

## 2008 Residential Energy Inspection Checklist for Newly Constructed Buildings and Additions

<b>FOOTING INSPECTION</b>				Yes	No	N/A	§
Do the following features match the CF-1R Form?							
	Front Orientation						10-103(a)2B
	All floor types (i.e. slab on grade, raised floor, etc.)						
<b>FOUNDATION INSPECTION</b>							
Do the following features match the CF-1R Form?							
	Slab Perimeter Insulation ( <i>Special Feature – Verify when modeled</i> )						10-103(a)2B
	Heated Slab Insulation ( <i>Mandatory Measure</i> )						118(g)
<b>ROUGH FRAME/FRAMING INSPECTION</b>							
Do the following features match the CF-1R Form?							
Envelope							
	U-factor and SHGC Values for Fenestration						10-103(a)2B
	Window Area and Orientation						
	Exterior Shading (i.e. overhangs, fins, etc.)						
	Is Wall Insulation installed behind the Tub and Shower?						
HVAC							
	Duct Insulation Values						
	Are Ducts and Plenums Properly Installed and Sealed? ( <i>Mandatory Measure</i> )						150 (m)
	Are exhaust fans installed and ducting is sized according to ASHRAE 62.2? ( <i>Mandatory Measure</i> )						150(o)
	Is the refrigerant suction line insulated and protected? ( <i>Mandatory Measure</i> )						150(j)2
Water Heating							
	Water Heating Distribution Type						10-103(a)2B
	Pipe Insulation Values (Including Hydronic Systems) ( <i>Mandatory Measure</i> )						150(j)2
Lighting							150(k)
	Are High Efficacy Luminaires installed in the Kitchen? ( <i>Mandatory Measure</i> )						150(k)8
	Are Recessed Luminaires IC Rated and Airtight? ( <i>Mandatory Measure</i> )						150(k)12
Special Features and HERS Measures – Verify when modeled							
	Radiant Barrier						10-103(a)2B
	Cool Roof						
	Quality Insulation Installation (QII) ( <i>HERS Measure</i> )						
<b>INSULATION INSPECTION</b>							
Do the following features match the CF-1R Form?							
Envelope							10-103(a)2B
	Wall, Roof, Floor Insulation Values						
	Is the Insulation Properly Installed? ( <i>Mandatory Measure</i> )						118
	Are all Infiltration Areas (joints and openings) Sealed? ( <i>Mandatory Measure</i> )						117
HERS Measures – Verify when modeled							
	Quality Insulation Installation (QII)						10-103(a)2B

FINAL INSPECTION	Yes	No	N/A	§
Do the following features match the CF-1R Form?				
Envelope				10-103(a)2B
Ceiling Insulation Values				
Are all exterior doors weatherstripped? ( <i>Mandatory Measure</i> )				
Is the drywall installed to limit infiltration and exfiltration around:				
HVAC Boots				117
Exhaust Fans				
Attic Access				
Lighting Cans				
HVAC				10-103(a)2B
HVAC Equipment Efficiency				150(j)2
Is the refrigerant suction line insulated and protected? ( <i>Mandatory Measure</i> )				150(o)
Do exhaust fans provide an airflow (cfm) <u>and</u> have a sone rating according to ASHRAE 62.2? ( <i>Mandatory Measure</i> )				
Water Heating				10-103(a)2B
Water Heater Efficiency and Type				150(j)2
Is pipe insulation installed on first 5 Feet of Water Heater Cold and Hot Lines? ( <i>Mandatory Measure</i> )				
Lighting ( <i>ALL are Mandatory Measures</i> )				150(k)
Are High Efficacy Luminaires or the Alternative Controls Installed?				150(k)8
Kitchen				150(k)10
Bathrooms, Garages, Laundry Rooms, Closets, and Utility Rooms				150(k)11
Other Rooms				150(k)16
Common Areas of Multifamily Buildings				150(k)13
Outdoor Lighting				150(k)12
Are High Efficacy and Low Efficacy Lighting Switched Separately?				
Are <b>ALL applicable CF-6R Forms</b> (Installation) posted on site and complete? ( <i>see next page</i> )				10-103(a)3A, 10-103(a)4
Are <b>ALL applicable CF-4R Forms</b> (HERS) <u>Registered</u> , posted on site and complete? ( <i>see next page</i> )				10-103(a)5

## 2008 Residential Energy Installation and HERS Verification Forms Checklist

Are ALL applicable CF-6R Forms (Installation) posted on site and complete?		Yes	No	N/A
<b>Envelope</b>				
CF-6R-ENV-01*	Insulation, Roofing, Fenestration			
CF-6R-ENV-20-HERS	Building Envelope Sealing			
CF-6R-ENV-21-HERS	Quality Insulation Installation (QII) – Framing Stage			
CF-6R-ENV-22-HERS	Quality Insulation Installation (QII) – Insulation Stage			
<b>Lighting</b>				
CF-6R-LTG-01*	Residential Lighting			
<b>Mechanical</b>				
CF-6R-MECH-01*	Domestic Hot Water			
CF-6R-MECH-02	Solar Domestic Hot Water Systems			
CF-6R-MECH-03	Pool and Spa Heating Systems			
CF-6R-MECH-04*	Space Conditioning Systems, Ducts and Fans			
CF-6R-MECH-05*	Indoor Air Quality and Mechanical Ventilation			
CF-6R-MECH-06	Evaporatively Cooled Condensing Units			
CF-6R-MECH-07	Evaporative Coolers			
CF-6R-MECH-08	Ice Storage Air Conditioning (ISAC) Units			
CF-6R-MECH-20-HERS	Duct Leakage Testing			
CF-6R-MECH-22-HERS	Airflow and Fan Watt Draw Testing (HSPP/PSPP)			
CF-6R-MECH-23-HERS	High EER Verification			
CF-6R-MECH-24-HERS	Charge Indicator Display (CID) Verification			
CF-6R-MECH-25-HERS	Refrigerant Charge Verification (Standard Procedure)			
CF-6R-MECH-26-HERS	Refrigerant Charge Verification (Alternate Procedure)			
CF-6R-MECH-27-HERS	Maximum Rated Total Cooling Capacity			
CF-6R-MECH-28-HERS	Low Leakage Air Handler Verification			
CF-6R-MECH-29-HERS	Supply Duct Verification (Location, Surface Area, etc.)			
Are ALL applicable CF-4R Forms (HERS) <b>Registered</b> , posted on site and complete?		Yes	No	N/A
<b>Envelope</b>				
CF-4R-ENV-20	Building Envelope Sealing			
CF-4R-ENV-21	Quality Insulation Installation (QII) – Framing Stage			
CF-4R-ENV-22	Quality Insulation Installation (QII) – Insulation Stage			
<b>Mechanical</b>				
CF-4R-MECH-20	Duct Leakage Testing			
CF-4R-MECH-22	Airflow and Fan Watt Draw Testing (HSPP/PSPP)			
CF-4R-MECH-23	High EER Verification			
CF-4R-MECH-24	Charge Indicator Display (CID) Verification			
CF-4R-MECH-25	Refrigerant Charge Verification (Standard Procedure)			
CF-4R-MECH-27	Maximum Rated Total Cooling Capacity			
CF-4R-MECH-28	Low Leakage Air Handler Verification			
CF-4R-MECH-29	Supply Duct Verification (Location, Surface Area, etc.)			

\* Required for ALL newly constructed buildings

# 2008 Residential Energy Inspection Checklist GUIDE For Newly Constructed Buildings *and* Additions

NOTE: This Guide will discuss the Inspection process for residential Newly Constructed Buildings and Additions when either the Prescriptive Approach or Performance Approach are used, but this Guide does not discuss the Prescriptive requirements for additions. If you have questions regarding the Prescriptive requirements for additions, please contact the Energy Standards Hotline at:

Energy Standards Hotline at: 1-800-772-3300

Fax: 916-653-7480

Email: [Title24@energy.state.ca.us](mailto:Title24@energy.state.ca.us)

## DEFINITIONS: §101

### *Newly Constructed Building*

A newly constructed building is a building that has never been used or occupied for any purpose. Some examples of a newly constructed building include:

- A custom home;
- A tract home; and
- Rebuilding a home that was completely demolished.

### *Addition*

An addition is a change to an existing building that increase both conditioned floor area (CFA) and volume. Some examples of an addition include:

- Building onto a home;
- Converting a garage or unheated basement into conditioned living space; and
- Enclosing and conditioning a patio area

## **FOOTING INSPECTION**

### **Do the following features match the CF-1R Form? §10-103(a)2B**

#### **Front Orientation**

The Inspector shall verify that the front orientation of the building on the lot matches the front orientation listed on the CF-1R Form. The front orientation is identified on the CF-1R Form in degrees from North clockwise to East as follows:

- North - 0°
- East - 90°
- South - 180°
- West - 270°

If the front orientation of the building on the lot does not match the front orientation listed on the CF-1R Form, the Inspector shall issue a Correction Notice to the builder stating: *“CF-1R Form shall be re-submitted and modeled with correct front orientation per §10-103(a)2B.”*

NOTE: The Inspector does not need to verify the front orientation of buildings that are modeled facing multiple orientations (i.e. tract homes).

**All floor types (i.e. slab on grade, raised floor, etc.)**

The Inspector shall verify that all floor types (slab on grade, raised floor, etc.) of the building on the lot match the floor types listed on the CF-1R Form. The conditioned floor area and floor type assemblies are identified under the Opaque Surface Details on the CF-1R Form.

If all floor types of the building on the lot do not match the floor type assemblies listed on the CF-1R Form, the Inspector shall issue a Correction Notice to the builder stating: *“CF-1R Form shall be re-submitted and modeled with the correct conditioned floor area for all floor assembly types per §10-103(a)2B.”*

***FOUNDATION INSPECTION***

**Do the following features match the CF-1R Form? §10-103(a)2B**

**Slab Perimeter Insulation (*Special Feature – Verify when modeled*)**

When slab perimeter insulation is modeled for non-heated slab floors, the Inspector shall verify that the R-value of the installed slab perimeter insulation matches the slab perimeter insulation R-value listed on the CF-1R Form. The R-value of slab perimeter insulation is identified under the Opaque Surface Details on the CF-1R Form.

If the R-value of the installed slab perimeter insulation is lower than the insulation R-Value listed on the CF-1R Form (or no insulation is installed but was modeled on the CF-1R), the Inspector shall issue a Correction Notice to the builder stating: *“Install slab perimeter insulation with an R-Value equal to or greater than the R-Value listed on the CF-1R Form; or CF-1R Form shall be re-submitted and modeled with installed slab perimeter insulation R-Value per §10-103(a)2B.”*

NOTE: The Inspector shall also verify that the slab perimeter insulation meets the *Installation Requirements* detailed in **Heated Slab Insulation** on the next page.

**Heated Slab Insulation (*Mandatory Measure*) §118(g)**

When a slab on grade floor will be heated, the Inspector shall verify that the R-value of the installed heated slab insulation meets the insulation requirements of Standards Table 118-A on the next page. The minimum insulation R-value requirements will depend on the climate zone of the building and the orientation of the installed insulation.

If the R-value of the installed heated slab insulation does not meet the minimum insulation requirements of Standards Table 118-A, the Inspector shall issue a

Correction Notice to the builder stating: “Install heated slab insulation with an R-Value equal to or greater than the R-Value required in Standards Table 118-A per §118(g).”

*Standards Table 118-A Slab Insulation Requirements For Heated Slab-On-Grade*

<b>Insulation Location</b>	<b>Insulation Orientation</b>	<b>Climate Zone</b>	<b>Insulation R-Value</b>
Outside edge of heated slab, either inside or outside the foundation wall	Vertical	1 – 15	5
		16	10
Between heated slab and outside foundation wall	Vertical and Horizontal	1 – 15	5
		16	10 vertical and 7 horizontal

*Installation Requirements*

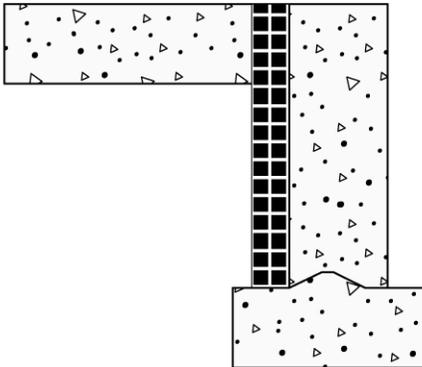
Insulation installed on the outside edge of the heated slab, either inside or outside the foundation wall, shall extend from the top of the slab, down 16 inches or to the frost line, whichever is greater (see *Heated Slab-On-Grade Floor Insulation Options* on next page). Insulation may stop at the top of the footing where this is less than the required depth. For below grade slabs, vertical insulation shall extend from the top of the foundation wall to the bottom of the foundation (or the top of the footing) or to the frost line, whichever is greater.

Insulation installed between the heated slab and outside foundation wall shall meet the following installation criteria (see *Heated Slab-On-Grade Floor Insulation Options* on next page):

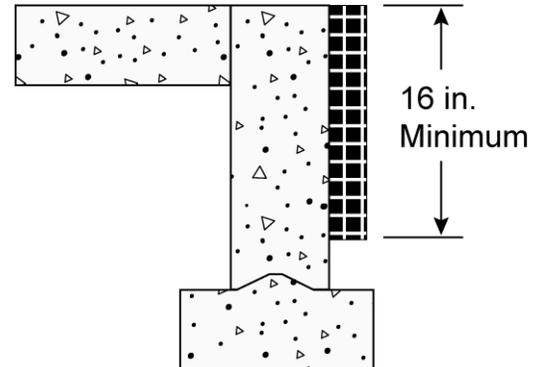
- Vertical insulation shall extend from the top of the slab on the inside edge of the outside wall, down to the top of the horizontal insulation.
- Horizontal insulation shall be installed from the outside edge of the vertical insulation and extend 4 feet toward the center of the slab.

## Heated Slab-On-Grade Floor Insulation Options

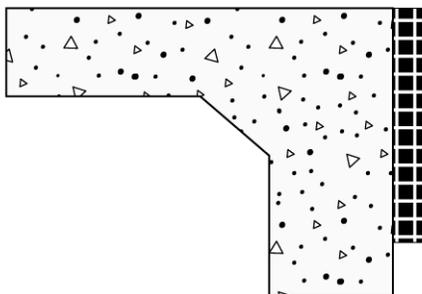
Inside Insulation



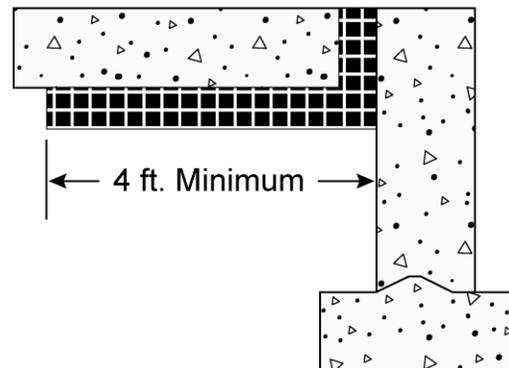
Outside Insulation



Monolithic Slab Insulation



Beneath Slab Insulation



Note: Not to scale.

### ***ROUGH FRAME/FRAMING INSPECTION***

**Do the following features match the CF-1R Form? §10-103(a)2B**

#### **Envelope**

#### **U-factor and SHGC Values for Fenestration**

The Inspector shall verify that the U-factor and SHGC values from the National Fenestration Rating Council (NFRC) label on the installed windows and skylights match the window/skylight U-factor and SHGC values listed on the CF-1R Form. The U-factor and SHGC values of windows and skylights are identified under the Fenestration Surface Details on the CF-1R Form.

If the U-factor or SHGC values on the NFRC labels (see sample on next page) of the installed fenestration are higher than the window/skylight U-factor and SHGC values listed on the CF-1R Form, the Inspector shall issue a Correction Notice to the builder stating: *“Install windows with U-factor and SHGC values equal to or lower than the*

window efficiencies identified on the CF-1R Form; or CF-1R Form shall be re-submitted and modeled with installed window/skylight U-factor and SHGC values per §10-103(a)2B.”

*NFRC Temporary Label*

	<p><b>World's Best Window Co.</b>                  Millennium 2000<sup>+</sup>                  Vinyl-Clad Wood Frame                  Double Glazing • Argon Fill • Low E                  Product Type: <b>Vertical Slider</b></p>	
	<p><b>ENERGY PERFORMANCE RATINGS</b></p>	
U-Factor (U.S./I-P) <b>0.35</b>	Solar Heat Gain Coefficient <b>0.32</b>	
<p><b>ADDITIONAL PERFORMANCE RATINGS</b></p>		
Visible Transmittance <b>0.51</b>	Air Leakage (U.S./I-P) <b>0.2</b>	
<p><small>Manufacturer stipulates that these ratings conform to applicable NFRC procedures for determining whole product performance. NFRC ratings are determined for a fixed set of environmental conditions and a specific product size. NFRC does not recommend any product and does not warrant the suitability of any product for any specific use. Consult manufacturer's literature for other product performance information.                  www.nfrc.org</small></p>		

**Window Area and Orientation**

The Inspector shall verify that the area and orientation of installed windows and skylights matches the window/skylight area and orientation listed on the CF-1R Form. The area and orientation of windows and skylights are identified under the Fenestration Surface Details on the CF-1R Form.

If the area of the installed windows or skylights is larger than the window/skylight area listed on the CF-1R Form, or if the orientation of the installed windows or skylights does not match the CF-1R Form, the Inspector shall issue a Correction Notice to the builder stating: *“CF-1R Form shall be re-submitted and modeled with the area and orientation of installed window/skylight per §10-103(a)2B.”*

**Exterior Shading (i.e. overhangs, fins, etc.)**

When overhangs or fins greater than 4 feet are modeled on the CF-1R Form, the Inspector shall verify that the dimensions (length, left and right extensions, etc.) of the installed overhangs or fins match the overhang/fin dimensions listed on the CF-1R

Form. The dimensions of overhangs and fins are identified under the Exterior Shading Details on the CF-1R Form (see *Overhang and Fin Dimensions* below).

If the dimensions (length, left and right extensions, etc.) of the installed overhangs or fins are less than the overhang/fin dimensions listed on the CF-1R Form (or no overhangs or fins are installed but were modeled on the CF-1R), the Inspector shall issue a Correction Notice stating: “*Install (identify overhang or fin) with dimensions equal to or greater than the overhang/fin dimensions identified on the CF-1R Form; or CF-1R Form shall be re-submitted and modeled with installed overhang or fin dimensions per §10-103(a)2B.*”

### Overhang and Fin Dimensions

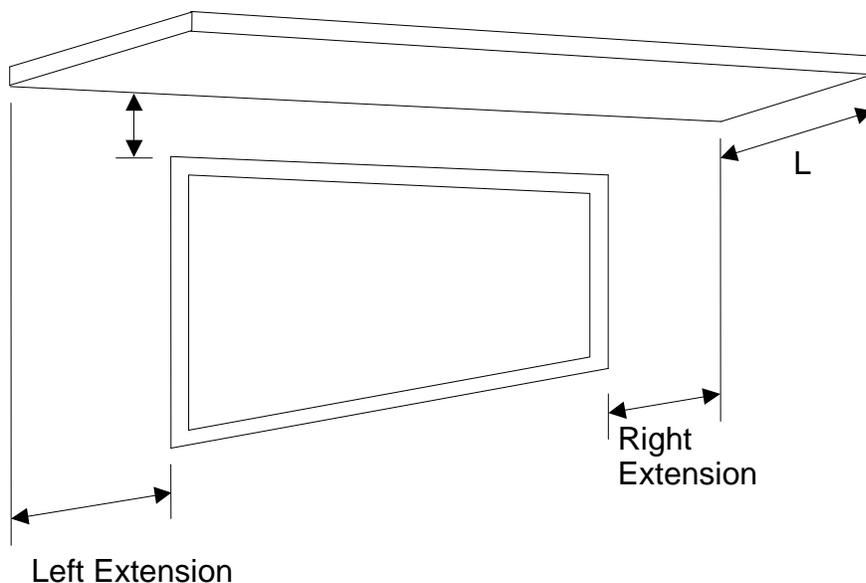
Overhangs are identified on the CF-1R Form by the following dimensions (see *Overhang Graphic* below):

- Length – distance overhang extends out from the window.
- Height – distance from the top of the window to the overhang.
- Left Extension – distance the overhang extends past the left side of the window.
- Right Extension – distance the overhang extends past the right side of the window.

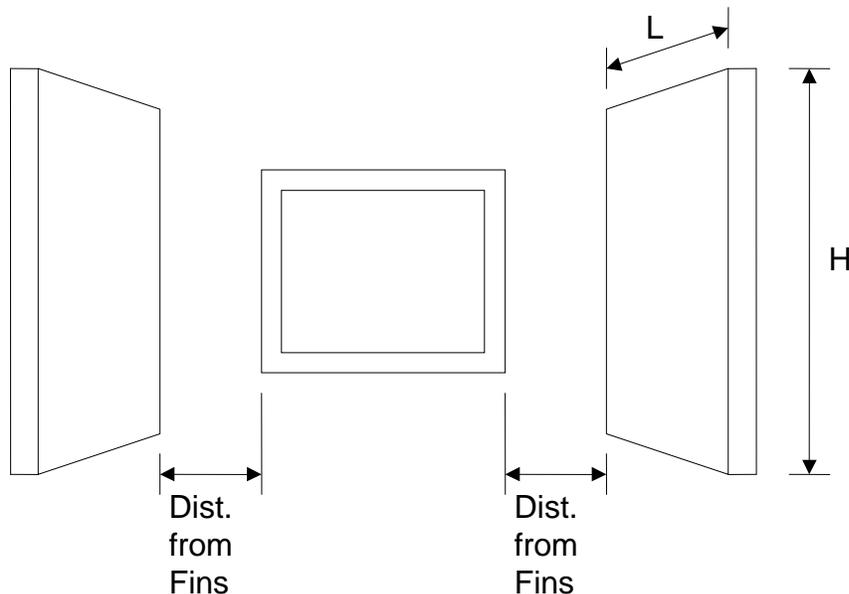
Fins are identified on the CF-1R Form by the following dimensions (see *Fin Graphic* on next page):

- Distance – distance from the side of the window to the fin.
- Length – distance the fin extends out from the window.
- Height – how tall the fin is.

### *Overhang Graphic*



### Fin Graphic



### Is Wall Insulation installed behind the Tub and Shower?

When a tub or shower is installed on an exterior wall, the Inspector shall verify that insulation is installed in the exterior wall cavity behind the tub or shower. The Inspector shall also verify that the R-value of the installed wall insulation matches the wall insulation R-value listed on the CF-1R Form. The R-value of the wall insulation is identified under the Opaque Surface Details on the CF-1R Form.

If no insulation is installed in the exterior wall cavity behind the tub or shower, the Inspector shall issue a Correction Notice to the builder stating: *"Install insulation in exterior wall cavity behind tub or shower with an R-value equal to or greater than the wall R-value listed on the CF-1R Form per §10-103(a)2B."*

### HVAC

#### Duct Insulation Values

When a ducted HVAC system is installed, the Inspector shall verify that the R-value of the installed duct insulation matches the duct insulation R-value listed on the CF-1R Form. The duct insulation R-value is identified under HVAC Distribution on the CF-1R Form.

If the R-value of the installed duct insulation is lower than the duct insulation R-value listed on the CF-1R Form, the Inspector shall issue a Correction Notice to the builder stating: *"Install duct insulation with an R-value equal to or greater than the duct insulation R-value identified on the CF-1R Form; or CF-1R Form shall be re-submitted and modeled with installed duct insulation R-value per §10-103(a)2B."*

NOTE: All ducts in unconditioned space shall be insulated. The air handler, plenum, connectors, and boots need only meet the mandatory minimum R-4.2 duct insulation requirement.

**Are Ducts and Plenums Properly Installed and Sealed? (*Mandatory Measure*)  
§150(m)**

When a ducted HVAC system is installed, the Inspector shall verify that the ducts and plenums are properly installed and sealed per §150(m):

- Ducts shall be properly connected. The inner core of flex ducts must overlap the collar by at least 1 inch and drawbands shall be used. Metal ducts must overlap the collar by at least 1½ inches and use three sheet metal screws equally spaced around the joint.
- Ducts shall be properly sealed. Ducts and plenums must be sealed with UL 181, UL 181A, or UL 181B tape. Cloth back rubber adhesive duct tape cannot be used unless such tape is used in combination with mastic and drawbands or the backing of the tape has the phrase "CEC approved."
  - a. For tape connections, there shall be at least two wraps of approved tape covering the inner core by one inch and onto the metal collar by at least 1 inch. The core will then be clamped onto the metal collar.
  - b. For mastic connections, the installer must first tighten the clamp over the overlapping section of the core, apply a coat of mastic covering both the metal collar and the core by at least 1 inch, then firmly press the fiber mesh into the mastic and cover with a second coat of mastic over the fiber mesh.
- Ducts shall not be crushed. Ducts must not be crushed or compressed to cause reductions in the cross-sectional area of the ducts. If the ducts need to be crushed or compressed to go through a small cavity, then a duct would need to be fabricated out of duct board with at least the same cross-sectional area of the original duct.
- Building cavities shall not be used unless lined. Building spaces such as cavities between walls, support platforms, etc. cannot be used as a plenum or duct unless they are lined with sealed sheet metal, duct board, or flexible duct.

If the ducts or plenums are not properly installed and sealed, the Inspector shall issue a Correction Notice to the builder stating: *"(Identify duct or plenum) shall be properly installed and sealed per §150(m)."*

**Are exhaust fans installed and ducting is sized according to ASHRAE 62.2?  
(*Mandatory Measure*) §150(o)**

The Inspector shall verify that the exhaust fans and ducting installed to provide indoor air quality and mechanical ventilation meet the following requirements of ASHRAE Standard 62.2 (ASHRAE 62.2):

*NOTE: Additions that are 1,000 ft<sup>2</sup> or less are not required to meet the ventilation requirements of ASHRAE Standard 62.2.*

## Local Exhaust Ventilation

### *Bathrooms*

A bathroom is defined as any room containing a tub, shower, a spa, or similar source of moisture. All bathrooms shall meet the following requirements:

- Have an exhaust fan ducted to the outside.
- The ducting for the exhaust fan shall be sized (duct diameter and length) according to ASHRAE Standard 62.2 Table 7.1 on the next page.

*NOTE: For additions, bathrooms in the existing home are not required to meet the Local Exhaust Ventilation requirements of ASHRAE Standard 62.2.*

If all bathrooms do not have an exhaust fan and ducting meeting the above requirements, the Inspector shall issue a Correction Notice to the builder stating: *“Bathrooms shall have an exhaust fan meeting the local exhaust ventilation and duct sizing requirements of ASHRAE Standard 62.2 per §150(o).”*

### *Kitchens*

A kitchen is defined as any room containing cooking appliances. All kitchens shall meet the following requirements:

- Have an exhaust fan ducted to the outside. The range hood over the stove may be used if vented to the outside; re-circulating range hoods cannot be used.
- The ducting for the exhaust fan shall be sized (duct diameter and length) according to ASHRAE Standard 62.2 Table 7.1 on the next page.

*NOTE: For additions, kitchens in the existing home are not required to meet the Local Exhaust Ventilation requirements of ASHRAE Standard 62.2.*

If all kitchens do not have an exhaust fan and ducting meeting the above requirements, the Inspector shall issue a Correction Notice to the builder stating: *“Kitchens shall have an exhaust fan meeting the local exhaust ventilation and duct sizing requirements of ASHRAE Standard 62.2 per §150(o).”*

## Whole-Building Ventilation

In addition to the local exhaust fans in bathrooms and kitchens, an exhaust fan shall be installed to provide ventilation for the whole house. One of the local exhaust fans in the bathroom or kitchen may be used to meet whole-building ventilation requirement, provided the exhaust fan meets all of the requirements for both the Local Exhaust and Whole-Building Ventilation. The whole-building exhaust fan shall meet the following requirement:

- The ducting for the exhaust fan shall be sized (duct diameter and length) according to ASHRAE Standard 62.2 Table 7.1 on the next page.

*NOTE: For additions greater than 1,000 ft<sup>2</sup>, the whole-building exhaust fan and ducting may be installed in either the addition or the existing home.*

If an exhaust fan is not installed that meets the whole-building ventilation requirement, the Inspector shall issue a Correction Notice to the builder stating: *“Building shall have an exhaust fan meeting the whole-building ventilation and duct sizing requirements of ASHRAE Standard 62.2 per §150(o).”*

NOTE: This Guide details how to verify compliance with the Exhaust-Only method for meeting the Indoor Air Quality requirements of ASHRAE Standard 62.2 (ASHRAE 62.2). If the Exhaust-Only method described in this Guide is not used to meet ASHRAE 62.2, the Inspector may refer to Section 4.6 of the 2008 Residential Compliance Manual, or visit the ASHRAE website to verify compliance at: <http://www.ashrae.org/>

ASHRAE Standard 62.2 Table 7.1

Table 7.1 Prescriptive Duct Sizing Requirements								
Duct Type	Flex Duct				Smooth Duct			
Fan Rating cfm @ 0.25 in. w.g.	50	80	100	125	50	80	100	125
Maximum Allowable Duct Length (ft)								
Diameter, (in)	Flex Duct				Smooth Duct			
3	X	X	X	X	5	X	X	X
4	70	3	X	X	105	35	5	X
5	NL	70	35	20	NL	135	85	55
6	NL	NL	125	95	NL	NL	NL	145
7 and above	NL	NL	NL	NL	NL	NL	NL	NL

This table assumes no elbows. Deduct 15 ft of allowable duct length for each turn, elbow, or fitting.  
 NL = no limit on duct length of this size  
 X = not allowed, any length of duct of this size with assumed turns, elbows, fittings will exceed the rated pressure drop

**Is the refrigerant suction line insulated and protected? (Mandatory Measure)**

**§150(j)2**

Insulation Thickness

The Inspector shall verify that the installed refrigerant suction lineset insulation meets the insulation thickness requirements of Standards Table 150-B:

- Refrigerant suction lines with a diameter less than or equal to 2 inches shall have a minimum pipe insulation thickness of 0.75 inches.
- Refrigerant suction lines with a diameter greater than 2 inches shall have a minimum pipe insulation thickness of 1.0 inch.

If the thickness of the installed refrigerant suction lineset insulation is lower than the insulation thickness requirements of Standards Table 150-B (or no pipe insulation is installed), the Inspector shall issue a Correction Notice to the builder stating: *“Install refrigerant lineset insulation with a thickness equal to or greater than the minimum pipe insulation thickness requirements of Standards Table 150-B per §150(j)2.”*

### Insulation Protection

The Inspector shall verify that the refrigerant lineset insulation is protected from damage, including that due to sunlight, moisture, equipment maintenance, and wind including but not limited to the following:

- Insulation exposed to weather shall be suitable for outdoor service; e.g., protected by aluminum, sheet metal, painted canvas, or plastic cover. Cellular foam insulation shall be protected as above or painted with a coating that is water retardant and provides shielding from solar radiation that can cause degradation of the material.
- Insulation covering chilled water piping and refrigerant suction piping located outside the conditioned space shall include a vapor retardant located outside the insulation (unless the insulation is inherently vapor retardant), and all penetrations and joints shall be sealed.

If the installed refrigerant lineset insulation is not protected from damage as detailed above, the Inspector shall issue a Correction Notice to the builder stating: *“Install (identify protection: i.e. plastic cover, cellular foam insulation, etc.) and protect refrigerant lineset insulation from damage per §150(j).”*

### **Water Heating**

#### **Water Heating Distribution Type §10-103(a)2B**

The Inspector shall verify that the installed water heating distribution type matches the distribution type of the water heater listed on the CF-1R Form. The water heating distribution type is identified under Water Heating Systems on the CF-1R Form. A standard water heating distribution system will be identified as “Standard” (STD) or “No Pipe Insulation” (SNI) on the CF-1R Form. A complete list of water heating distribution types may be found in Table 5-1 of the 2008 Residential Compliance Manual on the next page.

If the installed water heating distribution type does not match the distribution type of the water heater listed on the CF-1R Form, the Inspector shall issue a Correction Notice to the builder stating: *“CF-1R Form shall be re-submitted and modeled with installed water heating distribution type per §10-103(a)2B.”*

*Table 5-1 – Description of Distribution Systems within a Dwelling Unit*

<b>Distribution Systems</b>	<b>Description</b>
Standard (STD)	Standard system without any pumps for distributing hot water. The first 5 ft of pipes from the storage tank is insulated for both hot and cold water pipes. Pipes from the water heater to the kitchen must be insulated per §150(j).
Pipe Insulation (PIA)	All hot water pipes are insulated per the requirements of §150(j).
Standard Pipes with no Insulation (SNI)	Standard distribution system (STD) with no pipe insulation on lines to the kitchen.
Point of Use (POU)	System with no more than 8 ft horizontal distance between the water heater and hot water fixtures, except laundry.
Parallel Piping (PP)	Individual pipes radiate from a manifold near the water heater to each of the fixtures.
Uninsulated Pipe Below Grade (UPBG)	Piping installed below grade (outside of conditioned space) with no insulation.
Insulated and Protected Pipe Below Grade (IPBG)	Piping installed below grade (outside of conditioned space) with insulation and a protective covering.
Recirculation No Control (RNC)	Distribution system using a pump to recirculate hot water through a hot water loop that serves the individual use points. Pump operation and water flow are continuous. Pipe insulation is required per §150(j).
Recirculation with Timer Control (RTm)	Recirculation system that uses a timer control to control pump operation based on time of day. Pipe insulation is required per §150(j).
Recirculation with Temperature Control (RTmp)	Recirculation system that uses a remote temperature sensor attached to the hot water return line to cycle pump operation to maintain water temperatures within certain limits. Pipe insulation is required per §150(j).
Recirculation with Timer and Temperature Control (RTmTmp)	Recirculation system that uses both temperature and timer controls to regulate pump operation. Pipe insulation is required per §150(j).
Recirculation with Manual Demand Control (RDmc)	Recirculation system that uses brief pump operation to recirculate hot water to fixtures when a demand for hot water is initiated with push button control activation. Pipe insulation is required per §150(j).
Recirculation with Motion Sensor Demand Control (RDmc)	Recirculation system that uses brief pump operation to recirculate hot water to fixtures when a demand for hot water is initiated with motion sensor control activation. Pipe insulation is required per §150(j).
Temperature Buffering Tank (TBT)	A distribution system with a small storage electric water heater installed in the distribution system.

**Pipe Insulation Values (Including Hydronic Systems) (Mandatory Measure) §150(j)2**

The Inspector shall verify that the following installed piping is insulated to meet the minimum insulation thickness requirements in Standards Table 150-B on the next page:

- Recirculating sections;
- Piping from the heating source to the storage tank (indirect-fired systems);
- Piping insulation modeled for compliance credit in Table 5-1 above.

If the installed piping detailed above does not meet the minimum insulation thickness requirements in Standards Table 150-B (or no pipe insulation is installed), the Inspector shall issue a Correction Notice to the builder stating: *“Install (identify piping: recirculating, piping between heater and storage tank, etc.) insulation with a thickness equal to or greater than the minimum pipe insulation thickness requirements of Standards Table 150-B per §150(j)2.”*

Standards Table 150-B Pipe Insulation Minimum Thickness Requirements

SYSTEM	PIPE DIAMETER	
	Less than or Equal to 2 inches	Greater than 2 inches
	INSULATION THICKNESS REQUIRED (in inches)	
Domestic hot water (above 105°F)	1.0	1.5
Hydronic heating supply lines (above 200°F to 250°F) <sup>1</sup>	1.0	2.0
Hydronic heating supply lines (105°F to 200°F)	1.0	1.5
Cooling system refrigerant suction, chilled water and brine lines	0.75	1.0

<sup>1</sup> Steam hydronic heating systems or hot water systems with pressure above 15 psi shall meet the requirements of TABLE 123-A.

### Lighting §150(k)

#### Are High Efficacy Luminaires installed in the Kitchen? (Mandatory Measure) §150(k)8

The Inspector shall verify that at least 50% of the total rated wattage of permanently installed lighting in the kitchen is high efficacy (see *High Efficacy Luminaires* below). To simplify verification with this requirement, the Inspector shall verify that:

- All permanently installed lighting in the kitchen is high efficacy; or
- The wattage of installed low efficacy lighting does not exceed the wattage of installed high efficacy lighting.

NOTE: Lighting in areas adjacent to the kitchen, such as in dining and nook areas, are considered kitchen lighting if they are on the same switch as the kitchen lighting.

If at least 50% of the total rated wattage of permanently installed lighting in the kitchen is not high efficacy, the Inspector shall issue a Correction Notice to the builder stating: *“A minimum of 50% of the total rated wattage of permanently installed lighting in the kitchen shall be high efficacy per §150(k).”*

#### *High Efficacy Luminaires*

High efficacy luminaires are defined in §150(k) as:

- Having a lamp efficacy (lumens per watt) greater than or equal to the minimum lamp efficacy requirements in Standards Table 150-C on the next page; and
  - a. Majority of fluorescent lamps will meet the minimum lamp efficacy requirements.
  - b. LED luminaires shall be certified to the Energy Commission to be installed as a high efficacy luminaire.
- Not containing a medium screw base socket or other line-voltage socket or a line-voltage lamp holder; and
  - a. Factory installed GU-24 lamp holders may be installed as high efficacy lighting if:
    - i. It is not a recessed downlight that is rated to be used with compact fluorescent lighting; and
    - ii. Does not contain any other type of line-voltage socket or lamp holder; and

- iii. The manufacturer does not make available adaptors or modular components to convert the GU-24 lamp holder to another type of socket or lamp holder; and
- iv. It is rated for use only with high efficacy lamps or certified high efficacy LED lighting that meets the minimum lamp efficacy requirements in Standards Table 150-C below.
  - Not being low voltage incandescent lighting; and
  - Not being track lighting or other lighting system which allows the addition or relocation of luminaires without altering the wiring of the system; and
  - Not having modular components that allow converting between screw-based and pin-based sockets without changing the luminaires' housing or wiring; and
  - Not being an electrical box finished with a blank cover or where no electrical equipment has been installed, and where the electrical box for a luminaire or a surface mounted ceiling fan.

*Standards Table 150-C*

Lamp Power Rating for Non-LED Lighting (see Note 1), or System Power Rating for LED Lighting (see Notes 2, 3, and 4)	Minimum Lamp Efficacy for Non-LED Lighting, or Minimum System Efficacy for LED Lighting
5 watts or less	30 lumens per watt
over 5 watts to 15 watts	40 lumens per watt
over 15 watts to 40 watts	50 lumens per watt
over 40 watts	60 lumens per watt

Notes:

1. Determine minimum lamp efficacy category for lighting systems which are not LED using the initial rated lumens divided by the rated watts of the lamp (not including the ballast).
2. To qualify as high efficacy, an LED luminaire shall meet the minimum system efficacy requirements in Table 150-C when determined according to Reference Joint Appendix JA8, and be certified to comply with Section 119(m), and input power shall be determined according to Section 130(d)5.
3. For a Hybrid LED Luminaire to qualify as a high efficacy luminaire, all lighting systems in the luminaire shall qualify as high efficacy according to Section 150(k)1, and the LED Light Engine with Integral Heat Sink shall comply with Note 4, below.
4. To qualify as high efficacy, an LED Light Engine with Integral Heat Sink shall meet the minimum system efficacy requirements in Table 150-C when determined according to Reference Joint Appendix JA8, shall be certified to comply with Section 119(m), and input power shall be determined according to Section 130(d)5.

**Are Recessed Luminaires IC Rated and Airtight? (*Mandatory Measure*) §150(k)12**

When a luminaire is recessed into a ceiling that will be insulated, the Inspector shall verify that the installed recessed luminaire has a label certifying the luminaire:

- Is listed for zero clearance insulation contact (IC) by Underwriters Laboratories or other nationally recognized testing/rating laboratories; and
- Has a label that certifies the luminaire is air tight (AT) with an air leakage less than 2.0 CFM at 75 Pascals when tested in accordance with ASTM E283.

If a luminaire recessed into a ceiling that will be insulated is not labeled as being IC rated and airtight, the Inspector shall issue a Correction Notice to the builder stating: *“All luminaires recessed into insulated ceilings shall have labels certifying that they are IC Rated and Air Tight (AT) per §150(k)12.”*

NOTE: Luminaires recessed into ceilings between floors or into a ceiling that will not be insulated do not need to be IC Rated or airtight.

**Special Features and HERS Measures – Verify when modeled §10-103(a)2B  
Radiant Barrier**

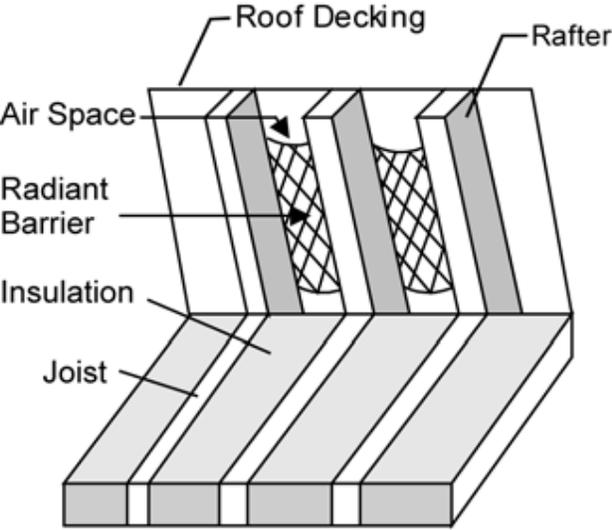
When a radiant barrier is modeled for compliance credit and identified under Special Features on the CF-1R Form, the Inspector shall verify that:

- The installed radiant barrier material has an emittance of 0.05 or less, tested in accordance with ASTM C1371 or ASTM E408, and is certified to the Department of Consumer Affairs, Bureau of Home Furnishing and Thermal Insulation (Inspector shall require a manufacturer's cut sheet for verification); **and**
- The radiant barrier is properly installed according to Reference Residential Appendix RA4 (see Figure 3-11 from the 2008 Residential Compliance Manual on the next page).

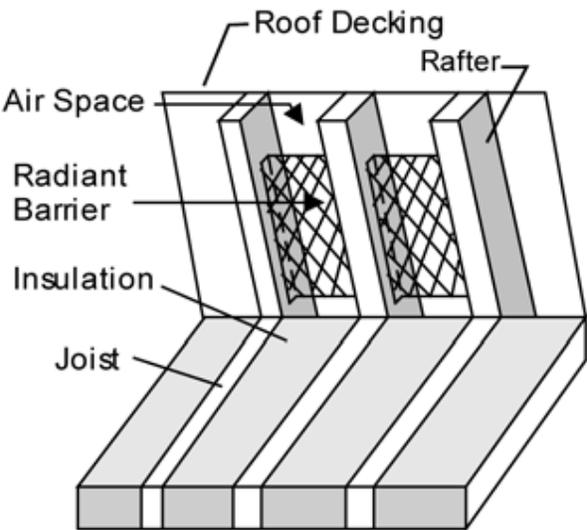
NOTE: The radiant barrier shall be installed on all roof surfaces, including gable ends.

If the installed radiant barrier is not certified with an emittance of 0.05, or is not properly installed (or no radiant barrier is installed) when a radiant barrier is modeled for compliance credit, the Inspector shall issue a Correction Notice to the builder stating: *“Certified radiant barrier with an emittance of 0.05 or less shall be installed in accordance with Reference Residential Appendix RA4; or CF-1R Form shall be re-submitted and modeled without radiant barrier compliance credit per §10-103(a)2B.”*

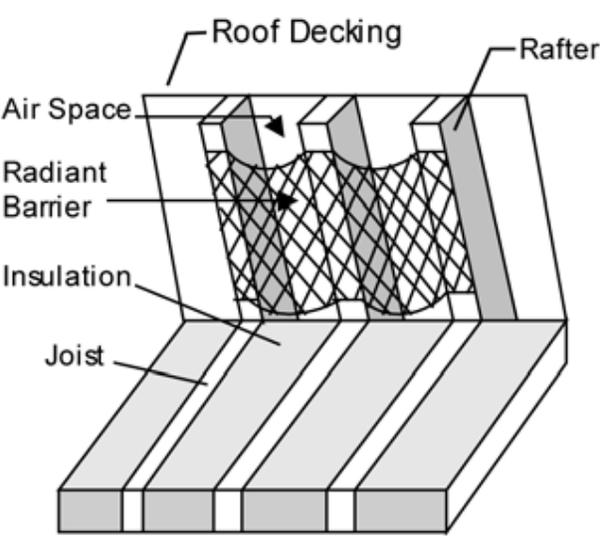
Figure 3-11 Radiant Barrier Installation Methods



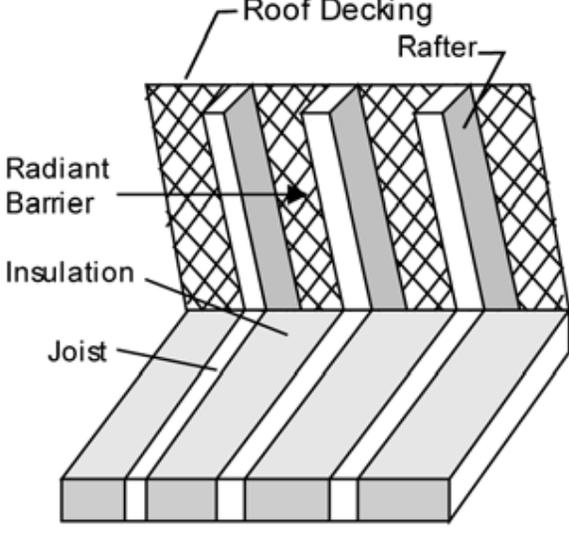
Method 1: Radiant Barrier Draped Over Top of Truss/Rafter



Method 2: Radiant Barrier Attached Between Truss/Rafters



Method 3: Radiant Barrier Attached to Bottom of Truss/Rafter



Method 4: Radiant Barrier Attached to Underside of Roof Deck

NOTE: The radiant barrier shall also be installed on all gable ends.

## Cool Roof

When a cool roof is modeled for compliance credit, the Inspector shall verify that the solar reflectance (aged or initial) and thermal emittance values from the Cool Roof Rating Council (CRRC) label on the installed cool roof material matches the cool roof solar reflectance (aged or initial) and thermal emittance values listed on the CF-1R Form. The solar reflectance and thermal emittance values of the cool roof are identified under Special Features on the CF-1R Form.

NOTE: The applicant may model an aged (3 year) solar reflectance value or an initial solar reflectance on the CF-1R Form. The Inspector shall pay special attention to ensure that the tested (aged or initial) solar reflectance value on the CRRC label (example below) matches the tested solar reflectance listed on the CF-1R Form.

If the solar reflectance (aged or initial) or thermal emittance values on the CRRC label of the installed cool roof material are lower than the solar reflectance (aged or initial) and thermal emittance values listed on the CF-1R Form (or no cool roof is installed) when a cool roof is modeled for compliance credit, the Inspector shall issue a Correction Notice stating: *“Install cool roof material with solar reflectance and thermal emittance values equal to or greater than the cool roof efficiencies identified on the CF-1R Form; or CF-1R Form shall be re-submitted and modeled with installed cool roof solar reflectance (identify: aged or initial) and thermal emittance values per §10-103(a)2B.”*

### CRRC Product Label and Information

		<u>Initial</u>	<u>Weathered</u>
	<b>Solar Reflectance</b>	<b>0.00</b>	<b>Pending</b>
	<b>Thermal Emittance</b>	<b>0.00</b>	<b>Pending</b>
	Rated Product ID Number	-----	
	Licensed Seller ID Number	-----	
	Classification	Production Line	
<p>Cool Roof Rating Council ratings are determined for a fixed set of conditions, and may not be appropriate for determining seasonal energy performance. The actual effect of solar reflectance and thermal emittance on building performance may vary.</p> <p>Manufacturer of product stipulates that these ratings were determined in accordance with the applicable Cool Roof Rating Council procedures.</p>			

### **Quality Insulation Installation (QII) (HERS Measure)**

When the Quality Insulation Installation (QII) HERS Measure is modeled for compliance credit and identified under HERS Required Verification on the CF-1R Form, the Inspector shall verify that the following forms are completed and posted on site for inspection:

- CF-6R-ENV-21-HERS – Envelope QII Framing Stage Installation Certificate shall be completed and signed by the installing contractor.
- CF-4R-ENV-21 – Envelope QII HERS Framing Stage Field Verification Certificate shall be Registered (see *Registration* on page 30), completed and signed by certified HERS Rater.

NOTE: The QII HERS Measure cannot be modeled for compliance credit for additions.

If both forms listed above are not completed and posted on the building site when the QII HERS Measure is modeled for compliance credit, the Inspector shall issue a Correction Notice to the builder stating: “*Submit completed (identify form: CF-6R-ENV-21-HERS, CF-4R-ENV-21); or CF-1R Form shall be re-submitted and modeled without QII HERS Measure compliance credit per §10-103(a)2B.*”

## **INSULATION INSPECTION**

### **Do the follow features match the CF-1R Form? §10-103(a)2B**

#### **Envelope**

#### **Wall, Roof, Floor Insulation Values**

The Inspector shall verify that the R-value of the installed insulation in the walls, roofs (if insulation is installed at the roof), and raised floors matches the insulation R-values listed on the CF-1R Form. The R-values of the wall, roof, and raised floor insulation are identified under the Opaque Surface Details on the CF-1R Form.

If the R-value of the installed insulation in the walls, roofs, or raised floors is less than the insulation R-values listed on the CF-1R Form, the Inspector shall issue a Correction Notice to the builder stating: “*Install (identify assembly: wall, roof, or raised floor) insulation with an R-value equal to greater than the assembly insulation value identified on the CF-1R Form; or CF-1R Form shall be re-submitted and modeled with installed (identify assembly: wall, roof, raised floor) insulation R-value per §10-103(a)2B.*”

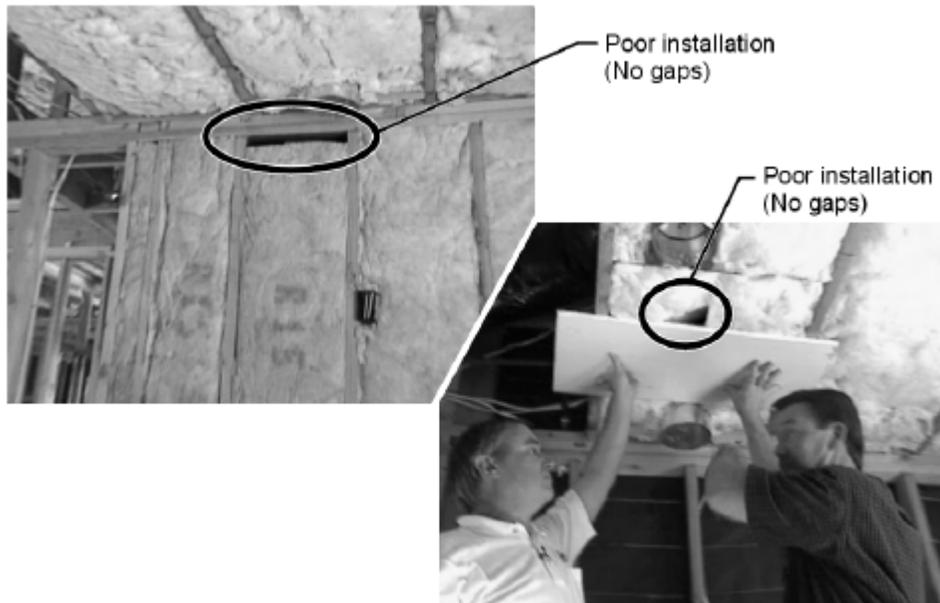
### **Is the Insulation Properly Installed? (Mandatory Measure) §118**

The Inspector shall verify that the insulation is properly installed and meets the following insulation installation requirements:

- There shall be no gaps or voids in the cavity (see Figure 3-19 of the 2008 Residential Compliance Manual on the next page).
- There shall be no compression (or stuffing) of the insulation into the cavity.
- Insulation shall be properly cut around obstructions like electrical boxes.
- Batt insulation shall be delaminated around ALL plumbing and electrical lines in ceilings, walls and floors.
- All cracks between the framing shall be filled with expanding foam.

- Low expanding foam shall be used around windows if allowed by the manufacturer. If this is not allowed then backer rod shall be used.
- Band joists shall be completely filled and insulation shall be cut to fit around cross bracings in ceiling.

*Figure 3-19 Examples of Poor Quality Insulation Installation*



Source: California Energy Commission

### Insulation Above the Garage

For homes with conditioned space above the garage, the Inspector shall verify that the insulation is properly installed above the garage and meets one of the following insulation installation requirements:

- When the insulation is installed on top of the ceiling above the garage, the exterior rim joists shall be insulated (see Figure 3 on the next page) with an R-value equal to or greater than the wall insulation R-value listed on the CF-1R Form .
- When the insulation is installed underneath the floor of the conditioned space above the garage, an air barrier (blocking) shall be installed between the garage and first story of the home that is insulated (see Figure 4 on the next page) with an R-value equal to or greater than the wall insulation R-value listed on the CF-1R Form .

## Proper Insulation Installation Above Garage

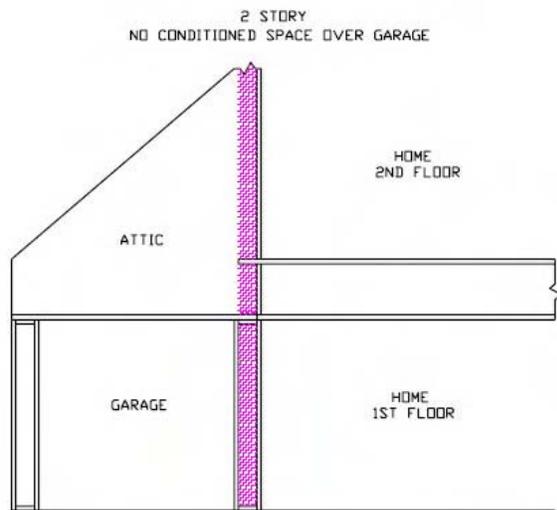


FIGURE 1

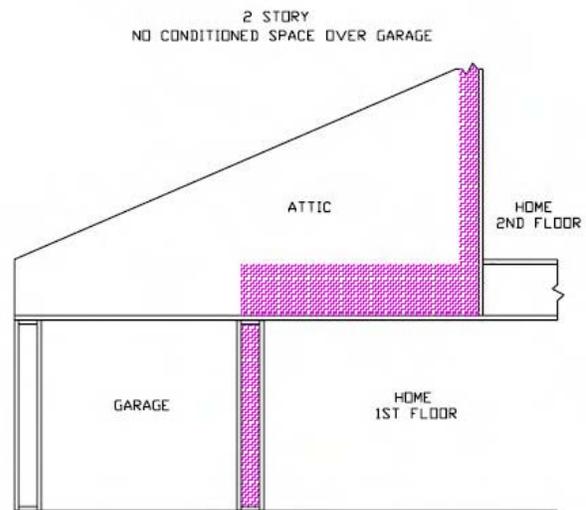


FIGURE 2

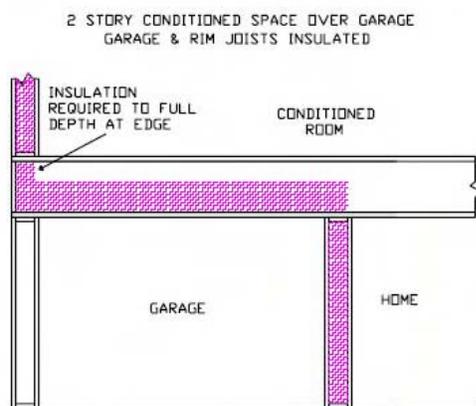


FIGURE 3

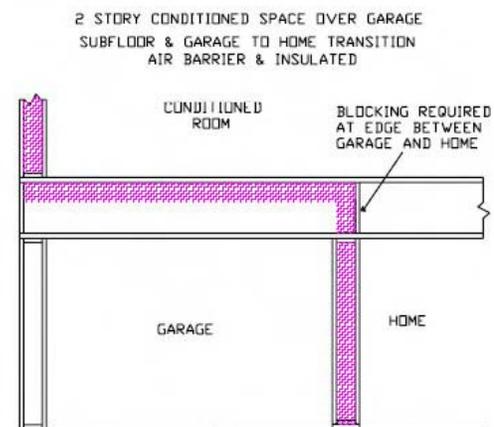


FIGURE 4

### Are all Infiltration Areas (joints and openings) Sealed? (*Mandatory Measure*) §117

The Inspector shall verify that the following openings in the building envelope are caulked, gasketed, weatherstripped or otherwise sealed to prevent infiltration and exfiltration:

- Exterior joints around windows and door frames, doors between the house and garage, between interior HVAC closets and the doors to the closet, attic access, wall sole plates sealed to the floor, raised floors, exterior panels and all siding materials; and
- The ceiling must be completely sealed with no openings into the interior of the building. This includes openings in the ceiling itself or openings in the interior walls, drops or chases. It is highly recommended that all drops and chases be covered with a hard cover and then sealed; and
- Openings for plumbing, electricity, gas lines, etc. shall be caulked in all: ceilings, top plates, both exterior and interior walls, etc.; and

- Openings in the ceiling (such as where ceiling panels meet interior and exterior walls and masonry fireplaces); and
- Openings around exhaust ducts such as those for clothes dryers, HVAC ducting and exhaust vents for the range hood and bathroom fans; and
- All other such openings in the building envelope; and
- All exterior rim joists shall be air tight and have no gaps or holes to the outside.

NOTE: Fiberglass insulation is not a sealant and cannot be used to caulk or seal openings in the building envelope.

If any openings in the building envelope are not caulked, gasketed, weatherstripped or otherwise sealed, the Inspector shall issue a Correction Notice to the builder stating: *“(Identify opening that is not sealed) shall be caulked, gasketed, weatherstripped or otherwise sealed to prevent infiltration and exfiltration per §117.”*

### **HERS Measures – Verify when modeled §10-103(a)2B Quality Insulation Installation (QII)**

When the Quality Insulation Installation (QII) HERS Measure is modeled for compliance credit and identified under HERS Required Verification on the CF-1R Form, the Inspector shall verify that the following forms are completed and posted on site for inspection:

- CF-6R-ENV-22-HERS – Envelope QII Insulation Stage Installation Certificate shall be completed and signed by the installing contractor.
- CF-4R-ENV-22 – Envelope QII HERS Insulation Stage Field Verification Certificate shall be Registered (see *Registration* on page 30), completed and signed by certified HERS Rater.

NOTE: The QII HERS Measure cannot be modeled for compliance credit for additions.

If both forms listed above are not completed and posted on the building site when the QII HERS Measure is modeled for compliance credit, the Inspector shall issue a Correction Notice to the builder stating: *“Submit completed (identify form: CF-6R-ENV-22-HERS, CF-4R-ENV-22); or CF-1R Form shall be re-submitted and modeled without QII HERS Measure compliance credit per §10-103(a)2B.”*

## **FINAL INSPECTION**

### **Do the following features match the CF-1R Form? §10-103(a)2B**

#### **Envelope**

#### **Ceiling Insulation Values**

When insulation is installed at the ceiling, the Inspector shall verify that the R-value of the installed ceiling insulation matches the insulation R-value listed on the CF-1R Form. The R-value of the ceiling insulation is identified under the Opaque Surface Details on the CF-1R Form.

If the R-value of the installed ceiling insulation is less than the insulation R-value listed on the CF-1R Form, the Inspector shall issue a Correction Notice to the builder stating: *“Install ceiling insulation with an R-value equal to greater than the ceiling insulation value identified on the CF-1R Form; or CF-1R Form shall be re-submitted and modeled with installed ceiling insulation R-value per §10-103(a)2B.”*

**Are all exterior doors weatherstripped? (Mandatory Measure) §117**

The Inspector shall verify that all exterior doors and doors that separate enclosed conditioned and unconditioned space (i.e. door to the garage) are weatherstripped or otherwise sealed to limit infiltration and exfiltration.

If all exterior doors are not weatherstripped or otherwise sealed to limit infiltration and exfiltration, the Inspector shall issue a Correction Notice to the builder stating: *“All exterior doors shall be weatherstripped or otherwise sealed to limit air leakage per §117.”*

**Is the drywall installed to limit infiltration and exfiltration around: §117**

The Inspector shall verify that the drywall is properly installed around:

- **HVAC Boots** shall be taped or caulked to the drywall.
- **Exhaust Fans** shall be sealed with a gasket or caulk between the exhaust fan housing and drywall.  
NOTE: Exhaust fans shall be installed with a backdraft or automatic damper to prevent air leakage.
- **Attic Access** shall be sealed with a gasket and insulated to the correct ceiling R-value listed on the CF-1R Form.
- **Lighting Cans** that are recessed into an insulated ceiling shall be sealed with a gasket or caulk between the luminaire housing and drywall, and all air leak paths in the luminaire housing shall be sealed with a gasket or caulk.

If the drywall is not properly installed as detailed above to limit infiltration and exfiltration, the Inspector shall issue a Correction Notice to the builder stating: *“Drywall shall be properly installed to seal (identify: HVAC boots, exhaust fans, lighting cans, etc.) with a gasket or caulk to limit air leakage per §117.”*

**HVAC**

**HVAC Equipment Efficiency §10-103(a)2B**

The Inspector shall verify that the AFUE and SEER values of the installed HVAC equipment match the HVAC efficiency values listed on the CF-1R Form. The AFUE and SEER values of HVAC equipment are identified under HVAC Systems on the CF-1R Form. The Inspector may request a manufacturer’s cut sheet or a printout from the CEC Appliance Database from the installing contractor to verify the AFUE and SEER values of the installed HVAC equipment.

If the AFUE and SEER values of the installed HVAC equipment are lower than the HVAC efficiencies listed on the CF-1R Form, the Inspector shall issue a Correction

Notice to the builder stating: *“CF-1R Form shall be re-submitted and modeled with installed HVAC equipment AFUE and SEER values per §10-103(a)2B.”*

**Is the refrigerant suction line insulated and protected? (Mandatory Measure) §150(j)2**

Insulation Thickness

The Inspector should double check and verify that the installed refrigerant suction lineset connected to the outdoor condensing unit is insulated and protected (see requirements on Pages 13 and 14).

If the installed refrigerant suction lineset connected to the outdoor condensing unit is not insulated and protected, the Inspector shall issue a Correction Notice to the builder stating: *“Install refrigerant lineset insulation with a thickness equal to or greater than the minimum pipe insulation thickness requirements of Standards Table 150-B per §150(j); or Install (identify protection: i.e. plastic cover, cellular foam insulation, etc.) and protect refrigerant lineset insulation from damage per §150(j).”*

**Do exhaust fans provide an airflow (cfm) and have a sone rating according to ASHRAE 62.2? (Mandatory Measure) §150(o)**

The Inspector shall verify that the exhaust fans installed to provide indoor air quality and mechanical ventilation meet the following requirements of ASHRAE 62.2:

*NOTE: Additions that are 1,000 ft<sup>2</sup> or less are not required to meet the ventilation requirements of ASHRAE Standard 62.2.*

Local Exhaust Ventilation

Bathrooms

All bathrooms shall meet the following ventilation and sound rating requirements:

- Have an exhaust fan ducted to the outside that provides a minimum ventilation rate of 50 cfm.
- The exhaust fan shall have a sound rating of 3 sones or less.

*NOTE: For additions, bathrooms in the existing home are not required to meet the Local Exhaust Ventilation requirements of ASHRAE Standards 62.2.*

If all bathrooms do not have an exhaust fan meeting the local exhaust ventilation and sound rating requirements above, the Inspector shall issue a Correction Notice to the builder stating: *“Bathrooms shall have an exhaust fan meeting the local exhaust ventilation and sound rating requirements of ASHRAE Standard 62.2 per §150(o).”*

Kitchens

All kitchens shall meet the following ventilation and sound rating requirements:

- Have an exhaust fan ducted to the outside that provides a minimum ventilation rate of 100 cfm. The range hood over the stove may be used if vented to the outside; re-circulating range hoods cannot be used.
- The exhaust fan shall have a sound rating of 3 sones or less.

*NOTE: For additions, kitchens in the existing home are not required to meet the Local Exhaust Ventilation requirements of ASHRAE Standards 62.2.*

If all kitchens do not have an exhaust fan meeting the local exhaust ventilation and sound rating requirements, the Inspector shall issue a Correction Notice to the builder stating: *“Kitchens shall have an exhaust fan meeting the local exhaust ventilation and sound rating requirements of ASHRAE Standard 62.2 per §150(o).”*

#### Whole-Building Ventilation

The whole-building exhaust fan shall meet the following ventilation, sound rating, and labeling requirements:

- Provide a minimum ventilation rate according to ASHRAE Standard 62.2 Equation 4.1(a) on the CF-6R-MECH-05. This minimum cfm is also identified under Indoor Air Quality on the CF-1R Form.
- The exhaust fan shall have a sound rating of 1 sone or less.
- The switch operating the exhaust fan shall have a label stating (or similar phrasing): “Operate when house is in use” or “Fan is to be left on to ensure indoor air quality,” etc.

One of the local exhaust fans in the bathroom or kitchen may be used to meet the whole-building ventilation requirement, provided the exhaust fan meets all of the requirements (ventilation, sound rating, etc.) for both the Local Exhaust and Whole-Building Ventilation.

*NOTE: For additions greater than 1,000 ft<sup>2</sup>, the whole-building exhaust fan may be installed in either the addition or the existing home.*

If an exhaust fan is not installed that meets the above requirements, the Inspector shall issue a Correction Notice to the builder stating: *“Building shall have an exhaust fan meeting the whole-building ventilation, sound rating, and labeling requirements of ASHRAE Standard 62.2 per §150(o).”*

#### **Water Heating**

##### **Water Heater Efficiency and Type §10-103(a)2B**

The Inspector shall verify that the energy factor or thermal efficiency (only for large water heaters with an input greater than 75,000 btu/hr) value and type of the installed water heater matches the water heater efficiency value and type listed on the CF-1R Form. The energy factor or thermal efficiency value of the water heater is identified under Water Heating Systems on the CF-1R Form. The Inspector may request a manufacturer’s cut sheet or a printout from the CEC Appliance Database from the installing contractor to verify the efficiency value of the installed water heater.

If the energy factor or thermal efficiency of the installed water heater is lower than the water heater efficiency listed on the CF-1R Form (or the type of the installed water heater is different), the Inspector shall issue a Correction Notice stating: *“CF-1R Form*

*shall be re-submitted and modeled with installed water heater energy factor (or thermal efficiency) value and type per §10-103(a)2B.”*

**Is pipe insulation installed on first 5 Feet of Water Heater Cold and Hot Lines?  
(Mandatory Measure) §150(j)2**

For nonrecirculating water heating systems, the Inspector shall verify that the first five feet of the hot and cold water lines from the storage tank are insulated to meet the minimum insulation thickness requirements in Standards Table-150 B:

- Piping with a diameter of 2 inches or less shall have a minimum insulation thickness of 1 inch.
- Piping with a diameter greater than 2 inches shall have a minimum insulation thickness of 1.5 inches.

Piping installed in insulated walls is exempt from the minimum insulation thickness requirements.

NOTE: Pipes that are closer than 6 inches to the water heater flue shall be insulated with fiberglass insulation.

If the first five feet of the hot and cold water lines from the storage tank do not meet the minimum insulation thickness requirements detailed above (or no pipe insulation is installed), the Inspector shall issue a Correction Notice to the builder stating: *“Install pipe insulation on first five feet of water heater hot and cold lines with a thickness equal to or greater than the minimum pipe insulation thickness requirements of Standards Table 150-B per §150(j)2.”*

**Lighting (ALL are Mandatory Measures) §150(k)**

**Are High Efficacy Luminaires or the Alternative Controls Installed?**

- In **Kitchens**, the wattage of installed low efficacy lighting shall not exceed the wattage of installed high efficacy lighting. This means that at least 50% of the total installed wattage must be high efficacy lighting. **§150(k)8**
- In **Bathrooms, Garages, Laundry Rooms, Closets, and Utility Rooms**, low efficacy lighting shall be controlled by a manual-on (and automatic off) occupancy sensor. Lighting in closets less than 70 ft<sup>2</sup> do not need to be high efficacy or controlled by a dimmer or occupancy sensor. **§150(k)10**
- In **Other Rooms**, low efficacy lighting shall be controlled by either a dimmer or manual-on (and automatic off) occupancy sensor. **§150(k)11**
- In the **Common Areas of Multifamily Buildings**, low efficacy lighting installed in the enclosed, non-dwelling spaces of low-rise residential buildings with four or more dwellings shall be controlled by a manual-on (and automatic off) occupancy sensor. **§150(k)16**
- For **Outdoor Lighting**, low efficacy lighting shall be controlled by a motion sensor and one of the following controls: **§150(k)13**
  - a. A photocontrol; or
  - b. An astronomical time clock; or
  - c. An energy management control system (EMCS)

If all installed luminaires are not high efficacy (see *High Efficacy Luminaires* on page16) or do not meet the alternative control requirements, the Inspector shall issue a Correction Notice to the builder stating: *“All installed lighting in the (identify location: bathroom, living room, hallway, outdoor, etc.) shall be high efficacy or meet the alternative control requirements per §150(k).”*

**Are High Efficacy and Low Efficacy Lighting Switched Separately? §150(k)12**

The Inspector shall verify that all high efficacy lighting is switched separately from low efficacy lighting throughout the entire house. This is a new requirement in the 2008 Energy Standards; the 2005 Energy Standards only required separate switching in the kitchen.

If all high efficacy lighting is not switched separately from low efficacy lighting, the Inspector shall issue a Correction Notice to the builder stating: *“High efficacy lighting must be switched separately from low efficacy lighting in (identify location: i.e. living room, bathroom, etc.) per §150(k)12.”*

**Are ALL applicable CF-6R Forms (Installation) posted on site and complete? §10-103(a)3A, 10-103(a)4**

The Inspector shall verify that all applicable CF-6R Forms (Installation Certificates) are completed, signed, and posted on site for inspection. The following CF-6R Forms are required for all newly constructed residential buildings:

- CF-6R-ENV-01 – Insulation, Roofing, Fenestration
- CF-6R-LTG-01 – Residential Lighting
- CF-6R-MECH-01 – Domestic Hot Water
- CF-6R-MECH-04 – Space Conditioning Systems, Ducts and Fans
- CF-6R-MECH-05 – Indoor Air Quality and Mechanical Ventilation

NOTE: The builder shall provide copies of all applicable CF-6R Forms to the building owner at occupancy.

When HERS Measures are modeled for compliance credit (or are required Prescriptively), the Inspector shall verify that the applicable CF-6R Forms are completed, signed, and posted on site for inspection. For example, if Duct Leakage Testing is modeled for compliance credit and listed under HERS Required Verification on the CF-1R Form (or is required Prescriptively), the Inspector shall verify that the CF-6R-MECH-20-HERS has been submitted.

The **2008 Residential Energy Installation and HERS Verification Forms Checklist** on Page 3 contains a list of all CF-6R Forms. The Inspector may use this checklist to verify that all applicable CF-6R Forms are posted on site and complete.

If all applicable CF-6R Forms are not completed, signed, and posted on site for inspection, the Inspector shall issue a Correction Notice stating: *“(Identify CF-6R Form) shall be completed, signed, and posted on site for inspection per §10-103(a)3A.”*

### Registration

When a newly constructed low-rise residential building is modeled facing multiple orientations (tract homes) and a HERS Measure is modeled for compliance credit on the CF-1R Form, the Inspector shall verify that all applicable CF-6R-HERS Forms are registered with an approved HERS Provider. Registered CF-6R-HERS Forms will have:

- The seal of the approved HERS Provider as a water mark on the center of each page; and
- A registration number, date and time on the bottom of each page.

Beginning on October 1, 2010, whenever a HERS Measure is modeled for compliance credit on the CF-1R Form (or is required Prescriptively), the Inspector shall verify that all applicable CF-6R-HERS Forms are registered with an approved HERS Provider.

If all applicable CF-6R-HERS Forms are not registered with an approved HERS Provider when a HERS Measure is modeled for compliance credit or is required Prescriptively, the Inspector shall issue a Correction Notice to the builder stating: *“(Identify form: CF-6R-MECH-20-HERS, etc.) shall be registered with an approved HERS Provider per §10-103(a)3A.”*

### **Are ALL applicable CF-4R Forms (HERS) Registered, posted on site and complete? §10-103(a)5**

When a HERS Measure is modeled for compliance credit and identified under HERS Required Verification on the CF-1R Form (or is required Prescriptively), the Inspector shall verify that the applicable CF-4R Forms are Registered (see *Registration* below), completed, signed, and posted on site for inspection.

The **2008 Residential Energy Installation and HERS Verification Forms Checklist** on Page 3 contains a list of all CF-4R Forms. When HERS Measures are modeled for compliance credit (or are required Prescriptively), the Inspector may use this checklist to verify that all applicable CF-4R Forms are posted on site and complete.

If all applicable CF-4R Forms are not completed, signed, and posted on site for inspection when a HERS Measure is modeled for compliance credit or is required Prescriptively, the Inspector shall issue a Correction Notice stating: *“(Identify CF-4R Form) shall be completed, signed, and posted on site for inspection per §10-103(a)5.”*

NOTE: The builder shall provide copies of all applicable CF-4R Forms to the building owner at occupancy.

### Registration

When a HERS Measure is modeled for compliance credit on the CF-1R Form (or is required Prescriptively), the Inspector shall verify that **ALL** applicable CF-4R Forms are Registered with an approved HERS Provider. Registered CF-4R Forms will have:

- The seal of the approved HERS Provider as a water mark on the center of each page; and
- A registration number, date and time on the bottom of each page.

If all applicable CF-4R Forms are not Registered with an approved HERS Provider when a HERS Measure is modeled for compliance credit or is required Prescriptively, the Inspector shall issue a Correction Notice to the builder stating: *“(Identify form: CF-4R-MECH-20, etc.) shall be Registered with an approved HERS Provider per §10-103(a)5.”*