

3.6.3.4 Quality Insulation Installation (QII)

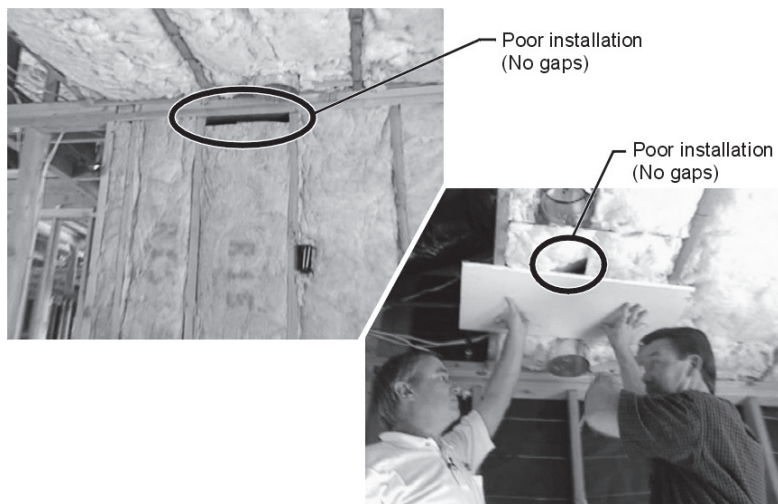
Energy Commission videos
RA3.5

All insulation shall be installed properly throughout the building. When compliance credit is taken for QII, a third-party HERS Rater is required to verify the integrity of the installed insulation. The installer shall provide evidence with compliance documentation that all insulation specified is installed to meet specified R-values and assembly U-factors.

Many residential insulation installations have flaws that degrade thermal performance. Four problems are generally responsible for this degradation:

1. There is an inadequate air barrier in the building envelope, or holes and gaps within the air barrier system inhibit the ability to limit air leakage.
2. Insulation is not in contact with the air barrier, creating air spaces that short-circuits the thermal barrier of the insulation when the air barrier is not limiting air leakage properly.
3. The insulation has voids or gaps, resulting in portions of the construction assembly that are not insulated and, therefore, has less thermal resistance than other portions of the assembly.
4. The insulation is compressed, creating a gap near the air barrier and/or reducing the thickness of the insulation.

Figure 3-46: Examples of Poor Quality Insulation Installation



Source: California Energy Commission

An energy credit for correctly installing an air barrier and insulation to eliminate or reduce common problems associated with poor installation is provided in the RA3.5. This compliance credit applies to framed and nonframed assemblies. Residential construction may incorporate multiple frame types, for example, using a combination of nonframed walls with a framed roof/ceiling. Likewise, multiple insulation materials are often used. Framed assemblies include wood and steel construction insulated with batts of mineral fiber, mineral and natural wool, and cellulose; loose-fill insulation of mineral fiber, mineral and natural wool, cellulose, and SPF; and rigid board insulation used on the exterior or interior of framed or nonframed assemblies. Nonframed assemblies include structural insulated panels, insulated concrete forms, and mass walls of masonry, concrete and concrete sandwich panels, log walls, and straw bale.

This compliance credit can only be taken for the whole building—roof/ceilings, walls, and floors – and requires field verification by a third-party HERS Rater. Further explanation is provided below:

1. Compliance credit is not allowed for walls alone, or credit is allowed for roofs/ceilings but not walls also.
2. Compliance credit is allowed for a building built on a slab floor, where the slab has no requirement for insulation. However, if insulation is installed (that is, slab edge insulation for radiant floor heating), then the integrity of the slab edge insulation must

also be field-verified in addition to the air barrier and insulation system for walls and the roof/ceiling.

3. Combinations of insulation types (hybrid systems) are allowed.
4. An air barrier shall be installed for the entire envelope.
5. Compliance credit is allowed for additions to existing buildings where energy compliance has been demonstrated for the “addition alone” (§150.2(a)2A).
6. Compliance credit is not allowed for additions to existing buildings where the “existing plus alteration plus addition” approach is used (§150.2(a)2B).
7. Compliance credit is not allowed when using the PV trade-off package.

Approved computer compliance modeling software automatically reduces the effectiveness of insulation for compliance. This reduction is accounted for in developing the Energy Standards and prescribing the required prescriptive measures for each climate zone to establish the standard design energy budget in performance compliance calculations. The effect of a poorly installed air barrier system and envelope insulation results in higher wall heat loss and heat gain than standard R-value and U-factor calculations would indicate. Similar increases in heat loss and heat gain are experienced for roof/ceilings where construction and installation flaws are present.

To take advantage of the QII energy credit, two primary installation criteria must be adhered to and they both must be field verified by a HERS Rater.

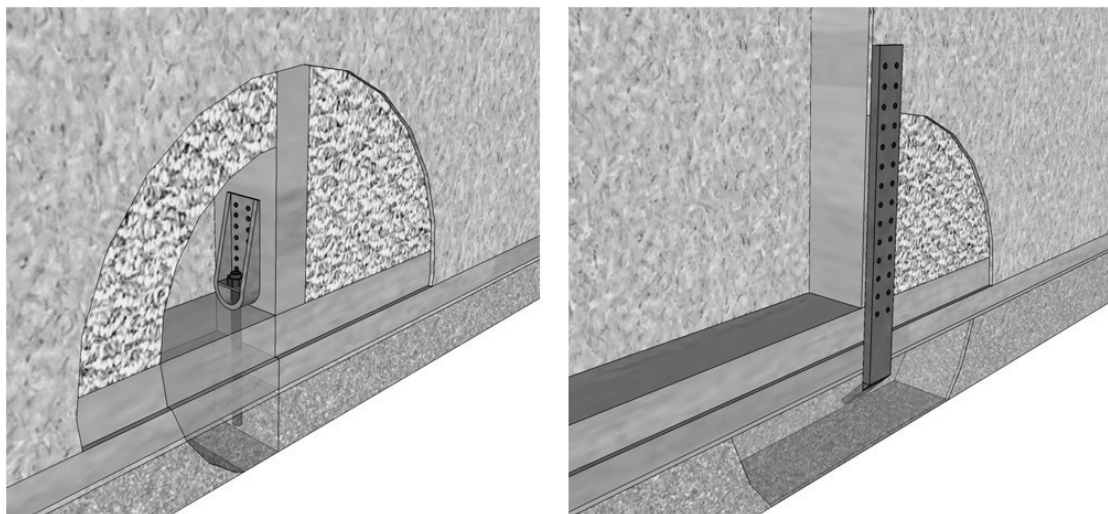
A. Structural Bracing, Tie-Downs, Steel Structural Framing

RA3.5.5.2.8

When metal bracing, tie-downs, or steel structural framing is used to connect to wood framing for structural or seismic purposes, the QII energy credit still can be taken if:

1. Metal bracing, tie-downs or steel structural framing is identified on the structural plans.
2. Insulation is installed in a manner that restricts the thermal bridging through the structural framing assembly.
3. Insulation fills the entire cavity and/or adheres to all sides and ends of structural assembly that separates conditioned from unconditioned space.

Figure 3-47: Structural Bracing, Tie-downs



Source: California Energy Commission

B. Air Barrier

RA3.5.2

An air barrier shall be installed enclosing the entire building. When this credit is shown to be taken on compliance documentation a third-party HERS Rater is required to verify the integrity of the air barrier system. The air barrier must be installed in a continuous manner across all components of framed and nonframed envelope assemblies. The installer shall provide evidence with compliance documentation that the air barrier system meets one or more of the air barrier specifications shown in Table 3-8 below. More detailed explanation is provided in RA3.5. Documentation for the air barrier includes product data sheets and manufacturer specifications and installation guidelines. The third-party HERS Rater shall verify that the air barrier has been installed properly and is integral with the insulation being used throughout the building.

Table 3-8: Continuous Air Barrier

Continuous Air Barrier	<p>A combination of interconnected materials and assemblies are joined and sealed together to provide a continuous barrier to air leakage through the building envelope separating conditioned from unconditioned space, or adjoining conditioned spaces of different occupancies or uses. An air barrier is required in all thermal envelope assemblies to limit air movement between unconditioned/outside spaces and conditioned/inside spaces and must meet one of the following:</p> <ol style="list-style-type: none"> 1. Using materials that have an air permeance not exceeding 0.004cfm/ft² under a pressure differential of 0.3in. w.g. (1.57psf) (0.02 L/s.m² at 75 pa) when tested in accordance with ASTM E2178. 2. Using assemblies of materials and components that have an average air leakage not to exceed 0.04 cfm/ft² under a pressure differential of 0.3 in. w.g (1.57psf) (0.2 L/s.m² at 75 pa) when tested in accordance with ASTM E2357, ASTM E1677, ASTM E1680 or ASTM E283. 3. Testing the completed building and demonstrating that the air leakage rate of the building envelope does not exceed 0.40 cfm/ft² at a pressure differential of 0.3 in w.g. (1.57 psf) (2.0 L/s.m² at 75 pa) in accordance with ASTM E779 or an equivalent approved method. <p>Materials and assemblies of materials that can demonstrate compliance with the air barrier testing requirements must be installed according to the manufacturer's instructions, and a HERS Rater shall verify the integrity of the installation. Below are example materials meeting the air permeance testing performance levels of 1 above. Manufacturers of these and other product types must provide a specification or product data sheet showing compliance to the ASTM testing requirements to be considered as an air barrier.</p> <ul style="list-style-type: none"> • Plywood – minimum 3/8 inch • Oriented strand board – minimum. 3/8 inches • Extruded polystyrene insulation board – minimum. ½ inch • Foil-back polyisocyanurate insulation board – minimum. ½ inch • Foil backed urethane foam insulation (1 inch) <p>-- Closed-cell spray polyurethane foam (ccSPF) with a minimum density of 2.0 pcf and a minimum thickness of 2.0 inches. Alternatively, ccSPF insulation shall be installed at a thickness that meets an air permeance no greater than 0.02 L/s-m2 at 75 Pa pressure differential when tested in accordance to ASTM E2178 or ASTM E283.</p> <p>-- Open cell spray polyurethane (ocSPF) foam with a minimum density of 0.4 to1.5 pcf and a minimum thickness of 5½ inches. Alternatively, ocSPF insulation shall be installed at a thickness that meets an air permeance no greater than 0.02 L/s-m2 at 75 Pa pressure differential when tested in accordance to ASTM E2178 or ASTM E283.</p> <ul style="list-style-type: none"> • Exterior or interior gypsum board - minimum 1/2 inch • Cement board - minimum 1/2 inch • Built-up roofing membrane • Modified bituminous roof membrane • Particleboard-minimum 1/2 inch • Fully adhered single-ply roof membrane • Portland cement/sand parge ,or gypsum plaster minimum 5/8 inch • Cast-in-place and precast concrete. • Fully grouted uninsulated and insulated concrete block masonry • Sheet steel or aluminum
------------------------	---