

ORDINANCE NO.

AN ORDINANCE REPEALING AND REPLACING ARTICLE 12 OF CITY CODE CHAPTER 25-12 (*TECHNICAL CODES*) RELATING TO THE INTERNATIONAL ENERGY CONSERVATION CODE AND LOCAL AMENDMENTS; AND CREATING OFFENSES.

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF AUSTIN:

PART 1. City Code Chapter 25-12 (*Technical Codes*) is amended to repeal and replace Article 12 (*Energy Code*) to read:

ARTICLE 12. ENERGY CODE

§ 25-12-261 INTERNATIONAL ENERGY CONSERVATION CODE.

- (A) The International Energy Conservation Code, 2021 Edition, published by the International Code Council (“2021 International Energy Conservation Code”), is adopted and incorporated by reference into this section with the deletions and amendments in Subsections (B), (C), and (D) and Section 25-12-263 (*Local Amendments to the International Energy Conservation Code*).
- (B) The following commercial provisions of the 2021 International Energy Conservation Code are deleted. A subsection contained within a deleted section or subsection is not deleted, unless specifically listed below.

| | | |
|--------|----------|--------|
| C402.3 | C402.4.3 | C405.2 |
|--------|----------|--------|

- (C) For purposes of commercial energy efficiency compliance with ASHRAE standards, as allowed under the 2021 International Energy Conservation Code, the following provisions of the 2019 edition of ASHRAE standard 90.1 (ASHRAE 90.1-2019), published by the American Society of Heating, Refrigeration, and Air-Conditioning Engineers, are deleted. A subsection contained within a deleted section or subsection is not deleted, unless specifically listed below.

| | | |
|-----------|--------|--------|
| 5.5.3.1.1 | 6.5.10 | G2.4.2 |
| 5.5.4.1 | 9.4.1 | |

- (D) The following residential provisions of the 2021 International Energy Conservation Code are deleted. A subsection contained within a deleted section or subsection is not deleted, unless specifically listed below.

| | | |
|---|----------|-------------------|
| R202 definition of “Residential Building” | R402.4.4 | Table R405.4.2(1) |
| R402.1.2 | R402.5 | R406.2 |
| R402.1.3 | R403.3.5 | R406.3.2 |
| Table R402.1.2 | R403.3.6 | Table 406.5 |
| Table R402.1.3 | R403.9 | |
| R402.4.1.2 | R405.2 | |

§25-12-262 CITATIONS TO THE ENERGY CODE.

In the City Code, “Energy Code” means the 2021 International Energy Conservation Code adopted by Section 25-12-261 (*International Energy Conservation Code*) and as amended by Section 25-12-263 (*Local Amendments to the International Energy Conservation Code*). In this article, “this code” means the Energy Code.

§25-12-263 LOCAL AMENDMENTS TO THE INTERNATIONAL ENERGY CONSERVATION CODE.

(A) The following provisions are local amendments to the commercial provisions of the 2021 International Conservation Code. Each provision in this subsection is a substitute for an identically numbered provision deleted by section 25-12-261(B) or an addition to the 2021 International Energy Conservation Code.

C201.3 Terms defined in other codes. Terms not defined in this code that are defined in the Building Code, Electrical Code, Fire Code, Mechanical Code, Plumbing Code, Residential Code, and Chapter 25-12, Article 3 (*Flood Hazard Areas*) have the meaning ascribed to them in those codes.

C402.2.8 Insulation encapsulation requirement. Insulation (including but not limited to loose fill, spray applied cellular fiber insulation as well as other blanket and batts insulation) installed in assemblies more than 60 degrees from the horizontal must be in substantial contact with an air barrier on all sides.

Exception: Air impermeable insulation. Air impermeable insulation is defined as:

A material having an air permeance equal to or less than 0.02 L/s-m^2 at 75 Pa pressure differential tested according to ASTM E2178 or E283.

C402.3 Roof solar reflectance and thermal emittance. Low-sloped roofs directly above cooled conditioned spaces in *Climate Zones* 1, 2 and 3 shall comply with one or more of the options in Table C402.3.

Exceptions: The following roofs and portions of roofs are exempt from the requirements of Table C402.3:

1. Portions of the roof that include or are covered by the following:
 - 1.1. Photovoltaic systems or components.
 - 1.2. Solar air or water-heating systems or components.
 - 1.3. Roof gardens or landscaped roofs.
 - 1.4. Above-roof decks or walkways.
 - 1.5. Skylights.
 - 1.6. HVAC systems and components, and other opaque objects mounted above the roof.
 - 1.7. Repairs to roof surfaces when the repair does not exceed the lesser of 50% of the roof surface or 20 squares (2000 sq ft).
2. Portions of the roof shaded during the peak sun angle on the summer solstice by permanent features of the building or by permanent features of adjacent buildings.
3. Portions of roofs that are ballasted with a minimum stone ballast of 17 pounds per square foot [74 kg/m^2] or 23 psf [117 kg/m^2] pavers.
4. Roofs where not less than 75 percent of the roof area complies with one or more of the exceptions to this section.

Roof surfaces with an incline greater than 2 units vertical in 12 units horizontal shall incorporate a roof material having a minimum reflectance of 0.35 or a minimum initial SRI of 29.

C402.4.3 Maximum U-factor and SHGC. The maximum U-factor and solar heat gain coefficient (SHGC) for fenestration shall be as specified in Table C402.4.

The window projection factor shall be determined in accordance with Equation 4-5.

$$PF = A/B \quad (\text{Equation 4-5}).$$

where:

PF = Projection factor (decimal).

A = Distance measured horizontally from the furthest continuous extremity of any overhang, eave or permanently attached shading device to the vertical surface of the glazing.

B = Distance measured vertically from the bottom of the glazing to the underside of the overhang, eave or permanently attached shading device.

Where different windows or glass doors have different PF values, they shall each be evaluated separately.

Exception: Where windows are required to comply with the visible transmittance (VT) requirement outlined in section 3.2.2.E, Glazing and Façade Relief on Building Facades, of the City of Austin's Subchapter E, Design Standards and Mixed Use ordinance, the solar heat gain coefficient (SHGC) requirement shall not apply. Instead, the window shall have a projection factor (PF) ≥ 0.5 .

C402.6 Commercial Solar Ready (Mandatory). A designated zone must be identified on the construction documents as "Reserved for Future Solar Installation". This identified "Solar-Ready Zone" must be located within the Potential Solar Area (defined below), free from obstructions such as, but not limited to, vents, pipes, ducts, and other equipment and must comply with access, pathway, smoke ventilation, spacing, and other requirements of the City of Austin Land Development Code.

Exceptions:

1. Potential Solar Area of less than 2,000 square feet (185.8 square meters).
2. High hazard buildings (Group H).
3. Buildings located within the downtown network, as identified by Austin Energy.

- 106 4. Buildings equipped with on-site renewable energy in accordance with
107 section C406.5.

108 **C402.6.1 Solar-Ready Zone area.** The size of the Solar-Ready Zone must be at least
109 half the Potential Solar Area. Potential Solar Area is calculated as the gross rooftop area
110 minus the Affected Area. Affected Area means the following areas:

- 111 1. Areas of the roof that are shaded for at least 50% of annual daylight hours.
112 2. Areas of the roof that are not Low-Sloped Roof that are oriented from 300°
113 northwest, north to 90° east.
114 3. Gross area of all skylights.
115 4. Area of rooftop equipment and required access paths.
116 5. Areas of roofs used for helicopter landing or for rooftop parking.
117 6. Green roofs and occupied rooftop areas.
118 7. Areas required by City Code to not contain solar equipment.

119 No part of the Solar-Ready Zone can be in an Affected Area. The designated Solar-
120 Ready Zone and the Potential Solar Area can be made up of multiple non-
121 contiguous areas. Each sub-area must be at least 80 square feet (7.432 square
122 meters) and must be a rectangle the short side of which measures at least 6 feet (1.83
123 meters).

124 **C402.6.2 Structural loads.** Areas of the roof that are part of the Solar-Ready Zone must
125 have structural design loads for roof dead load and roof live load clearly indicated on the
126 construction documents.

127 **C402.6.3 Equipment location and interconnection pathway.** The construction
128 documents must indicate a location for inverters and metering equipment and a pathway
129 for routing of conduit from the Solar-Ready Zone to the point of interconnection with the
130 electrical service.

131 **C402.6.4 Electrical distribution system.** The Building's electrical service distribution
132 system must have reserved space to allow for the future installation of solar electric and
133 must be permanently marked as "For Future Solar Electric".

C403.7.8 Ventilation filtration and filtration of return air. Ventilation systems shall incorporate filtration having a minimum efficiency reporting value (MERV) rating of 6 or greater. All return air as well as all air that is heated, cooled, or humidity controlled must be drawn through the air filtration system.

C403.15 Demand response. When Direct Digital Control is utilized, the controls shall have the capability to remotely setup the operating cooling temperature set point in all non-critical zones in response to signals, based on OpenADR 2.0 or higher protocols, from a centralized contact or software point. Controls may be programmed to provide either an automatic or an operator adjustable degree of change for the temperature setup.

C404.10 Electric water heater timers. For Group R buildings electric resistance water heaters must be installed in conjunction with a preprogrammed water heater timer. The timer shall be preprogrammed to turn the water heater off between the hours of 3:00 p.m. and 7:00 p.m. from June 1 to September 30 and from 12:00 a.m. to 4:00 a.m. throughout the year. The timer shall have a readily accessible override, as defined by the building official in an administrative rule, capable of restoring power to the water heater for one hour when activated.

Exception: Where approved water heater demand response capability has been installed.

C405.2 Lighting controls. Lighting systems shall be provided with controls that comply with one of the following.

1. Lighting controls as specified in Sections C405.2.1 through C405.2.8.
2. Luminaire level lighting controls (LLLC) and lighting controls as specified in Sections C405.2.1, C405.2.5 and C405.2.6. The LLLC luminaire shall be independently capable of:
 - 2.1 Monitoring occupant activity to brighten or dim lighting when occupied or unoccupied, respectively.
 - 2.2 Monitoring ambient light, both electric light and daylight, and brighten or dim artificial light to maintain desired light level.
 - 2.3 For each control strategy. Configuration and reconfiguration of performance parameters including, bright and dim setpoints, timeouts, dimming fade rates, sensor sensitivity adjustments, and wireless zoning configurations.

Exceptions: Lighting controls are not required for the following:

1. Areas designated as security or emergency areas that are required to be continuously lighted.
2. Interior exit stairways, interior exit ramps and exit passageways.
3. Emergency egress lighting that is normally off.

C405.2.8 Demand response. For all buildings having central control of a) lighting levels or b) the ability to turn on and off individual lamps, the controls shall have the capability to reduce lighting level in response to signals, based on OpenADR 2.0 or higher protocols, from a centralized contact or software point. Controls may be programmed to provide either an automatic or an operator adjustable degree of lighting reduction.

(B) For purposes of commercial energy efficiency compliance with ASHRAE standards, the following provisions are local amendments to ASHRAE 90.1-2019. Each provision in this subsection is a substitute for an identically numbered provision deleted by Section 25-12-261(C) or an addition to the Energy Code.

2.2 The provisions of this standard do not apply to

- a. Single-family houses, multifamily structures of four stories or fewer above grade, manufactured houses (mobile homes), and manufactured houses (modular); or
- b. Buildings that use neither electricity nor fossil fuels.

3.2 Definitions.

LOW-RISE RESIDENTIAL BUILDINGS: single-family houses, multifamily structures of four stories or fewer above *grade*, manufactured houses (mobile homes), and manufactured houses (modular).

5.4.4 Roof Solar Reflectance and Thermal Emittance. Roofs in Climate Zones 1 through 3 with a slope less than or equal to 2 units vertical in 12 units horizontal shall have one of the following:

- a. A minimum three-year-aged solar reflectance of 0.55 and a minimum three-year-aged thermal emittance of 0.75 when tested in accordance with CRRC-1 Standard.

- b. A minimum Solar Reflectance Index of 64 when determined in accordance with the Solar Reflectance Index method in ASTM E1980 using a convection coefficient of 2.1 Btu/h·ft²·°F, based on three-year-aged solar reflectance and three-year-aged thermal emittance tested in accordance with CRRC-1 Standard.

Exceptions:

1. Ballasted roofs with a minimum stone ballast of 17 lb/ft² or 23 lb/ft² pavers.
2. Vegetated roof systems that contain a minimum thickness of 2.5 in. of growing medium and covering a minimum of 75% of the roof area with durable plantings.
3. Roofs where a minimum of 75% of the roof area:
 - a. is shaded during the peak sun angle on June 21 by permanent components or features of the building;
 - b. is covered by offset photovoltaic arrays, building- integrated photovoltaic arrays, or solar air or water collectors; or
 - c. is permitted to be interpolated using a combination of 1 and 2 above.
4. Repairs to roof surfaces when the repair does not exceed the lesser of 50% of the roof surface or 20 squares (2000 sq ft).
5. Roofs over semi-heated spaces, or roofs over conditioned spaces that are not cooled spaces.

The values for three-year-aged solar reflectance and three-year-aged thermal emittance shall be determined by a laboratory accredited by a nationally recognized accreditation organization and shall be labeled and certified by the manufacturer.

Roof surfaces with an incline greater than 2 units vertical in 12 units horizontal shall incorporate a roof material having a minimum reflectance of 0.35 or a minimum initial SRI of 29.

5.4.5 Insulation encapsulation requirement. Insulation (including but not limited to loose fill, spray applied cellular fiber insulation as well as other blanket and batts insulation) installed in assemblies more than 60 degrees from the horizontal must be in substantial contact with an air barrier on all sides.

Exception: Air impermeable insulation. Air impermeable insulation is defined as:

A material having an air permeance equal to or less than 0.02 L/s-m² at 75 Pa pressure differential tested according to ASTM E2178 or E283.

5.4.6 Commercial Solar Ready (Mandatory). A designated zone must be identified on the construction documents as "Reserved for Future Solar Installation". This identified "Solar-Ready Zone" must be located within the Potential Solar Area (defined below), free from obstructions such as, but not limited to, vents, pipes, ducts, and other equipment and must comply with access, pathway, smoke ventilation, spacing, and other requirements of the City of Austin Land Development Code.

Exceptions:

1. Potential Solar Area of less than 2,000 square feet (185.8 square meters).
2. High hazard buildings (Group H).
3. Buildings located within the downtown network, as identified by Austin Energy.
4. Buildings equipped with on-site renewable energy in accordance with section C406.5.

5.4.6.1 Solar-Ready Zone area. The size of the Solar-Ready Zone must be at least half the Potential Solar Area. Potential Solar Area is calculated as the gross rooftop area minus the Affected Area. Affected Area means the following areas:

1. Areas of the roof that are shaded for at least 50% of annual daylight hours.
2. Areas of the roof that are not Low-Sloped Roof that are oriented from 300° northwest, north to 90° east.
3. Gross area of all skylights.
4. Area of rooftop equipment and required access paths.
5. Areas of roofs used for helicopter landing or for rooftop parking.

No part of the Solar Ready Zone can be in an Affected Area. The designated Solar-Ready Zone and the Potential Solar Area can be made up of multiple non-contiguous areas. Each sub-area must be at least 80 square feet (7.432 square meters) and must be a

rectangle the short side of which measures at least 6 feet (1.83 meters).

5.4.6.2 Structural loads. Areas of the roof that are part of the Solar-Ready Zone must have structural design loads for roof dead load and roof live load clearly indicated on the construction documents.

5.4.6.3 Equipment location and interconnection pathway. The construction documents must indicate a location for inverters and metering equipment and a pathway for routing of conduit from the Solar-Ready Zone to the point of interconnection with the electrical service.

5.4.6.4 Electrical distribution system. The Building's electrical service distribution system must have reserved space to allow for the future installation of solar electric and must be permanently marked as "For Future Solar Electric".

5.5.4.1 General. Compliance with U-factors, SHGC, and VT/SHGC shall be demonstrated for the overall fenestration product. Gross wall areas and gross roof areas shall be calculated separately for each space-conditioning category for the purposes of determining compliance.

Exceptions:

1. If there are multiple assemblies within a single class of construction for a single space-conditioning category, it shall be permitted to demonstrate compliance based on an area weighted average U-factor, SHGC, VT/SHGC, or LSG. The area-weighted average across multiple classes of construction or multiple space conditioning categories shall not be permitted for use to demonstrate compliance.
2. Vertical fenestration shall be permitted to demonstrate compliance based on an area-weighted average U-factor, SHGC, VT/SHGC, or LSG across multiple classes of construction for a single space conditioning category, but not across multiple space conditioning categories.
3. Where windows are required to comply with the visible transmittance (VT) requirement outlined in section 3.2.2.E, Glazing and Façade Relief on Building Facades, of the City of Austin's Subchapter E, Design Standards and Mixed Use ordinance, the solar heat gain coefficient (SHGC) requirement shall not apply. Instead, the window shall have a projection factor (PF) ≥ 0.5 .

6.4.3.10.4 Demand response. When DDC is utilized, the controls shall have the capability to remotely setup the operating cooling temperature set point in all non-critical zones in response to signals, based on OpenADR 2.0 or higher protocols, from a centralized contact or software point. Controls may be programmed to provide either an automatic or an operator adjustable degree of change for the temperature setup.

6.4.4.2.3 Ventilation filtration and filtration of return air. Ventilation systems shall incorporate filtration having a minimum efficiency reporting value (MERV) rating of 6 or greater. All return air as well as all air that is heated, cooled, or humidity controlled must be drawn through the air filtration system.

6.5.10 Door Switches. Any conditioned space with a door, including doors with more than one-half glass, opening to the outdoors shall be provided with controls that, when any such door is open,

- a. disable mechanical heating or reset the heating setpoint to 55°F or lower within five minutes of the door opening; and
- b. disable mechanical cooling or reset the cooling setpoint to 90°F or greater within five minutes of the door opening. Mechanical cooling may remain enabled if outdoor air temperature is below space temperature.

Exceptions:

1. Building entries with automatic closing devices.
2. Any space without a thermostat.
3. Alterations to existing buildings.
4. Loading docks.
5. Radiant heating systems.
6. Where HVAC equipment must remain on for safety, sanitation, or other health related reasons.

7.4.4.5 Electric water heater timers. For Group R buildings electric resistance water heaters must be installed in conjunction with a preprogrammed water heater timer. The timer shall be preprogrammed to turn the water heater off between the hours of 3:00 p.m. and 7:00 p.m. from June 1 to September 30 and from 12:00 a.m. to 4:00 a.m. throughout the year. The timer shall have a readily accessible override, as defined by the building

official administrative rule, capable of restoring power to the water heater for one hour when activated.

Exception: Where approved water heater demand response capability has been installed.

9.4.1 Lighting Control. Building lighting controls shall be installed to meet the provisions of Sections 9.4.1.1, 9.4.1.2, 9.4.1.3, 9.4.1.4, and 9.4.1.5.

9.4.1.5 Demand response. For all buildings having central control of a) lighting levels and/or b) the ability to turn on and off individual lamps, the controls shall have the capability to reduce lighting level in response to signals, based on OpenADR 2.0 or higher protocols, from a centralized contact or software point. Controls may be programmed to provide either an automatic or an operator adjustable degree of lighting reduction.

G2.4.2 Annual Energy Costs. The design energy cost and baseline energy cost shall be determined using actual rates for purchased energy. Where on-site renewable energy or site-recovered energy is used, the baseline building design shall be based on the energy source used as the backup energy source or the baseline system energy source in that category if no backup energy source has been specified. Where the proposed design includes on-site electricity generation systems other than on-site renewable energy systems, the baseline design shall include the same generation systems excluding its site-recovered energy.

Informative Note: The above provision allows users to gain credit for features that yield load management benefits.

(C) The following provisions are local amendments to the residential provisions to the 2021 International Energy Conservation Code. Each provision in this subsection is a substitute for an identically numbered provision deleted by Section 25-12-261(D) or an addition to the Energy Code.

R201.3 Terms defined in other codes. Terms not defined in this Code that are defined in the Building Code, Electrical Code, Fire Code, Mechanical Code, the Plumbing Code, Residential Code, and Chapter 25-12, Article 3 (*Flood Hazard Areas*) have the meaning ascribed to them as in those codes.

R202 General Definitions. Residential Building. For this code, includes detached one- and two-family dwellings and multiple single-family dwellings (townhouses) as well as Group R-2, R-3 and R-4 buildings four stories or less in height above grade plane.

R302.2 Exterior Design Conditions. The design parameters in Table 302.2 shall be used for calculations under this code.

**TABLE R302.2
EXTERIOR DESIGN CONDITIONS**

| CONDITION | VALUE |
|--|-------|
| Winter ^a , Design Dry-bulb (°F) | 30 |
| Summer ^a , Design Dry-bulb (°F) | 100 |
| Summer ^a , Design Wet-bulb (°F) | 74 |
| Climate Zone | 2A |

For SI: deg C=[(deg F)-32]/1.8

^a Adjustments shall be permitted to reflect local climates, which differ from the tabulated temperatures, or local weather experience determined by the building official.

R402.1.2 Insulation and fenestration criteria. The *building thermal envelope* shall meet the requirements of Table R402.1.2(1) for existing buildings and Table R402.1.2(2) for new construction. Assemblies shall have a *U*-factor equal to or less than that specified in Table R402.1.2(1) for existing buildings and Table R402.1.2(2) for new construction. Fenestration shall have a *U*-factor and glazed fenestration SHGC equal to or less than that specified in Table R402.1.2(1) for existing buildings and Table R402.1.2(2) for new construction.

**TABLE R402.1.2(1)
MAXIMUM ASSEMBLY *U*-FACTORS^{a,b} AND FENESTRATION
REQUIREMENTS FOR EXISTING BUILDINGS**

| CLIMATE ZONE | FENESTRATION <i>U</i> -FACTOR | SKYLIGHT <i>U</i> -FACTOR | GLAZED FENESTRATION SHGC ^d | CEILING <i>U</i> -FACTOR | ATTIC ROOFLINE <i>U</i> -FACTOR | WOOD FRAME WALL <i>U</i> -FACTOR | MASS WALL <i>U</i> -FACTOR ^e | FLOOR <i>U</i> -FACTOR | BASEMENT WALL <i>U</i> -FACTOR | CRAWL SPACE WALL <i>U</i> -FACTOR |
|--------------|-------------------------------|---------------------------|---------------------------------------|--------------------------|---------------------------------|----------------------------------|---|------------------------|--------------------------------|-----------------------------------|
| 2 | 0.40 | 0.60 | 0.25 | 0.026 | 0.045 | 0.075 | 0.165 | 0.064 | 0.36 | 0.477 |

^a The values in this table apply to additions having an area no more than 40% of the existing construction.

^b Non-fenestration *U*-factors shall be obtained from measurement, calculation or an approved source.

^c Mass walls shall be in accordance with Section R402.2.5. Where more than half the insulation is on the interior, the mass wall *U*-factors shall not exceed 0.14 in Climate Zone 2.

^d The SHGC row applies to all glazed fenestration.

Exception: In Climate Zone 2, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

TABLE R402.1.2(2)
***U*-FACTORS FOR NEW CONSTRUCTION^a**

| CLIMATE ZONE | FENESTRATION <i>U</i> -FACTOR | SKYLIGHT <i>U</i> -FACTOR | GLAZED FENESTRATION SHGC ^c | CEILING <i>U</i> -FACTOR | ATTIC ROOFLINE <i>U</i> -FACTOR | WOOD FRAME WALL <i>U</i> -FACTOR | MASS WALL <i>U</i> -FACTOR ^b | FLOOR <i>U</i> -FACTOR | BASEMENT WALL <i>U</i> -FACTOR | CRAWL SPACE WALL <i>U</i> -FACTOR |
|--------------|-------------------------------|---------------------------|---------------------------------------|--------------------------|---------------------------------|----------------------------------|---|------------------------|--------------------------------|-----------------------------------|
| 2 | 0.35 | 0.60 | 0.25 | 0.026 | 0.045 | 0.066 | 0.165 | 0.064 | 0.36 | 0.477 |

^a Non-fenestration *U*-factors shall be obtained from measurement, calculation or an approved source.

^b Mass walls shall be in accordance with Section R402.2.5. Where more than half the insulation is on the interior, the mass wall *U*-factors shall not exceed 0.14 in Climate Zone 2.

^c The SHGC row applies to all glazed fenestration.

Exception: In Climate Zone 2, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

R402.1.3 *R*-value alternative. Assemblies with *R*-value of insulation materials equal to or greater than that specified in Table R402.1.3(1) for existing buildings and Table R402.1.3(2) for new construction shall be an alternative to the *U*-factor in Table R402.1.2(1) for existing buildings and Table R402.1.2(2) for new construction, respectively.

TABLE R402.1.3(1)

INSULATION MINIMUM R-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT^{a,b} FOR EXISTING BUILDINGS

| CLIMATE ZONE | FENESTRATION U-FACTOR ^c | SKYLIGHT U-FACTOR ^c | GLAZED FENESTRATION SHGC ^c | CEILING R-VALUE ^{d,e} | ATTIC ROOFLINE R-VALUE ^{d,g} | WOOD FRAME WALL R-VALUE ^{e,f} | MASS WALL R-VALUE ^h | FLOOR R-VALUE | BASEMENT WALL R-VALUE | SLAB R-VALUE & DEPTH | CRAWL SPACE WALL R-VALUE |
|--------------|------------------------------------|--------------------------------|---------------------------------------|--------------------------------|---------------------------------------|--|--------------------------------|---------------|-----------------------|----------------------|--------------------------|
| 2 | 0.40 | 0.60 | 0.25 | 49 | 25&0ci or 0&20ci | 15, 13& 2ci, or 0&1 0ci | 4/6 | 13 | 0 | 0 | 0 |

^a The values in this table apply to *repairs, renovations, or additions* that increase the conditioned floor area by no more than 40 percent. All other construction shall use the values for new construction in Table R402.1.3(2)

^b R-values are minimums. U-factors and SHGC are maximums. When insulation is installed in a cavity which is less than the label or design thickness of the insulation, the installed R-value of the insulation shall not be less than the R-value specified in the table.

^c The fenestration U-factor row excludes skylights. The SHGC row applies to all glazed fenestration. Exception: Skylights may be excluded from glazed fenestration SHGC requirements in Climate Zones 2 where the SHGC for such skylights does not exceed 0.30

^d Air-impermeable insulation of R-25&0 or greater may be used if mechanical equipment and air distribution system are located entirely within the building thermal envelope. "Air-impermeable" shall be defined as having an air permeance not exceeding 0.02 L/s-m² at 75 Pa pressure differential tested according to ASTM E 2178 or ASTM E 283.

^e First value is *cavity insulation*, the second value is *continuous insulation* (ci) or *insulated siding*. Therefore, as an example, "13&2ci" means R-13 *cavity insulation* plus R-2 *continuous insulation* or *insulated siding*. Where R-13&2ci is used, non-insulated structural sheathing shall cover no more than 25% of the exterior.

^f Total-fill cavity insulation will be deemed as meeting the R-15 requirement.

^g R-0&20ci *continuous insulation* can be used where the insulation is completely above the roof framing and sub-roofing.

^h Mass walls shall be in accordance with Section R402.2.5. The second R-value applies where more than half of the insulation is on the interior of the mass wall.

TABLE R402.1.3(2)
INSULATION MINIMUM R-VALUES AND FENESTRATION REQUIREMENTS
BY COMPONENT^a FOR NEW CONSTRUCTION

| CLIMATE ZONE | FENESTRATION U-FACTOR ^b | SKYLIGHT U-FACTOR ^b | GLAZED FENESTRATION SHGC ^b | CEILING R-VALUE ^{d,g} | ATTIC ROOFLINE R-VALUE ^{d,g} | WOOD FRAME WALL R-VALUE ^{e,f} | MASS WALL R-VALUE ^h | FLOOR R-VALUE | BASEMENT WALL R-VALUE | SLAB R-VALUE & DEPTH ^e | CRAWL SPACE WALL R-VALUE |
|--------------|------------------------------------|--------------------------------|---------------------------------------|--------------------------------|---------------------------------------|--|--------------------------------|---------------|-----------------------|-----------------------------------|--------------------------|
| 2 | 0.35 | 0.60 | 0.25 | 49 | 25&0ci or 0&20ci | 19, 15&2ci, 13&3ci, or 0&15ci | 4/6 | 13 | 0 | 0 | 0 |

^a R-values are minimums. U-factors and SHGC are maximums. When insulation is installed in a cavity which is less than the label or design thickness of the insulation, the installed R-value of the insulation shall not be less than the R-value specified in the table.

^b The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration. Exception: Skylights may be excluded from glazed fenestration SHGC requirements in Climate Zone 2 where the SHGC for such skylights does not exceed 0.30

^c R-5 insulation shall be provided under the full slab area of a heated slabs in addition to the required slab-edge insulation R-value for slabs as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

^d Air-impermeable insulation of R-25 or greater may be used if mechanical equipment and air distribution system are located entirely within the building thermal envelope. "Air-impermeable" shall be defined as having an air permeance not exceeding 0.02 L/s-m² at 75 Pa pressure differential tested according to ASTM E 2178 or ASTM E 283.

^e First value is *cavity insulation*, the second value is continuous insulation (ci) or insulated siding, so "13&5ci" means R-13 cavity insulation plus R-5 *continuous insulation* or *insulated siding* and "10ci" means R-10 *continuous insulation*. Where R-

15&2ci or R-13&3ci is used, non-insulated structural sheathing shall cover no more than 25% of the exterior.

^f Total-fill cavity insulation in a 2x4 wall will be deemed as meeting the R-15 requirement.

^g R-0&20ci *continuous insulation* can be used where the insulation is completely above the roof framing and subroofing.

^h Mass walls shall be in accordance with Section R402.2.5. The second R-value applies where more than half of the insulation is on the interior of the mass wall.

R402.4.1.2 Testing. The *building* or *dwelling unit* shall be tested for air leakage. The maximum air leakage rate for any *building* or *dwelling unit* under any compliance path shall not exceed 5.0 air changes per hour or 0.28 cubic feet per minute (CFM) per square foot [$0.0079 \text{ m}^3/(\text{s} \times \text{m}^2)$] of dwelling unit enclosure area. Testing shall be conducted in accordance with ANSI/RESNET/ICC 380, ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inches w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* independent third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*. The report shall include address of the residence, building permit number, name and employer of the technician performing the test, and date of the test. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope* have been sealed.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures;
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures;
3. Interior doors, where installed at the time of the test, shall be open;
4. Exterior or interior terminations for continuous ventilation systems shall be sealed;
5. Heating and cooling systems, where installed at the time of the test, shall be turned off;

6. Supply and return registers, where installed at the time of the test, shall be fully open.

Exceptions:

1. Existing construction where the volume of the conditioned area is unchanged and additions that cannot be physically separated from the existing construction.
2. When testing individual dwelling units, an air leakage rate not exceeding 0.30 cubic feet per minute per square foot [0.008 m³/(s x m²)] of the dwelling unit enclosure area, tested in accordance with ANSI/RESNET/ICC 380, ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inch w.g. (50 Pa), shall be an accepted alternative permitted in all climate zones for:
 - a. Attached single-family and multiple-family building dwelling units.
 - b. Buildings or dwelling units that are 1,500 square feet (139.4 m²) or smaller.

Mechanical ventilation shall be provided in accordance with Section M1505 of the *International Residential Code* or Section 403.3.2 of the *International Mechanical Code*, as applicable, or with other *approved* means of ventilation.

R402.5 Maximum fenestration U-factor and SHGC. The area-weighted average maximum fenestration *U*-factor permitted using trade-offs from Section R402.1.5 or R405 shall be 0.50. The area-weighted average maximum SHGC permitted using tradeoffs from Section R405 fenestration facing East, South and West shall be 0.30. The SHGC of fenestration facing within 45 degrees of East and West shall be no greater than 0.25, unless the projection factor multiplier in Table R402.5.1 is applied. Glazed fenestration facing within 45 degrees of North shall not be included in the area-weighted SHGC calculation.

TABLE R402.5.1
SHGC MULTIPLIER FOR CERTAIN FENESTRATION

| Projection Factor | SHGC Multiplier (Glazed fenestration from 45 to 135 degrees and 225 to 315 degrees) | SHGC Multiplier (Glazed fenestration from 135 to 225 degrees) |
|-------------------|---|---|
|-------------------|---|---|

| | | |
|-------------|------|------|
| 0.10 - 0.25 | 0.85 | 0.75 |
| 0.26 - 0.50 | 0.75 | 0.60 |
| 0.51 - 0.75 | 0.60 | 0.40 |
| 0.76 – 1.00 | 0.40 | 0.20 |
| > 1.00 | 0.20 | 0.10 |

Exception: The maximum *U*-factor and solar heat gain coefficient (SHGC) for fenestration shall not be required in storm shelters complying with ICC 500.

R402.6 Radiant Barrier. A roof radiant barrier with an emittance of 0.05 or less as tested in accordance with ASTM C-1371 or ASTM E-408 is required. The radiant barrier shall be installed according to the manufacturer's instructions.

A roof radiant barrier is not required for:

1. Roofs covered with clay or concrete tile having a solar reflectance of 0.40 or greater.
2. Roofs covered with other materials having a solar reflectance of 0.50 or greater.
3. *Residential buildings* with sealed attics.
4. *Residential buildings* with mechanical equipment and all duct work located wholly within the conditioned space.
5. Existing construction where there is no modification to the roof framing structure.

R402.7 Attic Ventilation. Attic ventilation shall be installed in accordance with the Residential Code or Mechanical Code, respective to the building type. Ventilation shall not be provided where it introduces unconditioned air into the thermal envelope of the building.

R403.1.1.1 Thermostat Connectivity to Internet. The *thermostat* controlling the primary heating or cooling system of the dwelling unit shall be capable of connecting to the internet via either a cable or WiFi connection and allow cooling and heating set points to be altered remotely.

Exception: Heating and cooling systems with proprietary thermostats or controls that don't allow connection to the internet.

R403.3.5 Duct testing. Ducts shall be pressure tested in accordance with ANSI/RESNET/ICC 380 or ASTM E1554 to determine air leakage by one of the following methods:

1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. All registers shall be taped or otherwise sealed during the test.
2. Post-construction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure. All registers shall be taped or otherwise sealed during the test.

Exception: A duct air-leakage test shall not be required for ducts serving ventilation systems that are not integrated with ducts serving heating or cooling systems.

A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*.

R403.3.6 Duct leakage. The total leakage of the ducts, where measured in accordance with Section R403.3.5, shall be as follows:

1. Rough-in test: The total leakage shall be less than or equal to 4.0 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m²) of *conditioned floor area* where the air handler is installed at the time of the test. Where the air handler is not installed at the time of the test, the total leakage shall be less than or equal to 3.0 cubic feet per minute (85 L/min) per 100 square feet (9.29 m²) of *conditioned floor area*.
2. Post-construction test: Total leakage shall be less than or equal to 4.0 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m²) of *conditioned floor area*.
3. Test for ducts within thermal envelope: Where all ducts and air handlers are located entirely within the building thermal envelope, total leakage shall be less than or equal to 4.0 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m²) of *conditioned floor area*.

4. In dwelling units served by a single system with a condenser rated at 1.5 tons or less cooling capacity, total leakage shall be no more than 42 cubic feet per minute.

R403.3.8 Balancing of Air Distribution System. Volumetric airflow in cubic feet per minute (CFM) shall meet the design/application requirements. Airflow testing shall be performed by an independent third-party testing contractor approved by the building official, with all interior doors closed and all blowers operating at cooling speed.

The airflow at each supply register shall be measured. Supply registers with a design airflow exceeding 35 CFM shall have a measured airflow of within +/- 20% of design airflow. Supply registers with design airflow below 35 CFM but having a measured airflow 60 CFM or higher shall be balanced to bring measured airflow to within +/-20% of design airflow. Documentation shall verify that actual total system airflow is within +/- 10 percent of total system design airflow. All documentation shall be submitted with the final mechanical Code compliance package and provided to the code official.

Measurement of supply airflow shall be performed using a balometer (flow hood) per the manufacturer's instructions.

Documentation shall include the following:

- a. Address of building.
- b. Name and company of technician performing the testing.
- c. Date of final test.

Exceptions:

1. Ductless systems.
2. Existing construction with no modification of or addition to the existing ductwork.
3. An addition of 200 square feet or less of conditioned space to existing construction.
4. Systems with a Manual J recommended sizing of 4.5 tons or other size not typically available from manufacturers must be balanced to within +/-20% of design air flow as indicated on the Manual J for that building. It is the

responsibility for the HVAC contractor to communicate the lack of availability of a properly sized system to the third-party testing contractor.

R403.3.9 Pressure Differential. The pressure difference between each bedroom and adjacent interior area (i.e. hallway) shall not exceed 5 Pascals. The pressure difference between the interior area in the vicinity of the return side of the air handling equipment and the outside of the building does not exceed -5 Pascals. Testing shall be performed by an independent third-party testing contractor approved by the building official, with all interior doors closed and all blowers operating at cooling speed.

Exception: Ductless systems where the supply and return airflow are handled by a single unit within the room.

R403.3.10 System static pressure. Total system static pressure with filters installed shall not exceed 0.8 inch water column on gas furnaces and 0.6 inch water column on electric air handlers. Static pressure testing using a digital manometer or magnehelic shall be performed by an independent third-party testing contractor approved by the building official. Documentation verifying static pressure testing results within the allowed ranges shall be submitted with the final mechanical code compliance package and provided to the code official.

Documentation shall include the following:

- a. Address of building.
- b. Name and company of third-party testing contractor performing the testing.
- c. Date of final test.
- d. Procedure used for the test.
- e. Results of the test listing static pressure for applications tested.

Exceptions:

1. Existing construction with no modification of or addition to the existing ductwork, or replacement of mechanical equipment.
2. Ductless systems.
3. Systems where the air handler equipment is housed within the return plenum.

4. Air handlers for systems having a rated cooling capacity above 55,000 Btu per hour.

R403.3.11 Batch Testing For buildings having three or more dwelling units, a minimum of 15% of the dwelling units in each building must be tested as required by Sections R402.4.1.2, R403.3.5, R403.3.6, R403.3.8, R403.3.9, R403.3.10, and R403.6.3. If each tested dwelling unit within the batch meets code requirements, then all dwelling units in the batch are considered to meet code.

The third-party testing contractor shall perform all required tests on at least three consecutive dwelling units. Test results must meet code requirements before batch testing is allowed. Initial testing is required for each new multifamily project. Dwelling units must be within the same building to qualify for inclusion in a batch.

Batch Identification and Sampling

The builder shall identify a “batch” which is a building where the dwelling units are completed and ready for testing. The third-party testing contractor randomly selects at least 15% of dwelling units from a batch for testing. All units within the batch must be ready for testing (drywall complete, interior door jams installed, HVAC system installed, and final air sealing completed) before the third-party testing contractor can select the units to be tested.

Failure to Meet Code Requirement(s)

- a. If any dwelling units within the identified batch fail to meet a code requirement as a result of testing, the builder will be directed to fix the cause(s) of failure, and 30% of the remaining dwelling units in the batch will be randomly selected for testing regarding the specific cause(s) of failure.
- b. If any failures occur in the additional dwelling units, all remaining dwelling units in the batch must be individually tested for code compliance.
- c. A multifamily project with 3 failures within a 6-month period is no longer eligible to use the sampling protocol in that community or project until successfully repeating “Initial Testing.” Sampling can be reinstated after at least 3 consecutive dwelling units are individually verified to meet all code requirements.
- d. No dwelling unit in a batch may be issued a Certificate of Occupancy until testing has been performed and passed on the dwelling unit(s) selected for testing.

R403.3.12 Filtration for Air Distribution Systems. Filters installed in air distribution systems shall have a minimum efficiency reporting value (MERV) rating of 6 or greater. Filters shall be located to prevent unfiltered air from passing through the mechanical equipment. Filters shall be installed prior to operation of the air handling unit.

R403.5.4 Demand Response of Electric Resistance Water Heating. Electric resistance water heaters shall be controlled by a preprogrammed water heater timer. The timer shall be preprogrammed to turn the water heater off between the hours of 3:00PM and 7:00PM from June 1 to September 30. The timer shall have a readily accessible override, as defined by the building official, capable of restoring power to the water heater for one hour when activated. The timer shall be permanently programmed by the manufacturer or locked to prevent alteration of the programming by the building occupants.

Buildings that are accessory to a residential building are considered residential buildings for the purposes of this section.

Exceptions:

- a. Heat pump water heater installed where electric resistance is the secondary means of heating.
- b. Water heater installed with an OpenADR certified communications module or ANSI/CTA-2045 certified port allowing for remote management or other demand response capability as approved by the code official.

R403.7.1 Documentation of Heating and Cooling Equipment Sizing. Documentation verifying the methodology and accuracy of heating and cooling equipment sizing shall be submitted with final mechanical code compliance package. Documentation shall include the following information:

- a. Address of residence.
- b. Name of individual performing load calculations.
- c. Name and version of load calculation software.
- d. Design temperatures (outdoor and indoor) according to the Air Conditioning Contractors of America's (ACCA) Manual J, ACCA Manual N, American Society of Heating, Refrigeration and Air-Conditioning Engineers, U.S Department of Energy standards, or other methodology approved by the City of Austin.

- e. Area of walls, windows, skylights and doors within +/- 10% of architectural plans or actual building.
- f. Orientation of windows and glass doors, infiltration rate, duct loads, internal gains, insulation values, and Solar Heat Gain Coefficient of windows.
- g. Heating and cooling load calculations.
- h. Design supply airflows for each room.

R403.9 Space Heating. The use of electric resistance as a primary source of space heating is prohibited in all dwelling units having a conditioned floor area in excess of 500 square feet.

Exception: Buildings where dwelling units are cooled using chilled water.

R405.2 Performance-based compliance. Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.
2. The building thermal envelope shall be greater than or equal to levels of efficiency and solar heat gain coefficients in Table R402.1.1 or R402.1.3 of the 2012 International Energy Conservation Code as amended by Ordinance No. 20130606-091.
3. Annual energy use that is less than or equal to the annual energy use of the standard reference design.

Exception: Fenestration U-factor of 0.50 is allowed if offset by cooling and/or heating system efficiency.

Table R405.2 REQUIREMENTS FOR TOTAL BUILDING PERFORMANCE

| SECTION ^a | TITLE |
|----------------------|------------------------------|
| General | |
| R401.2.5 | Additional energy efficiency |
| R401.3 | Certificate |

| Building Thermal Envelope | |
|---|--|
| R402.1.1 | Vapor retarder |
| R402.2.3 | Eave baffles |
| R402.2.4.1 | Access hatches and doors |
| R402.2.10.1 | Crawl space wall insulation installations |
| R402.4 | Air Leakage |
| R402.5 | Maximum fenestration U-factor and SHGC |
| R402.6 | Radiant Barrier |
| Mechanical | |
| R403.1 | Controls |
| R403.3, except Sections R403.3.2, R403.3.3, R403.3.11 | Ducts and Additional HVAC Testing |
| R403.4 | Mechanical system piping insulation |
| R403.5.1 | Heated water circulation and temperature maintenance systems |
| R403.5.3 | Drain water heat recovery units |
| R403.5.4 | Demand Response of Electric Resistance Water Heating |
| R403.6 | Mechanical ventilation |
| R403.7 | Equipment sizing and efficiency rating |
| R403.8 | Systems serving multiple dwelling units |
| R403.9 | Space heating |
| R403.10 | Energy consumption of pools and spas |

| | |
|--|--|
| R403.11 | Portable spas |
| R403.12 | Residential pools and permanent residential spas |
| Electrical Power and Lighting Systems | |
| R404.1 | Lighting equipment |
| R404.2 | Interior lighting controls |

^a Reference to a code section includes all the relative subsections except as indicated in the table.

TABLE R405.4.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE
AND PROPOSED DESIGNS

| BUILDING COMPONENT | STANDARD REFERENCE DESIGN | PROPOSED DESIGN |
|--------------------------------|--|---|
| Above-grade walls | Type: mass wall if proposed wall is mass; otherwise wood frame Gross area: same as proposed U-factor: from Table R402.1.2(2) Solar absorptance = 0.75 Emittance = 0.90 | As proposed As proposed As proposed As proposed As proposed |
| Basement and crawl space walls | Type: same as proposed Gross area: same as proposed | As proposed As proposed As proposed |

| | | |
|-----------------------|--|---|
| | U-factor: from Table R402.1.2(2), with insulation layer on interior side of walls. | |
| Above-grade floors | Type: wood frame Gross area: same as proposed U-factor: from Table R402.1.2(2) | As proposed As proposed As proposed |
| Ceilings | Type: wood frame Gross area: same as proposed U-factor: from Table R402.1.2(2) | As proposed As proposed As proposed |
| Roofs | Type: composition shingle on wood sheathing Gross area: same as proposed Solar absorptance = 0.75 Emittance = 0.90 Radiant barrier per R402.6 | As proposed As proposed As proposed As proposed As proposed |
| Foundations | Type: same as proposed foundation wall area above and below grade and soil characteristics; same as proposed | As proposed As proposed |
| Opaque doors | Area: 40ft ² Orientation: North U-factor: same as fenestration from Table R402.1.2(2) | As proposed As proposed As proposed |

| | | |
|---|---|--|
| Vertical fenestration other than opaque doors | <p>Total area^h = 15% of conditioned floor area</p> <p>Orientation: equally distributed to four cardinal compass orientations (N, E, S & W)</p> <p>U-factor: area-weighted average of 0.35</p> <p>SHGC: 0.25</p> <p>Interior shade fraction: 0.92</p> <p>External shading: none</p> | <p>As proposed</p> <p>As proposed</p> <p>As proposed</p> <p>As proposed</p> <p>As proposed</p> <p>As proposed</p> |
| Skylights | None | As proposed |
| Thermally isolated sunrooms | None | As proposed |
| Air exchange rate | <p>The air leakage rate at a pressure of 0.2 inch w.g. (50 Pa) shall be 5 air changes per hour.</p> <p>The mechanical ventilation rate shall be in addition to the air leakage rate and shall be the same as in the proposed design, but not greater than $0.01 \times \text{CFA} + 7.5 \times (\text{N} + 1)$</p> <p>where:</p> | <p>The measured air exchange rate.^a</p> <p>The mechanical ventilation rate^b shall be in addition to the air leakage rate and shall be as proposed.</p> |

| | | |
|------------------------|--|---|
| | <p>CFA = conditioned floor area, ft².</p> <p>N = number of bedrooms.</p> <p>The mechanical ventilation system type shall be the same as in the proposed design.</p> <p>Energy recovery shall not be assumed for mechanical ventilation.</p> | |
| Mechanical ventilation | <p>Where mechanical ventilation is not specified in the proposed design: None</p> <p>Where mechanical ventilation is specified in the proposed design, annual vent fan energy use, in units of kWh/yr, shall equal:</p> $(1/e_f) \times [0.0876 \times CFA + 65.7 \times (N_{br} + 1)]$ <p>where:</p> <p>e_f = the minimum exhaust fan efficacy, as specified in Table R403.6.2, corresponding to the system type at a flow rate of $0.01 \times CFA + 7.5 \times (N_{br} + 1)$</p> <p>$CFA$ = conditioned floor area, ft²</p> <p>N_{br} = number of bedrooms</p> | As proposed |
| Internal Mass | <p>An internal mass for furniture and contents of 8 pounds per square foot of floor area</p> | <p>Same as standard reference, plus any additional mass designed as a thermal storage element^c but</p> |

| | | | |
|---------------------------------------|---|---|-------------|
| | | not integral to the building envelope or structure | |
| Structural mass | For masonry floor slabs, 80% of floor are covered by R-2 carpet and pad, and 20% of floor directly exposed to room air. | As proposed | |
| | For other walls, for ceilings, floors, and interior walls, wood frame construction | As proposed | |
| Heating systems ^{d, e} | Prevailing federal minimum efficiency | As proposed | |
| | Capacity in accordance with Section R403.7 | As proposed | |
| Cooling systems ^{d, f} | Prevailing federal minimum efficiency | As proposed | |
| | Capacity in accordance with Section R403.7 | | |
| Service water heating ^{d, g} | | As proposed | |
| | As proposed. | Use, in units of gal/day = (25.5 + (8.5 x N _{br}))*(1-HWDS) | |
| | Use, in units of gal/day = 25.5 + (8.5 x N _{br}) Where N _{br} = number of bedrooms | Where: N _{br} = number of bedrooms. HWDS = factor for the compactness of the hot water distribution system | |
| | | Compactness Ratio ⁱ | HWDS Factor |

| | | | | |
|------------------------------|--|---|-------------------|-------------|
| | | 1 story | 2 or More Stories | |
| | | > 60% | > 30% | 0 |
| | | > 30% to ≤ 60% | > 15% to ≤ 30% | 0.05 |
| | | > 15% to ≤ 30% | > 7.5% to ≤ 15% | 0.10 |
| | | ≤ 15% | ≤ 7.5% | <u>0.15</u> |
| Thermal distribution systems | <p>Duct insulation: in accordance with Section R403.3.1.</p> <p>A thermal distribution system efficiency (DSE) of 0.88 shall be applied to both the heating and cooling system efficiencies for all systems other than tested duct systems.</p> <p>Duct location: same as proposed design.</p> | <p>Duct insulation: as proposed.</p> <p>Duct location: as proposed</p> <p>As tested or, where not tested, as specified in Table R405.4.2(2)</p> | | |

| | | |
|--------------|--|------------------------------------|
| | <p>Exception: For nonducted heating and cooling systems that do not have a fan, the standard reference design thermal distribution system efficiency (DSE) shall be 1.</p> <p>For tested duct systems, the leakage rate shall be 4 cfm (113.3 L/min) per 100 ft² (9.29 m²) of conditioned floor area at a pressure of differential of 0.1 inch w.g. (25 Pa).</p> | |
| Thermostat | <p>Type: Programmable, cooling temperature setpoint = 75°F</p> <p>Heating temperature setpoint = 72°F</p> | Same as standard reference |
| Dehumidistat | <p>Where a mechanical ventilation system with latent heat recovery is not specified in the proposed design: None.</p> <p>Where the proposed design utilizes a mechanical ventilation system with latent heat recovery:</p> <p>Dehumidistat type: Manual, setpoint = 60% relative humidity.</p> | Same as standard reference design. |

| | | |
|--|---|--|
| | Dehumidifier: whole-home with integrated energy factor = 1.77 liters/kWh. | |
|--|---|--|

R406.2 ERI Compliance. Compliance based on the Energy Rating Index (ERI) requires that the rated design meets all of the following:

1. The requirements of the sections indicated within Table R406.2.
2. Maximum ERI of Table R406.5.

Table R406.2 REQUIREMENTS FOR ENERGY RATING INDEX

| SECTION ^a | TITLE |
|----------------------------------|---|
| General | |
| R401.2.5 | Additional energy efficiency |
| R401.3 | Certificate |
| Building Thermal Envelope | |
| R402.1.1 | Vapor retarder |
| R402.2.3 | Eave baffle |
| R402.2.4.1 | Access hatches and doors |
| R402.2.10.1 | Crawl space wall insulation installations |
| R402.4 | Air Leakage |
| R402.5 | Maximum fenestration U-factor and SHGC |
| R402.6 | Radiant Barrier |
| Mechanical | |
| R403.1 | Controls |

| | |
|---|--|
| R403.3, except Sections R403.3.2, R403.3.3, R403.3.10 | Ducts and Additional HVAC Testing |
| R403.4 | Mechanical system piping insulation |
| R403.5.1 | Heated water circulation and temperature maintenance systems |
| R403.5.3 | Drain water heat recovery units |
| R403.5.4 | Demand Response of Electric Resistance Water Heating |
| R403.6 | Mechanical ventilation |
| R403.7 | Equipment sizing and efficiency rating |
| R403.8 | Systems serving multiple dwelling units |
| R403.9 | Space heating |
| R403.10 | Energy consumption of pools and spas |
| R403.11 | Portable spas |
| R403.12 | Residential pools and permanent residential spas |
| Electrical Power and Lighting Systems | |
| R404.1 | Lighting equipment |
| R404.2 | Interior lighting controls |
| R406.3 | Building thermal envelope |

^a Reference to a code section includes all the relative subsections except as indicated in the table.

R406.3.2 On-site renewables are included. Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the *building thermal envelope* shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or

Table R402.1.4 of the 2015 International Energy Conservation Code as amended by Ordinance No. 20160623-099.

R406.4 Energy Rating Index. The Energy Rating Index (ERI) shall be determined in accordance with RESNET/ICC 301 except for buildings covered by the *International Residential Code*, the ERI Reference Design Ventilation rate shall be in accordance with Equation 4-2. The ERI shall consider all energy used in the *residential building*.

Ventilation rate, CFM = (0.01 x total square foot area of house) + [7.5 x (number of bedrooms + 1)]

Energy used to recharge or refuel a vehicle used for transportation on roads that are not on the building site shall not be included in the ERI reference design or the rated design. For compliance purposes, any reduction in energy use of the rated design associated with on-site renewable energy shall not exceed 5 percent of the total energy use.

**TABLE R406.5
MAXIMUM ENERGY RATING INDEX**

| CLIMATE ZONE | ENERGY RATING INDEX |
|--------------|---------------------|
| 2 | 59 |

R503.1.1.1 Replacement fenestration. Where some or all of an existing fenestration unit is replaced with a new fenestration product, including sash and glazing, the replacement fenestration unit shall meet the applicable requirements for *U*-factor and SHGC as specified in Table R402.1.3(1). Where more than one replacement fenestration unit is to be installed, an area-weighted average of the *U*-factor, SHGC or both of all replacement fenestration units shall be an alternative that can be used to show compliance.

CHAPTER 7 [RE] Residential Solar Ready

R701.1 Residential Solar Ready. New Residential Buildings must have a Solar-Ready Zone. A Solar-Ready Zone is a section or sections of the roof or building structure designated and reserved for future installation of a solar photovoltaic or solar thermal system. The Solar-Ready Zone must not include areas shaded by parts of the building or other obstructions.

R701.2 Construction document requirements for Solar-Ready Zone. Construction documents must indicate the Solar-Ready Zone on a roof plan.

R701.3 Obstructions. Solar-Ready Zones must be free from and not shaded by obstructions, including but not limited to vents, chimneys, parapets and roof-mounted equipment.

R701.4 Electrical service reserved space. The main electrical service panel must have a reserved space to allow installation of a dual pole circuit breaker for future solar electric installation and must be labeled "For Solar Electric." The reserved space must be positioned at the opposite (load) end from the input feed location or main circuit location.

R701.5 One-family and two-family dwellings. New detached one-family or two-family dwellings must have a total Solar-Ready Zone area of not less than 240 square feet (22.3 m²) per dwelling, exclusive of required access or setback areas. The Solar-Ready Zone must be oriented between 90 and 300 degrees of true North. The Solar-Ready Zone must comprise areas not less than six feet (1.83 m) on one side and at least one area of not less than 100 square feet (9.29 m²) exclusive of any required access or set back areas.

Exceptions:

1. A Building with less than 800 square feet (74.32 m²) of roof area per dwelling unit.
2. A Building with a Solar-Ready Zone that is shaded by trees or adjacent structures for more than 50 percent of annual daylight hours.
3. A Building Site on which the applicant has demonstrated, through documentation, existence of a unique hardship preventing compliance.
4. New residential buildings with a permanently installed on-site renewable energy system with an output of not less than one watt per square foot (0.092 m²) of conditioned floor area, or an on-site renewable energy system with a total output of at least two kilowatts.

R701.6 Townhomes. Townhomes must have a total Solar-Ready Zone area of not less than 160 square feet (14.86 m²) per dwelling unit, exclusive of required access or setback areas. The Solar-Ready Zone must be oriented between 90 and 300 degrees of true North. The Solar-Ready Zone must comprise areas not less than six feet (1.83 m) on a side and at least one area of not less than 100 square feet (9.29 m²) exclusive of required access or set back areas.

Exceptions:

1. Dwellings with less than 600 square feet (55.74 m²) of roof area per dwelling unit.
2. A building with a Solar-Ready Zone that is shaded by trees or adjacent structures for more than 50 percent of annual daylight hours.
3. A Building Site on which the applicant has demonstrated, through documentation, existence of a unique hardship preventing compliance.

R701.7 Multifamily buildings. New multifamily buildings of four stories or fewer must have a Solar-Ready Zone that is not less than 35% of the total roof area of the building.

Exceptions:

1. A building with a Solar-Ready Zone that is shaded by trees or adjacent structures for more than 50 percent of annual daylight hours.
2. A Building Site on which the applicant has demonstrated, through documentation, existence of a unique hardship preventing compliance.

PART 2. This ordinance takes effect on September 1, 2021.

PASSED AND APPROVED

_____, 2021 §
_____, 2021 §
_____, 2021 §

Steve Adler
Mayor

APPROVED: _____ **ATTEST:** _____
Anne L. Morgan Jannette S. Goodall
City Attorney City Clerk