crawl spaces. Check for manufacturer's specific approvals based on third-party testing for exceptions.

If a crawl space is not vented how would you deal with flood vents?

Several flood vents are on the market that operate based on hydrostatic pressure to protect your basement or foundation from bulk water intrusion. These vents will remain closed under normal atmospheric conditions and can even lower insurance premiums.

Does crawl space wall insulation create increased risk of termite infestation? How can this risk be mitigated?

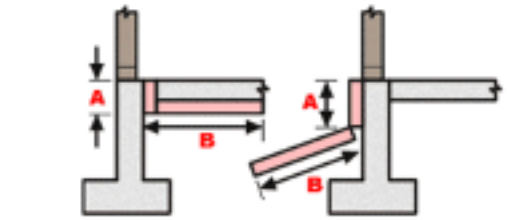
Foam insulation that is in contact with the soil provides a potential pathway for termites to tunnel from the soil to access the framing. (Even without foam insulation, termites can build mud tubes on foundation walls to access the framing.) Sheet metal termite shields/flashing placed under the sill plate will reduce termite infestation risk and termite resistant foam board products are available.

Does the energy code require insulation to be installed in the party wall between two townhouse units?

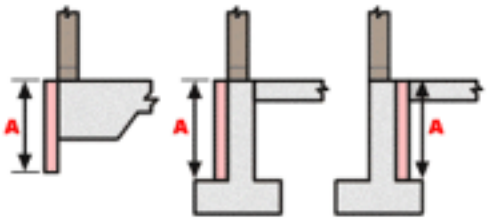
No, the energy code only requires wall insulation for walls that are part of the building thermal envelope. In other words, insulation is only required in walls that separate conditioned space from the outside or an adjacent unconditioned space (e.g. attic knee wall). Insulation is commonly installed in party walls, but this is for sound control only.

For monolithic slabs (a.k.a., haunched or turndown slabs), there is no way to achieve a thermal break between the slab and the footing. If insulation is located underneath the slab, but does not extend downward from the top of the slab, will REScheck provide credit for that insulation?

No. REScheck bases its calculations on the assumption that insulation will be installed per the requirements described in C402.2.4. This means that insulation must extend downward from the top of the slab if an R-value above zero is entered into REScheck. The alternative insulation installation for a monolithic slab is to provide the slab insulation on the exterior. (Note that this insulation must be protected from damage.) The input screen for a slab-on-grade in REScheck shows the following details in which the slab insulation depth always includes the vertical portion extending downward from the top of the slab.



Horizontal Insulation (A + B = Insulation Depth)



Vertical Insulation (A = Insulation Depth)

Are thermal breaks required for slabs at doors?

Yes. Slab perimeter insulation must extend down from the top of the slab around the entire perimeter of the conditioned space. Where the slab extends from the inside to the outside through a doorway, a separate pour is necessary when installing the concrete located on the outside.

Mechanical and Lighting

Are fireplaces a significant source of heat loss?

Yes, they can be because a fireplace can be a significant driver of air infiltration. Unless there is a source of outdoor combustion air, the combustion air required to maintain a fire is drawn from the interior of the building. It is possible for more BTUs of heat to be pulled up through the chimney than are created as useful heat. Temperatures in rooms other than the fireplace may drop when the fireplace is lit. Section R402.4.2 requires new wood-burning fireplaces have tight-fitting flue dampers or doors, and a dedicated source of outdoor combustion air.

Will centralized ducted return, one per floor perform adequately for code purposes?

Centralized ducts systems are not prohibited by the energy or building code. For proper duct design the residential code refers to ACCA manual D or other approved methods for proper sizing and installation.

The State of Delaware follows the 2018 International Mechanical Code (IMC), which requires balancing of HVAC systems. Does that section apply to residential buildings?

It depends. For buildings that fall under the scope of the International Residential Code (one- and two-family dwellings and townhouses), requirements that are found only the IMC do not apply. For residential buildings that fall under the International Building Code (e.g., Group R-2), the requirements of the IMC do apply. These requirements apply regardless of whether the building is defined as residential (Group R-2, R-3, and R-4 three stories or less) or commercial under the IECC.

Can the duct leakage for an HVAC system exceed 4 cfm@25 per 100 ft2 if the Simulated Performance Alternative or Energy Rating Index path is used?

Yes, the maximum duct leakage rates in Section R403.3.4 may be exceeded when using the Simulated Performance Alternative of Energy Rating Index paths. The Section R403.3.4 is labeled as “prescriptive” meaning this section only applies to homes using the prescriptive path (including REScheck).

When using the Simulated Performance Alternative or Energy Rating Index path, the tested leakage rate must be entered into the modeling software, but that value may be any number, provided the home passes overall.

Is duct testing required if a portion of the ductwork is within floor cavities above an unconditioned garage?

Yes, duct leakage testing is required in this case. Section R403.3.3 states that, “A duct air-leakage test shall not be required where the ducts and air handlers are located entirely within the building thermal envelope [emphasis added].” This means that the entire HVAC system must be to the interior of both the thermal layer (insulation) and air barrier. Ducts in floor cavities above an unconditioned basement typically do not have the full R-value of thermal envelope insulation separating them from the unconditioned space, so duct leakage testing is required.

Compliance Paths

Is the Performance Path the same as REScheck?

Not really. The performance path, or Simulated Performance Alternative, relies on a whole-building energy simulation where the energy cost of the proposed home must be less than or equal to a reference home. (The reference home is a home with the same size and geometry, but with all values set to prescriptive code minimums.) REScheck does have what the software developer calls a "limited-scope performance option," which incorporates impacts of house geometry and orientation, but does not include several elements of a true performance path simulation.

Existing Buildings

For the exception to duct leakage testing for additions and alterations, does the threshold of 40 feet of ducts in unconditioned space include the developed length of fittings?

No, IECC Section R502.1.1.2 for additions and Section 503.1.2 for alterations specifically refer to linear feet of ducts. This means that the total effective length of the duct system is not considered when determining if the exception applies.

What are the code requirements for insulation in existing thermal envelope cavities?

IECC Chapter 5 provides two key exceptions for insulation in existing buildings. Exception 2 in Section 503.1.1 says that if a cavity is exposed, it must be filled with insulation. In other words, the cavity must be filled, but the insulation does not have to meet the R-values specified in Chapter 4. Exception 3 says that if a cavity is not exposed, it is exempt from thermal envelope requirements.

Section 503.1.1 Exception 5 may be interpreted as contradictory to Exception 3 because it says that, "roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing." This means that if the roof covering (shingles, metal roofing, etc.) is removed such that the sheathing is exposed, and the roof cavity is part of the thermal envelope but is known to be uninsulated, that insulation must be added to the cavities or above the sheathing as continuous insulation. As with exposed cavities, there is no specific minimum R-value required. The wording for this exception requires interpretation by the authority having jurisdiction.

Commercial Building Energy Code FAQs

Commercial Envelope

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Insulation Installation

For monolithic slabs (a.k.a., haunched or turndown slabs), there is no way to achieve a thermal break between the slab and the footing. If insulation is located underneath the slab, but does not extend downward from the top of the slab, will COMcheck provide credit for that insulation?

No. COMcheck bases its calculations on the assumption that insulation will be installed per the requirements described in C402.2.4. This means that insulation must extend downward from the top of the slab if an R-value above zero is entered into COMcheck. The input screen for a slab-on-grade in COMcheck states:

"The vertical (slab edge) insulation construction details you specify in this screen and in the envelope table should represent the insulation that starts at the top of the slab edge and extends downward or downward then horizontally around the perimeter of the slab."

The alternative insulation installation for a monolithic slab is to provide the slab insulation on the exterior. Note that this insulation must be protected from damage.

If the minimum R-value can be achieved without filling the wall cavity, does the entire cavity need to be filled with insulation?

For air permeable insulation such as fiberglass, the answer is yes. While not explicitly stated in the energy code, the manufacturer's installation instructions for air permeable insulation usually state that the entire cavity must be filled, even if the required R-value can be met without filling the cavity.

Compliance Paths

Is ASHRAE 90.1 Appendix G specifically adopted by the State of Delaware?

No, ASHRAE 90.1 Appendix G is not adopted by the State of Delaware. ASHRAE Standard 90.1 is specifically referenced in Delaware Title 7: 2000 Section 2101 Regulations for State Energy Conservation Code as an alternative to the International Energy Conservation Code (IECC), but according to ASHRAE 90.1, "[Appendix G] does NOT offer an alternative compliance path for minimum standard compliance; that is the intent of Section 11 Energy Cost Budget Method."