

## What is Quality Insulation Installation?

California's 2019 Building Energy Efficiency Standards (Title 24, Part 6 or Energy Code) includes regulations for Quality Insulation Installation (QII). QII is the process of verifying the insulation and air barrier at the wall, roof and floor have been installed correctly according to the California Energy Commission's verification procedures found in the Energy Code's [Residential Reference Appendix 3.5 \(RA3.5\)](#). A Home Energy Rating System (HERS) Rater carries out the inspection to verify the necessary building components by making site visits at multiple stages during the construction process.

**Why?** These verification procedures ensure that the air barrier and insulation are installed to limit air leakage and thermal bridging between conditioned, unconditioned and outdoor spaces. Envelope assemblies, including insulation, are long-lasting materials that are difficult to retrofit after construction.

### Relevant Code Sections

2019 California Building Energy Efficiency Standards, Title 24, Part 6:

- [Section 150.1\(c\)1E](#) – Performance and Prescriptive Compliance Approaches for Low-rise Residential Buildings
- [Residential Reference Appendix 2 \(RA2\)](#) – Residential HERS Verification, Testing, and Documentation Procedures
- [Residential Reference Appendix 3.5 \(RA3.5\)](#) – Quality Insulation Installation Procedures
- [Residential Compliance Manual Section 3.5.8](#) – Building Envelope Requirements, Insulation Products, Quality Insulation Installation (QII)
- [Residential Alternative Calculation Method Reference Manual Section 2.2.5](#) – Quality Insulation Installation (QII)

### Relevant Compliance Forms

- [CF1R-PRF-01-E](#): Certificate of Compliance – Building Components, Performance
- [CF1R-ADD-01-E](#): Prescriptive Additions Compliance Form
- [CF1R-NCB-01-E](#): Prescriptive Newly Constructed Building Compliance Form
- [CF2R-ENV-21-H](#): HERS QII Framing Stage Installation Certificate
- [CF2R-ENV-22-H](#): HERS QII Insulation Stage Installation Certificate
- [CF3R-ENV-21-H](#): HERS QII Framing Stage Verification Certificate
- [CF3R-ENV-22-H](#): HERS QII Insulation Stage Verification Certificate

## How Does QII Apply to Modeling Title 24, Part 6 Compliance for Your Project?

Under the 2016 Energy Code, a compliance credit was awarded to single family and low-rise multifamily projects that completed QII. Under the 2019 Energy Code, QII moves to a Prescriptive requirement for New Construction and Additions > 700 ft<sup>2</sup> with the exception of multifamily buildings located in Climate Zone 7.

Because QII is a Prescriptive requirement, not a Mandatory Measure, it can be traded away for other efficient building features when using the Performance Approach. However, the Energy Design Rating (EDR) energy associated with QII is significant and finding energy features with equal or better EDR energy savings may be difficult. Coupling a PV system with a battery  $\geq 5$  kWh (known as the self-utilization credit) can be used to reduce the proposed building energy use. Self-utilization minimizes hourly exports back to the grid and maximizes the in-house use of all electricity generated (specific energy savings depend on individual design criteria).

## Need a HERS Rater for your project?

Get a HERS Rater involved early in the design process to identify atypical scenarios and ensure QII success.

[Click Here](#) to find a HERS Rater in your area.

## Want to know more about the HERS process?

See the [Energy Code Ace fact sheet, Just the Basics: HERS for Residential and Nonresidential Projects](#).

## Residential Occupancy Types

### Multifamily: R-1 & R-2 Occupancies

- Multifamily buildings 3-habitable stories or less above grade are addressed in the low-rise residential requirements of the Energy Code ([Sections 150.0, 150.1 and 150.2](#))
- Multifamily buildings 4-habitable stories or more above grade are addressed in the nonresidential, high-rise residential and hotel/motel requirements of the Energy Code ([Sections 110.0, 120.0, 130.0 and 141.0](#))

### Single Family: R-3 Occupancies

- R-3 includes single family, duplexes and townhomes of 3-habitable stories or less above grade and is subject to the single-family requirements of the Energy Code

Note that when QII is not included in the modeled design, the wall and floor insulation R-values are modeled at 70% of the recognized value with assumptions for attic deficiencies as well as added winter heat flow between the conditioned zone and attic. This results in a Performance penalty because QII is now part of the Standard Design as the Prescriptive baseline.

## Compliance Pathways



### Mandatory Measures:

All regulated residential buildings must comply with all applicable Mandatory Measures of the Energy Code.

In addition to meeting the Mandatory requirements, buildings must also comply with additional requirements specified within the Energy Code. Two approaches may be taken to meet these requirements: Prescriptive or Performance.



### Prescriptive Approach:

The Prescriptive Approach is considered the most direct path to compliance. It is a set of prescribed performance levels for various building components, where each component must meet the required minimum efficiency. There are different Prescriptive requirements for newly constructed buildings, Additions and Alterations.



### Performance Approach:

The Performance Approach builds on the Prescriptive Approach by allowing energy allotments to be traded between building systems for residential buildings. There can be proposed energy use trade-offs between features of the building envelope, space heating and cooling equipment and water heating. This compliance approach requires using energy analysis software that has been approved by the California Energy Commission.

## Why a Third-Party Inspector?

HERS measures such as QII require a HERS Rater to perform field verification and diagnostic testing to ensure proper measure installation and system performance. The HERS Rater must be a third-party inspector who is not financially involved in the project or employed by the contractor. HERS Raters are certified to verify compliance on behalf of the building owner and receive special training from the HERS Providers.

## Timeline for Completing QII

- **Design Phase:** The energy consultant and designer determine if QII should be part of the project. In this phase, a HERS Rater should be brought into the project to identify building features that are unique to QII such as attic knee walls, framed corners and architectural bump outs.
- **Construction Phase:** The contractor is aware of QII requirements and schedules the HERS Rater before the project begins. The HERS Rater works closely with contractor to ensure a successful QII process.
- **Rough Install:** The first inspection occurs during the framing stage and verifies features associated with the air barrier before any insulation is installed. Although air sealing has been a Mandatory requirement in [Section 110.7](#) since the 1990s, this is the most likely part of QII to be missed because different trades are involved. In the rough install stage, the contractor completes the CF2R-ENV-21-H form, and the HERS Rater completes the CF3R-ENV-21-H form. The building inspector confirms that QII is in progress at the rough install stage and verifies that appropriate compliance forms are submitted.

- **Insulation Installation:** The second inspection occurs when the insulation is installed. The HERS Rater may need multiple site visits depending on the construction schedule. The contractor completes the CF2R-ENV-22-H form, and the HERS Rater completes the CF3R-ENV-22-H form.
- **Final Stage:** The building inspector verifies that the HERS inspection was satisfactorily completed. The inspector verifies that all CF2R and CF3R forms have been completed and registered to the HERS Provider.

## Performing QII: Contractor Tasks

**HERS Rater Communication:** The contractor, insulation installer and HERS Rater should be present at the kickoff meeting so that the QII inspection schedule and process can be explained and supported before design drawings are complete. The contractor should ensure the appropriate coordination of the inspection and installation schedule with all subcontractors and HERS Rater.

**Insulation Installation:** The contractor should be aware of all requirements and insulation installation practices to ensure a successful inspection. The contractor or installer must use the checklist in the CF2R to verify the requirements and prepare for inspection. The HERS Rater must use the same checklist, repeated in the CF3R, to verify that all applicable building components meet their requirements.

**Compliance Documentation:** The contractor is required to document on the CFR2-ENV-21-H form that all applicable framing stage requirements were met and on the CFR2-ENV-21-H form that all applicable insulation stage requirements were met. The CF2R forms must be completed and registered with the HERS Registry and made available to the HERS Rater.

See the [CalCERTS Quality Insulation Installation \(QII\) Handbook](#) for a “simplified, yet enhanced” version of the official QII protocols found in RA3.5. CHEERS also has a YouTube video on QII.

## Common Failures and Corrections

QII has the highest failure rate of all HERS measures. The list below highlights a few of the more common QII challenges and how they can be corrected.

**Challenge:** Drywall was installed before first or second inspections.

**Solution:** Remove drywall (which can be very costly to the project) to expose the insulation, or fail QII inspection and return to the applicable CF1R form to determine how the project will comply with a QII failure penalty (self-utilization credit, increased equipment efficiency or other measure.)

**Challenge:** The air barrier around ducting was not installed properly.

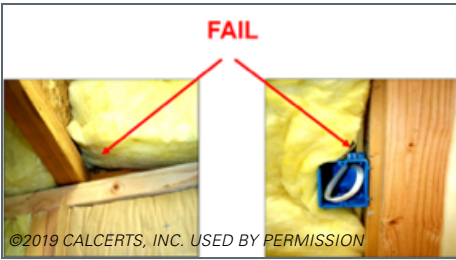
**Solution:** Use spray-applied polyurethane foam (SPF) to seal the air barrier. Make sure to meet the required thickness to qualify as an air barrier which can be found in [RA3.5.2](#) (5.5” for open cell SPF).



*The lack of air-barrier sealing around this ductwork does not comply with QII requirements.*



*SPF used as a draft stop*



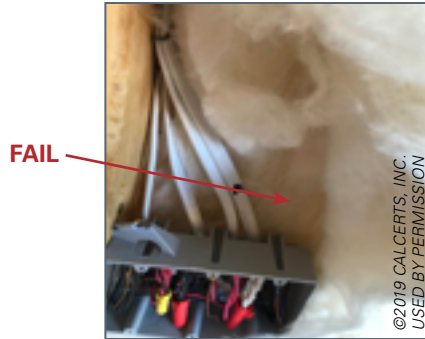
Insulation was not properly cut to fit spaces around framing members and an electrical box.

**Challenge:** The insulation is not in contact with the framing members due to improper insulation sizing or a protruding object.

**Solution:** Measure the insulation before cutting to ensure proper sizing. Make sure to take into account any protruding objects that may interfere with the contact of the insulation with the framing members.

**Challenge:** The insulation is not properly placed to fill up the stud cavity and fit between the exterior wall and the obstruction.

**Solution:** Measure and cut the insulation so that the obstruction is properly surrounded and insulation blocks thermal bridging to the exterior.



Insulation is not cut to fill up entire cavity without being compressed.



Insulation is not cut to fit behind and around obstruction to fill up cavity.

## Forms- Which and When

### During Design:

- [CF1R-PRF-01-E](#): Certificate of Compliance, Building Components, Performance
- [CF1R-ADD-01-E](#): Prescriptive Additions Compliance Form
- [CF1R-NCB-01-E](#): Prescriptive Newly Constructed Building Compliance Form
  - All forms must be completed through compliance software ([CF1R-PRF-01-E](#)) or through the HERS Provider's registry.
  - All forms must be submitted to the building department during permit application.

### Notes:

Whether the project is classified as an Addition or as New Construction determines which CF1R forms are required.

### During Construction:

- [CF2R-ENV-21-H](#): HERS QII Framing Stage Installation Certificate
- [CF2R-ENV-22-H](#): HERS QII Insulation Stage Installation Certificate
- [CF3R-ENV-21-H](#): HERS QII Framing Stage Verification Certificate
- [CF3R-ENV-22-H](#): HERS QII Insulation Stage Verification Certificate
  - The installing contractor completes and signs all CF2R forms.
  - The HERS Rater completes and signs all CF3R forms.
  - All forms must be made available for the inspector when onsite.

# For More Information

## Primary Documents

- Energy Code Section 150.1(c)1E – Performance and Prescriptive Compliance Approaches for Low Rise Residential Buildings  
[energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1501performanceandprescriptivecomplianceapproachesforlowr.htm](http://energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1501performanceandprescriptivecomplianceapproachesforlowr.htm)
- Energy Code Residential Reference Appendix 2 (RA2) – Residential HERS Verification, Testing, and Documentation Procedures  
[energycodeace.com/site/custom/public/reference-ace-2019/Documents/appendixra2residentialhersverificationtestinganddocumentationpro.htm](http://energycodeace.com/site/custom/public/reference-ace-2019/Documents/appendixra2residentialhersverificationtestinganddocumentationpro.htm)
- Energy Code Residential Reference Appendix 3.5 (RA3.5) – Residential Field Verification and Diagnostic Test Protocols, Quality Insulation Installation Procedures  
[energycodeace.com/site/custom/public/reference-ace-2019/Documents/ra35qualityinsulationinstallationprocedures.htm](http://energycodeace.com/site/custom/public/reference-ace-2019/Documents/ra35qualityinsulationinstallationprocedures.htm)
- Energy Code Residential Compliance Manual Section 3.5.8 – Building Envelope Requirements, Insulation Products, Quality Insulation Installation (QII)  
[energycodeace.com/site/custom/public/reference-ace-2019/Documents/35insulationproducts.htm](http://energycodeace.com/site/custom/public/reference-ace-2019/Documents/35insulationproducts.htm)
- Energy Code Residential Alternative Calculation Method Reference Manual Section 2.2.5 – Quality Insulation Installation (QII)  
[energycodeace.com/site/custom/public/reference-ace-2019/Documents/22thebuilding.htm](http://energycodeace.com/site/custom/public/reference-ace-2019/Documents/22thebuilding.htm)

## California Energy Commission Information & Services

### Title 24, Part 6

- Energy Code Hotline: 1-800-772-3300 (Free) or [Title24@energy.ca.gov](mailto:Title24@energy.ca.gov)
- Online Resource Center:  
[energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/online-resource-center](http://energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/online-resource-center)
  - The Energy Commission’s main web portal for the Energy Code, including information, documents and historical information
- Home Energy Rating System (HERS) Program Sub-site:  
[energy.ca.gov/programs-and-topics/programs/home-energy-rating-system-hers-program/home-energy-rating-system](http://energy.ca.gov/programs-and-topics/programs/home-energy-rating-system-hers-program/home-energy-rating-system)

## Additional Resources

### HERS Providers

- CalCERTS  
[calcerts.com](http://calcerts.com)
- Cal Energy  
[calenergy.org](http://calenergy.org)
- Energy Code Ace:  
[EnergyCodeAce.com](http://EnergyCodeAce.com)
  - An online “one-stop-shop” providing free resources and training to help appliance and building industry professionals decode and comply with Title 24, Part 6 and Title 20. The site is administered by California’s investor-owned utilities.

#### *Of special interest:*

- Fact Sheets  
[energycodeace.com/content/resources-fact-sheets/](http://energycodeace.com/content/resources-fact-sheets/)
  - Just the Basics: HERS for Residential and Nonresidential Projects
- Training  
[energycodeace.com/training](http://energycodeace.com/training)
  - Decoding QII: Let’s Talk What’s Coming for HERS Quality Insulation Installation

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