

Chapter 3 Prescriptive Packages

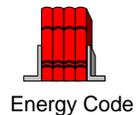
3.0 SUMMARY

This chapter details the use of the *Prescriptive Packages* (referred to as *Alternative Component Packages*) to show compliance with the *Energy Efficiency Standards* (standards). The prescriptive approach is one of the paths available for compliance. The other approach, the computer method, is a performance approach and is explained in Chapters 4 and 5.

The introductory Part 3.1 defines the structure of the prescriptive packages and how they are used for compliance. Part 3.2 explains how each package component is applied to the building design. Part 3.3, on compliance documentation, explains the type of forms submitted with this approach. A listing of all package requirements in each climate zone is included at the end of the chapter (Tables No. 1-Z1 through Z16 in Part 3.4).

Additions to existing buildings demonstrating compliance with the prescriptive package approach are discussed in Chapter 7.

3.1 INTRODUCTION



Prescriptive Standards/
Alternative Component Packages
(Section 151(f))

Buildings that comply with the prescriptive standards shall be designed, constructed and equipped to meet all of the requirements of one of the alternative packages of components shown in Tables No. 1-Z1 through 1-Z16 for the appropriate climate zone shown in Figure No. 1-A [see Chapter 1, Figure 1-1]. Installed components shall meet the following requirements:

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Applicable sections of California Code of Regulations, Title 24, Part 6: Sections 101(b), 150(f), 151(b), 151(e), 151(f), and Tables No. 1-Z1 through 1-Z16.

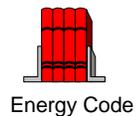


Compliance/
Plan Check

Prescriptive Standards

You can comply with the standards by installing a package of building conservation components and measures making up an *Alternative Component Package*. In this *prescriptive approach*, a building is shown to meet pre-defined levels of various building conservation features. Each measure in the package must be installed in the building to meet or exceed a minimum conservation level.

The packages are the simplest and least flexible compliance path. The only choice involved in the prescriptive approach is the selection of which package to use within the designated climate zone. Each package is generally described by the conservation strategy it emphasizes.



Prescriptive Packages (Section 151(f), footnote 1 to Tables No. 1-Z1 through 1-Z16)

Package A is a passive solar design requiring a significant amount of south facing glazing, a small amount of non-south facing glazing, and a large area of thermal mass. Package B allows a small area of glazing, with light and heavy mass wall alternatives; some zones require continuous infiltration barriers and air-to-air heat exchangers. Package C is the only package that allows electric resistance space heating. Package C may be used only if the building is in an area (1) where natural gas is not currently available and (2) where extension of natural gas service is impractical, as determined by the natural gas utility. Package D allows more glazing area in some zones with moderately high insulation levels; slab edge insulation is required in climate zone 16.



Prescriptive Packages

Package A employs a passive solar strategy requiring a significant amount of south glass, a small amount of nonsouth glass and a large area of exposed thermal mass. It is also characterized by moderate insulation levels and shading in several climate zones.

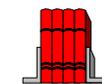
Package B was originally designed as a package that would not require minimum amounts of thermal mass. It allows a fairly small area of fenestration and requires shading in some climate zones. Most climate zones require R-19 wall insulation. Light mass and heavy mass wall R-value requirements are available as alternatives to the frame wall insulation requirements. Continuous infiltration barriers and air-to-air heat exchangers are also required in Climate Zones 1, 14, 15 and 16.

Package C is the only package that allows electric-resistance space heating. The package may be used *only* where natural gas is not available and where the natural gas utility has determined that providing natural gas service is impractical. It requires very high insulation levels and other features to offset the inefficiency of the electric-resistance space heating. Among its other features are high performance fenestration products with maximum U-values of either 0.50 or 0.40, plus additional shading. Electric-resistance water heating may be used in conjunction with a solar water-heating system or a wood stove boiler.

Package D requires moderately high insulation levels for more window area in most climate zones. Maximum U-values for fenestration products (windows + framing) are either 0.75, 0.65 or 0.60 with colder climates requiring the lower U-value. Shading requirements vary from no shading required in mild-to-cool climates to a maximum 0.40 solar heat gain coefficient (SHGC) for the fenestration product on some or all nonnorth-facing windows in warm climates. Only climate zone 16 requires slab edge insulation.

Package E no longer exists. It was originally designed as a package tailored to raised floor buildings with a lower amount of thermal mass required than for a slab floor building. With the elimination of thermal mass requirements for Package D, Package E was identical to Package D and was therefore eliminated.

3.2 PACKAGE REQUIREMENTS



Energy Code

Insulation (Section 151(f)1.)

- A. *Ceiling, wall, slab floor perimeter, and raised floor insulation shall be installed which has an R-value equal to or higher than that shown in Tables No. 1-Z1 through 1-Z16. The minimum opaque ceiling, wall (including heated basements and crawl spaces), and raised floor R-values shown are for insulation installed between wood framing members.*

ALTERNATIVE to Section 151(f)1.A: The insulation requirements of Tables No. 1-Z1 through 1-Z16 may also be met by ceiling, wall, or floor assemblies that meet equivalent minimum R-values that consider the effects of all elements of the assembly, using a calculation method approved by the Executive Director.

EXCEPTION to Section 151(f)1.A: Raised floor insulation may be omitted if the foundation walls are insulated to meet the wall insulation minimums shown in Tables No. 1-Z1 through 1-Z16, a vapor barrier is placed over the entire floor of the crawl space, and the vents are fitted with automatically operated louvers.

B. The minimum depth of concrete-slab floor perimeter insulation shall be 16 inches or the depth of the footing of the building, whichever is less.

EXCEPTION to Section 151(f)1.B: Perimeter insulation is not required along the slab edge between conditioned space and the concrete slab of an attached unconditioned enclosed space, covered porches, or covered patios.



Compliance/
Plan Check

Insulation

The minimum insulation requirements for the packages assume insulation, such as batt insulation, penetrated by wood framing. If the insulation used is not penetrated by framing (e.g., rigid insulation applied to the outside of an assembly), the assembly may comply with the minimum requirements by meeting a U-value equivalent to an assembly with batt insulation. For example, an R-19 wall may be achieved with either R-19 batt insulation set within 2 x 6 framing, or with R-11 batt insulation placed between 2 x 4 framing plus a minimum of R-4.61 rigid insulation applied to the outside of the framing (see Appendix H, page H-12, Reference Name: W.19.EQ1).

NOTE:

R-value is a minimum; U-value (the inverse of R) is a maximum. The higher the R-value the more energy efficient; the lower the U-value the more energy efficient.

See the *Glossary* for definition of R-Value and U-Value.

Ceiling Insulation

Prescriptive compliance of a wood-frame ceiling can be shown by specifying the minimum R-value indicated in the selected package.

For metal framing or as an alternative to meeting the installed R-value, document the U-value as specified in Chapter 2, Part 2.3. The U-value of the proposed ceiling assembly must be *less than or equal to* the U-value of a wood-frame ceiling assembly with the minimum R-value installed.

Ceiling Assembly U-values, Wood Frame		
Insulation	Framing/Spacing	U-value
R-30	2 x 12 / 16" o.c.	0.034
R-30	2 x 10 / 16" o.c.	0.036
R-30	2 x 4 / 24" o.c.	0.031
R-38	2 x 14 / 16" o.c.	0.028
R-38	2 x 12 / 16" o.c.	0.030
R-38	2 x 4 / 24" o.c.	0.024
R-49	2 x 4 / 16" o.c.	0.019
R-49	2 x 4 / 24" o.c.	0.019

Framed Wall Insulation

Prescriptive compliance of a wood-frame wall can be shown by specifying the minimum R-value indicated in the selected package.

For metal or steel frame, or as an alternative to meeting the installed R-value, document the U-value as specified in Chapter 2, Part 2.3. The U-value of the proposed wall assembly must be *less than or equal to* the U-value of a wood-frame wall assembly with the minimum R-value installed.

Wall Assembly U-values, Wood Frame		
Insulation	Framing/Spacing	U-value
R-13	2 x 4 / 16" o.c.	0.088
R-13	2 x 4 / 24" o.c.	0.085
R-19	2 x 6 / 16" o.c.	0.065
R-19	2 x 6 / 24" o.c.	0.063
R-21	2 x 6 / 16" o.c.	0.059
R-21	2 x 6 / 24" o.c.	0.056
R-25	2 x 6 / 16" o.c.	0.046
R-29	2 x 4 / 16" o.c.	0.035

Straw bales that are 23 inches by 16 inches and that have stucco or plaster on the inside and outside vertical surfaces are assumed to have a thermal resistance of R-30. Performance data on other sizes of bales was not available at the time of publication of this manual.

Metal framed assemblies will require rigid insulation in order to meet the maximum U-value.

Steel Frame Wall U-values*			
Wall	Rigid Insulation	Framing/ Spacing	U-value
R-13	0	2 x 4 / 16	0.195
R-13	7	2 x 4 / 16	0.081
R-13	5.25	2 x 4 / 24	0.087
R-15	7	2 x 4 / 24	0.074
R-19	5.25	2 x 6 / 16	0.064
R-19	5.25	2 x 6 / 24	0.060

*Additional assemblies in Appendices G and H.



Energy Code

Mass Wall Insulation (Section 151(f), footnote 2 to Tables No. 1-Z1 through 1-Z16)

The heavy mass wall R-value in parentheses is the minimum R-value for the entire wall assembly if the wall weight exceeds 40 pounds per square foot. The light mass wall R-value in brackets is the minimum R-value for the entire assembly if the heat capacity of the wall meets or exceeds the result of multiplying the bracketed minimum R-value by 0.65. Any insulation installed on heavy or light mass walls must be integral with or installed on the outside of the exterior mass. The inside surface of the thermal mass, including plaster or gypsum board in direct contact with the masonry wall, shall be exposed to the room air. The exterior wall used to meet the R-value in parentheses cannot also be used to meet the thermal mass requirement.



Compliance/
Plan Check

Mass Wall Insulation

Mass Wall Insulation

Mass walls meet the specified R-value depending on the weight of the wall (unframed walls are not required to meet the minimum mandatory wall insulation requirements of Section 150(c)). The R-value listed in Tables No. 1-Z1 through 1-Z16 is the minimum R-value for the entire wall assembly, including insulation and both interior and exterior air films.

Footnote 2 to the Alternative Component Packages, describes the installation requirements. Specifically, the insulation must be integral with or part of the masonry material or installed on the outside of the exterior mass. The inside surface of thermal mass, including plaster or gypsum board in direct contact with the masonry wall, must be exposed to the room air. The exterior wall used to meet the specified R-value cannot also be used to meet the thermal mass requirements of Package A or C.

Footnote 2 also describes how to differentiate between a heavy and light mass wall to determine the required R-value. The values in parenthesis or brackets are for the entire wall assembly.

- A heavy mass wall has a weight exceeding 40 pounds per square foot.
- A light mass wall is one where the *heat capacity* of the wall meets or exceeds the result of multiplying the bracketed minimum R-value by 0.65.



Energy Code

Heat Capacity (HC) (Section 101(b))

“ . . . the amount of heat necessary to raise the temperature of all the components of a unit area in the assembly one degree F. It is calculated as the sum of the average thickness times the density times the specific heat for each component, and is expressed in Btu per square foot per degree F.

Thermal Mass Properties		
Material	Density (lb/ft ³)	Specific Heat (Btu/lb-°F)
Adobe	120	0.20
Heavy Concrete	140	0.20
Lightweight Concrete	85	0.20
Gypsum	50	0.26
Masonry Veneer	127	0.20
Masonry Infill	120	0.20
Concrete Masonry Unit	105	0.20
Grouted Concrete Masonry Unit	134	0.20
Stucco	105	0.20
Tile in Mortar	120	0.20
Solid Wood (fir)	32	0.33

Where the Package indicates “N/A” for a mass wall, the assembly must comply with insulation requirements described above for “framed wall insulation.”



Mass Wall Insulation

Example 3-1

As defined above

HC = average thickness (in feet) x density x specific heat

A log wall with an average thickness of 6 inches (= 0.5 ft.) has a heat capacity of:

$$HC = 0.5 \text{ ft} \times 32 \text{ lb/ft}^3 \times 0.33 \text{ Btu/lb-}^\circ\text{F} = 5.28 \text{ Btu/ft}^2\text{-}^\circ\text{F}$$

For compliance with Alternative Component Package B in climate zone 16, a light mass wall is one with a required R-value of 7.5 and a heat capacity more than or equal to (see above footnote 2 to Tables No. 1-Z1 through 1-Z16):

$$HC_{\min} = 0.65 \times 7.5 = 4.875$$

Since this wall has 5.28 heat capacity, which is more than 4.875, it qualifies as light mass. It must have a 7.5 overall R-value for the wall in order to comply with Package B in climate zone 16 (see Table No. 1-Z16 in Part 3.4).

See Appendix B for a listing of materials to determine the R-value of the wood and whether additional insulation is required to meet the R-7.5.



Compliance/
Plan Check

Insulation (continued)

Raised Floor Insulation

Prescriptive compliance of a wood-frame raised floor can be shown by specifying the minimum R-value indicated in the selected package.

For metal framing, or as an alternative to meeting the installed R-value, document the U-value as specified in Chapter 2, Part 2.3. The U-value of the proposed floor assembly must be *less than or equal to* the U-value of a wood-frame floor assembly with the minimum R-value installed.

Floor Assembly U-values, Wood Frame

Insulation	Framing/Spacing	Crawl Space	U-value
R-13	2 x 6 / 16" o.c.	NO	0.064
R-13	2 x 6 / 16" o.c.	YES	0.046
R-19	2 x 8 / 16" o.c.	NO	0.048
R-19	2 x 8 / 16" o.c.	YES	0.037
R-21	2 x 8 / 16" o.c.	NO	0.045
R-21	2 x 8 / 16" o.c.	YES	0.035
R-30	2 x 10 / 16" o.c.	NO	0.034
R-30	2 x 10 / 16" o.c.	YES	0.028

Concrete Raised Floor Insulation

When the selected Alternative Component Package requires raised-floor insulation, the requirement may be met by installing insulation with the required R-value or by meeting an equivalent U-value for all components of the floor assembly.

Where the package indicates “N/A” for concrete raised floor insulation, no insulation is required.

Below Grade Wall Insulation

When a conditioned space will have concrete walls that are below grade, Alternative Component Package D in climate zone 16 requires R-13 insulation. (Unframed walls do not meet the minimum mandatory insulation requirements of Section 150(c).)

Where the package indicates “N/A” for concrete raised floor insulation, no insulation is required.



Construction

Insulation

- All insulation levels must meet or exceed the levels indicated on the CF-1R form, which must be on the plans. Insulation levels must also be indicated on the plans independently of the CF-1R.
- The frame type of the envelope must match that specified on the CF-1R form.
- After installing the insulation, it is the installing contractor's responsibility to complete the Insulation Certificate (IC-1) and either post it at the job site or make it available to the inspector at appropriate inspections.

Raised Floor Insulation

Exterior raised-floor insulation shall be installed between floor joists with a means of support that prevents the insulation from falling, sagging or deteriorating. Two approaches that accomplish this are:

- Nailing insulation hangers 18 inches apart prior to rolling out the insulation. Hangers are heavy wires up to 48 inches long with pointed ends which provide positive wood penetration.
- Attaching wire mesh to form a basket between joists to support the insulation. The mesh is nailed or stapled to the underside of the joists.

The standards exempt the installation of raised-floor insulation if three conditions are met: (1) the foundation walls are insulated to meet the wall

insulation minimums of the package, (2) a vapor barrier is placed over the entire floor of the crawl space and (3) the vents are fitted with automatically operated louvers. (See also *Controlled Ventilation Crawl Space* in Appendix G, the *Glossary*.)

Slab Floor Perimeter Insulation

When slab-edge insulation is required, the insulation must be installed to a maximum depth of 16 inches or to the bottom of the footing, whichever is less. The depth is measured from the top of the insulation, as near the floor line as practical, to the bottom edge of the insulation.

Perimeter insulation is not required along the slab edge between conditioned space and the concrete slab of an attached unconditioned enclosed space, covered porches or covered patios. Neither would it be practical or necessary to insulate concrete steps attached to the outside slab edge.

In situations where the slab is below grade and slab-edge insulation is being applied to a basement or retaining wall, the top of the slab-edge insulation should be placed as near to ground level as possible and extended down 16 inches. In situations where slab is above grade and slab edge is being applied, the top of the slab-edge insulation should be placed at the top of the slab.

Slab-edge insulation should be protected from physical damage and ultraviolet light exposure. Protection of the slab-edge insulation is important because deterioration from moisture, pest infestation, ultraviolet light exposure and other physical degradation can significantly reduce the effectiveness of the insulation.

The insulating material must meet the specifications of Section 150(l) as explained in Chapter 2, Part 2.3.

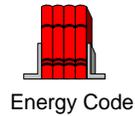


Inspection

Insulation

Check the Certificate of Compliance (CF-1R) form for the required insulation levels and frame type. Check the Insulation Certificate (IC-1) for consistency with the CF-1R. Check that

insulation is installed in all wall cavities including narrow cavities between framing members at windows and doors. Check for complete and uniform installation of insulation in all parts of ceilings.



Glazing/Fenestration U-value
(Sections 101(b), 151(f)2.A. and 151(e)5)

Section 101(b)

FENESTRATION PRODUCT is any transparent or translucent material plus any sash, frame, mullions, and dividers, in the envelope of a building, including, but not limited to: windows, sliding glass doors, french doors, skylights, curtain walls, garden windows, and other doors with a glazed area of more than one-half of the door area.

Section 151(f)2.A.

Installed fenestration products shall have U-values equal to or lower than those shown in Tables No. 1-Z1 through 1-Z16. The U-value of installed fenestration products shall be determined pursuant to Section 151(e)5.

Section 151(e)5

The U-value of installed manufactured fenestration products shall be those certified by an approved independent certification organization in accordance with Section 116. The U-value of field-fabricated fenestration products shall be those values from Section 116, Table No. 1-D, based on an approved method that determines the area weighted average U-value for generic types of products.



Glazing/Fenestration U-value

Each Alternative Component Package establishes a maximum U-value for all the fenestration products in the building. This includes skylights, doors with more than one-half the door area as glass, and windows. Weight averaging of U-values is not permitted.

Each window, glass door or skylight must have a U-value less than or equal to that specified in the selected package. If any of the fenestration products has a higher U-value, the building does not comply with the prescriptive approach.

Refer to Chapter 2, Part 2.3 for a full discussion of mandatory requirements and default U-values of fenestration products.



Construction

Glazing/Fenestration U-value

The U-value of fenestration being installed must be equal or lower than what is specified on the plans and CF-1R. In the prescriptive approach, weight averaging is not permitted. All products must be less than or equal to the value specified in the Alternative Component Package selected.

An Installation Certificate (CF-6R) is completed for the fenestration products installed.



Inspection

Glazing/Fenestration U-Value

Check the Certificate of Compliance (CF-1R) form for the required fenestration U-value. Compare this against the CF-6R for the U-value of installed products.



Energy Code

Maximum Glazing Area
(Section 151(f)2.)

B. *Total glazing area shall not exceed the percentage of conditioned floor area specified in Tables No. 1-Z1 through 1-Z16.*

C. *For Package A, the south-facing glazing area percentage (glass area/conditioned floor area) shall not be less than the percentage in Tables No. 1-Z1 through 1-Z16. South-facing glazing includes glazing in ceilings which is horizontal, tilted to the south, or tilted in any other direction at a pitch less than 1:12. North, east and west-facing glazing includes glazing in ceilings*

which is tilted at a pitch of 1:12 or greater to the north, east and west, respectively



Compliance/
Plan Check

Maximum Glazing Area

Alternative Component Packages B, C and D, limit the total area of fenestration products in the building without regard for the orientation of the glass. This maximum is expressed as a percent (%) representing the total area of fenestration products (in square feet) divided by the total conditioned floor area, then multiplying by 100 (see *Fenestration Area* in the *Glossary*).

$$\frac{\text{Fenestration (sq.ft.)}}{\text{Floor Area (sq.ft.)}} \times 100 = \% \text{ fenestration}$$

Package A has no maximum for fenestration area, but instead has fenestration orientation requirements.

Maximum Total Nonsouth-Facing Area

Only Package A places a limit on the total area of fenestration that does *not* face south. This value is fixed at 9.6 percent of the floor area in all climate zones, and is not applicable to the other packages.

Minimum South-Facing Area

Only Package A requires a *minimum* of 6.4 percent of the floor area as fenestration facing south in all climate zones. The *maximum* amount of south-facing area is limited by the amount of thermal mass in the building, as defined in Section 151(f)4 of the standards. This requirement is not applicable to the other packages.

Skylights

Within Package A only, a skylight with a slope equal to or less than 1 in 12 (less than 15°) is considered horizontal but is treated as south facing for shading and glazing area requirements. For other packages, glazing installed on a slope of 1:12 or less is part of the total glazing area and has a vertical orientation. For all packages, a

skylight installed on a surface with a pitch or tilt of greater than 1 in 12 (greater than or equal to 4.76° from horizontal) is treated as having the orientation of the tilted surface.



Construction

Maximum Glazing Area

The area of glass shown on the CF-1R is the maximum amount that can be installed without demonstrating that the total area of glass in the building is within the percentage allowed by the package used for compliance. (With Package A, south-facing glass cannot be less than specified on the CF-1R.)

Complete the fenestration portion of the CF-6R.



Inspection

Maximum Glazing Area

Compare the installed glass area both visually and as indicated on the CF-6R with the allowed glass areas indicated on the CF-1R. If more glass is installed, it must be demonstrated that the building does not exceed the glass area allowed by the prescriptive approach. Without such proof, the building is not in compliance with the standards.

With Package A, south-facing glass cannot be less than specified on the CF-1R.



Energy Code

Shading (Section 151(f)3)

Where Tables No. 1-Z1 through 1-Z16 require a solar heat gain coefficient of 0.40 or lower for south-facing, east-facing, or west-facing shading, the requirements shall be met by either:

- A. A fenestration product listed by the manufacturer to have the required solar heat gain coefficient; or
- B. An exterior operable louver or other exterior shading device that meets the required solar heat gain coefficient; or

- C. A combination of exterior shading device and fenestration product to achieve the same performance as achieved in A.
- D. The shading requirements for south-facing glazing may also be met by optimal overhangs installed so that the south-facing glazing is fully shaded at solar noon on August 21 and substantially exposed to direct sunlight at solar noon on December 21.

Except where the UBC requires emergency egress, exterior shading devices must be permanently attached to the outside of the structure with fasteners that require additional tools to remove (as opposed to clips, hooks, latches, snaps or ties).



The solar heat gain coefficient (SHGC) is a measure of the effectiveness of a glass and shade assembly in stopping heat gain from solar radiation (see *Shading* in the *Glossary*). SHGCs are fractional values that range between 0 and 1. A higher value indicates less shading effectiveness with a greater amount of solar radiation penetrating the combined glazing/frame/shade assembly and absorbed as heat. A lower SHGC value corresponds to better shading effectiveness with less solar gain making its way into the building.



Shading is required in some climate zones in certain orientations. SHGCs listed for the prescriptive packages represent maximum values not to be exceeded, for movable shading devices or intrinsic shading properties of the fenestration product. In some packages, "NR" is indicated. No specific shading needs to be installed.

The requirements for SHGCs of 0.40 or less may be met by a window, skylight or other fenestration unit that the manufacturer certifies to have the

required SHGC, or by installing an exterior shading device, or by some combination of the two.

NOTE:
Interior shading devices may *not* be used to achieve compliance with the required SHGC.

To determine compliance with prescriptive requirements for a maximum SHGC, options include constructing an optimal overhang (see below) or using a value from:

- Chapter 2, Table 1-E, of this manual for default SHGC values for fenestration products.
- Product literature for the proposed fenestration product(s) showing a value equal or lower than required by the Alternative Component Package selected.
- Table 3-1 for SHGC values of exterior shading devices.
- Form S calculations showing the combined $SHGC_{shade\ open}$ is less than the target value of 0.39 for the proposed fenestration and one of the exterior devices listed in Table 3-1. This target value is determined from a Form S calculation for an $SHGC_{fenestration}$ of 0.40 with default bugscreen exterior shading. Refer to *Shading* in the *Glossary* for an explanation of how to calculate a Form S SHGC for different combinations of exterior devices and glass types.

NOTE:
To gain credit for exterior shades, they 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). Exterior shades on windows or skylights that are prohibited by the UBC from being permanently attached for emergency egress reasons are exempt from this requirement.

Table 3-1: Allowed Solar Heat Gain

Coefficients Used for Form S	
Exterior Shading Device	SHGC
Bug Screen (default)	0.76
Woven SunScreen	0.30
Louvered SunScreen	0.27
Low Sun Angle Sunscreen	0.13
Roll-down Awning	0.13
Roll -down Blinds or Slats	0.13
None (skylights only/skylight default)	1.00

Optimal Overhangs

Shading requirements for south glazing can also be met by installing any overhang that completely shades the glazing at solar noon on August 21st and substantially exposes the glazing to direct sunlight at solar noon on December 21st. Any well-designed overhang, designed to meet this performance specification, may be used when shading is required for south glazing.

Skylights

Within Package A only, a skylight with a slope equal to or less than 1 in 12 (less than 15°) is considered horizontal and is treated as south facing for shading and glazing area requirements. For all packages a skylight with a pitch of greater than 1 in 12 (greater than or equal to 4.76° from horizontal) is treated as having the orientation of the tilted surface.



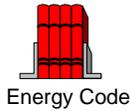
Shading

When shading is required, it is specified on the CF-1R form which must be on the plans and must be constructed or installed as specified for the building to be in compliance with the prescriptive approach. The only alternative to installing an exterior shading device or constructing an overhang used to achieve compliance is to install a fenestration product with an equal or lower SHGC value as specified on the CF-1R.



With the prescriptive approach, there are two options for compliance:

- Shading devices or overhangs specified on the CF-1R must be installed.
- Install a fenestration product with an equal or lower SHGC value as shown on the CF-1R.



Thermal Mass (Section 151(f)4)

Thermal mass required for Packages A and C in Tables No. 1-Z1 through 1-Z16 shall meet or exceed the minimum interior mass capacity specified in Table No. 1-U.

**TABLE NO. 1-U
Interior Mass Capacity Requirements
for Packages A and C**

Package	Minimum Interior Mass Capacity
A	35.9 X South Glazing Area (ft ²)
C (slab floor)	2.36 X Ground Floor Area (ft ²)
C (raised floor)	0.18 X Ground Floor Area (ft ²)

The mass requirements in Table No. 1-U may be met by calculating the combined interior mass capacity of the mass materials using Equation No. 1-P.

**EQUATION NO. 1-P
CALCULATION OF INTERIOR MASS
CAPACITY**

$$IMC = [(A_1 \times UIMC_1) + (A_2 \times UIMC_2) \dots + (A_n \times UIMC_n)]$$

Where,
 A_n = Area of mass material n, and
 $UIMC_n$ = Unit Interior Mass Capacity of mass material n

NOTE: *The Commission's Residential Manual lists the Unit Interior Mass Capacity (UIMC) of various mass materials.*



Introduction

Thermal Mass

Thermal mass stores heat as a house warms and slowly releases the stored heat as the house cools. This helps moderate temperature variations within the space and reduces the need to use heating and cooling equipment. Typical materials that are most effective as thermal mass include: concrete, tile, brick and other materials with high **Unit Interior Mass Capacities (UIMC)** as listed in Tables 3-2a, 3-2b and 3-3.



Compliance/
Plan Check

Thermal Mass

Thermal Mass is NOT required for Package D, but thermal mass is required for compliance with Packages A and C. Table No. 1-U above lists the minimum Interior Mass Capacity required for these packages.

Note that the Package A mass requirement is based on the south fenestration area and does not vary by floor type, while Package C requirements are based on the building Ground Floor Area and the floor type. See the *Glossary* for the definition of *Ground Floor Area* for slab and raised-floor buildings.

The *Interior Mass Capacity (IMC)* of a material is calculated by multiplying its *Area* times its *Unit Interior Mass Capacity (UIMC)*. Tables 3-2a and 3-2b list the UIMCs for a number of thermal mass materials. The prescriptive thermal mass requirements may be met by adding the IMCs of all mass elements in the building.

This method allows for multiple mass types in both raised-floor and slab-on-grade construction. The Thermal Mass Worksheet (WS-1R) works through Equation No. 1-P to calculate the IMC. On the WS-1R, describe each interior mass surface and enter its area and UIMC value. (See Tables 3-2a, 3-2b and 3-3). For each surface, multiply the surface area by the UIMC and add the results of all mass elements.

NOTE:

The inside surface of an exterior mass wall is counted as interior thermal mass and is included as part of the IMC calculation using Table 3-3.

Slab Floor Interior Mass

The interior mass requirement for Package C slab-floor buildings is comparable to having 20 percent of the *ground floor slab area* exposed to the conditioned space. This assumes a standard 140 lb/ft³ concrete slab at least 3.5 inches thick. A Package C slab-floor building may meet its thermal mass requirement by either calculating the IMC of all of the mass elements in the building, or by exposing 20 percent of a 3.5-inch concrete slab.

Table G-15 contains a complete list of floor coverings that qualify as *exposed mass*. This list includes brick, ceramic tile, stamped concrete (acceptable in any location) and vinyl tile, sheet vinyl and unfinished concrete (only when located in kitchens, dining areas, pantries, bathrooms, laundry rooms, service porches and entries).

Raised Floor Interior Mass

The interior mass requirement for Package C raised-floor buildings is based on having mass equivalent in performance to five percent of the ground floor area consisting of exposed two-inch thick concrete slab with a volumetric heat capacity of 28, a conductivity of 0.98, a surface conductance of 1.3 and no thermal resistance on the surface. The heat capacity and conductivity performance equivalent referred to is that of standard 140 lb/ft³ concrete.

**Table 3-2a: Interior Mass UIMC Values:
Interior Mass¹¹ - Surfaces Exposed on One Side¹³**

Material	Surface Condition	Mass Thickness (inches)	Unit Interior Mass Capacity
Concrete Slab-on-Grade and Raised Concrete Floors	Exposed ¹	2.00	3.6
		3.50	4.6
		6.00	5.1
	Covered ²	2.00	1.6
		3.50	1.8
		6.00	1.9
Lightweight Concrete ⁹	Exposed	0.75	1.0
		1.00	1.4
		1.50	2.0
		2.00	2.5
	Covered	0.75	0.9
		1.00	1.0
		1.50	1.2
		2.00	1.4
Solid Wood ⁹	Exposed	1.50	1.2
		3.00	1.6
Tile ^{3,9}	Exposed	0.50	0.8
		1.00	1.7
		1.50	2.4
		2.00	3.0
Masonry ^{4,9}	Exposed	1.00	2.0
		2.00	2.7
		4.00	4.2
Adobe ⁹	Exposed	4.00	3.8
		6.00	3.9
		8.00	3.9
Framed Wall	0.50" Gypsum	na	0.0
	0.63" Gypsum	na	0.1
	1.00" Gypsum	na	0.5
	0.88" Stucco	na	1.1
Masonry Infill ⁷	0.50" Gypsum	3.50	1.3

Table 3-2 continued on next page.

**Table 3-2b: Interior Mass UIMC Values:
Interior Mass¹¹ - Surfaces Exposed on Two Sides^{5, 13}**

Material	Surface Condition	Mass Thickness (inches)	Unit Interior Mass Capacity
Partial Grout Masonry ⁴	Exposed ¹	4.00	6.9
		6.00	7.4
		8.00	7.4
Solid Grout Masonry ^{4,6}	Exposed	4.00	8.3
		6.00	9.2
		8.00	9.6
Adobe	Exposed	4.00	7.6
		12.00	7.8
		16.00	7.6
Solid Wood/ Logs	Exposed	3.00	3.3
		4.00	3.3
		6.00	3.3
		8.00	3.3
Framed Wall	0.50" Gypsum	na	0.0
	0.63" Gypsum	na	0.2
	1.00" Gypsum	na	0.9
	0.88" Stucco	na	2.1
Masonry Infill ⁷	0.50" Gypsum	3.50	2.6

Notes follow Table 3-3.

Table 3-3: Exterior Wall Mass UIMC Values and Exterior Mass Factors¹³

Material	Surface Condition	Mass Thickness (inches)	Wall U-value	Unit Interior Mass Capacity	Exterior⁸ Mass Factor
Partial Grout Masonry ⁴	Exposed ¹	4.00	0.68	0.9	1.1
			0.58	1.0	1.0
		6.00	0.54	1.3	1.3
			0.44	1.5	1.1
		8.00	0.49	1.5	1.3
			0.38	1.7	1.2
	Furred ¹⁰	4.00	0.40	0.5	0.9
			0.30	0.5	0.7
			0.20	0.5	0.5
			0.10	0.5	0.3
			0.08	0.5	0.2
		6.00	0.40	0.9	1.2
			0.30	0.6	1.0
			0.20	0.5	0.7
			0.10	0.5	0.4
			0.08	0.5	0.3
8.00	0.30	0.8	1.0		
	0.20	0.5	0.7		
	0.10	0.5	0.4		
	0.08	0.5	0.3		
	Exposed	4.00	0.79	1.0	1.4
			0.68	1.5	1.9
			0.62	1.8	2.1
	Furred ¹⁰	4.00	0.40	0.5	1.0
			0.30	0.5	0.8
			0.20	0.5	0.6
0.10			0.5	0.3	
0.08			0.5	0.3	
6.00		0.40	0.7	1.4	
		0.30	0.5	1.1	
		0.20	0.5	0.7	
8.00		0.10	0.5	0.4	
		0.08	0.5	0.3	
		0.40	0.8	1.5	
		0.30	0.6	1.2	
	0.20	0.5	0.8		
Solid Grout Masonry ^{4,6}	Furred ¹⁰	0.10	0.5	0.4	
		0.08	0.5	0.3	

Table 3-3 continued on next page

Table 3-3: Exterior Wall Mass UIMC Values and Exterior Mass Factors¹³

Material	Surface Condition	Mass Thickness (inches)	Wall U-value	Unit Interior Mass Capacity	Exterior⁹ Mass Factor
Solid Wood/ Logs	Exposed ¹	3.00	0.22	0.7	0.5
		4.00	0.17	0.9	0.6
		6.00	0.12	1.1	0.6
		8.00	0.093	1.2	0.4
		10.00	0.075	1.3	0.3
		12.00	0.063	1.3	0.3
Wood Cavity Wall ¹²	Exposed	3.00 ¹²	0.11	1.1	0.5
			0.065	1.3	0.3
			0.045	1.4	0.2
Adobe	Exposed	8.00	0.35	2.1	1.5
		16.00	0.21	2.8	0.8
		24.00	0.15	3.1	0.5
Masonry Veneer ⁴	Framed Wall	4.00	0.10	na	0.3
			0.08	na	0.3
			0.06	na	0.2
Adobe Veneer	Framed Wall	4.00	0.10	na	0.4
			0.08	na	0.3
			0.06	na	0.2

Notes For Tables 3-2 and 3-3

1. "Exposed" means that the mass is directly exposed to room air or covered with a conductive material such as ceramic tile.
2. "Covered" includes carpet, cabinets, closets or walls.
3. The indicated thickness includes both the tile and the mortar bed, when applicable.
4. Masonry includes brick, stone, concrete masonry units, hollow clay tile and other masonry materials.
5. The unit interior mass capacity for surfaces exposed on two sides is based on the area of one side only.
6. "Solid Grout Masonry" means that all the cells of the masonry units are filled with grout.
7. The indicated thickness for masonry infill is for the masonry material itself.
8. Use the Exterior Mass value for calculating Exterior Wall Mass.
9. Mass located inside exterior walls or ceilings may be considered interior mass (exposed one side) when it is insulated on the exterior with at least R-11 insulation, or a total resistance of R-9 including framing effects.
10. "Furred" means that 0.50-inch gypsum board is placed on the inside of the mass wall separated from the mass with insulation or an air space.
11. When mass types are layered, e.g. tile over slab-on-grade or lightweight concrete floor, only the mass type with the greatest interior mass capacity may be accounted for, based on the total thickness of both layers.
12. This wall consists of 3 inches of wood on each side of a cavity. The cavity may be insulated as indicated by the U-value column.
13. Values based on properties of materials listed in 1993 *ASHRAE Handbook of Fundamentals*.



Thermal Mass

Example 3-2: Package A Thermal Mass

A 2,000 ft² residence in Climate Zone 12 meets most of the requirements needed to comply with Package A, but the owner still needs to determine whether or not the proposed design has enough thermal mass.

It has 160 ft² of south fenestration (a minimum of 6.4 percent or 128 ft² is required), so the required minimum IMC (using the equation from Section 151(f)4, Table No. 1-U above) is:

$$IMC_{\text{Required}} = 35.9 \times 160 = 5744$$

The house is a one-story, slab on grade construction with 700 ft² of 3.5" thick slab on grade finished with 1/4" wood veneer glued directly to the concrete. This counts as exposed slab (see Table G-15) and has a UIMC of 4.6 from Table 3-2a. The remaining 1300 ft² of the slab is carpeted, or covered with cabinets or walls, and is counted as covered slab on grade. It has a UIMC of 1.8. The IMC for the entire slab on grade equals:

$$IMC_{\text{Proposed}} = (700 \times 4.6) + (1300 \times 1.8) \\ = 5560$$

This does not meet the IMC requirement, but if the exposed mass area is increased to 800 ft² then:

$$IMC_{\text{Proposed}} = (800 \times 4.6) + (1200 \times 1.8) \\ = 5840$$

5840 is greater than the required 5744, so the building meets the Package A thermal mass requirements. Additional mass credit could also be gained by adding other mass materials, such as tile in a mortar base on the kitchen counters.

Example 3-3: Package C Thermal Mass

A 2,000 ft², two-story residence in Climate Zone 16 meets all the requirements needed to comply with Package C, but the designer must determine whether the house meets the thermal mass

requirement. There are 1,200 ft² on the ground floor, and 800 ft² on the second floor. The required minimum interior mass capacity is:

$$IMC_{\text{Required}} = 0.18 \times 1200 = 216$$

The living room has fireplace with 115 ft² of one-inch thick masonry veneer. This counts as exposed interior mass and has a UIMC of 2.0 from Table 3-2a. So the interior mass capacity of the exposed masonry veneer is:

$$IMC_{\text{Proposed}} = 115 \times 2.0 = 230$$

Since 230 is greater than or equal to 216, the masonry veneer meets the IMC requirement.



Thermal Mass

Construction

Check the CF-1R for any thermal mass requirements.

When the CF-1R shows thermal mass was used to achieve compliance with Packages A or C, it is important that the material type and area are consistent with those shown on the form. Changes could result in the building not complying with the prescriptive approach. If this occurs, it is not possible to verify that the building is in compliance with the standards without recalculating the thermal mass compliance or recalculating compliance for the entire building with a different compliance approach.



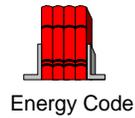
Thermal Mass

Inspection

With the prescriptive approach, there are three possibilities:

- Thermal mass is consistent with the specifications on the CF-1R for mass materials, including floors covered or exposed, or
- The “as built” thermal mass conditions are checked for compliance with the prescriptive package selected; or

- The calculations are resubmitted to check compliance with a different compliance approach.



Continuous Infiltration Barrier
(Sections 151(f)5 and 150(f))

Continuous infiltration barriers required in Tables No. 1-Z1 through 1-Z16 shall be installed over the inside face of framing in ceilings and over the inside or outside face of framing in exterior walls. Where ceilings are plank and beam construction exposed to the conditioned space, the barrier shall be placed on top of the planking, and the wall/ceiling joints shall be sealed with caulking or sealant. All openings in the building envelope for plumbing, electrical conduits and boxes, gas lines and valves, luminaires, ducts, flues and other elements which penetrate the infiltration barrier, shall be sealed with permanent tape or sealant.

Section 150(f)

If an infiltration barrier is installed to meet the requirements of Section 151, it must have an air porosity of less than 5 ft³ per hour per square foot per inch of mercury pressure difference when tested in accordance with the requirements of ASTM E283-91. If a vapor barrier functions as an infiltration barrier it shall be located on the conditioned side of the exterior framing.



Continuous Infiltration Barrier

Package B in Climate Zones 1, 14, 15 and 16 requires the installation of continuous infiltration barriers.



Continuous Infiltration Barrier

When the CF-1R calls for a continuous infiltration barrier or special infiltration barrier, it must be placed over the inside face of framing in ceilings and over the inside or outside face of

framing in exterior walls. Where ceilings are plank and beam construction exposed to the conditioned space, the barrier must be placed on top of the planking; in addition, ceiling joints must be sealed with caulking or other sealant.

Seal, with permanent tape or a sealant, all openings in the infiltration barrier, including spaces around plumbing, electrical conduits and boxes, gas lines and valves, light fixtures, ducts, flues and other elements which penetrate the infiltration barrier.

When a continuous infiltration barrier acts as a vapor barrier, it must be placed on the inside of the insulation. If an infiltration barrier is intended to act as a vapor barrier in Climate Zones 14 and 16, verify that the material and installation procedures used meet the requirements explained in Chapter 2, Part 2.2.

The infiltration barrier must have an air porosity of less than five cubic feet per hour per square foot per inch of mercury pressure difference when tested according to ASTM E-283-91 requirements. See Chapter 2, Part 2.2 for more information on material specifications required by Section 150(f).



Inspection

Continuous Infiltration Barrier

If the CF-1R shows Package B is being used in Climate Zones 1, 14, 15 or 16, an infiltration barrier is required. Installation criteria include:

- In ceilings, the material must be placed over the inside face of framing. Ceiling joints must be sealed with caulking or other sealant. If the ceiling is plank and beam construction, exposed to the conditioned space, the barrier must be placed on top of the planking.
- In exterior walls, the material must be placed over the inside or outside face of framing.
- All penetrations must be permanently sealed or taped.
- The barrier material must be tested to ASTM E-283-91.



Energy Code

Air-to-Air Heat Exchanger (Section 151(f)6)

The air-to-air heat exchanger required in Tables No. 1-Z1 through 1-Z16 shall be capable of ventilating the dwelling unit at a rate equal to at least 0.7 times the volume of the conditioned space per hour.

This requirement may be met by a central mechanical ventilation system with an integral air-to-air heat exchanger or by one or more single package room mechanical ventilators with an integral air-to-air heat exchanger.



Introduction

Air-to-Air Heat Exchanger

An air-to-air heat exchanger uses a mechanical ventilation process in which heat is transferred between the conditioned air being exhausted and the fresh unconditioned air being supplied. This reduces heat losses in the winter and heat gains in the summer.



Compliance/
Plan Check

Air-to-Air Heat Exchanger

Package B in Climate Zones 1, 14, 15 and 16 requires the installation of a mechanical ventilation system with an air-to-air heat exchanger.



Construction

Air-to-Air Heat Exchanger

If the compliance requires an air-to-air heat exchanger, the requirement may be met by a central mechanical ventilation system with an integral air-to-air heat exchanger between intake and exhaust ducts or by one or more single-package room mechanical ventilators, each with an integral air-to-air heat exchanger.



Energy Code

Space Conditioning (Section 151(f)7, 8, and 10)

7. *Heating System Type.* Heating system types shall be installed as required in Tables No. 1-Z1 through 1-Z16. A gas heating system is a natural or liquefied petroleum gas heating system. All supply ducts shall either be in conditioned space or be insulated to a minimum installed level of R-4.2.
8. *Space Heating and Space Cooling.* All space heating and space cooling systems must comply with minimum appliance efficiency standards as specified in Sections 110-112.
10. *Setback Thermostats.* All heating systems shall have an automatic thermostat with a clock mechanism or other setback mechanism approved by the Executive Director which the building occupant can manually program to automatically set back the thermostat set points for at least 2 periods within 24 hours. The exception to Section 150(i) shall not apply to any heating system installed in conjunction with the packages specified in Tables No. 1-Z1 through 1-Z16.



Compliance/
Plan Check

Space Conditioning

All heating systems must also comply with the mandatory measures explained in Chapter 2, including sizing according to design heating loads (see Chapter 2, Part 2.4).

Gas Systems

All packages require that gas space-heating systems meet the minimum *Appliance Efficiency Regulations*. Packages A, B and C additionally specify a minimum of 78 percent Annual Fuel Utilization Efficiency (AFUE). Package D does not specify a minimum efficiency, allowing any gas space-heating device, including noncentral furnaces, to be installed. See *AFUE* in the *Glossary* for a discussion of gas heating efficiency requirements.

Heat-Pump Systems

All heat pumps installed with the prescriptive packages must meet minimum appliance efficiency requirements. Packages A, B and C limit split system air source heat pumps to a Heating Seasonal Performance Factor (HSPF) rating of 6.8 or higher. Single package air source heat pumps must have an HSPF rating of at least 6.6. Package D does not specify a minimum efficiency, allowing any heat pump, including noncentral, to be installed.

Electric Resistance Heating

Electric resistance and electric radiant heating systems are allowed only in Package C. Package C may only be used for compliance if:

- The building is located in an area where natural gas is not currently available; and
- The local natural gas utility determines it is not practical to extend natural gas service to the site.

There are no minimum appliance efficiency standards for electric-resistance or electric-radiant heating systems.

Other Space-Heating Systems

Solar space-heating systems are not recognized within the prescriptive packages.

Wood heat is allowed with prescriptive compliance, provided all conditions as explained in Chapter 8, Part 8.6 are met.

Space Cooling System Type

Air conditioners and the cooling cycle of heat pumps must meet or exceed the Seasonal Energy Efficiency Ratio (SEER) required by Packages A, B and C. The values listed are the minimum established by the *Appliance Efficiency Regulations* for both split system and single package air conditioners or heat pumps. Split system air conditioners must have a minimum SEER of at least 10.0. The minimum SEER requirement for single package air conditioners is

9.7. Package D does not specify a minimum efficiency, allowing any space cooling device, including non-central units, to be installed.

Setback Thermostat

An automatic setback thermostat is required for all heating systems installed with prescriptive compliance. The setback thermostat must be designed so that the building occupant can program different temperature settings for at least two different time periods each day. For example, 68°F during the day and 60°F at night.

NOTE:

There are no exceptions to the automatic setback thermostat requirement with prescriptive compliance.

Ducts

All supply ducts for ducted space-conditioning systems installed with Packages A, B and D must be insulated to a minimum installed level of R-4.2. All ducts installed for Package C must be insulated to a minimum installed level of R-8.



Construction

Space Conditioning

Install:

- Equipment type as specified on the CF-1R
- Equipment efficiency as specified on the CF-1R
- Duct insulation as specified on the CF-1R
- Ducts in accordance with mandatory construction requirements from Chapter 2, Part 2.4

Complete:

Installation Certificate (CF-6R) for installed equipment.



Inspection

Space-Conditioning System

Check the CF-1R for required measures and the CF-6R for installation information. The following are acceptable changes:

- Installing a heat pump instead of gas-heating equipment (Packages A-C have minimum efficiencies).
- Installing gas heating equipment instead of a heat pump (Packages A-C have minimum efficiencies).



Energy Code

Water-Heating Systems (Sections 151(b)1 and (f)9)

Section 151(f)9:

All water heating systems must meet the water heating budgets calculated from Equation No. 1-N.

NOTE to Section 151(f)8.: Any gas type domestic water heater of 50 gallons or less, which is certified as meeting the Appliance Efficiency Standards, and which meets tank insulation requirements of 150(j) may be assumed to meet the water heating budget.

Section 151(b)1:

The annual water heating budget calculated from Equation No. 1-N may be met by either:

- Calculating the energy consumption of the proposed water heating system using an approved calculation method without an external insulation wrap or*
- Installing any gas storage type non-recirculating water heating system that does not exceed 50 gallons of capacity, and that meets the minimum standards specified in the Appliance Efficiency Standards.*

NOTE: Storage gas water heaters with an energy factor of less than 0.58 must be externally wrapped with insulation having an installed thermal

resistance of R-12 or greater in accordance with Section 150(j).



Compliance/
Plan Check

Water Heating Systems

All packages, except Package C, require that the installed water-heating system meet the water-heating energy budget. This means one 50-gallon or less, gas storage type water heater, nonrecirculating. If the energy factor is below 0.58 (i.e., 0.53 - 0.579) an R-12 external insulation blanket is a mandatory requirement.

If the water-heating system is other than described in the previous paragraph, Table 3-4 lists other water-heating systems that have been pre-calculated to meet the water-heating budget for residences of different sizes. Those systems which comply are designated with a "Y"; systems that do not comply are designated with an "N".

NOTE:

Interpolation is not allowed when using Table 3-4. If a water-heating efficiency falls between values on the table, use the lower value.

The remaining alternative is to show compliance with the water-heating budget as explained in Chapter 6. Part 6.3 of Chapter 6 contains forms, instructions, and installation criteria for various water heating and distribution system types.

Package C water-heating system complies if it meets the budget as explained above or by installing an electric-resistance water heater that is:

- Located within the building envelope; and
- Supplemented by either a solar water-heating system or a wood stove boiler which provides at least 25 percent of the residence's water heating requirements. See Chapter 6 for documentation requirements and installation criteria for active and passive solar water-heating systems and wood stove boilers. The wood stove boiler credit is not allowed in Climate Zones 8, 10 or 15, or in other jurisdictions which do not allow wood stoves.

Table 3-4: Water Heating Systems that Meet Package Requirements¹

One Water Heater - No Auxiliary Credits									One Water Heater - Solar Credits								
Water Heater Type ²	CZ	Energy Factor	Distribution ³			Recirc Systems			Water Heater Type ²	CZ	Energy Factor	Distribution ³			Recirc Systems		
			STD	HWR	Pipe Insul	No Ctrl	Temp/Timer	Demd/Temp				STD	HWR	Pipe Insul	No Ctrl	Temp/Timer	Demd/Temp
SG50	All	0.53	Y ⁴	Y	Y	N ⁴	N	Y	SG50	All	0.53	Y	Y	Y	Y	Y	Y
		0.63	Y	Y	Y	N	Y	Y			0.63	Y	Y	Y	Y	Y	Y
		0.73	Y	Y	Y	Y	Y	Y			0.73	Y	Y	Y	Y	Y	Y
SG75	All	0.48	N	Y	N	N	N	N	SG75	All	0.48	Y	Y	Y	Y	Y	Y
		0.58	Y	Y	Y	N	N	Y			0.58	Y	Y	Y	Y	Y	Y
		0.68	Y	Y	Y	Y	Y	Y			0.68	Y	Y	Y	Y	Y	Y
SE	All	0.87	N	N	N	N	N	N	SE	All	0.87	N	Y	Y	N	N	Y
		0.93	N	N	N	N	N	N			0.93	Y	Y	Y	N	N	Y
IG ⁶	All	0.80	Y	Y	Y				IG	All	0.80	Y	Y	Y			
IE	All	0.93	N	N					IE	All	0.93	Y	Y				
H	1,14	1.80	Y	Y	Y	N	N	Y	HP	1,14	1.80	Y	Y	Y	Y	Y	Y
		2.20	Y	Y	Y	N	Y	Y			2.20	Y	Y	Y	Y	Y	Y
		2.60	Y	Y	Y	Y	Y	Y			2.60	Y	Y	Y	Y	Y	Y
HP	2-5,12	1.80	Y	Y	Y	N	N	Y	HP	2-5,12	1.80	Y	Y	Y	Y	Y	Y
		2.20	Y	Y	Y	N	Y	Y			2.20	Y	Y	Y	Y	Y	Y
		2.60	Y	Y	Y	Y	Y	Y			2.60	Y	Y	Y	Y	Y	Y
HP	6-11 & 13, 15	1.80	Y	Y	Y	N	N	Y	HP	6-11 & 13, 15	1.80	Y	Y	Y	Y	Y	Y
		2.20	Y	Y	Y	Y	Y	Y			2.20	Y	Y	Y	Y	Y	Y
		2.60	Y	Y	Y	Y	Y	Y			2.60	Y	Y	Y	Y	Y	Y
HP	16	1.80	N	N	N	N	N	N	HP	16	1.80	Y	Y	Y	N	N	Y
		2.20	N	N	N	N	N	N			2.20	Y	Y	Y	N	Y	Y
		2.60	Y	Y	Y	N	N	Y			2.60	Y	Y	Y	Y	Y	Y
Two Water Heaters - No Auxiliary Credits									Two Water Heaters - Solar Credit								
SG50	All	0.53	N	N	N	N	N	N	SG50	All	0.53	Y	Y	Y	N	N	Y
		0.63	Y	Y	Y	N	N	Y			0.63	Y	Y	Y	Y	Y	Y
		0.73	Y	Y	Y	Y	N	Y			0.73	Y	Y	Y	Y	Y	Y
SG75	All	0.48	N	N	N	N	N	N	SG75	All	0.48	N	N	N	N	N	N
		0.58	N	Y	Y	N	Y	Y			0.58	Y	Y	Y	Y	Y	Y
IE	All	0.93	N	N					IE	All	0.93	Y	Y				
HP	1,14	1.80	N	N	N	N	N	N	HP	1,14	1.80	Y	Y	Y	N	Y	Y
		2.20	Y	Y	Y	N	N	Y			2.20	Y	Y	Y	Y	Y	Y
		0.68	Y	Y	Y	N	Y	Y			0.68	Y	Y	Y	Y	Y	Y
SE	All	0.87	N	N	N	N	N	N	SE	All	0.87	N	Y	Y	N	N	Y
		0.93	N	N	N	N	N	N			0.93	Y	Y	Y	N	N	Y
IG6	All	0.80	N	N	N				IG	All	0.80	Y	Y	Y			
I		2.60	Y	Y	Y	N	Y	Y			2.60	Y	Y	Y	Y	Y	Y
HP	4,5,12	1.80	N	Y	N	N	N	Y	HP	2-5,12	1.80	Y	Y	Y	Y	Y	Y
		2.20	Y	Y	Y	N	N	Y			2.20	Y	Y	Y	Y	Y	Y
		2.60	Y	Y	Y	N	N	Y			2.60	Y	Y	Y	Y	Y	Y
HP	6-11 & 13, 15	1.80	N	Y	Y	N	N	Y	HP	6-11 & 13, 15	1.80	Y	Y	Y	N	Y	Y
		2.20	Y	Y	Y	N	Y	Y			2.20	Y	Y	Y	Y	Y	Y
		2.60	Y	Y	Y	Y	Y	Y			2.60	Y	Y	Y	Y	Y	Y
HP	16	1.80	N	N	N	N	N	N	HP	16	1.80	N	N	N	N	N	N
		2.20	N	N	N	N	N	N			2.20	N	Y	N	N	N	N
		2.60	N	N	N	N	N	N			2.60	Y	Y	Y	N	N	Y

NOTES:

- The water-heating systems listed here have been pre-calculated to determine compliance with the water-heating budgets (see Note 4). See Chapter 6 for the complete method, including definitions and installation criteria for all system components. **NOTE: All storage tank water heaters with less than 0.58 energy factor are assumed to have R-12 external tank insulation. This insulation is a mandatory requirement for storage tank water heaters with an energy factor between 0.53 and 0.579.** Notes for Table 3-4 continued on next page

Notes for Table 3-4: (continued) Water Heating Systems that Meet Package Requirements

2. Water heater types: SG50 = Storage gas, 50 gallons or less; SG75 = Storage gas, 51 to 75 gallons, less than 75,000 Btu/hr input; HP = Heat Pump, 50 gallons or less; IG = Instantaneous Gas, pilot loss may not exceed 600 Btu/hr; SE = Storage electric, 50 gallons or less. Note that compliance of heat pump water heaters varies by climate zone. See Chapter 7???
3. Distribution Systems: STD = Standard; HWR = Hot water recovery; POU = Point of use; Pipe Insul = Pipe insulation credit; Recirculation: NoCtrl = Recirculation system with no controls; Temp/Timer = Recirculation system with either temperature or timer controls; Demand/Temp = Recirculation system with either demand controls, or with a combination time/temperature control. Pipe insulation is required on the entire length of recirculating piping, except when equipped with demand control. See Chapter 6 for installation criteria and definitions.
4. Water-heater systems listed with a "Y" meet the water-heating budget and must be installed with the applicable efficiency and distribution devices used to receive credits. Water heater systems listed with an "N" do not meet standard water-heating budget.
5. Solar credit requires 50 percent solar contribution. See Chapter 7.
6. For instantaneous gas water heaters (IG), the value listed in the Energy Factor column is the Recovery Efficiency (RE).



Water Heating

Install:

- Equipment type as specified on the CF-1R
- Equipment efficiency as specified on the CF-1R
- Distribution type specified on the CF-1R
- Pipe insulation:
 - » R-2 on the first 5 feet hot and cold for nonrecirculating systems
 - » Entire length of recirculating piping (mandatory except when equipped with demand control)
 - » If "pipe insulation" is indicated, it was used for credit and the entire length of hot water piping must be insulated to R-4 (R-6 if pipe > 2")

Complete:

Installation Certificate (CF-6R) for installed equipment.



Inspection

Water Heating

Check the CF-1R for required measures and the CF-6R for installation information.



Useful Information

Reference House

Package D is considered the reference house for performance compliance. Approved computer programs model a house with the features of Package D to determine the space-conditioning and water-heating budgets.

Table 3-5 provides the Package D requirements for all 16 climate zones into one table. This can be used as a guide for assessing how a proposed design compares to this package of features.

**TABLE 3-5
ALTERNATIVE COMPONENT
PACKAGE D**

COMPONENT	Zones 1/16	Zones 2/5	Zones 3-4,6-7	Zones 8-10	Zones 11-13	Zones 14/15
BUILDING ENVELOPE						
Insulation Minimums ²						
Ceiling	R38	R30	R30	R30	R38	R38
Wood Frame Walls	R21	R13	R13	R13	R19	R21
"Heavy Mass" Walls	(R4.76)	(R2.44)	(R2.44)	(R2.44)	(R4.76)	(R4.76)
"Light Mass" Walls	NA	NA	NA	NA	NA	NA
Below Grade Walls	R0/R13	R0	R0	R0	R0	R0
Slab Floor Perimeter	NR/R7	NR	NR	NR	NR	NR
Raised Floors	R19	R19	R19	R19	R19	R19
Concrete Raised Floors	R8	*	R0	R0	*	*
GLAZING						
Maximum U-value ³	0.65/0.60	0.65/0.75	0.75	0.75	0.65	0.65
Maximum Total Area	16%	16%	20%	20%	16%	16%
SOLAR HEAT GAIN COEFFICIENT⁴						
South Facing Glazing	NR	NR	NR	NR	NR	NR/0.40
West Facing Glazing	NR	NR	NR	0.40	0.40	0.40
East Facing Glazing	NR	NR	NR	0.40	0.40	0.40
North Facing Glazing	NR	NR	NR	NR	NR	NR
THERMAL MASS⁵	NR	NR	NR	NR	NR	NR
INFILTRATION CONTROL						
Continuous Barrier	NR	NR	NR	NR	NR	NR
Air-to-Air Heat Exchanger	NR	NR	NR	NR	NR	NR
SPACE HEATING						
Electric Rsisant Allowed	NO	NO	NO	NO	NO	NO
If Gas. AFUE =	MIN	MIN	MIN	MIN	MIN	MIN
If Heat Pump HSPF ⁸ =	MIN	MIN	MIN	MIN	MIN	MIN
SPACE COOLING SYSTEM						
SEER =	MIN	MIN	MIN	MIN	MIN	MIN
DOMESTIC WATER						
System must meet budget, see 151(b)1 and 151(f)9	MEET BDGT	MEET BDGT	MEET BDGT	MEET BDGT	MEET BDGT	MEET BDGT

Concrete Raised Floor = R8 in zones 1, 2, 11, 13, 14 and 16, R4 in zones 12 and 15, R0 in zones 3-9

SEE NOTES FOLLOWING TABLE NO. 1-Z16

3.3 PRESCRIPTIVE COMPLIANCE DOCUMENTATION



Compliance/
Plan Check

Documentation

Documentation of the prescriptive compliance approach is simple. In many cases, the only requirement is to complete a residential Certificate of Compliance (CF-1R) form as explained in Chapter 1, Part 1.3, as well as submit a Mandatory Measures Checklist (MF-1R).

A Form 3R is required to document equivalent assembly R-values if the proposed R-value is not the same or higher than the R-value listed in the package.

Form S, Solar Heat Gain Coefficient (SHGC) Worksheet, is required to document fenestration and exterior shading combinations. When a fenestration product has an SHGC equal or lower to that required by the package, or an exterior device listed in Table 3-1 has an SHGC equal or lower to that required by the package, Form S is not required. Only exterior devices and SHGCs from Table 3-1 may be used in SHGC combination calculations for Form S.

On the CF-1R form, the climate zone and package selected for compliance should be specified. The building features and devices needed to be installed to meet the package requirements are also indicated.

An example of a completed CF-1R is presented in Figures 3-1 and 3-2. Blank copies of the CF-1R and other forms, which can be used with any compliance path, are included in Appendix A.

CERTIFICATE OF COMPLIANCE: RESIDENTIAL (Page 1 of 2) **CF-1R**

<u>Garcia Residence</u>		<u>July 1, 1999</u>
Project Title		Date
<u>5432 State Street, Fresno, CA</u>		
Project Address		
<u>FRED JONES</u>	<u>(916)654-5106</u>	
Documentation Author	Telephone	
<u>PACKAGE D</u>	<u>13</u>	
Compliance Method (Package or Computer)	Climate Zone	

Building Permit # _____
 Plan Check / Date _____
 Field Check / Date _____
 Enforcement Agency Use Only

GENERAL INFORMATION

Total Conditioned Floor Area 2010 ft² Average Ceiling Height: 9.2 ft
 Conditioned Slab Floor Area 1710 ft²

Building Type: Single Family _____ Addition
 (check one or more) _____ Multi-Family _____ Existing-Plus-Addition

Front Orientation: 160° North / (South) East / West / All Orientations
 (input front orientation in degrees from True North and circle one)

Number of Stories 2
 Number of Dwelling Units: 1
 Floor Construction Type: Slab/Raised Floor (circle one or both)

BUILDING SHELL INSULATION

Component Type	Frame Type wd = wood stl = steel	Cavity Insulation R-Value	Sheathing Insulation R-Value	Total R-Value ¹	Assembly U-Value ¹	Location/Comments (attic, garage, typical, etc.)
Wall	<u>wd 2x6.24</u>	<u>R-19</u>		<u>16.75</u>	<u>0.060</u>	<u>House Frame Walls</u>
Wall	<u>Conc. Block</u>		<u>R-5</u>	<u>6.60</u>	<u>0.152</u>	<u>Solid Grout/"Heavy Mass"</u>
Roof	<u>wd 2x4.24</u>	<u>R-38</u>		<u>41.667</u>	<u>0.024</u>	<u>2x4 trusses with R-38 insul.</u>
Floor	<u>wd 2x8.16</u>	<u>R-19</u>		<u>20.408</u>	<u>0.049</u>	<u>2x8 floor joists 16" o.c. w/R-19</u>
Slab Edge						

FENESTRATION

Shading Devices

Penetration #/Type/Pos.	Ori-entation	Area (ft ²)	Penetration U-Value	Penetration SHGC	Interior Shading Att. ²	Exterior Shading Att.	Overhangs /Fins
Front	<u>South</u>	<u>100</u>	<u>0.65</u>	<u>0.68</u>	<u>Standard</u>	<u>Standard</u>	<u>Overhang</u>
Front					<u>Standard</u>		
Left	<u>West</u>	<u>50</u>	<u>0.55</u>	<u>0.68</u>	<u>Standard</u>	<u>Sunscreen</u>	<u>None</u>
Left					<u>Standard</u>		
Rear	<u>North</u>	<u>80</u>	<u>0.65</u>	<u>0.70</u>	<u>Standard</u>	<u>Standard</u>	<u>None</u>
Rear					<u>Standard</u>		
Right	<u>East</u>	<u>50</u>	<u>0.65</u>	<u>0.68</u>	<u>Standard</u>	<u>Sunscreen</u>	<u>None</u>
Right					<u>Standard</u>		
Skylight					<u>Standard</u>		
Skylight					<u>Standard</u>		

¹ For prescriptive compliance, Total R-Value and Assembly U-Value are not required for a wood-framed wall that meets cavity R-value insulation requirement for the Prescriptive Package.
² For prescriptive compliance, there are no credits for any interior shading except the default or "Standard" drapery. These default interior shading devices (draperies) need not be installed for compliance purposes.

March 31, 1999

**Figure 3-2: Example Certificate of Compliance
 CF-1R Form (Page 1) With a Prescriptive Package**

CERTIFICATE OF COMPLIANCE: RESIDENTIAL (Page 2 of 2) **CF-1R**

Project Title GARCIA RESIDENCE Date July 1, 1999

HVAC SYSTEMS

Note: Input hydronic or combined hydronic data under Water Heating Systems, except Design Heating Load.

Heating Equipment Type (furnace, heat pump, etc.)	Minimum Efficiency (AFUE or HSPF)	Distribution Type and Location (ducts, attic, etc.)	Duct or Piping R-Value	Thermostat Type	Heat Pump Configuration (split or package)
<u>Gas Furnace</u>	<u>78%</u>	<u>Attic/Crawlspace</u>	<u>R-4.2</u>	<u>Setback</u>	<u>Split System</u>
Cooling Equipment Type (air conditioner, heat pump, evap. cooling)	Minimum Efficiency (SEER)	Duct Location (attic, etc.)	Duct R-Value	Thermostat Type	Heat Pump Configuration (split or package)
<u>Air Conditioner</u>	<u>10.0</u>	<u>Attic/Crawlspace</u>	<u>R-4.2</u>	<u>Setback</u>	<u>Split System</u>

WATER HEATING SYSTEMS

Water Heater Type	Distribution Type	Number in System	Rated ¹ Input (kW or Btu/hr)	Tank Capacity (gallons)	Energy ¹ Factor or Recovery Efficiency	Standby ¹ Loss (%)	External Tank Insulation R-Value
<u>Storage Gas</u>	<u>Hot Water Recovery</u>	<u>1</u>	<u>70,000</u>	<u>75</u>	<u>0.50</u>	<u>NA</u>	<u>None</u>

1. For small gas storage water heaters (rated inputs of less than or equal to 75,000 Btu/hr), electric resistance, and heat pump water heaters, list Energy Factor. For large gas storage water heaters (rated input of greater than 75,000 Btu/hr), list Rated Input, Recovery Efficiency and Standby Loss. For instantaneous gas water heaters, list rated input and recovery efficiencies.

SPECIAL FEATURES and MODELING ASSUMPTIONS (Add extra sheets if necessary)

Including Thermal Mass (thermal mass type, covering, thickness, and description)
None

COMPLIANCE STATEMENT

This certificate of compliance lists the building features and performance specifications needed to comply with Title 24, Parts 1 and 6 of the California Code of Regulations, and the administrative regulations to implement them. This certificate has been signed by the individual with overall design responsibility. When this certificate of compliance is submitted for a single building plan to be built in multiple orientations, any shading feature that is varied is indicated in the Special Features / Remarks section.

Designer or Owner (per Business and Professions Code)

Name: _____
Title/Firm: _____
Address: _____
Telephone: _____
Lic. #: _____

Documentation Author

Name: _____
Title/Firm: _____
Address: _____
Telephone: _____

(signature) _____ (date) _____

(signature) _____ (date) _____

Enforcement Agency

Name: _____
Title: _____
Agency: _____
Telephone: _____

(signature / stamp) _____ (date) _____

March 31, 1999

**Figure 3-3: Example Certificate of Compliance
CF-1R Form (Page 2) With a Prescriptive Package**

3.4 PACKAGE REQUIREMENTS FOR ALL CLIMATE ZONES

The following Tables No. 1-Z1 through 1-Z16 are from Section 151 of the standards. These tables list all of the requirements for Packages A, B, C and D in all 16 climate zones. See Part 3.3 for more information on general prescriptive compliance requirements.

TABLE NO. 1-Z1
**ALTERNATIVE COMPONENT PACKAGES
 FOR CLIMATE ZONE 1**

COMPONENT	PACKAGE ¹			
	A	B	C	D
BUILDING ENVELOPE				
<i>Insulation Minimums²</i>				
Ceiling	R30	R30	R49	R38
Wood Frame Walls	R19	R19	R29	R21
"Heavy Mass" Walls	(R8.5)	(R5.0)	NA	(R4.76)
"Light Mass" Walls	[R8.5]	[R6.0]	NA	NA
Below Grade Walls	NA	NA	NA	R0
Slab Floor Perimeter	R7	R7	R7	NR
Raised Floors	R19	R19	R30	R19
Concrete Raised Floors	NA	NA	NA	R8
GLAZING				
Maximum U-value ³	0.65	0.65	0.40	0.65
Maximum Total Area	NR	16%	14%	16%
Maximum Total Nonsouth Facing Area	9.6%	NR	NR	NR
Minimum South Facing Area	6.4%	NR	NR	NR
SOLAR HEAT GAIN COEFFICIENT⁴				
South Facing Glazing	NR	NR	NR	NR
West Facing Glazing	NR	NR	NR	NR
East Facing Glazing	NR	NR	NR	NR
North Facing Glazing	NR	NR	NR	NR
THERMAL MASS⁵	REQ	NR	REQ	NR
INFILTRATION CONTROL				
Continuous Barrier	NR	REQ	NR	NR
Air-to-Air Heat Exchanger	NR	REQ	NR	NR
SPACE HEATING SYSTEM⁶				
Electric Resistant Allowed	NO	NO	YES ⁷	NO
If Gas, AFUE =	78%	78%	78%	MIN
If Heat Pump,				
Split System HSPF ⁸ =	6.8	6.8	6.8	MIN
Single Package System HSPF =	6.6	6.6	6.6	MIN
SPACE COOLING SYSTEM				
If Split System A/C, SEER =	10.0	10.0	10.0	MIN
If Single Package A/C, SEER ⁹ =	9.7	9.7	9.7	MIN
DOMESTIC WATER HEATING TYPE				
System must meet budget, see 151(b)1 and 151(f)(9)	ANY	ANY	ANY ⁹	ANY

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required; MIN = Minimum
 SEE NOTES FOLLOWING TABLE NO. 1-Z16

TABLE NO. 1-Z2
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 2

COMPONENT	PACKAGE ¹			
	A	B	C	D
BUILDING ENVELOPE				
<i>Insulation Minimums²</i>				
<i>Ceiling</i>	<i>R30</i>	<i>R30</i>	<i>R49</i>	<i>R30</i>
<i>Wood Frame Walls</i>	<i>R13</i>	<i>R19</i>	<i>R29</i>	<i>R13</i>
<i>"Heavy Mass" Walls</i>	<i>(R2.3)</i>	<i>(R2.2)</i>	<i>NA</i>	<i>(R2.44)</i>
<i>"Light Mass" Walls</i>	<i>[R4.5]</i>	<i>[R4.5]</i>	<i>NA</i>	<i>NA</i>
<i>Below Grade Walls</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>R0</i>
<i>Slab Floor Perimeter</i>	<i>R7</i>	<i>R7</i>	<i>R7</i>	<i>NR</i>
<i>Raised Floors</i>	<i>R13</i>	<i>R19</i>	<i>R30</i>	<i>R19</i>
<i>Concrete Raised Floors</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>R8</i>
GLAZING				
<i>Maximum U-value³</i>	<i>1.10</i>	<i>0.65</i>	<i>0.40</i>	<i>0.65</i>
<i>Maximum Total Area</i>	<i>NR</i>	<i>14%</i>	<i>16%</i>	<i>16%</i>
<i>Maximum Total Nonsouth Facing Area</i>	<i>9.6%</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>Minimum South Facing Area</i>	<i>6.4%</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
SOLAR HEAT GAIN COEFFICIENT⁴				
<i>South Facing Glazing</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>West Facing Glazing</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>East Facing Glazing</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>North Facing Glazing</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
THERMAL MASS⁵				
<i>REQ</i>	<i>NR</i>	<i>NR</i>	<i>REQ</i>	<i>NR</i>
INFILTRATION CONTROL				
<i>Continuous Barrier</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>Air-to-Air Heat Exchanger</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
SPACE HEATING SYSTEM⁶				
<i>Electric Ristant Allowed</i>	<i>NO</i>	<i>NO</i>	<i>YES⁷</i>	<i>NO</i>
<i>If Gas, AFUE =</i>	<i>78%</i>	<i>78%</i>	<i>78%</i>	<i>MIN</i>
<i>If Heat Pump,</i>				
<i>Split System HSPF⁸ =</i>	<i>6.8</i>	<i>6.8</i>	<i>6.8</i>	<i>MIN</i>
<i>Single Package System HSPF =</i>	<i>6.6</i>	<i>6.6</i>	<i>6.6</i>	<i>MIN</i>
SPACE COOLING SYSTEM				
<i>If Split System A/C, SEER =</i>	<i>10.0</i>	<i>10.0</i>	<i>10.0</i>	<i>MIN</i>
<i>If Single Package A/C, SEER⁹ =</i>	<i>9.7</i>	<i>9.7</i>	<i>9.7</i>	<i>MIN</i>
DOMESTIC WATER HEATING TYPE				
<i>System must meet budget, see 151(b)1 and 151(f)(9)</i>	<i>ANY</i>	<i>ANY</i>	<i>ANY⁹</i>	<i>ANY</i>

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required; MIN = Minimum
SEE NOTES FOLLOWING TABLE NO. 1-Z16

**TABLE NO. 1-Z3
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 3**

COMPONENT	PACKAGE ¹			
	A	B	C	D
BUILDING ENVELOPE				
<i>Insulation Minimums²</i>				
<i>Ceiling</i>	<i>R30</i>	<i>R30</i>	<i>R38</i>	<i>R30</i>
<i>Wood Frame Walls</i>	<i>R13</i>	<i>R19</i>	<i>R25</i>	<i>R13</i>
<i>"Heavy Mass" Walls</i>	<i>(R4.5)</i>	<i>(R3.5)</i>	<i>NA</i>	<i>(R2.44)</i>
<i>"Light Mass" Walls</i>	<i>[R5.0]</i>	<i>[R5.0]</i>	<i>NA</i>	<i>NA</i>
<i>Below Grade Walls</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>R0</i>
<i>Slab Floor Perimeter</i>	<i>R7</i>	<i>R7</i>	<i>R7</i>	<i>NR</i>
<i>Raised Floors</i>	<i>R13</i>	<i>R19</i>	<i>R30</i>	<i>R19</i>
<i>Concrete Raised Floors</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>R0</i>
GLAZING				
<i>Maximum U-value³</i>	<i>1.10</i>	<i>0.65</i>	<i>0.40</i>	<i>0.75</i>
<i>Maximum Total Area</i>	<i>NR</i>	<i>16%</i>	<i>14%</i>	<i>20%</i>
<i>Maximum Total Nonsouth Facing Area</i>	<i>9.6%</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>Minimum South Facing Area</i>	<i>6.4%</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
SOLAR HEAT GAIN COEFFICIENT⁴				
<i>South Facing Glazing</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>West Facing Glazing</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>East Facing Glazing</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>North Facing Glazing</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
THERMAL MASS⁵	<i>REQ</i>	<i>NR</i>	<i>REQ</i>	<i>NR</i>
INFILTRATION CONTROL				
<i>Continuous Barrier</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>Air-to-Air Heat Exchanger</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
SPACE HEATING SYSTEM⁶				
<i>Electric R-sistant Allowed</i>	<i>NO</i>	<i>NO</i>	<i>YES⁷</i>	<i>NO</i>
<i>If Gas, AFUE =</i>	<i>78%</i>	<i>78%</i>	<i>78%</i>	<i>MIN</i>
<i>If Heat Pump,</i>				
<i>Split System HSPF⁸ =</i>	<i>6.8</i>	<i>6.8</i>	<i>6.8</i>	<i>MIN</i>
<i>Single Package System HSPF =</i>	<i>6.6</i>	<i>6.6</i>	<i>6.6</i>	<i>MIN</i>
SPACE COOLING SYSTEM				
<i>If Split System A/C, SEER =</i>	<i>10.0</i>	<i>10.0</i>	<i>10.0</i>	<i>MIN</i>
<i>If Single Package A/C, SEER⁹ =</i>	<i>9.7</i>	<i>9.7</i>	<i>9.7</i>	<i>MIN</i>
DOMESTIC WATER HEATING TYPE				
<i>System must meet budget, see 151(b)1 and 151(f)(9)</i>	<i>ANY</i>	<i>ANY</i>	<i>ANY⁹</i>	<i>ANY</i>

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required; MIN = Minimum
SEE NOTES FOLLOWING TABLE NO. 1-Z16

**TABLE NO. 1-Z4
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 4**

COMPONENT	PACKAGE ¹			
	A	B	C	D
BUILDING ENVELOPE				
<i>Insulation Minimums²</i>				
<i>Ceiling</i>	<i>R30</i>	<i>R30</i>	<i>R38</i>	<i>R30</i>
<i>Wood Frame Walls</i>	<i>R13</i>	<i>R19</i>	<i>R25</i>	<i>R13</i>
<i>"Heavy Mass" Walls</i>	<i>(R3.5)</i>	<i>(R3.5)</i>	<i>NA</i>	<i>(R2.44)</i>
<i>"Light Mass" Walls</i>	<i>[R5.0]</i>	<i>[R5.0]</i>	<i>NA</i>	<i>NA</i>
<i>Below Grade Walls</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>R0</i>
<i>Slab Floor Perimeter</i>	<i>R7</i>	<i>R7</i>	<i>R7</i>	<i>NR</i>
<i>Raised Floors</i>	<i>R13</i>	<i>R19</i>	<i>R30</i>	<i>R19</i>
<i>Concrete Raised Floors</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>R0</i>
GLAZING				
<i>Maximum U-value³</i>	<i>1.10</i>	<i>0.65</i>	<i>0.40</i>	<i>0.75</i>
<i>Maximum Total Area</i>	<i>NR</i>	<i>16%</i>	<i>14%</i>	<i>20%</i>
<i>Maximum Total Nonsouth</i>	<i>9.6%</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>Minimum South Facing Area</i>	<i>6.4%</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
SOLAR HEAT GAIN COEFFICIENT⁴				
<i>South Facing Glazing</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>West Facing Glazing</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>East Facing Glazing</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>North Facing Glazing</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
THERMAL MASS⁵	<i>REQ</i>	<i>NR</i>	<i>REQ</i>	<i>NR</i>
INFILTRATION CONTROL				
<i>Continuous Barrier</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>Air-to-Air Heat Exchanger</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
SPACE HEATING SYSTEM⁶				
<i>Electric Ristant Allowed</i>	<i>NO</i>	<i>NO</i>	<i>YES⁷</i>	<i>NO</i>
<i>If Gas, AFUE =</i>	<i>78%</i>	<i>78%</i>	<i>78%</i>	<i>MIN</i>
<i>If Heat Pump,</i>				
<i>Split System HSPF⁸ =</i>	<i>6.8</i>	<i>6.8</i>	<i>6.8</i>	<i>MIN</i>
<i>Single Package System HSPF =</i>	<i>6.6</i>	<i>6.6</i>	<i>6.6</i>	<i>MIN</i>
SPACE COOLING SYSTEM				
<i>If Split System A/C, SEER =</i>	<i>10.0</i>	<i>10.0</i>	<i>10.0</i>	<i>MIN</i>
<i>If Single Package A/C, SEER⁹ =</i>	<i>9.7</i>	<i>9.7</i>	<i>9.7</i>	<i>MIN</i>
DOMESTIC WATER HEATING TYPE				
<i>System must meet budget, see 151(b)1 and 151(f)(9)</i>	<i>ANY</i>	<i>ANY</i>	<i>ANY⁹</i>	<i>ANY</i>

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required; MIN = Minimum
SEE NOTES FOLLOWING TABLE NO. 1-Z16

**TABLE NO. 1-Z5
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 5**

COMPONENT	PACKAGE ¹			
	A	B	C	D
BUILDING ENVELOPE				
<i>Insulation Minimums²</i>				
<i>Ceiling</i>	R30	R30	R38	R30
<i>Wood Frame Walls</i>	R13	R19	R25	R13
<i>"Heavy Mass" Walls</i>	(R2.4)	(R2.3)	NA	(R2.44)
<i>"Light Mass" Walls</i>	[R4.5]	[R4.5]	NA	NA
<i>Below Grade Walls</i>	NA	NA	NA	R0
<i>Slab Floor Perimeter</i>	R7	R7	R7	NR
<i>Raised Floors</i>	R13	R19	R30	R19
<i>Concrete Raised Floors</i>	NA	NA	NA	R0
GLAZING				
<i>Maximum U-value³</i>	1.10	0.65	0.40	0.75
<i>Maximum Total Area</i>	NR	14%	16%	16%
<i>Maximum Total Nonsouth Facing Area</i>	9.6%	NR	NR	NR
<i>Minimum South Facing Area</i>	6.4%	NR	NR	NR
SOLAR HEAT GAIN COEFFICIENT⁴				
<i>South Facing Glazing</i>	NR	NR	NR	NR
<i>West Facing Glazing</i>	NR	NR	NR	NR
<i>East Facing Glazing</i>	NR	NR	NR	NR
<i>North Facing Glazing</i>	NR	NR	NR	NR
THERMAL MASS⁵	REQ	NR	REQ	NR
INFILTRATION CONTROL				
<i>Continuous Barrier</i>	NR	NR	NR	NR
<i>Air-to-Air Heat Exchanger</i>	NR	NR	NR	NR
SPACE HEATING SYSTEM⁶				
<i>Electric Ristant Allowed</i>	NO	NO	YES ⁷	NO
<i>If Gas, AFUE =</i>	78%	78%	78%	MIN
<i>If Heat Pump,</i>				
<i>Split System HSPF⁸ =</i>	6.8	6.8	6.8	MIN
<i>Single Package System HSPF =</i>	6.6	6.6	6.6	MIN
SPACE COOLING SYSTEM				
<i>If Split System A/C, SEER =</i>	10.0	10.0	10.0	MIN
<i>If Single Package A/C, SEER⁹ =</i>	9.7	9.7	9.7	MIN
DOMESTIC WATER HEATING TYPE				
<i>System must meet budget, see 151(b)1 and 151(f)(9)</i>	ANY	ANY	ANY ⁹	ANY

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required; MIN = Minimum
SEE NOTES FOLLOWING TABLE NO. 1-Z16

**TABLE NO. 1-Z6
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 6**

COMPONENT	PACKAGE ¹			
	A	B	C	D
BUILDING ENVELOPE				
<i>Insulation Minimums²</i>				
<i>Ceiling</i>	<i>R19</i>	<i>R30</i>	<i>R38</i>	<i>R30</i>
<i>Wood Frame Walls</i>	<i>R13</i>	<i>R19</i>	<i>R21</i>	<i>R13</i>
<i>"Heavy Mass" Walls</i>	<i>(R1.5)</i>	<i>(R1.6)</i>	<i>NA</i>	<i>(R2.44)</i>
<i>"Light Mass" Walls</i>	<i>[R4.0]</i>	<i>[R4.5]</i>	<i>NA</i>	<i>NA</i>
<i>Below Grade Walls</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>R0</i>
<i>Slab Floor Perimeter</i>	<i>NR</i>	<i>R7</i>	<i>R7</i>	<i>NR</i>
<i>Raised Floors</i>	<i>R13</i>	<i>R19</i>	<i>R21</i>	<i>R19</i>
<i>Concrete Raised Floors</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>R0</i>
GLAZING				
<i>Maximum U-value³</i>	<i>1.10</i>	<i>0.65</i>	<i>0.50</i>	<i>0.75</i>
<i>Maximum Total Area</i>	<i>NR</i>	<i>16%</i>	<i>14%</i>	<i>20%</i>
<i>Maximum Total Nonsouth Facing Area</i>	<i>9.6%</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>Minimum South Facing Area</i>	<i>6.4%</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
SOLAR HEAT GAIN COEFFICIENT⁴				
<i>South Facing Glazing</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>West Facing Glazing</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>East Facing Glazing</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>North Facing Glazing</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
THERMAL MASS⁵	<i>REQ</i>	<i>NR</i>	<i>REQ</i>	<i>NR</i>
INFILTRATION CONTROL				
<i>Continuous Barrier</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>Air-to-Air Heat Exchanger</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
SPACE HEATING SYSTEM⁶				
<i>Electric Resistant Allowed</i>	<i>NO</i>	<i>NO</i>	<i>YES⁷</i>	<i>NO</i>
<i>If Gas, AFUE =</i>	<i>78%</i>	<i>78%</i>	<i>78%</i>	<i>MIN</i>
<i>If Heat Pump,</i>				
<i>Split System HSPF⁸ =</i>	<i>6.8</i>	<i>6.8</i>	<i>6.8</i>	<i>MIN</i>
<i>Single Package System HSPF =</i>	<i>6.6</i>	<i>6.6</i>	<i>6.6</i>	<i>MIN</i>
SPACE COOLING SYSTEM				
<i>If Split System A/C, SEER =</i>	<i>10.0</i>	<i>10.0</i>	<i>10.0</i>	<i>MIN</i>
<i>If Single Package A/C, SEER⁹ =</i>	<i>9.7</i>	<i>9.7</i>	<i>9.7</i>	<i>MIN</i>
DOMESTIC WATER HEATING TYPE				
<i>System must meet budget, see 151(b)1 and 151(f)(9)</i>	<i>ANY</i>	<i>ANY</i>	<i>ANY⁹</i>	<i>ANY</i>

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required; MIN = Minimum
SEE NOTES FOLLOWING TABLE NO. 1-Z16

**TABLE NO. 1-Z7
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 7**

COMPONENT	PACKAGE ¹			
	A	B	C	D
BUILDING ENVELOPE				
<i>Insulation Minimums²</i>				
Ceiling	R19	R30	R38	R30
Wood Frame Walls	R13	R13	R21	R13
"Heavy Mass" Walls	(R1.7)	(R1.4)	NA	(R2.44)
"Light Mass" Walls	[R4.0]	[R3.5]	NA	NA
Below Grade Walls	NA	NA	NA	R0
Slab Floor Perimeter	NR	R7	R7	NR
Raised Floors	R13	R13	R21	R19
Concrete Raised Floors	NA	NA	NA	R0
GLAZING				
Maximum U-value ³	1.10	0.65	0.50	0.75
Maximum Total Area	NR	14%	14%	20%
Maximum Total Nonsouth Facing Area	9.6%	NR	NR	NR
Minimum South Facing Area	6.4%	NR	NR	NR
SOLAR HEAT GAIN COEFFICIENT⁴				
South Facing Glazing	NR	NR	NR	NR
West Facing Glazing	NR	NR	NR	NR
East Facing Glazing	NR	NR	NR	NR
North Facing Glazing	NR	NR	NR	NR
THERMAL MASS⁵				
	REQ	NR	REQ	NR
INFILTRATION CONTROL				
Continuous Barrier	NR	NR	NR	NR
Air-to-Air Heat Exchanger	NR	NR	NR	NR
SPACE HEATING SYSTEM⁶				
Electric Ristant Allowed	NO	NO	YES ⁷	NO
If Gas, AFUE =	78%	78%	78%	MIN
If Heat Pump,				
Split System HSPF ⁸ =	6.8	6.8	6.8	MIN
Single Package System HSPF =	6.6	6.6	6.6	MIN
SPACE COOLING SYSTEM				
If Split System A/C, SEER =	10.0	10.0	10.0	MIN
If Single Package A/C, SEER ⁹ =	9.7	9.7	9.7	MIN
DOMESTIC WATER HEATING TYPE				
System must meet budget, see 151(b)1 and 151(f)(9)	ANY	ANY	ANY ⁹	ANY

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required; MIN = Minimum
SEE NOTES FOLLOWING TABLE NO. 1-Z16

**TABLE NO. 1-Z8
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 8**

COMPONENT	PACKAGE ¹			
	A	B	C	D
BUILDING ENVELOPE				
<i>Insulation Minimums²</i>				
Ceiling	R30	R30	R38	R30
Wood Frame Walls	R13	R19	R21	R13
"Heavy Mass" Walls	(R1.6)	(R1.6)	NA	(R2.44)
"Light Mass" Walls	[R4.0]	[R4.5]	NA	NA
Below Grade Walls	NA	NA	NA	R0
Slab Floor Perimeter	NR	R7	R7	NR
Raised Floors	R13	R19	R21	R19
Concrete Raised Floors	NA	NA	NA	R0
GLAZING				
Maximum U-value ³	1.10	0.65	0.50	0.75
Maximum Total Area	NR	14%	14%	20%
Maximum Total Nonsouth Facing Area	9.6%	NR	NR	NR
Minimum South Facing Area	6.4%	NR	NR	NR
SOLAR HEAT GAIN COEFFICIENT⁴				
South Facing Glazing	0.40	0.40	NR	NR
West Facing Glazing	0.40	0.40	0.40	0.40
East Facing Glazing	NR	NR	0.40	0.40
North Facing Glazing	NR	NR	NR	NR
THERMAL MASS⁵				
	REQ	NR	REQ	NR
INFILTRATION CONTROL				
Continuous Barrier	NR	NR	NR	NR
Air-to-Air Heat Exchanger	NR	NR	NR	NR
SPACE HEATING SYSTEM⁶				
Electric Ristant Allowed	NO	NO	YES ⁷	NO
If Gas, AFUE =	78%	78%	78%	MIN
If Heat Pump,				
Split System HSPF ⁸ =	6.8	6.8	6.8	MIN
Single Package System HSPF =	6.6	6.6	6.6	MIN
SPACE COOLING SYSTEM				
If Split System A/C, SEER =	10.0	10.0	10.0	MIN
If Single Package A/C, SEER ⁹ =	9.7	9.7	9.7	MIN
DOMESTIC WATER HEATING TYPE				
System must meet budget, see 151(b)1 and 151(f)(9)	ANY	ANY	ANY ⁹	ANY

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required; MIN = Minimum
SEE NOTES FOLLOWING TABLE NO. 1-Z16

**TABLE NO. 1-Z9
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 9**

COMPONENT	PACKAGE ¹			
	A	B	C	D
BUILDING ENVELOPE				
<i>Insulation Minimums²</i>				
Ceiling	R30	R30	R38	R30
Wood Frame Walls	R13	R19	R21	R13
"Heavy Mass" Walls	(R1.4)	(R1.5)	NA	(R2.44)
"Light Mass" Walls	[R4.0]	[R4.0]	NA	NA
Below Grade Walls	NA	NA	NA	R0
Slab Floor Perimeter	R7	R7	R7	NR
Raised Floors	R13	R19	R21	R19
Concrete Raised Floors	NA	NA	NA	R0
GLAZING				
Maximum U-value ³	1.10	0.65	0.50	0.75
Maximum Total Area	NR	14%	14%	20%
Maximum Total Nonsouth Facing Area	9.6%	NR	NR	NR
Minimum South Facing Area	6.4%	NR	NR	NR
SOLAR HEAT GAIN COEFFICIENT⁴				
South Facing Glazing	0.40	0.40	NR	NR
West Facing Glazing	0.40	0.40	0.40	0.40
East Facing Glazing	NR	NR	0.40	0.40
North Facing Glazing	NR	NR	NR	NR
THERMAL MASS⁵				
	REQ	NR	REQ	NR
INFILTRATION CONTROL				
Continuous Barrier	NR	NR	NR	NR
Air-to-Air Heat Exchanger	NR	NR	NR	NR
SPACE HEATING SYSTEM⁶				
Electric Ristant Allowed	NO	NO	YES ⁷	NO
If Gas, AFUE =	78%	78%	78%	MIN
If Heat Pump,				
Split System HSPF ⁸ =	6.8	6.8	6.8	MIN
Single Package System HSPF =	6.6	6.6	6.6	MIN
SPACE COOLING SYSTEM				
If Split System A/C, SEER =	10.0	10.0	10.0	MIN
If Single Package A/C, SEER ⁹ =	9.7	9.7	9.7	MIN
DOMESTIC WATER HEATING TYPE				
System must meet budget, see 151(b)1 and 151(f)(9)	ANY	ANY	ANY ⁹	ANY

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required; MIN = Minimum
SEE NOTES FOLLOWING TABLE NO. 1-Z16

**TABLE NO. 1-Z10
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 10**

COMPONENT	PACKAGE ¹			
	A	B	C	D
BUILDING ENVELOPE				
<i>Insulation Minimums²</i>				
Ceiling	R30	R30	R49	R30
Wood Frame Walls	R13	R19	R25	R13
"Heavy Mass" Walls	(R1.9)	(R2.0)	NA	(R2.44)
"Light Mass" Walls	[R4.5]	[R4.5]	NA	NA
Below Grade Walls	NA	NA	NA	R0
Slab Floor Perimeter	R7	R7	R7	NR
Raised Floors	R13	R19	R30	R19
Concrete Raised Floors	NA	NA	NA	R0
GLAZING				
Maximum U-value ³	1.10	0.65	0.40	0.75
Maximum Total Area	NR	16%	16%	20%
Maximum Total Nonsouth Facing Area	9.6%	NR	NR	NR
Minimum South Facing Area	6.4%	NR	NR	NR
SOLAR HEAT GAIN COEFFICIENT⁴				
South Facing Glazing	0.40	0.40	NR	NR
West Facing Glazing	0.40	0.40	0.40	0.40
East Facing Glazing	NR	NR	0.40	0.40
North Facing Glazing	NR	NR	NR	NR
THERMAL MASS⁵				
	REQ	NR	REQ	NR
INFILTRATION CONTROL				
Continuous Barrier	NR	NR	NR	NR
Air-to-Air Heat Exchanger	NR	NR	NR	NR
SPACE HEATING SYSTEM⁶				
Electric Ristant Allowed	NO	NO	YES ⁷	NO
If Gas, AFUE =	78%	78%	78%	MIN
If Heat Pump,				
Split System HSPF ⁸ =	6.8	6.8	6.8	MIN
Single Package System HSPF =	6.6	6.6	6.6	MIN
SPACE COOLING SYSTEM				
If Split System A/C, SEER =	10.0	10.0	10.0	MIN
If Single Package A/C, SEER ⁹ =	9.7	9.7	9.7	MIN
DOMESTIC WATER HEATING TYPE				
System must meet budget, see 151(b)1 and 151(f)(9)	ANY	ANY	ANY ⁹	ANY

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required; MIN = Minimum
SEE NOTES FOLLOWING TABLE NO. 1-Z16

**TABLE NO. 1-Z11
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 11**

COMPONENT	PACKAGE ¹			
	A	B	C	D
BUILDING ENVELOPE				
<i>Insulation Minimums²</i>				
Ceiling	R30	R30	R49	R38
Wood Frame Walls	R13	R19	R29	R19
"Heavy Mass" Walls	(R5.0)	(R5.5)	NA	(R4.76)
"Light Mass" Walls	[R6.0]	[R6.5]	NA	NA
Below Grade Walls	NA	NA	NA	R0
Slab Floor Perimeter	R7	R7	R7	NR
Raised Floors	R13	R19	R30	R19
Concrete Raised Floors	NA	NA	NA	R8
GLAZING				
Maximum U-value ³	0.65	0.65	0.40	0.65
Maximum Total Area	NR	14%	16%	16%
Maximum Total Nonsouth Facing Area	9.6%	NR	NR	NR
Minimum South Facing Area	6.4%	NR	NR	NR
SOLAR HEAT GAIN COEFFICIENT⁴				
South Facing Glazing	0.40	0.40	NR	NR
West Facing Glazing	0.40	0.40	0.40	0.40
East Facing Glazing	NR	NR	0.40	0.40
North Facing Glazing	NR	NR	NR	NR
THERMAL MASS⁵				
	REQ	NR	REQ	NR
INFILTRATION CONTROL				
Continuous Barrier	NR	NR	NR	NR
Air-to-Air Heat Exchanger	NR	NR	NR	NR
SPACE HEATING SYSTEM⁶				
Electric Ristant Allowed	NO	NO	YES ⁷	NO
If Gas, AFUE =	78%	78%	78%	MIN
If Heat Pump,				
Split System HSPF ⁸ =	6.8	6.8	6.8	MIN
Single Package System HSPF =	6.6	6.6	6.6	MIN
SPACE COOLING SYSTEM				
If Split System A/C, SEER =	10.0	10.0	10.0	MIN
If Single Package A/C, SEER ⁹ =	9.7	9.7	9.7	MIN
DOMESTIC WATER HEATING TYPE				
System must meet budget, see 151(b)1 and 151(f)(9)	ANY	ANY	ANY ⁹	ANY

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required; MIN = Minimum
SEE NOTES FOLLOWING TABLE NO. 1-Z16

**TABLE NO. 1-Z12
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 12**

COMPONENT	PACKAGE ¹			
	A	B	C	D
BUILDING ENVELOPE				
<i>Insulation Minimums²</i>				
<i>Ceiling</i>	<i>R30</i>	<i>R30</i>	<i>R49</i>	<i>R38</i>
<i>Wood Frame Walls</i>	<i>R13</i>	<i>R19</i>	<i>R29</i>	<i>R19</i>
<i>"Heavy Mass" Walls</i>	<i>(R3.5)</i>	<i>(R3.5)</i>	<i>NA</i>	<i>(R4.76)</i>
<i>"Light Mass" Walls</i>	<i>[R5.0]</i>	<i>[R5.5]</i>	<i>NA</i>	<i>NA</i>
<i>Below Grade Walls</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>R0</i>
<i>Slab Floor Perimeter</i>	<i>NR</i>	<i>R7</i>	<i>R7</i>	<i>NR</i>
<i>Raised Floors</i>	<i>R13</i>	<i>R19</i>	<i>R30</i>	<i>R19</i>
<i>Concrete Raised Floors</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>R4</i>
GLAZING				
<i>Maximum U-value³</i>	<i>0.65</i>	<i>0.65</i>	<i>0.40</i>	<i>0.65</i>
<i>Maximum Total Area</i>	<i>NR</i>	<i>14%</i>	<i>16%</i>	<i>16%</i>
<i>Maximum Total Nonsouth Facing Area</i>	<i>9.6%</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>Minimum South Facing Area</i>	<i>6.4%</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
SOLAR HEAT GAIN COEFFICIENT⁴				
<i>South Facing Glazing</i>	<i>0.40</i>	<i>0.40</i>	<i>NR</i>	<i>NR</i>
<i>West Facing Glazing</i>	<i>0.40</i>	<i>0.40</i>	<i>0.40</i>	<i>0.40</i>
<i>East Facing Glazing</i>	<i>NR</i>	<i>NR</i>	<i>0.40</i>	<i>0.40</i>
<i>North Facing Glazing</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
THERMAL MASS⁵				
<i>REQ</i>	<i>NR</i>	<i>NR</i>	<i>REQ</i>	<i>NR</i>
INFILTRATION CONTROL				
<i>Continuous Barrier</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>Air-to-Air Heat Exchanger</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
SPACE HEATING SYSTEM⁶				
<i>Electric Resistant Allowed</i>	<i>NO</i>	<i>NO</i>	<i>YES⁷</i>	<i>NO</i>
<i>If Gas, AFUE =</i>	<i>78%</i>	<i>78%</i>	<i>78%</i>	<i>MIN</i>
<i>If Heat Pump,</i>				
<i>Split System HSPF⁸ =</i>	<i>6.8</i>	<i>6.8</i>	<i>6.8</i>	<i>MIN</i>
<i>Single Package System HSPF =</i>	<i>6.6</i>	<i>6.6</i>	<i>6.6</i>	<i>MIN</i>
SPACE COOLING SYSTEM				
<i>If Split System A/C, SEER =</i>	<i>10.0</i>	<i>10.0</i>	<i>10.0</i>	<i>MIN</i>
<i>If Single Package A/C, SEER⁹ =</i>	<i>9.7</i>	<i>9.7</i>	<i>9.7</i>	<i>MIN</i>
DOMESTIC WATER HEATING TYPE				
<i>System must meet budget, see 151(b)1 and 151(f)(9)</i>	<i>ANY</i>	<i>ANY</i>	<i>ANY⁹</i>	<i>ANY</i>

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required; MIN = Minimum
SEE NOTES FOLLOWING TABLE NO. 1-Z16

**TABLE NO. 1-Z13
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 13**

COMPONENT	PACKAGE ¹			
	A	B	C	D
BUILDING ENVELOPE				
<i>Insulation Minimums²</i>				
Ceiling	R30	R30	R49	R38
Wood Frame Walls	R13	R19	R29	R19
"Heavy Mass" Walls	(R4.0)	(R4.0)	NA	(R4.76)
"Light Mass" Walls	[R5.5]	[R6.0]	NA	NA
Below Grade Walls	NA	NA	NA	R0
Slab Floor Perimeter	NR	R7	R7	NR
Raised Floors	R13	R19	R30	R19
Concrete Raised Floors	NA	NA	NA	R8
GLAZING				
Maximum U-value ³	0.65	0.65	0.40	0.65
Maximum Total Area	NR	14%	16%	16%
Maximum Total Nonsouth Facing Area	9.6%	NR	NR	NR
Minimum South Facing Area	6.4%	NR	NR	NR
SOLAR HEAT GAIN COEFFICIENT⁴				
South Facing Glazing	0.40	0.40	NR	NR
West Facing Glazing	0.40	0.40	0.40	0.40
East Facing Glazing	NR	NR	0.40	0.40
North Facing Glazing	NR	NR	NR	NR
THERMAL MASS⁵				
	REQ	NR	REQ	NR
INFILTRATION CONTROL				
Continuous Barrier	NR	NR	NR	NR
Air-to-Air Heat Exchanger	NR	NR	NR	NR
SPACE HEATING SYSTEM⁶				
Electric Ristant Allowed	NO	NO	YES ⁷	NO
If Gas, AFUE =	78%	78%	78%	MIN
If Heat Pump,				
Split System HSPF ⁸ =	6.8	6.8	6.8	MIN
Single Package System HSPF =	6.6	6.6	6.6	MIN
SPACE COOLING SYSTEM				
If Split System A/C, SEER =	10.0	10.0	10.0	MIN
If Single Package A/C, SEER ⁹ =	9.7	9.7	9.7	MIN
DOMESTIC WATER HEATING TYPE				
System must meet budget, see 151(b)1 and 151(f)(9)	ANY	ANY	ANY ⁹	ANY

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required; MIN = Minimum
SEE NOTES FOLLOWING TABLE NO. 1-Z16

**TABLE NO. 1-Z14
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 14**

COMPONENT	PACKAGE ¹			
	A	B	C	D
BUILDING ENVELOPE				
<i>Insulation Minimums²</i>				
Ceiling	R38	R38	R49	R38
Wood Frame Walls	R19	R19	R29	R21
"Heavy Mass" Walls	(R7.0)	(R5.5)	NA	(R4.76)
"Light Mass" Walls	[R8.0]	[R6.5]	NA	NA
Below Grade Walls	NA	NA	NA	R0
Slab Floor Perimeter	R7	R7	R7	NR
Raised Floors	R19	R19	R30	R19
Concrete Raised Floors	NA	NA	NA	R8
GLAZING				
Maximum U-value ³	0.65	0.65	0.40	0.65
Maximum Total Area	NR	16%	14%	16%
Maximum Total Nonsouth Facing Area	9.6%	NR	NR	NR
Minimum South Facing Area	6.4%	NR	NR	NR
SOLAR HEAT GAIN COEFFICIENT⁴				
South Facing Glazing	0.15	0.15	NR	NR
West Facing Glazing	0.15	0.15	0.40	0.40
East Facing Glazing	NR	NR	0.40	0.40
North Facing Glazing	NR	NR	NR	NR
THERMAL MASS⁵				
	REQ	NR	REQ	NR
INFILTRATION CONTROL				
Continuous Barrier	NR	REQ	NR	NR
Air-to-Air Heat Exchanger	NR	REQ	NR	NR
SPACE HEATING SYSTEM⁶				
Electric Ristant Allowed	NO	NO	YES ⁷	NO
If Gas, AFUE =	78%	78%	78%	MIN
If Heat Pump,				
Split System HSPF ⁸ =	6.8	6.8	6.8	MIN
Single Package System HSPF =	6.6	6.6	6.6	MIN
SPACE COOLING SYSTEM				
If Split System A/C, SEER =	10.0	10.0	10.0	MIN
If Single Package A/C, SEER ⁹ =	9.7	9.7	9.7	MIN
DOMESTIC WATER HEATING TYPE				
System must meet budget, see 151(b)1 and 151(f)(9)	ANY	ANY	ANY ⁹	ANY

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required; MIN = Minimum
SEE NOTES FOLLOWING TABLE NO. 1-Z16

**TABLE NO. 1-Z15
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 15**

COMPONENT	PACKAGE ¹			
	A	B	C	D
BUILDING ENVELOPE				
<i>Insulation Minimums²</i>				
Ceiling	R30	R38	R49	R38
Wood Frame Walls	R19	R19	R29	R21
"Heavy Mass" Walls	(R5.5)	(R4.5)	NA	(R4.76)
"Light Mass" Walls	[R7.0]	[R6.0]	NA	NA
Below Grade Walls	NA	NA	NA	R0
Slab Floor Perimeter	R7	R7	R7	NR
Raised Floors	R19	R19	R21	R19
Concrete Raised Floors	NA	NA	NA	R4
GLAZING				
Maximum U-value ³	0.65	0.65	0.40	0.65
Maximum Total Area	NR	16%	16%	16%
Maximum Total Nonsouth Facing Area	9.6%	NR	NR	NR
Minimum South Facing Area	6.4%	NR	NR	NR
SOLAR HEAT GAIN COEFFICIENT⁴				
South Facing Glazing	0.15	0.15	0.40	0.40
West Facing Glazing	0.15	0.15	0.40	0.40
East Facing Glazing	NR	NR	0.40	0.40
North Facing Glazing	NR	NR	NR	NR
THERMAL MASS⁵				
	REQ	NR	REQ	NR
INFILTRATION CONTROL				
Continuous Barrier	NR	REQ	NR	NR
Air-to-Air Heat Exchanger	NR	REQ	NR	NR
SPACE HEATING SYSTEM⁶				
Electric Ristant Allowed	NO	NO	YES ⁷	NO
If Gas, AFUE =	78%	78%	78%	MIN
If Heat Pump,				
Split System HSPF ⁸ =	6.8	6.8	6.8	MIN
Single Package System HSPF =	6.6	6.6	6.6	MIN
SPACE COOLING SYSTEM				
If Split System A/C, SEER =	10.0	10.0	10.0	MIN
If Single Package A/C, SEER ⁹ =	9.7	9.7	9.7	MIN
DOMESTIC WATER HEATING TYPE				
System must meet budget, see 151(b)1 and 151(f)(9)	ANY	ANY	ANY ⁹	ANY

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required; MIN = Minimum
SEE NOTES FOLLOWING TABLE NO. 1-Z16

**TABLE NO. 1-Z16
ALTERNATIVE COMPONENT PACKAGES
FOR CLIMATE ZONE 16**

COMPONENT	PACKAGE ¹			
	A	B	C	D
BUILDING ENVELOPE				
<i>Insulation Minimums²</i>				
Ceiling	R38	R38	R49	R38
Wood Frame Walls	R19	R19	R29	R21
"Heavy Mass" Walls	(R9.5)	(R7.0)	NA	(R4.76)
"Light Mass" Walls	[R9.5]	[R7.5]	NA	NA
Below Grade Walls	NA	NA	NA	R13
Slab Floor Perimeter	R7	R7	R7	R7
Raised Floors	R19	R19	R30	R19
Concrete Raised Floors	NA	NA	NA	R8
GLAZING				
Maximum U-value ³	0.65	0.65	0.40	0.60
Maximum Total Area	NR	16%	14%	16%
Maximum Total Nonsouth Facing Area	9.6%	NR	NR	NR
Minimum South Facing Area	6.4%	NR	NR	NR
SOLAR HEAT GAIN COEFFICIENT⁴				
South Facing Glazing	NR	NR	NR	NR
West Facing Glazing	NR	NR	NR	NR
East Facing Glazing	NR	NR	NR	NR
North Facing Glazing	NR	NR	NR	NR
THERMAL MASS⁵				
REO	REQ	NR	REQ	NR
INFILTRATION CONTROL				
Continuous Barrier	NR	REQ	NR	NR
Air-to-Air Heat Exchanger	NR	REQ	NR	NR
SPACE HEATING SYSTEM⁶				
Electric Ristant Allowed	NO	NO	YES ⁷	NO
If Gas, AFUE =	78%	78%	78%	MIN
If Heat Pump,				
Split System HSPF ⁸ =	6.8	6.8	6.8	MIN
Single Package System HSPF =	6.6	6.6	6.6	MIN
SPACE COOLING SYSTEM				
If Split System A/C, SEER =	10.0	10.0	10.0	MIN
If Single Package A/C, SEER ⁹ =	9.7	9.7	9.7	MIN
DOMESTIC WATER HEATING TYPE				
System must meet budget, see 151(b)1 and 151(f)(9)	ANY	ANY	ANY ⁹	ANY

LEGEND: NR = Not Required; NA = Not Applicable; REQ = Required; MIN = Minimum
SEE NOTES FOLLOWING TABLE NO. 1-Z16

**NOTES TO THE LOW-RISE RESIDENTIAL PACKAGES
IN TABLES NO. 1-Z1 THROUGH 1-Z16**

1. *Package A is a passive solar design requiring a significant amount of south facing glazing, a small amount of non-south facing glazing, and a large area of thermal mass. Package B allows a small area of glazing, with light and heavy mass wall alternatives; some zones require continuous infiltration barriers and air-to-air heat exchangers. Package C is the only package that allows electric resistance space heating. Package C may be used only if the building is in an area (1) where natural gas is not currently available and (2) where extension of natural gas service is impractical, as determined by the natural gas utility. Package D allows more glazing area in some zones with moderately high insulation levels; slab edge insulation is required in climate zone 16.*
2. *The R-values shown for ceiling, wood frame wall and raised floor are for wood frame construction with insulation installed between the framing members. For alternative construction assemblies, see Section 151(f)1.A.*

The heavy mass wall R-value in parentheses is the minimum R-value for the entire wall assembly if the wall weight exceeds 40 pounds per square foot. The light mass wall R-value in brackets is the minimum R-value for the entire assembly if the heat capacity of the wall meets or exceeds the result of multiplying the bracketed minimum R-value by 0.65. Any insulation installed on heavy or light mass walls must be integral with or installed on the outside of the exterior mass. The inside surface of the thermal mass, including plaster or gypsum board in direct contact with the masonry wall, shall be exposed to the room air. The exterior wall used to meet the R-value in parentheses cannot also be used to meet the thermal mass requirement.

3. *For glazing U-value rating procedures and labeling requirements see Section 116(a)2.*
4. *If the package specifies a solar heat gain coefficient the builder shall meet the requirements of Section 151(f)3.*
5. *If the package requires thermal mass, meet the requirements of Section 151(f)4.*
6. *Automatic setback thermostats must be installed in conjunction with all space heating systems, in accordance with Section 151(f)9.*
7. *Ducts in Package C shall be insulated to an installed value of at least R-8.*
8. *HSPF means "heating seasonal performance factor."*
9. *Electric resistance water heating is allowed as the main water heating source in Package C only if the water heater is located within the building envelope and a minimum of 25 percent of the energy for water heating is provided by a passive or active solar system or a wood stove boiler. The wood stove boiler credit is not allowed in climate zones 8, 10, and 15, nor in localities that do not allow wood stoves.*