

151150.1 Res General Performance and Prescriptive

SUBCHAPTER 8

LOW-RISE RESIDENTIAL BUILDINGS—PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES FOR NEWLY CONSTRUCTED BUILDINGS

SECTION 151150.1 – PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES FOR NEWLY CONSTRUCTED BUILDINGS

(a) **Basic Requirements.** New low-rise residential buildings shall meet all of the following:

1. The requirements of Sections 110.1 through 110.9-10 applicable to new residential buildings.
2. The requirements of Section 150.0 (mandatory features).
3. Either the performance standards (~~energy budgets~~) or the prescriptive standards (~~alternative component packages~~) set forth in this section for the climate zone in which the building will be located. Climate zones are shown in FIGURE 101-A.

ALTERNATIVE to Section 151150.1(a)3: If a single contiguous subdivision or tract falls in more than one climate zone, all buildings in the subdivision or tract may be designed to meet the performance or prescriptive standards for the climate zone that contains 50 percent or more of the dwelling units.

NOTE: The Commission periodically updates, publishes, and makes available to interested persons and local enforcement agencies precise descriptions of the ~~metes and bounds for~~ climate zones, which is available by -zip codes boundaries depicted in Joint Appendix JA2 – Reference Weather /Climate Data, FIGURE 101-A and a list of the communities in each zone.

4. For other provisions applicable to new low-rise residential buildings, refer to Section 100.

(b) **Performance Standards.** A building complies with the performance standard if the energy budget calculated for the Proposed Design Building under Subsection 2 is no greater than the energy budget calculated for the Standard Design Building under Subsection 1. the combined depletable TDV energy use for water heating Section 151(b)1 and space conditioning Section 151(b)2 is less than or equal to the combined maximum allowable TDV energy use for both water heating and space conditioning, even if the building fails to meet either the water heating or space conditioning budget alone.

1. Energy Budget for the Standard Design Building. The energy budget for a Standard Design Building is determined by applying the mandatory and prescriptive requirements to the Proposed Design Building. The energy budget is the sum of the TDV energy for space-conditioning, mechanical ventilation and water heating.

2. Energy Budget for the Proposed Design Building. The energy budget for a Proposed Design Building is determined by calculating the TDV energy for the Proposed Design Building. The energy budget is the sum of the TDV energy for space-conditioning, mechanical ventilation and water heating.

3. Calculation of Energy Budget. The TDV energy for both the Standard Design Building and the Proposed Design Building shall be computed by Compliance Software certified for this use by the Commission. The methods, assumptions and required inputs for Compliance Software are approved by the Commission and documented in the Residential ACM Reference Manual.

1. Water heating budgets. The water heating budgets for each climate zone shall be the calculated consumption of energy from depletable sources required for water heating in buildings in which the requirements of Section 151(a) and of Section 151(f)8A for systems serving individual dwelling units or of Section 151(f)8C for systems serving multiple dwelling units are met. To determine the water heating budget, use an approved calculation method.

~~2.—Space conditioning budgets. The space conditioning budgets for each climate zone shall be the calculated consumption of energy from depletable sources required for space conditioning in buildings in which the basic requirements of Section 151(a) and the measures in Section 151(f) applicable to Alternative Component Package D are installed. To determine the space conditioning budget, use an approved calculation method.~~

~~3.—Multiple heating systems. If a space or a zone is served by more than one heating system, compliance shall be demonstrated with the most TDV energy consuming system serving the space or the zone. For spaces or zones that are served by electric resistance heat in addition to other heating systems, the electric resistance heat shall be deemed to be the most TDV energy consuming system.~~

~~**EXCEPTION to Section 151(b)3:** A supplemental heating unit may be installed in a space served directly or indirectly by a primary heating system, provided that the unit thermal capacity does not exceed 2 kW or 7,000 Btu/hr and is controlled by a time limiting device not exceeding 30 minutes.~~

~~(c)—Compliance Demonstration Requirements for Performance Standards. The application for a building permit shall include documentation which demonstrates, using an approved calculation method, that the newly constructed building has been designed so that its TDV energy use from depletable energy sources does not exceed the combined water heating and space conditioning energy budgets for the appropriate climate zone.~~

~~1.—To demonstrate compliance, the applicant's documentation shall:~~

~~A.—Determine the combined energy budget for the proposed building by adding the following:~~

~~i.—The annual water heating budget (TDV kBtu/yr ft²) as determined pursuant to Section 151(b)1; and~~

~~ii.—The annual space conditioning budget (TDV kBtu/yr ft²) as determined pursuant to Section 151(b)2.~~

~~B.—Calculate the TDV energy consumption total of the proposed building, using the proposed building's actual glazing area, orientation, and distribution, and its actual energy conservation and other features, including the actual water heating, space conditioning equipment and duct conditions and locations.~~

~~Include in the calculation the energy required for building cooling even if the building plans do not indicate that air conditioning will be installed.~~

~~2.—The proposed building design complies if the energy consumption calculated pursuant to Section 151(c)1B is equal to or less than the combined energy budget established in Section 151(c)1A.~~

~~**MULTIPLE ORIENTATION ALTERNATIVE to Section 151(c):** A permit applicant may demonstrate compliance with the energy budget requirements of Section 151(a) and (b) for any orientation of the same building model if the documentation demonstrates that the building model with its proposed designs and features would comply in each of the four cardinal orientations.~~

~~(d)—Compliance Methods for Performance Standards. Compliance with the energy budget requirements of Section 151(b) must be demonstrated by using the compliance version of the Commission's Public Domain Computer Program or any alternative calculation method approved by the Commission for use in complying with Sections 151(a), 151(b), 151(c), and 151(e).~~

~~(e)—Required Performance Calculation Assumptions. The Commission shall publish the assumptions and calculation methods it used to develop the standards for low rise residential buildings, including those specified in Section 151. In determining the water heating and space conditioning budgets and calculating the energy use of the proposed building design, the applicant shall use only these assumptions and calculation methods, or alternative assumptions and methods approved by the Commission.~~

~~1.—Such assumptions shall include, but not be limited to, the following:~~

~~A.—The operating conditions regarding indoor temperature; occupancy loads and schedules; equipment loads and operation schedules, including lighting, HVAC, and miscellaneous electrical; and outdoor weather conditions.~~

~~B.—The physical characteristics of building pressurization, interior heat transfer, film coefficients, solar heat gain coefficient and operation of installed shading devices, ground temperatures, and the method of determining slab heat loss.~~

~~C.—The applicable modeling procedures for the assumptions, design conditions, and physical characteristics described in Section 151(e)1.~~

~~D. Water heating use schedules, cold water inlet temperatures, and average outdoor temperatures for calculating water heating loads and losses.~~

~~**EXCEPTION to Section 151(e)1:** The Commission may approve alternative schedules, assumptions, and performance modeling procedures that may be used in lieu of those described in Section 151(e)1, provided such alternatives do not alter the efficiency level required by these standards.~~

~~2. The total calculated annual energy consumption shall include all energy used for comfort heating, comfort cooling, ventilation for the health and comfort of occupants, and service water heating.~~

~~3. Heat transfers within the same building to adjacent spaces that are not covered by the permit and that are independently provided with space conditioning may be considered to be zero. Heat transfers to spaces not yet provided with space conditioning may be modeled as separate unconditioned zones, or as outdoor conditions.~~

~~4. The total calculated annual energy consumption need not include energy from any nondepletable sources, regardless of the purpose of the energy consumed.~~

~~5. Solar heat gain coefficients for interior shading devices used with fenestration products shall be 0.68 for vertical fenestration products and 1.0 for non-vertical fenestration products. No other solar heat gain coefficients shall be used for interior shading. The calculations for vertical fenestration products include the effects of draperies and insect screens without installation being verified at the time of final inspection.~~

(cf) Prescriptive Standards/-Component Packages. Buildings that comply with the prescriptive standards shall be designed, constructed, and equipped to meet all of the requirements ~~of one of the packages of components shown in TABLE 151-B, TABLE 151-C, or TABLE 151-D~~ for the appropriate climate zone shown in TABLE 150.1-C-FIGURE 101-A. In ~~TABLE 151-B, 151-C, AND TABLE 151-D~~TABLE 150.1-C, a NA (not allowed) means that feature is not allowed in a particular climate zone and a NR (no requirement) means that there is no prescriptive requirement for that feature in a particular climate zone. Installed components shall meet the following requirements:

1. Insulation.

A. Ceiling, roof deck, wall, slab floor perimeter, and raised-floor insulation which have an R-value equal to or higher or U-factor equal to or less than that shown in ~~TABLE 151-B, TABLE 151-C, or TABLE 151-D~~ TABLE 150.1-C shall be installed. 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 151.150.1(f)1A:** The insulation requirements of ~~TABLE 151-B, TABLE 151-C, or TABLE 151-D~~ TABLE 150.1-C may also be met by ceiling, roof deck, wall, or floor assemblies that meet equivalent minimum R-values or U-factors that consider the effects of all elements of the assembly, using a calculation method approved by the Executive Director.~~

~~**EXCEPTION to Section 151.150.1(f)1A:** Raised-floor insulation may be omitted if the foundation walls are insulated to meet the wall insulation minimums shown in ~~TABLE 151-B, TABLE 151-C, or TABLE 151-D~~ TABLE 150.1-C, and a vapor barrier-retarder 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)1B:** 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.~~

2. **Radiant Barrier.** A radiant barrier required in ~~TABLE 151-B, TABLE 151-C, or TABLE 151-D~~ TABLE 150.1-C shall have an emittance of 0.05 or less, tested in accordance with ASTM C1371 or ASTM E408, shall be certified to the Department of Consumer Affairs as required by Title 24, Part 12, Chapter 12-13, Standards for Insulating Material, and shall meet the installation criteria specified in the Reference Residential Appendix RA4.

EXCEPTION to Section 150.1(c)2: Radiant Barrier installation is not required when the roof deck insulation is installed under the roof deck.

3. Fenestration.

A. Installed vertical fenestration products shall have an area-weighted average, except for skylights, U-factor and SHGC equal to or lower than those shown in TABLE 151-B, TABLE 151-C, or TABLE 151-D-TABLE 150.1-C and shall be determined in accordance with Section 110.6(a)2 or Section 110.6(a)3. Skylights shall have an U-factor and SHGC equal to or lower than those shown in TABLE 150.1-C, or and shall be determined in accordance with Section 110.6(a).

~~The U factor of installed fenestration products shall be determined in accordance with Section 116.~~

EXCEPTION to Section ~~151~~150.1(f)3A: For each building, up to 3 square feet of the glazing installed in doors and up to 23 square foot of tubular skylights with dual-pane diffusers.

EXCEPTION to Section 150.1(c)3A: For each building up to 8 square feet of skylight with a maximum U-factor of 0.55.

B. ~~_____~~ Total fenestration area shall not exceed the percentage of conditioned floor area specified in TABLE 151-B, TABLE 151-C, or TABLE 151-D-TABLE 150.1-C.

C. For Package AD, the west-facing fenestration area shall not exceed the percentage of conditioned floor area specified in TABLE 151-B, TABLE 151-C, OR TABLE 151-D-TABLE 150.1-C. West-facing fenestration area includes skylights tilted ~~to the west or tilted~~ in any direction when the pitch is less than 1:12.

4. **Shading.** Where TABLE 151-B, TABLE 151-C, or TABLE 151-D-TABLE 150.1-C requires a solar heat gain coefficient (SHGC), the requirements shall be met by either one of the following:

A. Installing fenestration products, except for skylights, that have an area weighted average SHGC equal to or lower than those shown in TABLE 151-B, TABLE 151-C, or TABLE 151-D-TABLE 150.1-C. Skylights shall have an SHGC equal to or lower than those shown in TABLE 151-B, TABLE 151-C, or TABLE 151-D-TABLE 150.1-C. ~~The solar heat gain coefficient of installed fenestration products shall be determined in accordance with Section 116;~~ 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 Item A.

D. For south-facing glazing 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 California Building Code (CBC) 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).

EXCEPTION to Section 150.1(f)4A: For each building up to 8 square feet of skylight with a maximum U-SHGC factor of 0.3055.

5. ~~RESERVED~~ **Thermal mass.** Thermal mass required for Package C in TABLE 151-B shall meet or exceed the minimum interior mass capacity specified in TABLE 151-A.

The mass requirements in TABLE 151-A may be met by calculating the combined interior mass capacity of the mass materials using EQUATION 151-A.

EQUATION 151-A — 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.
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UIMC _n	=	Unit interior mass capacity of mass material, n.
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~~NOTE: The Commission's Residential Compliance Manual lists the unit interior mass capacity (UIMC) of various mass materials.~~

6. **Heating system type.** Heating system types shall be installed as required in ~~TABLE 151-B~~ ~~TABLE 151-C~~ or ~~TABLE 151-D~~ Table 150.1-C. A gas-heating system is a natural or liquefied petroleum gas-heating system.

7. **Space heating and space cooling.** All space heating and space cooling equipment shall comply with minimum Appliance Efficiency Regulations as specified in Sections 110.0 through 110.2 and meet ~~the all applicable~~ requirements of ~~subsections A and B~~ Sections 150.0, and 150.1(c)7:

A. When refrigerant charge measurement or charge indicator display is shown as required by ~~TABLE 151-B, TABLE 151-C~~ or ~~TABLE 151-D~~ Table 150.1-C, ducted split system central air conditioners and ducted split system heat pumps shall:

- i. Have temperature measurement access holes (TMAH) installed according to the specifications in Reference Residential Appendix RA3.2.2.2.2; saturation pressure measurement sensors (SPMS) that meet the requirements of Reference Joint Appendix JA6 that are installed permanently by the air conditioning equipment manufacturer or according to the air conditioning equipment manufacturer specifications to provide digital indication of the condenser saturation pressure and the evaporator saturation pressure; saturation temperature measurement sensors (STMS); and proper refrigerant charge confirmed through field verification and diagnostic testing in accordance with applicable procedures set forth in ~~the~~ Reference Residential Appendix RA3.2, or RA1; or
- ii. Be equipped with a charge indicator display (CID) clearly visible to the occupant. The display shall demand attention when the air conditioner fails to meet the requirements contained in Reference Joint Appendix JA6.2. The display shall be constantly visible and within one foot of the thermostat. Systems equipped with a CID shall meet the requirements of Residential Field Verification and Diagnostic Test Procedures of Reference Residential Appendix RA3.4 and the specifications of Reference Joint Appendix JA6.

B. For systems other than ducted split system central air conditioners and ducted split system heat pumps, when refrigerant charge measurement or charge indicator display is shown as required by Table 150.1-C, and when a space conditioning system is an air conditioner or heat pump that cannot meet the requirements of 150.1(c)7Ai or 150.1(c)7Aii, the space conditioning system shall submit Installation Certificate documentation that certifies the system has correct refrigerant charge as determined in accordance with the weigh-in charging method specified in Reference Residential Appendix RA3.2.3. -HERS field verification and diagnostic testing of the refrigerant charge for these systems is not required.

Additionally, these systems shall conform to one of the following alternatives:

- i. The system shall have a SEER of 14 and an EER of 11; -or
- ii. The space conditioning system shall be a non-ducted system. ~~B. When airflow and fan watt draw is shown as required by TABLE 151-B, TABLE 151-C or TABLE 151-D, ducted split system central air conditioners and ducted split system heat pumps shall:~~
 - i. ~~Central forced air system fans shall simultaneously demonstrate, in every zonal control mode, an airflow greater than 350 CFM/ton of nominal cooling capacity and a fan watt draw less than 0.58 W/CFM as specified in Reference Residential Appendix RA3; and~~
 - ii. ~~Have a hole for the placement of a static pressure probe (HSPP) or a permanently installed static pressure probe (PSPP) in the supply plenum downstream of the air conditioning evaporator coil. The size, location, and labeling shall meet the requirements specified in Reference Residential Appendix RA3.3.~~

8. **Domestic Water-heating systems.** Water heating systems shall meet the requirements of either A, B, ~~or C,~~ or D and meet the requirements of ~~D and E~~ and F or shall meet the requirements of Section ~~151~~ 150.1(b)1.

- A. For systems serving individual dwelling units, a single gas or propane storage type water heater with an input of 75,000 Btu per hour or less and no recirculation pumps, and that meets the tank insulation requirements of Section 150.0(j) and the requirements of Sections 110.1 and 110.3 shall be installed.
- B. For systems serving individual dwelling units, a single gas or propane instantaneous water heater with an input of 200,000 Btu per hour or less and no recirculation pumps or storage tank, and that meets the requirements of Sections 110.1 and 110.3 shall be installed.
- C. For systems serving multiple dwelling units, a central water-heating system that ~~has~~ includes the following components shall be installed:
 - i. ~~Gas~~ Gas or propane water heaters, boilers or other water heating equipment that meet the minimum efficiency requirements of Sections 110.1 and 110.3, and
 - ii. ~~A~~ A water heating recirculation loop that meets the requirements of Section 110.3(c)2 and Section 110.3(c)5 ~~shall be installed and is equipped with a demand control and has two recirculation loops each serving half of the building, and~~

EXCEPTION to Section 151(f)8Cii: Buildings with eight or fewer dwelling units are exempt from the requirement for two recirculation loops.
 - iii. A solar water-heating system that provides a minimum of 20 percent of the annual energy for water heating in climate zones 1 through 9 and a minimum of 35 percent of the annual energy for water heating in climate zones 10 through 16.
- D. For systems serving individual dwelling units, electric-resistance water heating may be installed as the main water heating source only if natural gas is unavailable and only if the water heater is located within the building envelope and a minimum of 50 percent of the annual energy for water heating is provided by a passive or active solar water-heating system.
- E. All hot water pipes from the heating source to the kitchen fixtures shall be thermally insulated as specified by Section 150.0(j)2.
- ~~E~~F. All buried hot water piping shall be insulated to meet the requirements of Section 150.0(j)2 and be installed in a waterproof and non-crushable casing or sleeve that allows for installation, removal and replacement of the enclosed water piping. The internal cross-section or diameter of the casing or sleeve shall be large enough to allow for insulation of the hot water piping.

~~9. **Thermostats.** Heating systems shall be equipped with thermostats that meet the setback thermostat requirements of Section 110.2(c). The exception 1 to Section 112 (c) shall not apply to any heating system installed in conjunction with TABLE 151-B, TABLE 151-C or TABLE 151-D.~~

10. **Space conditioning ducts.** All ducts shall either be in directly conditioned space or be insulated to a minimum installed level as specified by ~~Table 150.1-C~~ TABLE 151-B, TABLE 151-C or TABLE 151-D and meet ~~the all~~ applicable minimum mandatory requirements of Section 150.0(m).

~~When duct sealing is shown as required by TABLE 151-B, TABLE 151-C or TABLE 151-D, duct systems shall be sealed, as confirmed through field verification and diagnostic testing, in accordance with procedures specified in the Reference Residential Appendix RA3.~~

NOTE: Requirements for ~~duct sealing and~~ duct insulation in Table Tables 151-B, 151-C, and 151-D do not apply to buildings with space conditioning systems that ~~have~~ do not have ducts.

11. **Central Fan Integrated Ventilation Systems.** Central forced air system fans used in central fan integrated ventilation systems shall demonstrate, in Air Distribution Mode, a watt draw less than 0.58 W/CFM, as confirmed through field verification and diagnostic testing in accordance with the all applicable procedures specified in Reference Residential Appendix RA3.3.

12. **Roofing products.** All roofing products shall meet the requirements of Section 110.8 and the applicable requirements of subsection A or B:

A. ~~In~~ Low-rise residential buildings with steep-sloped roofs:

~~i. For roofing products with a density of less than 5 pounds per square foot, in climate zones 10 through 15 shall have a minimum aged solar reflectance of 0.20 and a minimum thermal emittance of 0.8575, or a minimum SRI of 16.~~

~~ii. For roofing products with a density of 5 pounds per square foot or more, in climate zones 1 10 through 15 shall have a minimum aged solar reflectance of 0.1520 and a minimum thermal emittance of 0.8575, or a minimum SRI of 16 10.~~

B. Low-rise residential buildings with low-sloped roofs, in climate zones 13 and 15 shall have a minimum aged solar reflectance of 0.55-67 and a minimum thermal emittance of 0.8575, or a minimum SRI of 8064.

EXCEPTION 1 to Section 151150.1 (fc)12: Building integrated photovoltaic panels and building integrated solar thermal panels are exempt from the minimum requirements for solar reflectance and thermal emittance or SRI.

EXCEPTION 2 to Section 151150.1 (fc)12: Roof constructions that have thermal mass over the roof membrane with a weight of at least 25 lb/ft² are exempt from the minimum requirements for solar reflectance and thermal emittance or SRI.

13. **Quality Insulation Installation.** Verifying the quality of insulation installation shall be met following the procedure specified in Reference Residential Appendices, RA3.5.

TABLE 151150.1-A-B RESERVED INTERIOR MASS CAPACITY REQUIREMENTS FOR PACKAGE C

<i>FLOOR TYPE</i>	<i>MINIMUM INTERIOR MASS CAPACITY</i>
<i>slab floor</i>	<i>2.36 x ground floor area (ft²)</i>
<i>raised floor</i>	<i>0.18 x ground floor area (ft²)</i>

TABLE 151-B COMPONENT PACKAGE C

Climate Zone	1, 16	3	4	5	6	7	8, 9	10	2, 11-13	14	15
BUILDING ENVELOPE											
Insulation minimums ¹											
Ceiling	R49	R38	R38	R38	R38	R38	R38	R49	R49	R49	R49
Wood-frame walls	R20	R25	R25	R25	R21	R21	R21	R25	R20	R20	R20
—“Heavy mass” walls	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
—“Light mass” walls	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
—Below-grade walls	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
—Slab floor perimeter	R7	R7	R7	R7	R7	R7	R7	R7	R7	R7	R7
—Raised floors	R30	R30	R30	R30	R21	R21	R21	R30	R30	R30	R21
—Concrete raised floors	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Radiant Barrier	NR	NR	REQ	NR	NR	NR	REQ	REQ	REQ	REQ	REQ
Roofing Products	See TABLE 151-C, COMPONENT PACKAGE D										
FENESTRATION											
—Maximum U-factor ²	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38
—Maximum Solar Heat Gain Coefficient (SHGC) ³	NR	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
—Maximum total area	14%	14%	14%	16%	14%	14%	14%	16%	16%	14%	16%
—Maximum West-facing area	NR	NR	5%	NR	NR	5%	5%	5%	5%	5%	5%
THERMAL MASS⁴	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ
SPACE HEATING⁵											
—Electric resistant allowed	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
—If gas, AFUE =	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
—If heat pump, HSPF ⁶ =	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
SPACE COOLING											
—SEER =	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
—If split system, Refrigerant charge measurement or charge indicator display	NR	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ
Central Forced Air Handler:	See TABLE 151-C, COMPONENT PACKAGE D										
DUCTS											
—Duct sealing	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ
—Duct Insulation	R-8	R-8	R-8	R-8	R-8	R-8	R-8	R-8	R-8	R-8	R-8
WATER HEATING	System shall meet Section 151(f)8 or Section 151(b)1 ⁷										

TABLE 151-C—COMPONENT PACKAGE D

			Climate Zone																
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Insulation minimums ⁺	Ceilings		R38	R30	R30	R30	R30	R30	R30	R30	R30	R30	R38	R38	R38	R38	R38	R38	
	Walls	Wood-frame walls	R21	R13	R13	R13	R13	R13	R13	R13	R13	R13	R13	R19	R19	R19	R21	R21	R21
		Heavy-mass walls	R4.7 6	R2.4 4	R2.4 4	R2.4 4	R2.4 4	R2.4 4	R2.4 4	R2.4 4	R2.4 4	R2.4 4	R2.4 4	R4.7 6	R4.7 6	R4.7 6	R4.7 6	R4.7 6	R4.7 6
		Light mass walls	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		Below-grade walls	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R13
	Floors	Slab floor-perim.	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	R7
		Raised floors	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19
Concrete-raised floors		R8	R8	R0	R0	R0	R0	R0	R0	R0	R0	R0	R8	R4	R8	R8	R4	R8	
Radiant Barrier			NR	REQ	NR	REQ	NR	NR	NR	REQ	NR								
Roofing Products	Low-sloped	Aged Solar Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.55	NR	0.55	NR
		Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.75	NR	0.75
	Steep-Sloped (less than 5 lb/ft ²)	Aged Solar Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.20	0.20	0.20	0.20	0.20	0.20	NR
		Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.75	0.75	0.75	0.75	0.75	0.75	NR
	Steep-Sloped (5 lb/ft ² or more)	Aged Solar Reflectance	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
		Thermal Emittance	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Fenestration	Maximum U-factor ²		0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	
	Maximum Solar Heat Gain Coefficient (SHGC) ³		NR	0.40	NR	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.35	NR
	Maximum Total Area		20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Maximum West-Facing Area		NR	5%	NR	5%	NR	NR	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	NR
THERMAL MASS ⁴			NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	
SPACE HEATING ^{5, 10}	Electric-resistant allowed		No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	
	If gas, AFUE =		MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	
	If heat pump, HSPF ⁶ =		MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	
SPACE COOLING	SEER =		MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	
	If split system, Refrigerant charge measurement or charge indicator display		NR	REQ	NR	NR	NR	NR	NR	NR	REQ	NR							
Central Forced Air Handlers	Cooling Airflow and Watt Draw		NR	NR	NR	NR	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	REQ	NR	
	Central Fan Integrated Ventilation System Watt Draw		REQ	REQ	REQ ²	REQ													
DUCTS	— Duct sealing		REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	
	— Duct Insulation		R-6	R-6	R-6	R-6	R-6	R-6	R-4.2	R-4.2	R-4.2	R-6	R-6	R-6	R-6	R-6	R-8	R-8	R-8
WATER HEATING			System shall meet Section 151(f)8 or Section 151(b)1																

TABLE 150.1-C COMPONENT PACKAGE A Standard Building Design (continuation)

		Climate Zone																	
		<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>	<u>15</u>	<u>16</u>		
HVAC SYSTEM	Space Heating	Electric-Resistant Allowed	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	
		If gas, AFUE=	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
		If Heat Pump, HSPF=	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
	Space cooling	SEER=	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
		Refrigerant Charge Measurement or Charge Indicator Display	NR	REQ	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR
		Whole House Fan	NR	NR	NR	REQ	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR	NR
	Central Forced Air Handlers	Cooling Airflow and Watt Draw	NR	NR	NR	NR	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR
		Central Fan Integrated Ventilation System Watt Draw	REQ	REQ	REQ ²	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ
	DUCTS	Duct Insulation	R-8	R-8	R-8	R-8	R-8	R-6	R-6	R-6	R-8	R-8	R-8						
	Water Heating	All Buildings ^{11, 12}	<u>System Shall meet Section 150.1(c)8 or Section 150.1(b)1</u>																

TABLE 151-D—COMPONENT PACKAGE E

			Climate Zone																
			4	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Insulation minimums ⁴	Coilings		R38	R30	R38	R30	R38	R38	R30	R30	R30	R30	R38	R38	R38	R38	R38	R49	
	Walls	Wood-frame walls	R24	R19	R21	R21	R21												
		Heavy mass walls	(R4.76)	(R2.44)	(R4.76)	(R4.76)	(R4.76)	(R4.76)	(R4.76)	(R4.76)									
		Light mass walls	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		Below-grade walls	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R13
	Floors	Slab floor perim.	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	R7
		Raised floors	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19
Concrete-raised floors		R8	R8	R0	R8	R4	R8	R8	R4	R8									
Radiant Barrier			NR	REQ	NR	REQ	NR	NR	NR	REQ	NR								
Roofing Products	Low-sloped	Aged Solar Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.66	NR	0.66	NR	
		Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.75	NR	0.75	NR	
	Steep-Sloped (less than 5-lb/ft ²)	Aged Solar Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.20	0.20	0.20	0.20	0.20	0.20	NR
		Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.75	0.75	0.75	0.75	0.75	0.75	NR
	Steep-Sloped (5-lb/ft ² or more)	Aged Solar Reflectance	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
		Thermal Emittance	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Fenestration	Maximum U-factor ²		0.50 ⁸	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.45 ⁹	
	Maximum Solar Heat Gain Coefficient (SHGC) ⁵		NR	0.40	0.40	0.25	0.40	0.40	0.25	0.40	0.40	0.40	0.25	0.25	0.30	0.25	0.25	NR	
	Maximum Total Area		20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Maximum West-Facing Area		NR	5%	NR	5%	NR	NR	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	NR
THERMAL MASS ⁴			NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	
SPACE-HEATING ⁵⁻¹⁰	Electric-resistant allowed		No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	
	If gas, AFUE =		MIN ⁸	MIN	MIN ⁹														
	If heat pump, HSPF ⁶ =		MIN ⁸	MIN	MIN ⁹														
SPACE-COOLING	SEER =		MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	
	If split system, Refrigerant charge measurement or charge indicator display		NR	REQ	NR	NR	NR	NR	NR	REQ	NR								
Central Forced Air Handlers	Cooling Airflow and Watt Draw		NR	NR	NR	NR	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	REQ	NR	
	Central Fan-Integrated Ventilation System Watt Draw		REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ
DUCTS	—Duct sealing		REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	
	—Duct Insulation		R-8	R-6	R-8	R-6	R-6	R-4.2	R-4.2	R-4.2	R-6	R-6	R-8	R-8	R-8	R-8	R-8	R-8	
WATER-HEATING			System shall meet Section 151(f)8 or Section 151(b)4																

Footnote requirements to TABLE 151-B, TABLE 151-C, and TABLE 151-D.

for desiccant

~~*No Requirement (NR), or 0.60 TBD*~~

~~*1—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)1A.*~~

~~*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.*~~

~~*2—The installed fenestration products shall meet the requirements of Section 151(f)3.*~~

~~*3—The installed fenestration products shall meet the requirements of Section 151(f)4.*~~

~~*4—If the package requires thermal mass, the thermal mass shall meet the requirements of Section 151(f)5.*~~

~~*5—Thermostats shall be installed in conjunction with all space heating systems in accordance with Section 151(f)9.*~~

~~*6—HSPF means "heating seasonal performance factor."*~~

~~*7—Electric resistance water heating may be installed 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.*~~

~~8 — As an alternative under Package E in climate zone 1, glazing with a maximum 0.57 U-factor and a 92% AFUE furnace or an 8.4 HSPF heat pump may be substituted for the Package E glazing U-factor requirement. All other requirements of Package E must be met.~~

~~9 — As an alternative under Package E in climate zone 16, glazing with a maximum 0.57 U-factor and a 90% AFUE furnace or an 8.4 HSPF heat pump may be substituted for may be substituted for the Package E glazing U-factor requirement. All other requirements of Package E must be met.~~

~~10 — A supplemental heating unit may be installed in a space served directly or indirectly by a primary heating system, provided that the unit thermal capacity does not exceed 2 kilowatts or 7,000 Btu/hr and is controlled by a time-limiting device not exceeding 30 minutes.~~

Footnote requirements to TABLE 150.1-C

- 1 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 150.1(f)1A.

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.
- 2 Insulation shall be installed either above (on top) or alternatively directly below (underneath) the roof deck sheathing. Required (REQ) insulation installed above the roof deck shall be a minimum R-4; insulation installed below the roof deck shall be a minimum R-13.
- 3 Air permeable -insulation materials installed directly below the roof deck shall be covered with a Class II vapor retarder ($0.1 < \text{perm} < 1.0$) tested in accordance with the desiccant method of ASTM E 96.
- 4 "R-13+4" means R-13 cavity insulation plus R-4 continuous insulated sheathing. "R-13+4, 20" means R-13 cavity insulation plus R-4 continuous insulated sheathing or R-20 cavity insulation.
- 5 The installed fenestration products shall meet the requirements of Section 150.1(c)3.
- 6 The installed fenestration products shall meet the requirements of Section 150.1(c)4.
- 7 Thermostats shall be installed in conjunction with all space-heating systems in accordance with Section 150.1(c)9.
- 8 HSPF means "heating seasonal performance factor."
- 9 Required (REQ) whole house fans shall be listed in the Appliance Efficiency Directory and capable of providing a minimum 2 cfm/square foot of conditioned floor area.
- 10 A supplemental heating unit may be installed in a space served directly or indirectly by a primary heating system, provided that the unit thermal capacity does not exceed 2 kilowatts or 7,000 Btu/hr and is controlled by a time-limiting device not exceeding 30 minutes.
- 11 Multi-family buildings with a central water-heating system serving multiple dwelling units shall have a solar water-heating system that provides a minimum of 20 percent of the annual energy for water heating in climate zones 1 through 9 and a minimum of 35 percent of the annual energy for water heating in climate zones 10 through 16. The calculation of solar fraction shall account for all solar obstructions on the site.
- 12 For systems serving individual dwelling units, electric-resistance water heating may be installed as the main water heating source only if natural gas is unavailable and only if the water heater is located within the building envelope and a minimum of 50 percent of the annual energy for water heating is provided by a passive or active solar water-heating system. The calculation of solar fraction shall account for all solar obstructions on the site.