

# 2008 Residential Energy Plan Review Checklist

## Newly Constructed Buildings

Was the correct compliance software used? ( <i>Performance Only</i> )		Yes	No	N/A
CalRes version 2008				
Energy Pro version 5.0				
Micropas version 8.0				
Is the CF-1R Form signed and dated by both the:				
Designer and/or Owner				
Documentation Author				
Is the CF-1R Form filed on the plans?				
Does the building "Comply" according to the CF-1R Form?				
Is the correct Climate Zone listed on the CF-1R Form?				
Does the CF-1R Form have a registration number?				
Is the MF-1R Form filed on the plans?				
<b>DOES THE CF-1R FORM MATCH THE PLANS?</b>				
Conditioned Floor Area for all floor types (i.e. slab on grade, raised floor, etc.)				
Front Orientation of the building				
Envelope				
Insulation for walls, ceilings, and floors ( <i>from Reference Joint Appendix JA4</i> )				
Window area and orientation				
U-factor and SHGC values for fenestration ( <i>a window schedule required upon Plan Checker's request</i> )				
Exterior shading (i.e. overhangs, fins, exterior shades)				
HVAC				
Efficiencies of HVAC equipment				
Duct Insulation				
Indoor Air Quality and Mechanical Ventilation ( <i>Mandatory Measures</i> )				
Water Heating				
Efficiency and Type of Water Heating/Boiler equipment (i.e. storage, instantaneous, etc.)				
Distribution Type (i.e. recirculating, standard, pipe insulation credit, etc.)				
Pipe Insulation Values ( <i>Mandatory Measures</i> )				
Lighting				
All lighting is high efficacy lighting (i.e. fluorescent, LED) or meets applicable alternatives ( <i>Mandatory Measures</i> )				
<b>ALL Special Features</b> are verified on the plans and highlighted for the Inspector? ( <i>i.e. Thermal Mass, Radiant Barrier, Cool Roof</i> )				
<b>ALL HERS Measures</b> are verified on the plans and highlighted for the Inspector? [ <i>i.e. Duct Leakage, Refrigerant Charge, Airflow (Fan Flow) and Watt Draw</i> ]				

# 2008 Residential Energy Plan Review Checklist GUIDE For Newly Constructed Buildings

Energy Standards Hotline at: 1-800-722-3300

Fax: 916-653-7480

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

## **Was the correct compliance software used? (Performance Only)**

The compliance documentation must be developed from certified compliance software for the 2008 Building Energy Efficiency Standards (Standards). If an outdated version of the software has been used, the CF-1R will have to be resubmitted using a current certified version. Certified versions of the software can be found at:

[http://www.energy.ca.gov/title24/2008standards/2008\\_computer\\_prog\\_list.html](http://www.energy.ca.gov/title24/2008standards/2008_computer_prog_list.html).

## **Is the CF-1R Form signed and dated by both the Designer and/or Owner and the Documentation Author?**

Signatures are necessary to show who is taking legal responsibility for the building design and the accuracy of the energy efficiency documentation.

The Building Designer is the person who is responsible for the design of the building. The Building Designer is also responsible for the accuracy of the energy compliance documentation, even if the actual work is delegated to someone else (the Documentation Author as described below). The Building Designer's signature declares that the energy compliance documentation is consistent with the plans. The Business and Professions Code governs who is qualified to accept responsibility of the building design and who can sign this statement. The person's telephone number is provided to facilitate response to any questions that may arise.

The Documentation Author is the person who prepared the energy compliance documentation. The Documentation Author's signature declares that the energy compliance documentation is accurate and complete. The person's telephone number is provided to facilitate response to any questions that may arise. A Documentation Author may have additional certifications, such as an Energy Analyst or a Certified Energy Plans Examiner, and shall enter their certification number in the EA# or CEPE# box.

Both the Building Designer and Documentation Author shall sign the CF-1R. If the CF-1R is not signed by both the Designer and the Documentation Author, the Plans Examiner shall request that both signatures be provided on the CF-1R prior to approval of the plans for a building permit.

### **Is the CF-1R Form filed on the plans?**

The CF-1R Form shall be filed on the plans. To simplify enforcement the California Energy Commission (Energy Commission) recommends that the CF-1R be printed on the plans (electronically incorporated on the plans). Having the CF-1R Form printed on the plans simplifies the Plan Review process, and helps the Inspector identify the energy components that must be verified in the field.

### **Does the building “Comply” according to the CF-1R Form?**

#### *Performance Approach*

The Plans Examiner shall verify that the building in fact complies. When the Performance Approach is used the CF-1R Form (which is generated by a certified compliance software program) will state on the first page if the building complies or not. The Plans Examiner should also verify that all pages of the CF-1R have the same run number and date at the bottom of each page. This prevents pages from other computer runs being mixed and ensures accuracy.

#### *Prescriptive Approach*

Under the Prescriptive Approach the Plans Examiner shall verify that ALL of the energy efficiency values and building features, including HERS Measures and Special Features, listed on the CF-1R Form meet or exceed the prescriptive requirements of the component package used to comply. If one efficiency or building component specified on the CF-1R does not meet or exceed all of the prescriptive requirements, the building does not comply, and the Plans Examiner shall require the applicant to resubmit the CF-1R.

### **Component Packages**

Component Package C is used when electric resistance heating and/or water heating will be installed, but only when natural gas is not available to the home. Component Package D is the most widely used component package for gas homes. Component Package E is new for the 2008 Standards and allows the installation of metal windows with higher U-Factor values, but has more stringent requirements for duct insulation, HVAC efficiencies, Solar Heat Gain Coefficient (SHGC) values, etc.

The requirements for the prescriptive requirements can be found in §151 of the Standards:

- Package C – Standards Table 151-B
- Package D – Standards Table 151-C
- Package E – Standards Table 151-D

### **Is the correct Climate Zone listed on the CF-1R Form?**

The Plans Examiner shall verify that the building is modeled in the correct Climate Zone because there are different energy efficiency requirements for each specific Climate Zone. There are 16 different Climate Zones in the state of California. To verify Climate Zone by zip code or city go to the Energy Commission's website at:

[www.energy.ca.gov/maps/building\\_climate\\_zones.html](http://www.energy.ca.gov/maps/building_climate_zones.html) or call the Energy Standards Hotline at 1-800-772-3300.

The CF-1R shall be re-submitted to determine compliance with the appropriate Climate Zone if the Climate Zone is incorrect or not listed on the CF-1R Form.

### **Does the CF-1R Form have a registration number?**

Under the 2008 Standards the CF-1R Form filed on the plans will have to be a registered CF-1R from an approved HERS Provider for certain projects. HERS registration will go into effect in two phases. The following projects will require HERS registration of the CF-1R Form on the following dates:

- January 1, 2010 – Low-rise residential homes modeled facing multiple orientations (i.e. track homes) and that model HERS Verification will be required to submit a registered CF-1R.
- October 1, 2010 – Any Low-rise residential home requiring HERS Verification (Prescriptive or Performance Approach) will be required to submit a registered CF-1R.

When registration is required the applicant will submit their energy documentation to one of the approved HERS providers for registration. The approved HERS Provider will input the data of the home into a registry database and create a CF-1R Form with a registration number, date, and seal of the HERS Provider at the bottom of each page. An approved HERS Provider may be found on the Energy Commission website at: <http://www.energy.ca.gov/HERS/>

For projects that require registration, the Plans Examiner shall verify that the CF-1R has a registration number at the bottom of each page. If the CF-1R does not have a registration number, the Plans Examiner shall require that the applicant submit a registered CF-1R Form from an approved HERS Provider.

### **Is the MF-1R Form filed on the plans?**

The MF-1R Form lists the Mandatory Measures, which are minimum energy efficiency requirements that apply to all low-rise residential buildings regardless of the compliance approach used. The Mandatory Measures ensure a minimum level of energy performance for all residential homes to obtain energy efficiency.

For the 2008 Standards, the MF-1R Form is no longer a checklist but a summary of the Mandatory Measures that should be included on the plans. To simplify enforcement the Energy Commission recommends that the MF-1R be printed on the plans (electronically incorporated on the plans). Having the MF-1R Form on the plans simplifies the Plan Review process, and helps the Inspector identify the Mandatory Measures that must be verified in the field. The MF-1R Form can be found in Appendix A of the 2008 Residential Compliance Manual at: <http://www.energy.ca.gov/title24/2008standards/>

### **Does the CF-1R Form match the plans?**

Section 10-103 of the Administrative Regulations (Title 24, Part 1) mandates that the building characteristics modeled to demonstrate compliance with the Energy Standards shall be specified on the plans. The Plans Examiner shall verify that the following efficiency

values and energy building components identified on the CF-1R Form are specified on the appropriate sections of the Building Plans.

**Conditioned Floor Area for all floor types (i.e. slab on grade, raised floor, etc.)**

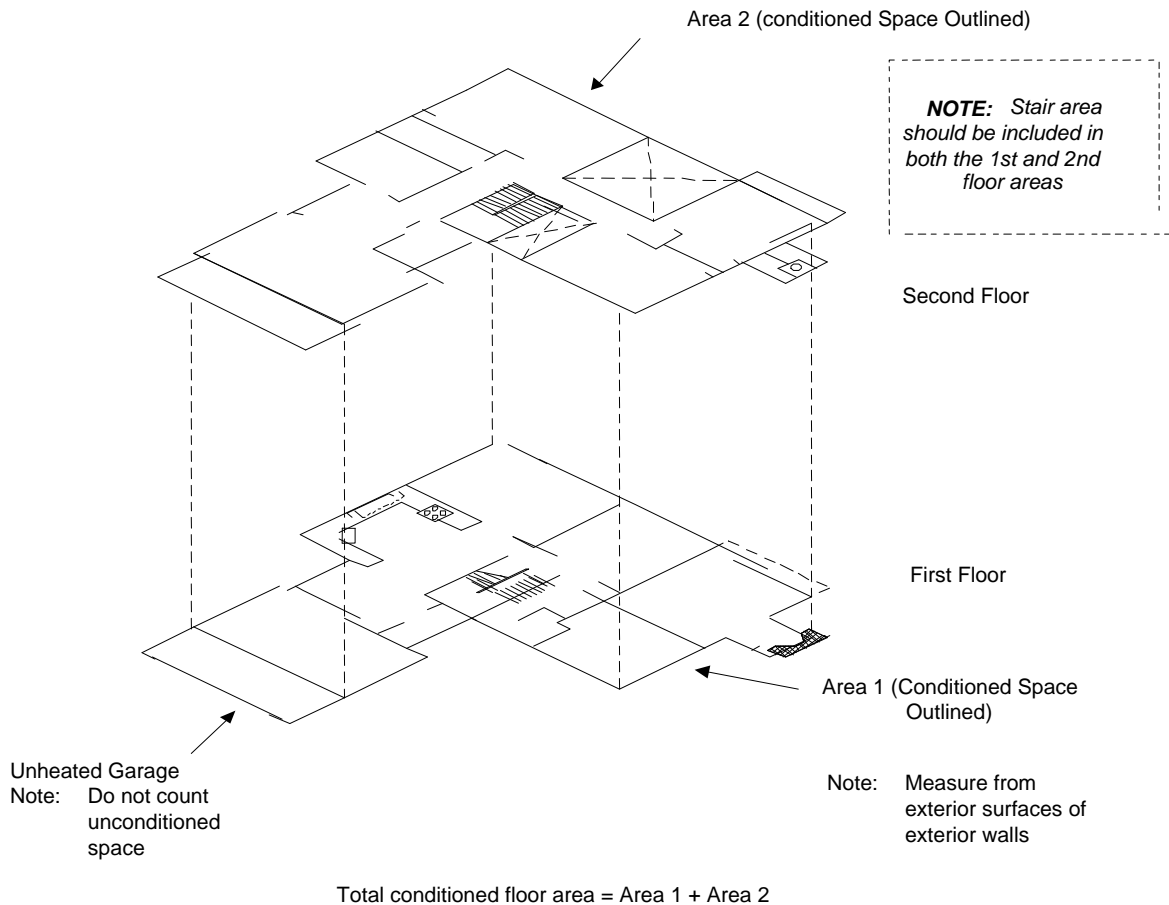
Verification:

The Plans Examiner shall verify that the conditioned floor area (CFA) identified on the CF-1R for all floor types (slab on grade, raised floor, etc.) match the CFA for each floor type specified on the plans. Conditioned floor area is the total floor area (in square feet) of enclosed conditioned space on all floors of a building. It is measured at the floor level of the exterior surfaces of the exterior walls that enclose conditioned space.

Overview:

Figure 1-5 (below) of the 2008 Residential Compliance Manual illustrates how to correctly calculate the conditioned floor area of a residential building. *NOTE:* The floor area of a stairway includes the CFA beneath the stairs and the tread area of the stairs themselves.

Figure 1-5



## **Front Orientation of the building**

### Verification:

The Plans Examiner shall verify that the front orientation listed on the CF-1R Form accurately reflects how the building is situated on the lot according to the plans. The front orientation is listed in degrees from North clockwise to East, and this should be checked against the North azimuth symbol on the plans.

For buildings modeled facing multiple orientations, the Plans Examiner shall verify that the building complies for all four cardinal orientations (located on page 1 of the CF-1R, where the Proposed and Standard budgets are listed for North, South, East, and West orientations).

### Overview:

The front orientation is defined as follows:

- North is orientated to within 45 degrees of true north, including 45 degrees east of north (NE) and 44 degrees west of north (NW).
- East is oriented to within 45 degrees of true east, including 45 degrees south of east (SE) and 44 degrees north of east (NE).
- South is orientated to within 45 degrees of true south, including 45 degrees west of south (SW) and 44 degrees east of south (SE).
- West is orientated to within 45 degrees of true west, including 45 degrees north of west (NW) and 44 degrees south of west (SW).

## ***Envelope***

### **Insulation for walls, ceilings, and floors (from Reference Joint Appendix JA4)**

#### Verification:

The Plans Examiner shall verify that the insulation values identified under Opaque Surfaces on the CF-1R match the insulation values specified on the Structure/Architecture plans for the floors, walls, and ceilings. Insulation values for each assembly may be listed in the Cross Sections or the Architecture Details of the Structure/Architecture plans.

For assemblies other than standard 2x4 or 2x6 wood framing, the Plans Examiner shall verify that the assembly features on the structural plans match the assembly details in Reference Joint Appendix JA4. Reference Joint Appendix JA4 can be found at: <http://www.energy.ca.gov/2008publications/CEC-400-2008-004/CEC-400-2008-004-CMF.PDF>

## **Window area and orientation**

### Verification:

The Plans Examiner shall verify that the window area (including skylights) for each orientation identified under Fenestration Surfaces on the CF-1R matches the window areas specified on the Floor Plan. To simplify enforcement, the Energy Commission recommends that applicants model each window and skylight separately for each orientation so that the Plans Examiner may easily verify the area and orientation of each window specified on the Floor Plan. The window areas and orientations are usually

specified on the Floor Plan, but the Plans Examiner has the discretion of requesting a Window Schedule detailing the size and orientation of each window and skylight to verify compliance.

Overview:

A fenestration product (window, skylight, sliding glass door, etc.) is defined as the glass plus the framing. When calculating the area of a fenestration product, the total area of the glass plus the framing shall be included on the CF-1R and the plans. If the window and skylight areas do not include the framing, the Plans Examiner shall request that the applicant resubmit the CF-1R with the correct window areas.

**U-factor and SHGC values for fenestration (*a window schedule required upon Plans Examiner's request*)**

Verification:

The Plans Examiner shall verify that the window U-factor and SHGC values identified under Fenestration Surfaces on the CF-1R match the window efficiency values specified on the Structure/Architecture plans. The U-factor and SHGC values of the windows may be specified in a note block on the Floor Plan or Cover Sheet, but a Plans Examiner has the discretion of requesting a Window Schedule detailing the U-factor and SHGC of each window to verify the windows were modeled correctly on the CF-1R.

Overview:

The efficiency of the windows in a building is measured by the U-factor and SHGC values. U-factor is a measure of heat flow, which is the heat that conducts through all parts of the windows. The SHGC is the Solar Heat Gain Coefficient and measures the radiant energy that passes through the glass. In both cases the lower the number, the better.

For example, a window with a 0.35 U-factor and 0.35 SHGC is significantly more efficient than a window with a 0.98 U-factor and 0.98 SHGC. If we used the windows with these higher values the building would absorb more heat and would require a larger air conditioning system to cool the building down. Lower efficient windows with larger HVAC equipment equals higher energy use.

*NFRC and Default Values*

How the window efficiency values (U-factor and SHGC) were determined shall be identified on the CF-1R. The applicant shall list NFRC as the "source" of the window efficiencies when the U-Factor and SHGC values come from an NFRC Label Certificate. For fenestration products that are not NFRC Rated, the default U-factor and SHGC values from Standards Table 116-A and Table 116-B (on the next page) shall be used to determine the efficiency values. When the U-Factor and SHGC values come from the default tables in §116, the applicant shall list CEC as the "source" of the window efficiencies.

Standards Table 116-A

FRAME	PRODUCT TYPE	SINGLE PANE U-FACTOR	DOUBLE PANE <sup>1</sup> U-FACTOR	GLASS BLOCK <sup>2</sup> U-FACTOR
Metal	Operable	1.28	0.79	0.87
	Fixed	1.19	0.71	0.72
	Greenhouse/garden window	2.26	1.40	N.A.
	Doors	1.25	0.77	N.A.
	Skylight	1.98	1.30	N.A.
Metal, Thermal Break	Operable	N.A.	0.66	N.A.
	Fixed	N.A.	0.55	N.A.
	Greenhouse/garden window	N.A.	1.12	N.A.
	Doors	N.A.	0.59	N.A.
	Skylight	N.A.	1.11	N.A.
Nonmetal	Operable	0.99	0.58	0.60
	Fixed	1.04	0.55	0.57
	Doors	0.99	0.53	N.A.
	Greenhouse/garden windows	1.94	1.06	N.A.
	Skylight	1.47	0.84	N.A.

1. For all dual-glazed fenestration products, adjust the listed U-factors as follows:  
a. Add 0.05 for products with dividers between panes if spacer is less than 7/16 inch wide.  
b. Add 0.05 to any product with true divided lite (dividers through the panes).  
2. Translucent or transparent panels shall use glass block values.

Standards Table 116-B

FRAME TYPE	PRODUCT	GLAZING	TOTAL WINDOW SHGC		
			Single Pane	Double Pane	Glass Block <sup>1</sup>
Metal	Operable	Clear	0.80	0.70	0.70
	Fixed	Clear	0.83	0.73	0.73
	Operable	Tinted	0.67	0.59	N.A.
	Fixed	Tinted	0.68	0.60	N.A.
Metal, Thermal Break	Operable	Clear	N.A.	0.63	N.A.
	Fixed	Clear	N.A.	0.69	N.A.
	Operable	Tinted	N.A.	0.53	N.A.
	Fixed	Tinted	N.A.	0.57	N.A.
Nonmetal	Operable	Clear	0.74	0.65	0.70
	Fixed	Clear	0.76	0.67	0.67
	Operable	Tinted	0.60	0.53	N.A.
	Fixed	Tinted	0.63	0.55	N.A.

1. Translucent or transparent panels shall use glass block values.



## **Exterior shading (i.e. overhangs, fins, exterior shades)**

### Verification:

The Plans Examiner shall verify that the exterior shading devices for windows identified under Interior and Exterior Shading on the CF-1R match the exterior shading devices specified on the Structure/Architecture plans. The Plans Examiner shall verify that the exterior shading devices and dimensions for each device with a length extending beyond 4 feet identified on the CF-1R Form are specified in a note block or window schedule on the Structure/Architecture plans.

### Overview:

Shading devices will help block the solar heat gain through the windows, but the shading needs to be large enough to be effective. Building plans should indicate that exterior shades must be permanently attached to the outside of the residence. Operable shading devices, such as shutters, may be used as long as they are permanently attached to the building. Lump sum window areas per orientation shall not be modeled with overhangs, awnings, and fins.

### *Overhangs*

For overhangs with a length extending beyond 4 feet, the Plans Examiner shall verify that the values of the following dimensions from the CF-1R Form match the window schedule on the plans:

- 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.

*(See Overhang Graphic on the next page)*

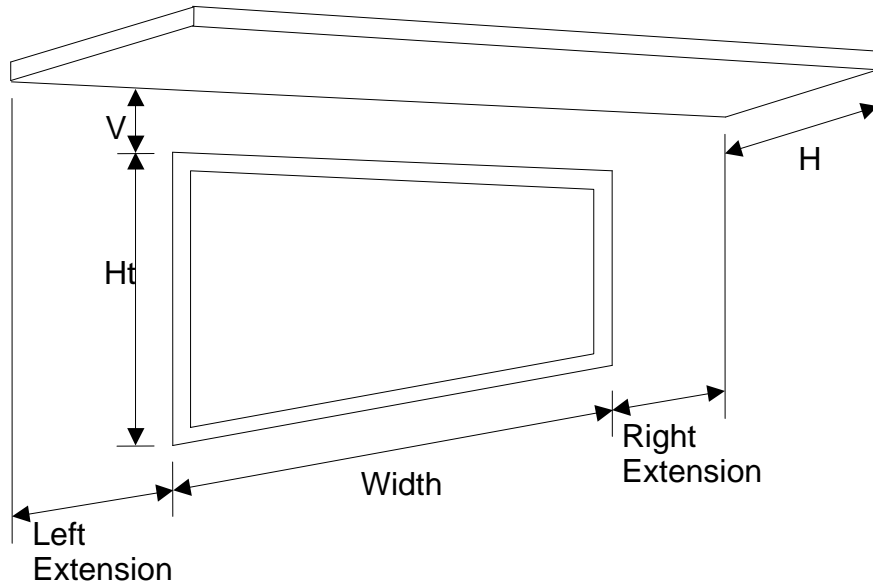
### *Fins*

For fins with a length extending beyond 4 feet, the Plans Examiner shall verify that the values of the following dimensions from the CF-1R Form match the window schedule on the plans:

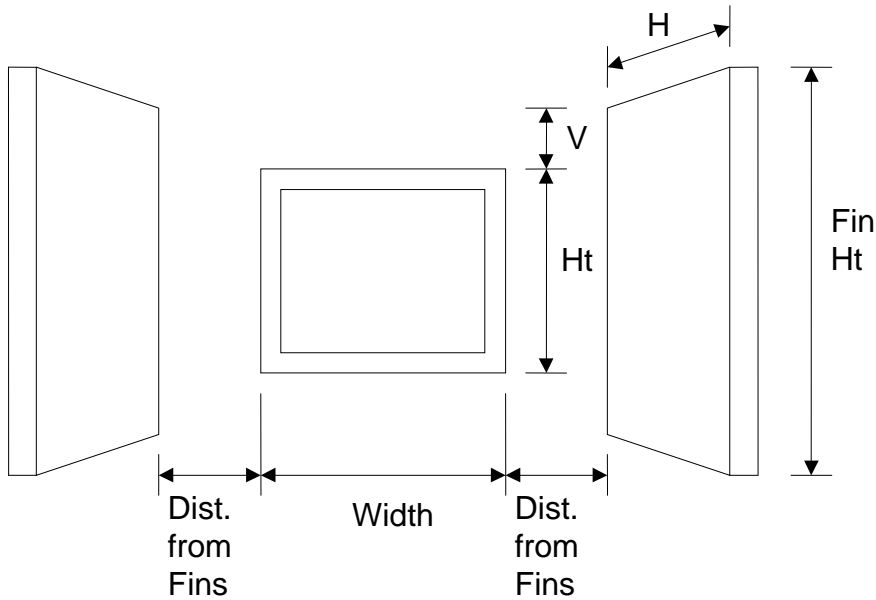
- Distance – distance from the side of the window to the fin.
- Length – distance the fin extends out from the window.
- Height – how tall the fin is.

*(See Fin Graphic on the next page)*

*Overhang Graphic*



*Fin Graphic*



**HVAC**

**Efficiencies of HVAC equipment**

Verification:

The Plans Examiner shall verify that the HVAC equipment efficiencies identified under HVAC Systems on the CF-1R match the HVAC efficiencies specified in either a note block or mechanical schedule on the Building Plans. If the equipment meets the minimum efficiency requirements (i.e. 78% AFUE furnace and 13 SEER A/C) then the

HVAC equipment efficiencies should be specified on the plans. When higher efficient equipment is modeled on the CF-1R, the Plans Examiner should “highlight” the higher HVAC values with a stamp or note block on the Cover Sheet to inform the inspector that higher HVAC efficiency values shall be verified in the field.

*NOTE:* When the EER is modeled on the CF-1R for the A/C equipment, the EER value shall also be specified on the plans along with the SEER efficiency.

## **Duct Insulation**

### Verification:

The Plans Examiner shall verify that the duct insulation values for each HVAC system identified under HVAC Distribution on the CF-1R Form match the duct insulation values specified in either a note block or mechanical schedule on the Building Plans. The ducts shall be insulated with a minimum of R-4.2 duct insulation. When higher duct insulation values (above R-4.2) are identified on the CF-1R, the Plans Examiner should “highlight” the higher duct insulation values with a stamp or note block on the Cover Sheet to inform the inspector that higher duct insulation values shall be verified in the field.

*NOTE:* The duct insulation requirements apply to ducts in unconditioned space.

### Overview:

All air-distribution system ducts and plenums, including, but not limited to, mechanical closets and air-handler boxes, shall be installed, sealed and insulated to meet the requirements of the CMC Sections 601, 602, 603, 604, 605 and Standard 6-5. Portions of supply-air and return-air ducts and plenums shall either be insulated to a minimum installed level of R-4.2 (or any higher level required by CMC Section 605) or be enclosed entirely in conditioned space. Connections of metal ducts and the inner core of flexible ducts shall be mechanically fastened. Openings shall be sealed with mastic, tape, or other duct-closure system that meets the applicable requirements of UL 181, UL 181A or UL 181B or aerosol sealant that meets the requirements of UL 723. If mastic or tape is used to seal openings greater than 1/4 inch, the combination of mastic and either mesh or tape shall be used.

Building cavities, support platforms for air handlers, and plenums defined or constructed with materials other than sealed sheet metal, duct board or flexible duct shall not be used for conveying conditioned air. Building cavities and support platforms may contain ducts. Ducts installed in cavities and support platforms shall not be compressed to cause reductions in the cross-sectional area of the ducts.

*NOTE:* These requirements do not apply to ducts and fans integral to a wood heater or fireplace.

## **Indoor Air Quality and Mechanical Ventilation (*Mandatory Measures*)**

Starting with the 2008 Building Energy Standards, the Mandatory Measures require that all newly constructed low-rise residential buildings meet the requirements of

ANSI/ASHRAE Standard 62.2 for Indoor Air Quality and Mechanical Ventilation. This is a health and safety measure developed by ASHRAE to ensure that dwelling units obtain acceptable indoor air quality.

ASHRAE Standard 62.2 specifies two mechanical ventilation requirements: Local Exhaust and Whole-Building Ventilation. ASHRAE Standard 62.2 provides a couple of approaches to meet these two requirements, but this Guide will only discuss the simplified Prescriptive Approach for meeting the Local Exhaust and Whole-Building Ventilation requirements. When the Prescriptive Approach described below is not used to meet ASHRAE Standard 62.2, the Plans Examiner may refer to Section 4.6 of the 2008 Residential Compliance Manual, or visit the ASHRAE website at:

<http://www.ashrae.org/> to verify compliance.

### *Local Exhaust Ventilation*

#### Bathrooms

A bathroom is defined as any room containing a bathtub, a shower, a spa, or similar source of moisture. Each bathroom is required to have an exhaust fan ducted to the outside with a minimum ventilation rate of 50 cfm. The ducting for the exhaust fan shall be sized according to ASHRAE Standard 62.2 Table 7.1 (see *ASHRAE Standard Table 62.2 Table 7.1* on page 15). Depending on the type of ducting and the cfm of the exhaust fan, Table 7.1 is used to size the diameter of the duct and determine the maximum length in feet of the duct. Using Table 7.1 is the Prescriptive Approach for duct sizing to ensure that the fan will provide the minimum ventilation rate required. These local exhaust fans may operate continuously or intermittently. Installing these local exhaust fans in each bathroom will allow the home occupant to regulate the indoor air quality when needed.

The Plans Examiner shall verify a note block on the plans that identifies each bathroom has an exhaust fan that provides a minimum ventilation rate of 50 cfm, with a duct diameter and maximum duct length according to Table 7.1 similar to the note block on the next page:

#### **Local Ventilation Rate Summary**

Enter the required fan flow rate (cfm).

Bathroom Fan Flow (cfm) = \_\_\_\_\_ ( # of Bathrooms \_\_\_\_\_ )

Use the fan flow rate from this summary for selection of the local ventilation fan and for the duct design for the local ventilation system from Table 7.1.

Duct Size (in) = \_\_\_\_\_

Maximum Allowable Duct Length (ft) = \_\_\_\_\_

### Kitchens

A kitchen is defined as any room containing cooking appliances. Each kitchen is required to have an exhaust fan ducted to the outside with a minimum ventilation rate of 100 cfm. The range hood over the stove may be used to meet this requirement, but the range hood must vent to the outside; re-circulating range hoods cannot be used. The ducting for the exhaust fan shall be sized according to ASHRAE Standard 62.2 Table 7.1 as described above. This local exhaust fan may operate continuously or intermittently. Installing this local exhaust fan in the kitchen will allow the home occupant to regulate the indoor air quality when needed.

The Plans Examiner shall verify a note block on the plans that identifies each kitchen has an exhaust fan that provides a minimum ventilation rate of 100 cfm, with a duct diameter and maximum duct length according to Table 7.1 similar to the note block provided below:

<p><b>Local Ventilation Rate Summary</b> Enter the required fan flow rate (cfm).</p> <p><input type="checkbox"/> Kitchen Fan Flow (cfm) = _____ (# of kitchens _____ )</p> <p>Use the fan flow rate from this summary for selection of the local ventilation fan and for the duct design for the local ventilation system from Table 7.1.</p> <p><input type="checkbox"/> Duct Size (in) = _____</p> <p><input type="checkbox"/> Maximum Allowable Duct Length (ft) = _____</p>
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### Sound Rating

Majority of the local exhaust fans will operate intermittently, and are required to be rated for sound at a maximum of 3 sone, unless their maximum rated airflow exceeds 400 cfm (200 L/s).

### *Whole-Building Ventilation*

In addition to the local exhaust fans in the bathrooms and kitchens, an exhaust fan shall be sized to provide ventilation for the whole house. The minimum ventilation rate for the whole-building exhaust fan shall be calculated according to ASHRAE Standard 62.2 Equation 4.1(a) (below). The conditioned floor area and the number of bedrooms in the home will determine the minimum ventilation rate. One of the local exhaust fans in the bathrooms or kitchens may be used to meet the whole-building ventilation, provided the exhaust fan meets the minimum ventilation rates for both the Local Exhaust and Whole-Building Ventilation requirements. The ducting for the whole-building exhaust fan shall be sized according to ASHRAE Standard 62.2 Table 7.1 as described above (see *Local Exhaust Ventilation on page 12*), and this exhaust fan shall operate continuously.

The Plans Examiner shall verify a note block on the plans identifying a whole-building exhaust fan that provides a minimum ventilation rate according to Equation 4.1(a) below, with a duct diameter and maximum duct length according to Table 7.1 similar to the note block provided below:

**Whole-Building Ventilation Rate Summary**

Enter the required fan flow rate (cfm).

Continuous Fan Flow (cfm) = \_\_\_\_\_

Use the fan flow rate from this summary for selection of the whole-building ventilation fan and for the duct design for the whole-building ventilation system from Table 7.1.

Duct Size (in) = \_\_\_\_\_

Maximum Allowable Duct Length (ft) = \_\_\_\_\_

*ASHRAE Standard 62.2 Equation 4.1(a)*

The whole-building exhaust fan shall provide a minimum ventilation rate according to Equation 4.1(a) below:

$$Q_{fan} = 0.01A_{floor} + 7.5(N_{br} + 1)$$

Where:

$Q_{fan}$  = fan flow rate, (cfm)

$A_{floor}$  = conditioned floor area, ft<sup>2</sup>

$N_{br}$  = number of bedrooms; not to be less than one

Here (on the next page) is an example of how to complete the equation for a 2,500 ft<sup>2</sup> house with 5 bedrooms:

$$Q_{fan} = 0.01(2,500 \text{ ft}) + 7.5(5 + 1)$$

$$Q_{fan} = 25 + 7.5(6)$$

$$Q_{fan} = 25 + 45$$

$$Q_{fan} = 70 \text{ cfm}$$

**NOTE:** This equation should be included on the plans along with the whole-building ventilation note block above.

Sound Rating and Continuous Operation

The whole-building ventilation exhaust fan will operate continuously, and is required to be rated for sound at a maximum of 1 sone. This exhaust fan can be controlled by a standard on/off switch, but the switch must be labeled to inform the occupant that the exhaust fan is the whole-building ventilation exhaust fan and is intended to operate continuously. No specific wording is mandated, but the wording needs to make clear

what the control is for and the importance of operating the system. This may be as simple as “Ventilation Control” or might include wording such as: “Operate when the house is in use” or “Keep on except when gone over 7 days” or “Fan is to be left on to ensure indoor air quality.”

*ASHRAE Standard 62.2 Table 7.1*

Table 7.1 Prescriptive Duct Sizing Requirements								
Diameter, (in)	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

**Water Heating**

**Efficiency and Type of Water Heating/Boiler equipment (i.e. storage, instantaneous, etc.)**

Verification:

The Plans Examiner shall verify that the efficiency and type of water heating/boiler equipment identified under Water Heating Systems on the CF-1R Form match the efficiencies and water heater type specified in either a note block or mechanical/water heating schedule on the Building Plans. If a storage water heater with an Energy Factor below 0.58 is identified on the CF-1R, the Plans Examiner shall verify that an external insulation blanket of R-12 or greater is specified on the CF-1R and the plans. When a higher efficiency storage water heater (an Energy Factor greater than 0.58) is identified on the CF-1R, the Plans Examiner should “highlight” the higher Energy Factor of the water heater with a stamp or note block on the Cover Sheet to inform the inspector that a higher Energy Factor efficiency value shall be verified in the field.

Overview:

The majority of residential homes install small storage water heaters (input equal to or less than 75,000 btu/hr). The following information shall be verified on the CF-1R and specified on the plans for small water heaters:

- Energy Factor
- Tank Volume (gallons)
- Insulation blanket (if required as detailed above)

When a large storage gas water heater (input greater than 75,000 btu/hr) is identified on the CF-1R, the following information shall be verified and submitted on the plans for large water heaters:

- Thermal Efficiency
- Standby Loss
- Tank Volume (gallons)

#### *Non-Standard Water Heater*

When a water heater other than a storage water heater is identified on the CF-1R (i.e. instantaneous, boiler, heat pump, etc.), the Plans Examiner should “highlight” the non-standard storage type of water heater with a stamp or note block on the Cover Sheet to inform the inspector that a non-storage type of water heater shall be verified in the field.

#### **Distribution Type (i.e. recirculating, standard, pipe insulation credit, etc.)**

##### Verification:

The Plans Examiner shall verify that the distribution type (how the water is distributed from the water heater to the fixtures) of the water heater identified under Water Heating Systems on the CF-1R Form match the distribution type specified in either a note block or mechanical/water heating schedule on the Building Plans. A standard water heating distribution system will be identified as “Standard” or “No Pipe Insulation” on the CF-1R. When a non-standard water heating distribution system is identified on the CF-1R (i.e. recirculating, parallel piping, etc.) the Plans Examiner should “highlight” the non-standard water heating distribution system with a stamp or note block on the Cover Sheet to inform the inspector that a non-standard water heating distribution system shall be verified in the field.

##### Overview:

Majority of water heating systems provide hot water with a Standard distribution system (piping that draws water from the tank and takes it straight to the source of use, i.e. sink, shower, etc.). If the distribution system on the CF-1R is modeled as a Recirculating System or Compliance Credit is taken for the distribution system (Pipe Insulation, Point of Use, Parallel Piping, etc.) then the specifications of the distribution system and/or Compliance Credit shall be included in a note block or mechanical/water heating schedule on the plans. A listing of the distribution systems that may be modeled on the CF-1R for water heating may be found in Table 5-1 of the 2008 Residential Compliance Manual (on the next page).



*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 (*Mandatory Measures*)**

The Mandatory Measures require that the following piping shall be insulated to meet the insulation conductivity and minimum insulation thickness requirements listed in Standards Table 150-A and Table 150-B:

- First 5 feet of the hot and cold water lines from the storage tank (nonrecirculating systems)
- Recirculating sections
- Piping from the heating source to the storage tank (indirect-fired systems)

The Plans Examiner shall verify a note block on the plans along with the water heating specifications described above that identifies the pipe insulation and conductivity values similar to the note block provided on the next page:

## Pipe Insulation Summary

Pipes	Conductivity Range	Insulation Thickness (inches)
First 5 feet of cold and hot water from storage tank	0.24 – 0.28	1.0
Recirculating Sections	N/A	N/A
Piping from heating source to storage tanks (indirect-fired)	N/A	N/A
Kitchen Piping	0.24 – 0.28	1.5

### **Lighting**

**All lighting is high efficacy lighting (i.e. fluorescent, LED) or meets applicable alternatives (*Mandatory Measures*)**

High Efficacy Lighting:

LED lighting systems and GU-24 lamp holders can now be installed to meet the High Efficacy requirements under the following conditions:

- LED lighting systems must be tested by the manufacturer and certified to the Energy Commission, and meet the lamp efficacy values listed in Table 150-C (see *Table 150-C* below).

*Note: LED lighting which is not listed as high efficacy on the Energy Commission Appliance Efficiency Database shall be classified as low efficacy. The Database may be found on the Energy Commission's website at:*

<http://www.energy.ca.gov/appliances/database/index.html>

- GU-24 lamp holders must be rated for use only with high efficacy lamps or high efficacy LED lighting that meet the lamp efficacy values listed in Table 150-C.

### *2008 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
<p>Notes:</p> <ol style="list-style-type: none"> <li>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).</li> <li>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.</li> <li>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.</li> <li>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.</li> </ol>	

Verification:

ALL lighting in a residential building shall be high efficacy, or depending on the location of the lighting, be controlled by a dimmer switch or manual-on occupant sensor (occupant sensor). Majority of plans contain a key that identify high efficacy lighting with an “F” for Fluorescent, but now may include an “LED” or “GU-24”. The Plans Examiner shall verify that the Electrical Plans specify high efficacy lighting or identify the device controlling the lighting (dimmer switch, occupant sensor, etc.) to satisfy the applicable exception to the high efficacy requirements described below.

*Kitchen Lighting*

A minimum of 50% of the total rated wattage of permanently installed lighting in kitchens must be high efficacy. Lighting in areas adjacent to the kitchen, such as in dining and nook areas, is considered kitchen lighting if it is not separately switched from the kitchen lighting, and shall be considered when calculating the installed wattage of the kitchen lighting. If the plans specify that low efficacy lighting will be installed, the Plans Examiner shall verify the applicant has included the wattage of the proposed installed lighting in a note block or Lighting Schedule on the Electrical Plans that totals a minimum of 50% high efficacy wattage.

Lighting inside cabinets that has been installed only for the purpose of illuminating the inside of the cabinets is not considered kitchen lighting and will not be included when calculating the installed wattage of the kitchen lighting. However, the 2008 Standards do limit the installed wattage of internal cabinet lighting to 20 watts per linear foot of illuminated cabinets. If the plans specify internal cabinet lighting, the Plans Examiner shall verify the applicant has included the wattage of the proposed installed lighting in a note block or Lighting Schedule on the Electrical Plans that does not exceed 20 watts per linear foot similar to the note block below:

Internal Cabinet Lighting Schedule

FIXTURE DESCRIPTION	PROPOSED WATTS	LINEAR FEET	ALLOWED WATTS
<b>FLOUR. LTG. FIX</b>	<b>15</b>	<b>8 FEET</b>	<b>LINEAR FEET (FT) X 20 WATTS</b>
<b>FLOUR. LTG. FIX</b>	<b>12</b>		
<b>INCAN. LTG. FIX</b>	<b>40</b>		
<b>FLOUR. LTG. FIX</b>	<b>15</b>		
<b>INCAN. LTG. FIX</b>	<b>35</b>		
<b>INCAN. LTG. FIX</b>	<b>40</b>		
TOTAL:	157 WATTS	TOTAL:	160 WATTS

*Lighting in bathrooms, garages, laundry rooms, closets, and utility rooms*

Lighting in these areas must be high efficacy luminaires, but low efficacy luminaires are allowed if they are controlled by a manual-on occupant sensor. Low-efficacy lighting in these areas shall be specified on the plans, usually with a symbol from a Key, or included in a Lighting Schedule identifying the lighting to be installed with a manual-on occupant sensor on the Electrical Plans.

*Lighting in other areas of the house (Hallways, living room, bedrooms, etc.)*

Lighting in these areas must be high efficacy, but low efficacy luminaires are allowed if they are controlled by either a dimmer switch or a manual-on occupant sensor. Again, Low-efficacy lighting in these areas shall be specified on the plans, usually with a symbol from a Key, or included in a Lighting Schedule identifying the lighting to be installed with a manual-on occupant sensor or dimmer on the Electrical Plans.

*NOTE:* Closets less than 70 square feet are not required to be controlled by a manual-on occupant sensor, a dimmer, or to be high efficacy.

*Switching*

The Plans Examiner shall verify that the new switching requirements for the 2008 Standards are specified on the Electrical Plans:

- All permanently installed high efficacy luminaires shall be switched separately from low efficacy luminaires; and
- Exhaust fans shall be switched separately from lighting system(s).

*Outdoor Lighting*

The Plans Examiner shall verify that all permanently installed outdoor lighting (mounted/attached to the building) is specified as high efficacy on the Electrical Plans in the same manner as indoor lighting (symbols from a Key or a Lighting Schedule). Low efficacy lighting is allowed, but only when fixtures are controlled by:

- A motion sensor; and
- One of the following controls:
  - a. A photo-control; or
  - b. An astronomical time clock; or
  - c. An energy management control system (EMCS)

Low-efficacy outdoor lighting shall be specified on the plans, usually with a symbol from a Key, or included in a Lighting Schedule identifying that the lighting will be installed with a motion sensor and one of the controls listed above on the Electrical Plans.

*Swimming Pool Lighting*

Permanently installed luminaires in or around swimming pools, water features, or other locations subject to Article 680 of the California Electric Code are exempt from the high efficacy requirements and can be low-efficacy luminaires.

**ALL Special Features are verified on the plans and highlighted for the Inspector?  
(i.e. Thermal Mass, Radiant Barrier, Cool Roof)**

Items listed in the Special Features section (i.e. Radiant Barrier, Cool Roof, Hydronic Heating, Air-retarding wrap, etc.) indicate that unusual features or assumptions are used for compliance. That is, the designer is seeking performance credit for these features and they call for special care by the local building department. A Special Feature will have specific installation criteria for that building component. When any Special Feature is listed on the CF-1R the installation criteria for that feature shall be

specified on the plans in a note block and be highlighted to inform the Inspector of the Special feature to be verified in the field.

For example, when a Cool Roof is included under the Special Features listing, the applicant shall include a note block on the Structure/Architecture plans that specifies a Cool Roof material with the solar reflectance and thermal emittance values listed on the CF-1R will be installed as part of the roofing assembly. The note block may look similar to the note block provided here:

A "Cool Roof" material shall be installed that is certified to the Cool Roof Rating Council (CRRC) with an Aged Solar Reflectance of 0.30 and a Thermal Emittance of 0.75.

Another example, when a Radiant Barrier is included under the Special Features listing, the applicant shall include a note block on the Structure/Architecture plans that specifies a Radiant Barrier with a thermal emittance of 0.05 or less will be installed as part of the roofing assembly. The note block may look similar to the note block provided here:

A radiant barrier shall be installed with an emittance of 0.05 or less, tested in accordance with ASTM C1371 or ASTM E408 and certified to the Department of Consumer Affairs as required by Title 24, Part 12, Chapter 12-13, Standards for Insulating Material and shall meet the installation criteria specified in Reference Residential Appendix RA4.

### *Frequently Modeled Special Features*

#### Thermal Mass

Thermal mass consists of exposed tile floors over concrete, mass walls such as stone or brick, and other heavy elements within the building envelope that serve to stabilize indoor temperatures. Thermal mass tends to keep things warmer when it is cold outside and keep things cooler when it is hot outside. In order to be considered thermal mass, concrete can only be covered by tile, solid wood or vinyl flooring. Areas covered by carpet, cabinets, closets or walls cannot be used for thermal mass credit. If the CF-1R shows more than 50% exposed slab for the first floor then the Plans Examiner needs to verify the claimed exposed area on the plans and that this area on the plans lists the material to be installed on the slab. Usually thermal mass cannot be claimed for a second story. More information can be found in Section 3.4 of the 2008 Residential Compliance Manual.

#### Exterior Shades

Exterior shades must be permanently attached to the outside of the residence with fasteners that require additional tools to remove (as opposed to clips, hooks, latches, snaps, or ties). Operable shading devices such as shutters may be used as long as they are permanently attached to the building. Exterior shades on windows or skylights that are prohibited by life-safety codes from being permanently attached for emergency egress reasons are exempt from this requirement.

### Combined Hydronic System

Combined hydronic heating refers to the use of a single water heating device as the heat source for both space heating and domestic hot water heating. There are two types of combined hydronic systems. One uses a boiler as a heat source for the hydronic space heating system. The boiler also heats domestic water by circulating hot water through a heat exchanger in an indirect-fired water heater.

The other type uses a water heater as a heat source. The water heater provides domestic hot water as usual. Space heating is accomplished by circulating water from the water heater through the space heating delivery system. Sometimes a heat exchanger is used to isolate potable water from the water circulated through the delivery system. Some water heaters have built-in heat exchangers for this purpose.

### *Solar Reflectance and Thermal Emittance – §118(i)*

When a Cool Roof is included under the Special Features listing, the Mandatory Measures require that all roofing products installed as a Cool Roof shall be certified to the Cool Roof Rating Council (CRRC). Roofing products that are not certified to the CRRC cannot be installed to meet the Cool Roof requirements. Certified roofing products can be found on the CRRC website at: <http://www.coolroofs.org/>

The Mandatory Measures also mandate how the applicant shall determine the Solar Reflectance and Thermal Emittance of the roofing product to meet the Cool Roof Requirements. The efficiency values of the roofing product shall be determined by one of the following methods:

- The roofing product is certified to the CRRC with a 3-year aged solar reflectance and thermal emittance values.
- The roofing product is certified to the CRRC with an initial solar reflectance and thermal emittance values. The applicant shall input the initial solar reflectance into the equation  $R_{\text{aged}}$  below to calculate the aged solar reflectance:

$$R_{\text{aged}} = 0.2 + 0.7(\text{initial solar reflectance} - 0.2)$$

Here is an example of how to calculate the aged solar reflectance for a CRRC certified roofing product with an initial solar reflectance of 0.77:

$$R_{\text{aged}} = 0.2 + 0.7(0.77 - 0.2)$$

$$R_{\text{aged}} = 0.2 + 0.7(0.57)$$

$$R_{\text{aged}} = 0.2 + 0.40$$

$$R_{\text{aged}} = 0.60$$

- The roofing product is certified to the CRRC with a 3-year aged solar reflectance and thermal emittance values, but these values do not meet the Prescriptive requirements of §151(f)12. As an alternative, the applicant may input the 3-year aged solar reflectance and thermal emittance into the Solar Reflectance Index (SRI) calculator to meet the SRI requirements of §151(f)12. The SRI calculator

can be downloaded from the Energy Commission website at:  
<http://www.energy.ca.gov/title24/>

*Table RC-1*

The Special Features you may see on the Performance CF-1R may be found in Table RC-1 of the 2008 Residential ACM Manual (below). The Plans Examiner can contact the Energy Standards Hotline when questions arise regarding a Special feature at: 1-800-772-3300.

Table RC-1 – Required descriptors and References for Special Features

<i>Measure</i>	<i>Required Description</i>
Housewrap/ Air -retarding wrap	This building incorporates an air retarding wrap which shall be installed to meet the requirements of Section 150 (f) of the Standards.
Multiple conditioned zones	This building uses multiple conditioned zones. The non-closable area between zones cannot exceed 40 ft <sup>2</sup> and each zone must be controlled with a separate thermostat. In addition the air flow requirements and fan watt draw requirements in Reference Residential Appendix RA3.3 must be met.
Sunspace attached to building	This building has an attached sunspace with interzone surfaces, custom solar heat gain distribution and sunspace thermal mass elements.
Non-standard free ventilation area	Standard free ventilation area is 10% of rough-out opening of all fenestration.
All orientations	When all orientations are specified, see section 151(c)2 of the Standards and section RA1.3.2 in Reference Residential Appendix RA1 .
High mass building features	High-mass building features are described in the THERMAL MASS FOR HIGH MASS DESIGN table of compliance form CF-1R.
Gas Absorption equipment	Minimum efficiency for Gas Absorption equipment is specified in Table 112-D in Subchapter 2 of the 2008 Building Energy Efficiency Standards.
Cool Roofing products installed	Cool roof products installed on this building qualifying for compliance with Sections 151(f)12 or 152(b)1H shall be rated and labeled by the Cool Roof Rating Council in accordance with Section 10-113 of the Standards.
Radiant Barriers installed	The radiant barriers installed in this building shall meet eligibility and installation criteria as specified in Reference Residential Appendix RA4.2.2.
Non-standard Ventilation Height Difference	Non-standard ventilation height difference must be verified according to the rules in 2008 Residential ACM Manual Chapter 3 under Building Zone Information.

Hydronic heating system	Table R3-50 specifies default assumptions for hydronic systems for existing buildings. System details are in the SPECIAL SYSTEMS - HYDRONIC DISTRIBUTION SYSTEMS AND TERMINALS table of compliance form CF-1R.
Reduced infiltration and/or Mechanical ventilation	This building is modeled with reduced infiltration and/or mechanical ventilation. Consequently the homeowner's manual provided by the builder to the homeowner shall include operating instructions for the homeowner on how to use operable windows and/or mechanical ventilation to achieve adequate ventilation. Testing for reduced infiltration shall be performed as specified in ASTM E 779-03. This listing shall also report the target CFM50 <sub>H</sub> required for the blower door test to achieve the modeled SLA and the minimum CFM50 <sub>H</sub> (corresponding to an SLA of 1.5) allowed to avoid backdraft problems.
Metal-framed walls <construction type>	This building uses metal-framed walls that shall meet mandatory insulation requirements. In many cases sheathing insulation is used in addition to cavity insulation. Metal-framed walls shall be built according to the details in Reference Joint Appendix JA4 for this construction type.
Non-NAECA large storage gas water heater	A non-NAECA large storage gas water heater is specified for this building. System specifications are shown in the SPECIAL WATER HEATER/BOILER DETAILS table of compliance form CF-1R.
Water heating system does not have a single separate water heater serving each dwelling unit	Water heating system specifications are in the SPECIAL WATER HEATER/BOILER DETAILS table of compliance form CF-1R.
Controlled-ventilation Crawlspace	Controlled-ventilation Crawlspace is to be constructed in accordance with the alternative to section 150(d) of the Standards and Section 3.5.4 of the 2008 Residential ACM Manual.
Solar thermal water heating	Solar Savings Fraction (SF) for solar thermal water heating is calculated from the equations in Section RG3.4 of the 2008 Residential ACM Manual Appendix RG. See also Section 5.13 of the 2008 Residential ACM Manual.

**ALL HERS Measures are verified on the plans and highlighted for the Inspector?**

**[i.e. Duct Leakage, Refrigerant charge, Airflow (Fan Flow) and Watt Draw]**

There are a few HERS Measures that may be modeled in an approved compliance software program for compliance credit (Duct Sealing, Refrigerant Charge, Quality Installation of Insulation (QII), etc.). If the HERS Measures section on the CF-1R lists any HERS Measures, then the Plans Examiner shall verify that the listed HERS Measure(s) is specified on the plans. The Plans Examiner may use a red stamp or require that the applicant provide a note block on the Cover Sheet to inform the



inspector that HERS verification is required, and a CF-4R Form shall be collected during the Final Inspection.

Items listed in the HERS Required Verification section identify features that rely on diagnostic testing and independent verification by certified HERS raters to ensure proper field installation. For this reason, it is important that the Plans Examiner make special note of all of these measures on the plans (highlight, circle in red pen, use a stamp, etc.) to alert the Building Inspector that a completed CF-4R Form shall be submitted before the Final Inspection is complete.

#### *HERS Providers*

Diagnostic testing and verification by a certified HERS Rater is in addition to local building department inspections. A listing of certified HERS raters may be found on the HERS provider website at: <http://www.energy.ca.gov/HERS/>

#### *Table RA2-1*

The HERS Measures you may see on the Performance CF-1R may be found in Table RA2-1 (on the next page) of the 2008 Reference Residential Appendices. The Plans Examiner can contact the Energy Standards Hotline when questions arise regarding a HERS Measure at: 1-800-772-3300.

Measure Title	Description	Protocol or Test Procedure
<b>Duct Measures</b>		
Duct Sealing	Component Packages require that space conditioning ducts be sealed. If sealed and tested ducts are claimed for compliance, field verification and diagnostic testing is required to verify that approved duct system materials are utilized, and that duct leakage meets the specified criteria	Reference Residential Appendix RA3.1
Supply Duct Location, Surface Area and R-value	Compliance credit can be taken for improved supply duct location, surface area and R-value. Field verification is required to verify that the duct system was installed according to the design, including location, size and length of ducts, duct insulation R-value and installation of buried ducts. <sup>1</sup> The system must also meet the Verified Prescriptive Cooling Coil Airflow requirement. For buried ducts measures, Duct Sealing and High Quality Insulation Installation is required.	Reference Residential Appendix RA3.1
Low Leakage Ducts in Conditioned Space	Compliance credit can be taken for verified duct systems that have air leakage to outside conditions equal to or less than 25 cfm when measured in accordance with Reference Residential Appendix Section RA3.1.4.3.9. Field Verification for ducts in conditioned space is required. Duct sealing is required.	Reference Residential Appendix RA3.1
Low Leakage Air Handlers	Compliance credit can be taken for installation of a factory sealed air handler unit tested by the manufacturer and certified to the Commission to have achieved a 2 percent or less leakage rate. Field verification of the air handler's model number is required. Duct Sealing is required.	Reference Residential Appendix RA3.1
<b>Air Conditioning Measures</b>		
Improved Refrigerant Charge	Component Packages require in some climate zones that split system air conditioners and heat pumps be diagnostically tested in the field to verify that the system has the correct refrigerant charge. For the performance method, the Proposed Design is modeled with less efficiency if diagnostic testing and field verification is not performed. The system must also meet the prerequisite minimum Cooling Coil Airflow requirement.	Reference Residential Appendix RA3.2
Installation of Charge Indicator Display	Component Packages specify that a Charge Indicator Display can be installed as an alternative to refrigerant charge testing. The existence of a Charge Indicator Display has the same calculated benefit as refrigerant charge testing. Field verification is required.	Reference Residential Appendix RA3.4
Verified Cooling Coil Airflow	Compliance credit can be taken when airflow is higher than the criteria specified. Field verification and diagnostic testing is required.	Reference Residential Appendix RA3.3
Air Handler Fan Watt Draw	Compliance credit can be taken for reductions in fan power. Diagnostic testing and field verification is required. The system must also meet the Verified Prescriptive Cooling Coil Airflow requirement.	Reference Residential Appendix RA3.3
High Energy Efficiency Ratio (EER)	Compliance credit can be taken for increased EER by installation of specific air conditioner or heat pump models. Field verification is required. <sup>2</sup>	Reference Residential Appendix RA3.4
Maximum Rated Total Cooling Capacity	The calculations for determining Maximum Rated Total Cooling Capacity need not be field verified, but the prerequisites to taking the credit – Prescriptive Cooling Coil Airflow, duct sealing, and EER – must be field verified and diagnostically tested.	Reference Residential Appendix RA3.1, RA3.3, RA3.4
Evaporatively Cooled Condensers	Compliance credit can be taken for installation of evaporatively cooled condensers. Duct Sealing is required. Field verification is required.	Reference Residential Appendices RA3.1, RA3.4, RA4.3.2
Ice Storage Air Conditioners	Compliance Credit can be taken for installation of distributed energy storage equipment. Duct sealing is required. Field verification is required	Reference Residential Appendices RA3.1, RA3.4, RA4.3.1
<b>Building Envelope Measures</b>		
Building Envelope Sealing	The default building envelope Specific Leakage Area (SLA) is specified in Residential ACM Manual Section 3.3.3. Compliance credit can be taken for improved building envelope sealing. Field verification and diagnostic testing is required to confirm reduced infiltration.	ASTM E779-03
High Quality Insulation Installation	Compliance Software recognizes standard and improved envelope construction. Compliance credit can be taken for quality installation of insulation. Field verification is required.	Reference Residential Appendix RA3.5

Measure Title	Description	Protocol or Test Procedure
Quality Insulation Installation for Spray Polyurethane Foam	Closed-cell spray polyurethane foam insulation must be installed pursuant to the procedures of JA7. If the installation pursuant to JA7 is certified by a HERS rater, a compliance credit can be taken.	Reference Joint Appendix JA7
<b>Solar Measures</b>		
PV Field Verification Protocol	To receive rebates for photovoltaic installations pursuant to the New Solar Home Partnership, the output of the installed system must be measured and shown to comply with the output specified on the rebate application (taking into account variables such as the solar insolation, the time, and the temperature).	Reference Residential Appendix RA3.6
<p>1. Note: Compliance credit for increased duct insulation R-value (not buried ducts) may be taken without field verification if the R-value is the same throughout the building, and for supply ducts located in crawlspaces and garages where all supply registers are either in the floor or within 2 feet of the floor. These two credits may be taken subject only to enforcement agency inspection.</p> <p>2. Note: The requirement for verification of a high EER does not apply to equipment rated only with an EER.</p>		