

# Envelope

## INSULATION – BATT



### Pressure or Friction Fit

Insulation should be cut to fit snugly against studs on all sides, and should completely fill the cavity with no air gaps. Cut lengths of insulation should be butted together with no gaps. Friction fit batts are slightly wider than the stud cavity and so held in place by friction, not stapling. Friction fit batts should not be used in walls over 8 feet tall.



### Face & Inset Stapling

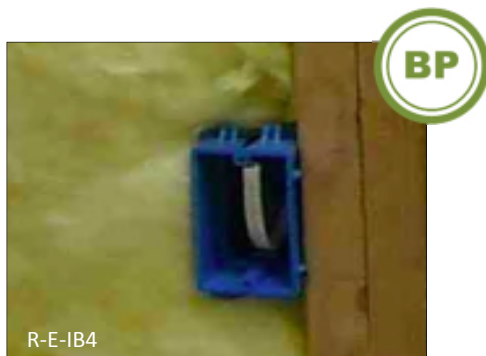
Push batt into stud cavity so that it makes contact with framing, especially at corners and sides. Then pull batt forward to full loft so that it fills the whole cavity.

**(1) Face Stapling:** Paper flanges are stapled to stud face. This method of installation is best practice and avoids loss of performance from air gap channels created with inset stapling.



**(2) Inset Stapling:** Insulation should be compressed only as far as is required to staple the flange to the inside of the stud. Extra compression will result in loss of performance therefore **this method is NOT RECOMMENDED.**

**Code Reference:** 2016 Title 24, Reference Appendices §RA3.5



### Obstructions

Junction boxes that back to outside walls should have insulation cut to fit snugly around and behind them to fill the cavity. Similarly, insulation should be cut to fit around ceiling exhaust fans. All holes in junction boxes with or without wires entering the boxes should be air sealed.

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## INSULATION – BATT



### Split , Don't Stuff

Take the time to split insulation to fit snugly around electrical wires and plumbing. Do not stuff the batt in front of or behind the wire; this compresses the insulation and leaves an air gap.



### Proper Support

Wire struts or laced wire can be used to support fiberglass to keep it in touch with the floor above. Wire should not compress the insulation but also should not let it sag. Netting or mesh can also be used.

**Code Reference:** 2016 Title 24, Reference Appendices §RA3.5

**Notes:**

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## INSULATION – BLOWN

FYI



### Fill the Crevices

Blown attic insulation fills in spaces between framing and covers bottom chords for an even and full installation. In walls, the blown insulation surrounds wires and piping. Always seal all penetrations to unconditioned space including attic, bottom plate, and exterior, before insulating. Be sure to install eave vent baffles if eave vents are present to prevent wind washing.

FYI



### Dry Blown

Dry blown cellulose can be blown into walls through holes in netting fixed to the studs. The insulation should be packed firmly but not bulging. Rolling the packed insulation helps evenly distribute the cellulose in the stud cavity and leaves it flat ready for drywall installation.

FYI



### Damp Blown

Damp blown cellulose is typically used in new construction or major renovations and sticks to the framing to fill the cavity. It is trimmed so that it aligns with the face of the studs. The wall should not be covered until the insulation is totally dry (follow manufacturer instructions for approximate dry times).

FYI



### Spray

Open-cell foam sprayed into walls fully fills the stud cavity with no voids. Properly installed foam will not shrink away from framing members. Pay attention to the rim joist area, where blocking and other obstructions, in addition to nozzles used to spray the foam, make it hard to cover the lower edge of that space. Closed cell foam has a higher R value per inch and adds shear strength to the building. Thickness of more than 1.5 inches of closed-cell foam can act as an air and moisture barrier.

**Code Reference:** 2016 Title 24, Reference Appendices §RA3.5

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R-E-IBL3: © Architectural Energy Corporation  
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## INSULATION – BLOWN

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## INSULATION – RIGID/ SIPs



### Rigid

Install rigid foam on the exterior of the home to cover the studs and provide continuous insulation. This approach requires greater attention to finish details for the windows, trim, electrical boxes and gas meters. Extend insulating sheathing up the eave to meet the ventilation air space.

### SIPs

Structural Insulated Panels sandwich rigid foam insulation between layers of sheathing. Air seal electrical wiring channels in exterior walls. Seal connections between panels, sill and top plates when assembling to reduce water vapor and air transmission. Where appropriate, use SIPs with splines, allowing insulation to remain as continuous as possible. Some panels are produced with rough sawn plywood to speed up installation for board and batt siding.

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## INSULATION – RIGID/ SIPs

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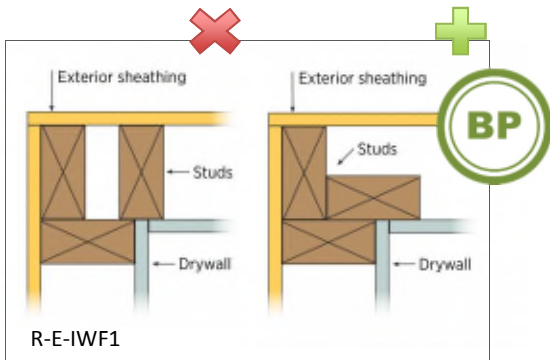
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## INSULATION – WALLS/ FOUNDATION



### Advanced Framing- Corners

Install wall components to allow for as much insulation coverage as possible while meeting structural requirements. Use two or three stud corners that allow insulation to reach these cavities.



### Advanced Framing- Ladder Blocking

Frame exterior with advanced framing techniques such as ladder blocking so that insulation can continue along the exterior wall where interior walls meet exterior ones.



### Slab Insulation

Insulation should extend all the way to the top of the slab. The best type for this application is extruded polystyrene (typically blue or pink boards). Mandatory slab edge insulation only required for heated slabs, with increased R-value required in CZ 16 for projects complying prescriptively.

**Code Reference:** 2016 Title 24, Part 6 Standards §110.8(g) & §150.0(f)

## INSULATION – WALLS/ FOUNDATION



R-E-IWF5

### Minimum R-Values

2x4 Walls shall be insulated between framing members with insulation having an installed thermal resistance of not less than R-13, or the weighted average U-factor shall not exceed U-0.102 (the U-factor that results from installing R-13 in a 2x4 inch wood framed assembly).

**Code Reference:** 2016 Title 24, Part 6 Standards §150.0(c)

2x6 Walls shall be insulated between framing members with insulation having an installed thermal resistance of not less than R-19 in framing of 2x6 inch or greater, or the U-factor shall not exceed the U-0.074 (the U-factor that results from installing R-19 in a 2x6 inch or greater wood framed assembly)

**Code Reference:** 2016 Title 24, Part 6 Standards §150.0(c)

NOTE: These are absolute minimums. The prescriptive or performance compliance approaches may result in higher minimum levels of insulation. See CF-1R for specific project requirements.

**Notes:**

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## INSULATION – ATTIC



### Minimum R-values

Ceilings and rafter roofs shall be insulated between wood-framing members with insulation resulting in:

1. An installed thermal resistance of R-22 (R-19 for alterations) or greater for the insulation alone. ~OR~
2. The weighted average U-factor shall not exceed 0.043 (0.054 for alterations)

NOTE: These are absolute minimums. The prescriptive or performance compliance approaches may result in higher minimum levels of insulation. See CF-1R for specific project requirements.

**Code Reference:** 2016 Title 24, Part 6 Standards §150.0(a)



### Attic Access Doors Insulated and Gasketed

Attic access doors shall have permanently attached insulation using adhesive or mechanical fasteners. The attic access shall be gasketed to prevent air leakage.

**Code Reference:** 2016 Title 24, Part 6 Standards §150.0(a)



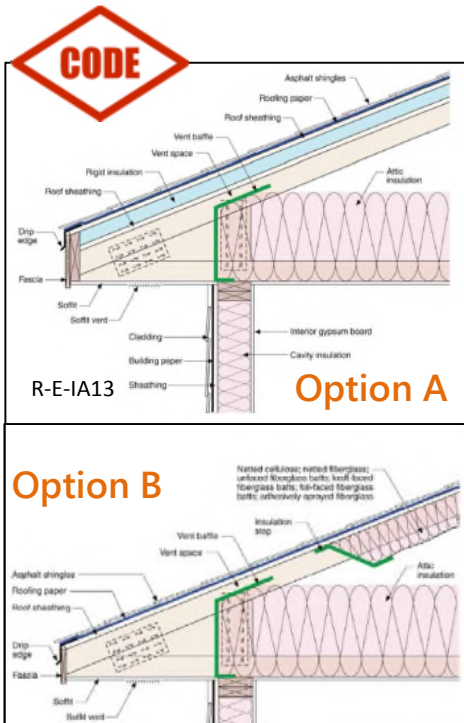
### Loose-fill Insulation to be Proper Weight/sf

When loose-fill (blown-in) insulation is installed, the minimum installed weight per square foot shall conform with the insulation manufacturer's installed design weight per square foot at the manufacturer's labeled R-value. This ensures that the insulation has not been "fluffed" and will not settle over time. Refer to the CF-2R-ENV-XXX for installer certification that this was done.

**Code Reference:** 2016 Title 24, Part 6 Standards §150.0(b)

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## INSULATION – ATTIC



### Placement in Attics

For vented attics, the mandatory insulation shall be installed at the ceiling level; for unvented attics, the mandatory insulation shall be placed at either ceiling or roof level. For prescriptive high performance attic requirements, insulation can be placed above roof deck, or below-but ceiling insulation is also required.

Insulation shall be installed in direct contact with a continuous roof or ceiling which is sealed to limit infiltration and exfiltration as specified in Section 110.7

**Code Reference:** 2016 Title 24, Part 6 Standards §150.0(a) and Table 150.1-A

## INSULATION – ATTIC



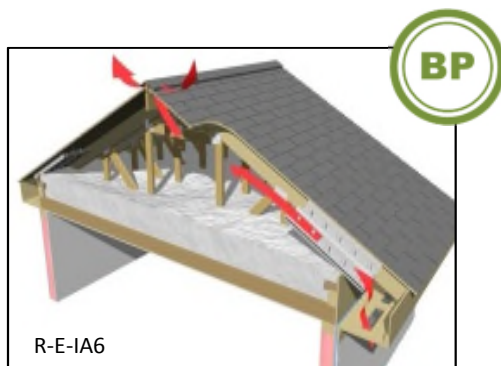
### Attic Baffles

Baffles should be installed in every bay of eaves with vents. These allow insulation to reach full depth over the exterior wall and at the same time they maintain air flow below the roof and prevent wind washing of loose fill insulation. Make sure there is at least a 1" air gap between the baffle and roof. Baffles are often made of cardboard or plastic. Do not locate water supply pipes in vented bay. Remember to install a baffle at the edge of attic insulation above a kneewall as well.



### Measure the Depth

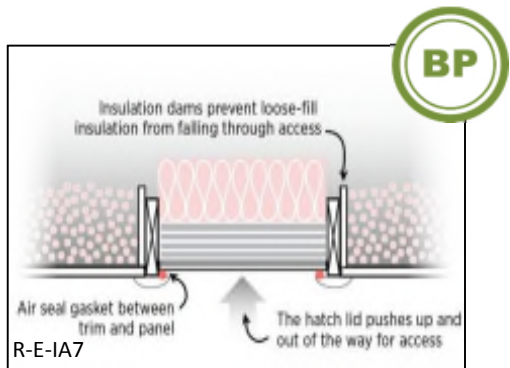
When using blown insulation, rulers should be installed throughout the attic to clearly show proper depth and evenness of insulation. Markers should face attic hatch opening. Add an extra inch of insulation to allow for settling of loose fill material.



### Cover the joists

Insulation should cover joist/bottom chord of the attic truss to slow heat loss. This is easy to achieve with blown insulation. Although loose fill is recommended for this application, one way to accomplish this with fiberglass is to lay a second layer crosswise to the first layer. Always make sure batt layers are continuous with no air gaps.

## INSULATION – ATTIC



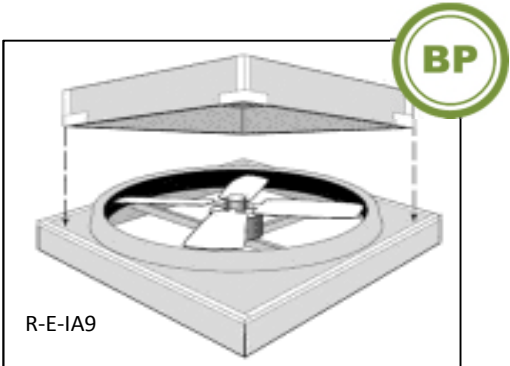
### Build A Dam

Achieve full attic R value immediately surrounding an attic hatch, whole house fan or pull down stairs, by building a dam to the height of the insulation. The dam can be constructed of plywood, or fiberglass batts can be placed around the hatch opening the full depth of the loose fill insulation to prevent the loose fill from falling into the hatch when opened.



### Raise the Roof

Raised heel trusses allow for full attic insulation R value over exterior walls by increasing the available space. Attic baffles are an integral part of this strategy to maintain venting space under the roof deck. Raised heel trusses are also a good idea if the attic will be sealed, thus allowing for full depth of spray foam insulation around the entire building envelope.



### Whole House Fan

When not in use during winter months, a whole house fan should be air sealed and insulated.



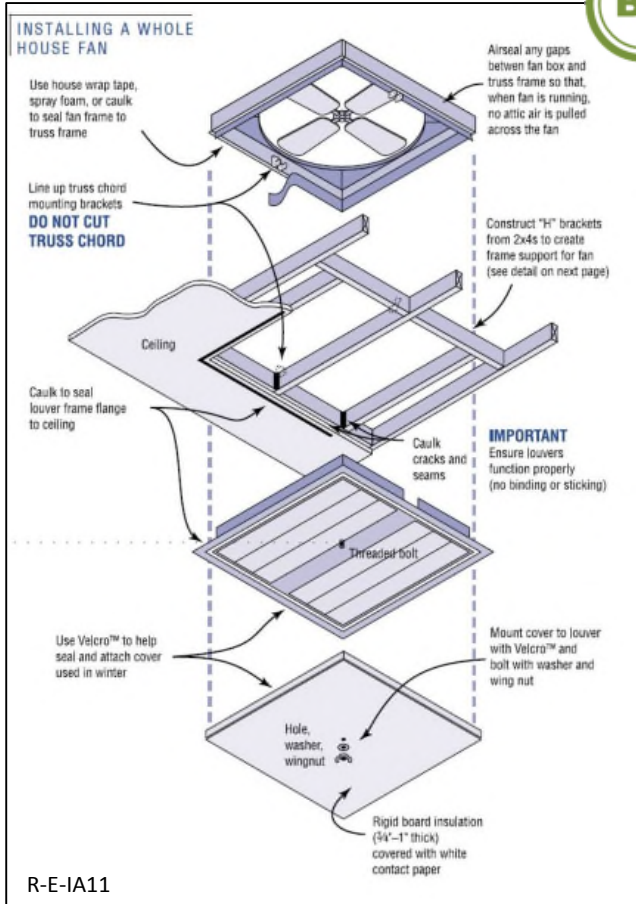
### Integral Insulation on Fans

Build a box made of rigid insulation that fits over the fan from the attic side and cover the box with batt insulation. Air seal the box to the drywall on the attic side. New fans are available with rigid foam insulation built in to louvered doors that close when not in use.

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## INSULATION – ATTIC

BP

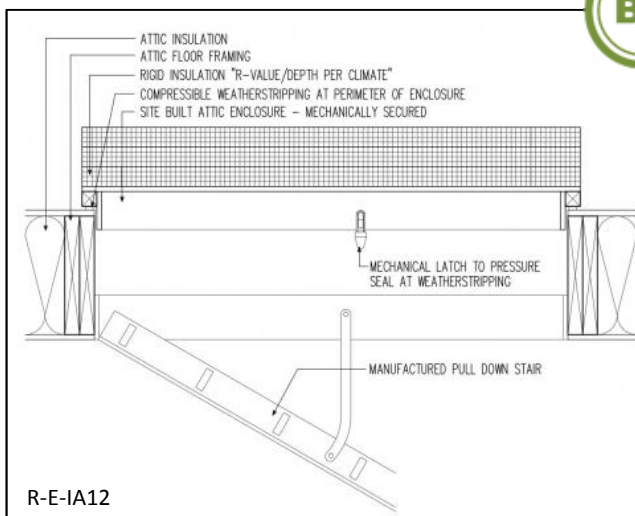


### Sealing Details

Seal 1) fan frame to truss frame with caulk or UL listed house wrap tape and 2) louver frame flange to ceiling with caulk.

Flexible material can be used to air seal from below with UL listed magnetic tape.

BP



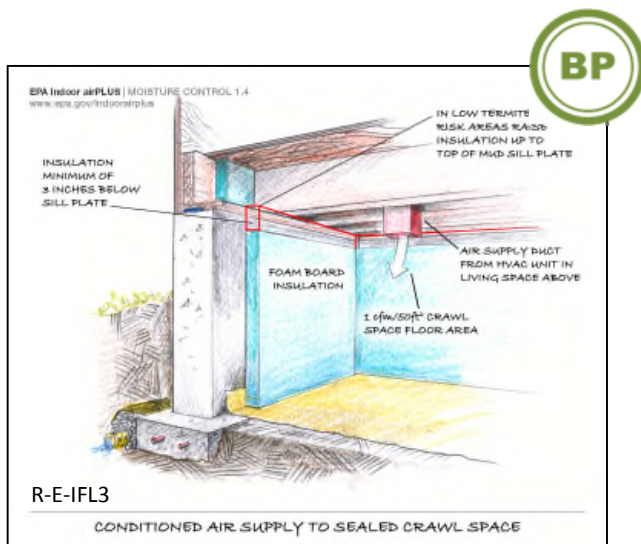
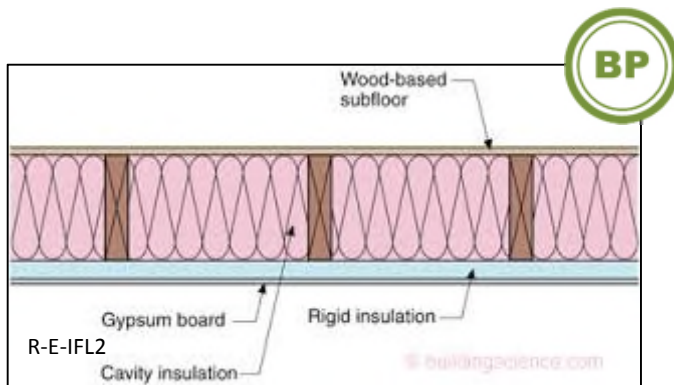
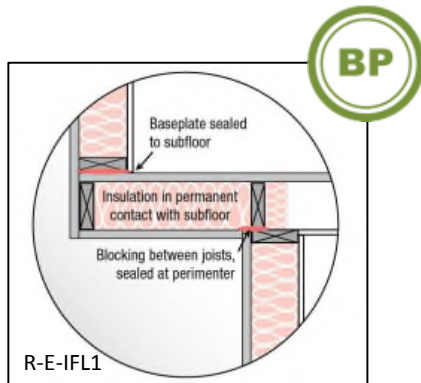
### Air Seal & Insulate Attic Stairs

Create an air tight lid from the attic side by building a box made of rigid insulation that fits over the stairs.

Other products zip up suitcase style. Cover with batt insulation to full R-value (or additional layers of rigid foam) and attach to the rigid foam box.

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## INSULATION - FLOORS



### Cantilevers

Insulate cantilevers with blown insulation that fills the cavity. Dense Pack cellulose will get the most R-value and air tightness from the assembly. Block and air seal the cantilever from the floor joist space.

### Garage

After air sealing any penetrations that lead to the home, insulate floor above the garage. Either fully fill the floor joist cavity or install the insulation aligned with the underside of the floor above. Duct work and plumbing in this cavity should be insulated and located close to the conditioned space. Consider adding rigid insulation across the bottom of the joists to reduce thermal bridging.

### Crawlspace

Treat your crawlspace like a short basement. Condition it and insulate the walls and rim joist area. Seal out moisture with a vapor barrier covering the ground and attached to the walls. Be sure to air seal all penetrations through the floor and exterior walls. Conditioning the Crawlspace is only appropriate if radon has been addressed and moisture controlled. The rigid insulation gap for termite inspection can be placed near the bottom of the exterior walls, below grade, thereby reducing energy loss.

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R-E-IFL2: **Permission Pending**  
R-E-IFL3: **Permission Pending**

## INSULATION – FLOORS



### Minimum R-Value

Raised floors separating conditioned space from unconditioned space shall be insulated between wood-framing members with insulation having an installed thermal resistance of R-19 or greater,

or the weighted average U-factor of floor assemblies shall not exceed 0.037 (the U-factor that would result from installing R-19 insulation between wood-framing members and accounting for the effects of framing members).

NOTE: These are absolute minimums. The prescriptive or performance compliance approaches may result in higher minimum levels of insulation. See CF-1R for specific project requirements.

**Code Reference:** 2016 Title 24, Part 6 Standards § 150.0(d)

**Notes:**

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