ARTICLE 12. ENERGY CODE.

§ 25-12-261 INTERNATIONAL ENERGY CONSERVATION CODE.

(A) The International Energy Conservation Code, 2024 Edition, published by the International Code Council ("2024 International Energy Conservation Code") and Appendices CG, CH, CI, CJ, RE, RF, RJ, and RK, are 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 2024 International Energy Conservation Code are deleted. A subsection contained within a deleted section or subsection is not deleted, unless specifically listed below:

C201.3	Table CG101.2.1	CH103.1.3.1
C402.4	CG101.2.2	CH103.1.3.2
C402.5.3	CG101.2.5	CH103.1.4.1
Table C405.13.2	CH103.1.1.2	CH103.1.4.2
C405.15.1	CH103.1.2.1	CI101.1
CG101.2.1	CH103.1.2.3	CI102.1

(C) For purposes of commercial energy efficiency compliance with ASHRAE standards, as allowed under the 2024 International Energy Conservation Code, the following provisions of the 2022 edition of ASHRAE standard 90.1 (ASHRAE 90.1-2022), 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:

2.2	6.7.3.2	9.4.1
4.2.1.1	7.7.3.2	10.5.1.1
5.5.3.1.4	7.9.1	10.7.3.1
5.5.4.1	8.4.3.1	G2.4.2
6.5.10	8.7.3.1	

(D) The following residential provisions of the 2024 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"	R402.5.1.2.1	R403.6.3
R402.1.2	R402.5.1.3	Table R405.2
Table R402.1.2	R402.6	Table R405.4.2(1)
R402.1.3	R403.3.7	Table R406.2
Table R402.1.3	R403.3.8	R503.1.1.1
R402.3	Table R403.3.8	RJ101.1
R402.5.1.2	R403.3.9	RK101.1

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

In the City Code, "Energy Code" means the 2024 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 2024 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 2024 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.

C402.4 Roof solar reflectance and thermal emittance. *Low slope* roofs directly above cooled *conditioned spaces* in Climate Zones 0 through 3 shall comply with one or more of the options in **Table C402.4**.

Exceptions: The following roofs and portions of roofs are exempt from the requirements of **Table C402.4**:

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. *Vegetative roofs* 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 (2,000 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.

C402.5.3 Maximum U-factor and SHGC. The maximum *U-factor* and *solar heat gain coefficient* (SHGC) for *fenestration* shall be as specified in **Table C402.5**.

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

PF = A/B (Equation 4-4).

where:

PF = Projection factor (decimal).

DRAFT

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.

C402.8 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 systems in accordance with **Section C405.15 or C406.3.1**.

C402.8.1 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.
6. Green roofs and occupied rooftop areas.
7. Areas required by City Code to not contain solar equipment.

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).

C402.8.2 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.

C402.8.3 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.

C402.8.4 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".

DRAFT

C403.7.10 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.

TABLE C405.13.2

ELECTRICAL ENERGY USE CATEGORIES

LOAD CATEGORY	DESCRIPTION OF ENERGY USE
Total HVAC system	Heating, cooling and ventilation, including but not limited to fans, pumps, boilers, chillers and water heating. Energy used by 120-volt equipment, or by 208/120-volt equipment that is located in a building where the main service is 480/277-volt power, is permitted to be excluded from total HVAC system energy use.
Interior lighting	Lighting systems located within the building.
Exterior lighting	Lighting systems located on the building site but not within the building.
Plug loads	Devices, appliances and equipment connected to convenience receptacle outlets.
Process load	Any single load that is not included in an HVAC, lighting or plug load category and that exceeds 5 percent of the peak connected load of the whole building, including but not limited to data centers, manufacturing equipment and commercial kitchens.
Electric vehicle charging	Electric vehicle charging loads that are powered through the building's electrical service.
Building operations and other miscellaneous loads	The remaining loads not included elsewhere in this table, including but not limited to vertical transportation systems, automatic doors, motorized shading systems, ornamental fountains, fireplaces, swimming pools, spas and snow-melt systems.
Electric hot water heating for uses other than space conditioning	Electricity used to generate hot water. **Exception**: Electric water heating with design capacity that is less than 10 percent of the building service rating.

C405.15.1 On-site renewable energy systems. *Buildings* shall be provided with on-site renewable electricity generation systems with a direct current (DC) nameplate power rating of not less than 0.75 watts per square foot (8.1 W/m2) multiplied by the sum of the gross *conditioned floor area* of all *floors*, not to exceed the combined gross *conditioned floor area* of the three largest *floors*.

Exceptions: The following *buildings* or building sites shall comply with **Section C405.15.2**:

1. A *building site* located where an unshaded flat plate collector oriented toward the equator and tilted at an angle from horizontal equal to the latitude receives an annual daily average incident solar radiation less than 1.1 kBtu/ft2 per day (3.5 kWh/m2/day).
2. A *building* where more than 80 percent of the roof area is covered by any combination of permanent obstructions such as, but not limited to, mechanical equipment, vegetated space, access pathways or occupied roof terrace.
3. Any *building* where more than 50 percent of the roof area is shaded from direct-beam sunlight by natural objects or by *structures* that are not part of the *building* for more than 2,500 annual hours between 8:00 a.m. and 4:00 p.m.

DRAFT

4. A *building* with gross *conditioned floor area* less than 5,000 square feet (465 m2)
5. Alterations.
6. A building with Potential Solar Area of less than 2,000 square feet (185.8 square meters).
7. High hazard *buildings* (Group H).
8. *Buildings* located within the downtown network, as identified by Austin Energy.

CG101 Definitions.

LOW POWER LEVEL 2 ELECTRIC VEHICLE (EV) CHARGING RECEPTACLE. A 208/240 Volt 20-ampere minimum branch circuit and a receptacle.

CG101.2.1 Quantity. The number of required electric vehicle (EV) spaces, *EV capable spaces* and *EV ready spaces* shall be determined in accordance with this section and either **Table CG101.2.1 or Table CG101.2.2** based on the total number of *automobile parking spaces* and shall be rounded up to the nearest whole number. For R-2 buildings, the **Table CG101.2.1 or Table CG101.2.2** requirements shall be based on the total number of *dwelling units* or the total number of *automobile parking spaces*, whichever is less.

1. Where more than one parking facility is provided on a *building site*, the number of required *automobile parking spaces* required to have EV power transfer infrastructure shall be calculated separately for each parking facility.
2. Where one shared parking facility serves multiple building occupancies, the required number of spaces shall be determined proportionally based on the floor area of each building occupancy.
3. Installed electric vehicle supply equipment installed spaces (*EVSE spaces*) that exceed the minimum requirements of this section may be used to meet the minimum requirements for *EV ready spaces* and *EV capable spaces*.
4. Installed *EV ready spaces* that exceed the minimum requirements of this section may be used to meet the minimum requirements for *EV capable spaces*.
5. Where the number of *EV ready spaces* allocated for R-2 occupancies is equal to the number of *dwelling units* or to the number of *automobile parking spaces* allocated to R-2 occupancies, whichever is less, requirements for *EVSE spaces* for R-2 occupancies shall not apply.
6. Requirements for a Group S-2 parking garage shall be determined by the occupancies served by that parking garage. Where new automobile spaces do not serve specific occupancies, the values for Group S-2 parking garage in Table CG101.2.1 shall be used.
7. Group S-2 parking garages with no less than 50% long term parking spaces shall provide no less than 10% EV capable spaces. Long term parking spaces are considered as parking spaces where users generally park for more than 8 hours at a time, including overnight, at places such as airports, transit hubs, etc.
8. The installation of each DCFC EVSE shall be permitted to reduce the minimum number of required EV capable spaces without EVSE or EVCS with Level 2 EVSE by five and reduce proportionally the required electrical load capacity to the service panel or subpanel.
9. The installation of two Low Power Level 2 EV charging receptacles shall be permitted to reduce the minimum number of required EV capable spaces without EVSE in **Table CG101.2.1** by one in Group R-1 and Group R-2 occupancies.

Exception: Parking facilities serving occupancies other than R2 with fewer than 10 *automobile parking spaces*.

TABLE CG101.2.1

REQUIRED EV POWER TRANSFER INFRASTRUCTURE

OCCUPANCY	EVSE SPACES	EV READY SPACES	EV CAPABLE SPACES

DRAFT

Group A	0%	0%	10%
Group B	0%	0%	30%
Group E	0%	0%	30%
Group F	0%	0%	5%
Group H	0%	0%	0%
Group I	0%	0%	30%
Group M	0%	0%	30%
Group R-1	0%	5%	35%
Group R-2	0%	5%	35%
Group R-3 and R-4	0%	0%	5%
Group S exclusive of parking garages	0%	0%	0%
Group S-2 parking garages	0%	0%	30%

TABLE CG101.2.2

REQUIRED EV POWER TRANSFER INFRASTRUCTURE – POWER ALLOCATION METHOD

TOTAL NUMBER OF ACTUAL PARKING SPACES	MINIMUM TOTAL kVA @ 6.6 kVA	TOTAL kVA REQUIRED IN ANY COMBINATION OF EV CAPABLE,[3,4] LOW POWER LEVEL 2, LEVEL 2,[1,2] OR DCFC
0 - 9	0	0
10 - 25	26.4	26.4
26 – 50	52.8	52.8
51 – 75	85.8	85.8
76 – 100	112.2	112.2
101 – 150	165	165
151 – 200	231	231
201 and over	20 percent of actual parking spaces x 6.6	Total required kVA = P x .20 x 6.6 Where P = Parking spaces in facility

1. Level 2 EVSE @ 6.6 kVA minimum.
2. At least one Level 2 EVSE shall be provided.
3. Maximum allowed kVA to be utilized for EV capable spaces is 75 percent.
4. If EV capable spaces are utilized, they shall meet the requirements of section CG101.2.2.

CG101.2.2 EV capable spaces. Each *EV capable space* used to meet the requirements of **Section CG101.2.1** shall comply with the following:

1. A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within 3 feet (914 mm) of the *EV capable space* and electrical distribution equipment.
2. Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with **Section CG101.2.5**.
3. The electrical distribution equipment to which the raceway or cable assembly connects shall have dedicated overcurrent protection device space and electrical capacity to supply a calculated load in accordance with **Section CG101.2.5**.
4. The enclosure or outlet and the electrical distribution equipment directory shall be marked: “For electric vehicle supply equipment (EVSE).”

Exception: In parking garages, the conduit required for *EV capable spaces* may be omitted.

CG101.2.5 System and circuit capacity. The system and circuit capacity shall comply with **Sections CG101.2.5.1** and **CG101.2.5.2**. Group S-2 parking garages providing at least 50% *long term parking* shall meet CG101.2.5.4. *Long term parking* is parking spaces where users generally park for more than 8 hours at a time, including overnight, at places such as airports, transit hubs, etc.

CG101.2.5.4 Long-term parking garages system and circuit capacity. Provide a minimum electrical panel capacity of at least 1.8 kVA (120V/15A) per *EV capable space*.

CH103.1.1.2 Dedicated branch circuits for future electric space-heating equipment. Spaces containing combustion space-heating equipment with a capacity not more than 65,000 Btu/h (19 kW) shall be provided with a dedicated 240-volt branch circuit with ampacity of not less than 50. The branch circuit shall terminate within 6 feet (1829 mm) of the space heating equipment and be in a location with ready access. Both ends of the branch circuit shall be labeled "Spare" and be electrically isolated. Spaces containing combustion equipment for space heating with a capacity of not less than 65,000 Btu/h (19 kW) shall be provided with a dedicated branch circuit rated and sized in accordance with Section CH103.1.1.3, and terminating in a junction box within 3 feet (914 mm) of the location the space heating equipment in a location with ready access. Both ends of the branch circuit shall be labeled "Spare."

Exceptions:

1. Where a branch circuit provides electricity to the space heating combustion equipment and is rated and sized in accordance with Section CH103.1.1.3.
2. Where a branch circuit provides electricity to space cooling equipment and is rated and sized in accordance with Section CH103.1.1.3.
3. Where future electric space heating equipment would require three-phase power and the space containing combustion equipment for space heating is provided with an electrical panel with a label stating "Spare" and a bus bar rated and sized in accordance with Section CH103.1.1.3.
4. Buildings where the 99.6 percent design heating temperature is not less than 50°F (10°C).

CH103.1.2.1 Combustion service water heating electrical infrastructure. For each piece of combustion equipment for water heating with an input capacity of not more than 75,000 Btu/h (22 kW), the following electrical infrastructure is required:

1. An individual 240-volt branch circuit with an ampacity of not less than 30 shall be provided and terminate within 6 feet (1829 mm) of the water heater and shall be in a location with ready access.
2. The branch circuit overcurrent protection device and the termination of the branch circuit shall be labeled "Spare."
3. The space for containing the future water heater shall include the space occupied by the combustion equipment and shall have a height of not less than 7 feet (2134 mm), a width of not less than 3 feet (914 mm), a depth of not less than 3 feet (914 mm) and with a volume of not less than 700 cubic feet (20 m3).

Exceptions:

1. Where the space containing the water heater provides for air circulation sufficient for the operation of a heat pump water heater, the minimum room volume shall not be required.
2. Water heaters serving multiple dwelling units in a R-2 occupancy.

CH103.1.2.3 Dedicated branch circuits for future electric heat pump water heating equipment. Spaces containing combustion equipment for water heating with a capacity of greater than 75,000 Btu/h (21 980 W) shall be provided with a dedicated branch circuit rated and sized in accordance with Section CH103.1.2.4 and terminating in a junction box within 3 feet (914 mm) of the location the water heating equipment in a location with ready access. Both ends of the branch circuit shall be labeled "Spare."

Exceptions:

1. Where future electric water heating equipment would require three-phase power and the main electrical service panel has a reserved space for a bus bar rated and sized in accordance with Section CH103.1.2.4 and labeled “Spare.”

2. Water heaters serving multiple dwelling units in a R-2 occupancy.

CH103.1.3.1 Commercial cooking. Spaces containing commercial cooking appliances shall be provided with a dedicated branch circuit with a minimum electrical capacity in accordance with Table CH103.1.3.1 based on the appliance in the space. The branch circuit shall terminate within 3 feet (914 mm) of the appliance in a location with ready access. Both ends of the branch circuit shall be labeled “Spare” and be electrically isolated.

CH103.1.3.2 All other cooking. Spaces containing all other cooking equipment not designated as commercial cooking appliances shall be provided with a dedicated branch circuit in compliance with NFPA 70 Section 422.10. The branch circuit shall terminate within 6 feet (1829 mm) of fossil fuel ranges, cooktops and ovens and be in a location with ready access. Both ends of the branch circuit shall be labeled “Spare” and be electrically isolated.

CH103.1.4.1 Commercial drying. Spaces containing clothes drying equipment and end uses for commercial laundry applications shall be provided with conduit that is continuous between a junction box located within 3 feet (914 mm) of the equipment and an electrical panel. The junction box, conduit and bus bar in the electrical panel shall be rated and sized to accommodate a branch circuit with sufficient capacity for equivalent electric equipment with equivalent equipment capacity. The electrical junction box and electrical panel shall have labels stating, “Spare.”

CH103.1.4.2 Residential drying. Spaces containing clothes drying equipment, appliances and end uses serving multiple dwelling units or sleeping areas with a capacity less than or equal to 9.2 cubic feet (0.26 m3) shall be provided with a dedicated 240-volt branch circuit with a minimum capacity of 30 amperes, shall terminate within 6 feet (1829 mm) of fossil fuel clothes dryers and shall be in a location with ready access. Both ends of the branch circuit shall be labeled “Spare” and be electrically isolated.

CI101.1 Demand responsive controls. Electric heating and cooling systems shall be provided with demand responsive controls capable of executing the following actions in response to a *demand response signal*:

1. Automatically increasing the zone operating cooling setpoint by the following values: 1°F (0.5°C), 2°F (1°C), 3°F (1.5°C) and 4°F (2°C).

2. Automatically decreasing the zone operating heating setpoint by the following values: 1°F (0.5°C), 2°F (1°C), 3°F (1.5°C) and 4°F (2°C).

Where a *demand response signal* is not available, the heating and cooling system controls shall be capable of performing all other functions. Where *thermostats* are controlled by direct digital control including, but not limited to, an energy management system, the system shall be capable of *demand responsive control* and capable of adjusting all thermal setpoints to comply. The demand responsive controls shall comply with either **Section CI101.1.1** or **CI101.1.2**.

Exceptions:

1. Group I occupancies.

2. Group H occupancies.

3. Controls serving *data center systems*.

4. Occupancies or applications requiring precision in indoor temperature control as approved by the *code official*.

5. *Buildings* that comply with Load Management measure G02 in **Section C406.3.3**.

6. *Buildings* with energy storage capacity for not less than a 25 percent load reduction at peak load for a period of not less than 3 hours.

DRAFT

7. Special occupancy or special applications where wide temperature ranges are not acceptable (such as retirement homes, process applications, museums, some areas of hospitals) and are approved by the authority having jurisdiction.

CI102.1 Demand responsive water heating. Electric storage water heaters with a rated water storage volume of 40 gallons (151 L) to 120 gallons (454 L) and a nameplate input rating equal to or less than 12 kW shall be provided with demand responsive controls in accordance with **Table CI102.1**.

Exceptions:

1. Water heaters that provide a hot water delivery temperature of 180°F (82°C) or greater.
2. Water heaters that comply with Section IV, Part HLW or Section X of the ASME Boiler and Pressure Vessel Code.
3. Water heaters that use three-phase electric power.
4. Water heaters for Group R *buildings* 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.
5. Special occupancy or special applications where water temperature ranges are not acceptable (such as retirement homes, process applications, some areas of hospitals or other health care facilities) and are approved by the authority having jurisdiction.

DRAFT

(B) For purposes of commercial energy efficiency compliance with ASHRAE standards, the following provisions are local amendments to ASHRAE 90.1-2022. 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.

APPLIANCE. A device or apparatus that is manufactured and designed to utilize energy and for which this code provides specific requirements.

AUTOMOBILE PARKING SPACE. A space within a building or private or public parking lot, exclusive of driveways, ramps, columns, office and work areas, for the parking of an automobile.

COMBUSTION EQUIPMENT. Any equipment or appliance used for space heating, service water heating, cooking, clothes drying or lighting that uses a fossil fuel.

COMMERCIAL COOKING APPLIANCES. Commercial cooking appliances used in a commercial food service establishment for heating or cooking food and which produce grease vapors, steam, fumes, smoke or odors that are required to be removed through a local exhaust ventilation system. Such appliances include deep fat fryers, upright broilers, griddles, broilers, steam-jacketed kettles, hot-top ranges, under-fired broilers (charbroilers), ovens, barbecues, rotisseries and similar appliances.

ELECTRIC VEHICLE (EV). An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, neighborhood electric vehicles and electric motorcycles, primarily powered by an electric motor that draws current from a building electrical service, electric vehicle supply equipment (EVSE), a rechargeable storage battery, a fuel cell, a photovoltaic array or another source of electric current.

ELECTRIC VEHICLE CAPABLE SPACE (EV CAPABLE SPACE). A designated automobile parking space that is provided with electrical infrastructure such as, but not limited to, raceways, cables, electrical capacity, a panelboard or other electrical distribution equipment space necessary for the future installation of an EVSE.

ELECTRIC VEHICLE READY SPACE (EV READY SPACE). An automobile parking space that is provided with a branch circuit and an outlet, junction box or receptacle that will support an installed EVSE.

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). Equipment for plug-in power transfer, including ungrounded, grounded and equipment grounding conductors; electric vehicle connectors; attached plugs; any personal protection system; and all other fittings, devices, power outlets or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the electric vehicle.

ELECTRIC VEHICLE SUPPLY EQUIPMENT INSTALLED SPACE (EVSE SPACE). An automobile parking space that is provided with a dedicated EVSE connection.

LOW POWER LEVEL 2 ELECTRIC VEHICLE (EV) CHARGING RECEPTACLE. A 208/240 Volt 20-ampere minimum branch circuit and a receptacle.

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

4.2.1.1 New Buildings. New *buildings* shall comply with **Section 4.2.2** through **4.2.5** and either the provisions of

a. Sections 5, “Building Envelope”; 6, “Heating, Ventilating, and Air Conditioning”; 7, “Service Water Heating”; 8, “Power”; 9, “Lighting”; 10, “Other Equipment”; and 11, “Additional Efficiency Requirements,” or

b. Section 12, “Energy Cost Budget Method,” or

c. Normative Appendix G, “Performance Rating Method,” or

d. Normative Appendix G, "Performance Rating Method" with the following modifications to substitute the carbon emissions metric for the *energy* cost metric:

1. Replace references to "annual energy cost" with "carbon emissions" in the definitions of *baseline building performance* and *proposed building performance* under Section 3.

2. Replace all references to "*energy* cost" in **Section 4.2.1.1** with "carbon emissions," as appropriate, throughout.

3. Replace all references to "Performance Cost Index" in **Section 4.2.1.1** with "Performance Index (Carbon Emissions)," as appropriate throughout.

4. Replace **Table 4.2.1.1** with **Table I3-2**.

5. Replace references to "*energy* cost" with references to "carbon emissions" as appropriate in **Sections G1.2.2, G1.3.2, G2.1, G2.4.2, and G2.5** section headings.

6. Replace **Section G2.4.1** with the following:

Section G2.4.1 The *baseline building performance* and *proposed building performance* shall be determined using the conversion factors in **Table G2.1**.

TABLE G2.1

UNITS OF FUEL TO CARBON EMISSIONS CONVERSION FACTORS

Building Project Energy Source	Units	Carbon Emissions CO2*e*, lb/unit
Electricity	kWh	1.2
Natural gas	therm	19.96
Propane	therm	19.080
Distillate fuel oil	gal	28.330

Exception: Alternative conversion factors as appropriate for *building* location and as approved by the *authority having jurisdiction* are allowed.

When using Normative Appendix G, the Performance Cost Index (PCI) of new *buildings*, *additions* to *existing buildings*, and/or *alterations* to *existing buildings* shall be less than or equal to the Performance Cost Index Target (PCI_t) when calculated in accordance with the following:

$$PCI_t = [BBUEC + (BPF \times BBREC) - PRE] / BBP$$

where

PCI = Performance Cost Index calculated in accordance with **Section G1.2.2**

BBUEC = baseline *building* unregulated *energy* cost, the portion of the annual *energy* cost of a *baseline building design* that is due to *unregulated energy use*

BPF = *building* performance factor from **Table 4.2.1.1**. For *building* area types not listed in **Table 4.2.1.1**, use "All others." Where a *building* has multiple *building* area types, the required BPF shall be equal to the area-weighted average of the *building* area types based on their *gross floor area*. Where a project includes an *existing building* and an *addition*, the required BPF shall be equal to the area-weighted average, based on the *gross floor area*, of the *existing building* BPF determined as described in **Section 4.2.1.3** and the *addition* BPF from **Table 4.2.1.1**.

BBREC = baseline *building* regulated *energy* cost, the portion of the annual *energy* cost of a *baseline building design* that is due to *regulated energy use.*

PRE = $PBP_{nre} - PBP_{pre}$

PBP = *proposed building performance*, including the reduced, annual *purchased energy* cost associated with all *on-site renewable energy* generation *systems.*

PBP_{nre} = *proposed building performance* without any credit for reduced annual *energy* costs from *onsite renewable energy* generation *systems.*

PBP_{pre} = *proposed building performance*, excluding any renewable *energy system* in the *proposed design* and including an *on-site renewable energy system* that meets but does not exceed the requirements of **Section 10.5.1.1** modeled following the requirements for a *budget building design* in **Table 12.5.1**, row 15.

BBP = *baseline building performance*

Regulated *energy* cost shall be calculated by multiplying the total *energy* cost by the ratio of *regulated energy use* to total *energy* use for each *fuel* type. Unregulated *energy* cost shall be calculated by subtracting regulated *energy* cost from total *energy* cost.

When $(PBP_{pre} – PBP)/BBP > 0.05$, new *buildings*, *additions* to *existing buildings*, and/or *alterations* to *existing buildings* shall comply with the following:

$PCI + [(PBP_{pre} – PBP)/BBP] – 0.05 < PCI_t$

Informative Notes:

1. PBP_{nre} = *proposed building performance*, no renewable *energy*.
2. PBP_{pre} = *proposed building performance*, prescriptive renewable *energy*.
3. PRE = prescriptive renewable *energy*.
4. See Informative Appendix I for using other metrics, including *site energy*, source *energy*, and carbon emissions, in conjunction with the Normative Appendix G *Performance Rating Method* when approved by the *rating authority*.

5.4.4 Roof Solar Reflectance and Thermal Emittance. *Roofs* in Climate Zones 0 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 S100.

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 $Btu/h \cdot ft^2 \cdot °F$, based on three-year-aged solar reflectance and three-year-aged thermal *emittance* tested in accordance with CRRC S100.

Exceptions:

1. Ballasted *roofs* with a minimum stone *ballast* of 17 lb/ft^2 or 23 lb/ft^2 pavers.
2. *Vegetated roof* systems that contain a minimum thickness of 2.5 inches 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 subsections 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 (2,000 sq. ft.).

DRAFT

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-m^2 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 10.5.1** or **11.5.2.6**.

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.
6. Green roofs and occupied rooftop areas.
7. Areas required by City Code to not contain solar equipment.

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.

DRAFT

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.

6.4.3.1.3 Demand responsive controls. Electric heating and cooling systems shall be provided with demand responsive controls capable of executing the following actions in response to a *demand response signal*:

1. Automatically increasing the zone operating cooling setpoint by the following values: 1°F (0.5°C), 2°F (1°C), 3°F (1.5°C) and 4°F (2°C).
2. Automatically decreasing the zone operating heating setpoint by the following values: 1°F (0.5°C), 2°F (1°C), 3°F (1.5°C) and 4°F (2°C).

Where a *demand response signal* is not available, the heating and cooling system controls shall be capable of performing all other functions. Where *thermostats* are controlled by direct digital control including, but not limited to, an energy management system, the system shall be capable of demand responsive control and capable of adjusting all thermal setpoints to comply. The demand responsive controls shall comply with either **Section 6.4.3.1.3.1** or **6.4.3.1.3.2**.

Exceptions:

1. Group I occupancies.
2. Group H occupancies.
3. Controls serving *data center systems*.
4. Occupancies or applications requiring precision in indoor temperature control as approved by the *code official*.
5. *Buildings* that comply with Load Management measure G02 in **Section 11.5.2.8**.
6. *Buildings* with energy storage capacity for not less than a 25 percent load reduction at peak load for a period of not less than 3 hours.
7. Special occupancy or special applications where wide temperature ranges are not acceptable (such as retirement homes, process applications, museums, some areas of hospitals) and are approved by the *authority having jurisdiction*.

6.4.3.1.3.1 Air conditioners and heat pumps with two or more stages of control and cooling capacity of less than 65,000 Btu/h. *Thermostats* for air conditioners and heat pumps with two or more stages of control and a cooling

capacity less than 65,000 Btu/h (19 kW) shall be provided with a demand responsive control that complies with the communication and performance requirements of AHRI 1380.

6.4.3.1.3.2 All other heating and cooling systems. *Thermostats* for heating and cooling systems shall be provided with a demand responsive control that complies with one of the following:

1. Certified OpenADR 2.0a VEN, as specified under Clause 11, Conformance.
2. Certified OpenADR 2.0b VEN, as specified under Clause 11, Conformance.
3. Certified by the *manufacturer* as being capable of responding to a *demand response signal* from a certified OpenADR 2.0b VEN by automatically implementing the control functions requested by the VEN for the equipment it controls.
4. IEC 62746-10-1.

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.

6.4.8 Hydronic heating design requirements. For all hydronic space heating systems, the design entering water temperature for coils, radiant panels, radiant floor systems, radiators, baseboard heaters and any other device that uses hot water to provide heat to a space shall be not more than 130°F (54°C).

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 *set point* 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.

6.7.3.2 Manuals. *Construction documents* shall require that an operating manual and a maintenance manual be provided to the *building* owner or the designated representative of the *building* owner within 90 days after the date of *system* acceptance. These manuals shall be in accordance with industry-accepted standards (see Informative Appendix E) and shall include, at a minimum, the following:

a. Submittal data stating *equipment* size and fuel type, and selected options for each piece of *equipment* requiring maintenance.

b. Operation manuals and maintenance manuals for each piece of *equipment* and *system* requiring maintenance, except *equipment* not furnished as part of the project. Required routine maintenance actions shall be clearly identified.

c. Names and addresses of at least one *service agency*.

d. HVAC controls *system* maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field-determined *set points* and demand response *set points* shall

be permanently recorded on control drawings at *control devices* or, for digital control *systems*, in programming comments.

e. A complete narrative of how each *system* is intended to operate, including suggested *set points* and demand response *set points*.

7.4.4.5 Demand responsive water heating. Electric storage water heaters with a rated water storage volume of 40 gallons (151 L) to 120 gallons (454 L) and a nameplate input rating equal to or less than 12 kW shall be provided with demand responsive controls in accordance with Table 7.4-3.

Exceptions:

1. Water heaters that provide a hot water delivery temperature of 180°F (82°C) or greater.
2. Water heaters that comply with Section IV, Part HLW or Section X of the ASME Boiler and Pressure Vessel Code.
3. Water heaters that use three-phase electric power.
4. Water heaters for Group R *buildings* 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.
5. Special occupancy or special applications where water temperature ranges are not acceptable (such as retirement homes, process applications, some areas of hospitals or other health care facilities) and are approved by the authority having jurisdiction.

TABLE 7.4-3

DEMAND RESPONSIVE CONTROLS FOR WATER HEATING

EQUIPMENT TYPE	**CONTROLS**	
	Manufactured before 7/1/2025	**Manufactured on or after 7/1/2025**
Electric storage water heaters	**AHRI Standard 1430** or **ANSI/CTA-2045-B** Level 1 and also capable of initiating water heating to meet the temperature setpoint in response to a *demand response signal*	**AHRI Standard 1430**

7.7.3.2 Manuals. *Construction documents* shall require that an operating manual and a maintenance manual be provided to the *building* owner, or the designated representative of the *building* owner, within 90 days after the date of *system* acceptance. These manuals shall be in accordance with industry-accepted standards and shall include, at a minimum, information on water heating fuel type, operation manuals and maintenance manuals for each component of the *system* requiring maintenance, except components not furnished as part of the project. Required routine maintenance actions shall be clearly identified. Automated demand response sequences and controls shall be clearly identified.

7.9.1 Verification and Testing. Service hot-water controls shall be verified and tested in accordance with this section and **Section 4.2.5.1**. Testing shall verify that *systems* and controls are configured and operating in accordance with applicable requirements of

a. *service water heating system* temperature controls (**Sections 7.4.4.1, 7.4.4.3**, and **7.4.4.5**),

b. recirculation *pump* or *heat trace* controls (**Section 7.4.4.2**), or

c. *pool* time switch controls (**Section 7.4.5.3**).

Verification and *FPT* documentation shall comply with **Section 4.2.5.1.2**.

8.4.3.1 Monitoring. Measurement devices shall be installed in new *buildings* to monitor the electrical *energy* use for each of the following separately:

a. Total electrical *energy*

b. *HVAC systems*

c. Interior lighting

d. Exterior lighting

e. Receptacle circuits

f. Refrigeration *systems*

g. *Electric vehicle* charging

For *buildings* with tenants, these *systems* shall be separately monitored for the total *building* and (excluding shared *systems*) for each individual tenant.

Exception to 8.4.3.1: Where the design load of any of the categories (b) through (g) are less than 10% of the whole-building load, these categories shall be allowed to be combined with other categories.

8.4.5 Additional electric infrastructure. Electric infrastructure in *buildings* that contain combustion equipment shall be installed in accordance with this section.

8.4.5.1 Combustion space heating. Spaces containing combustion equipment for space heating shall comply with **Sections 8.4.5.1.1**, **8.4.5.1.2** and **8.4.5.1.3**

8.4.5.1.1 Designated exterior locations for future electric space-heating equipment. Spaces containing combustion equipment for space heating shall be provided with designated exterior location(s) shown on the plans and of sufficient size for outdoor space-heating heat pump equipment, with a chase that is sized to accommodate refrigerant lines between the exterior location and the interior location of the space heating equipment, and with natural drainage for condensate from heating operation or a condensate drain located within 3 feet (914 mm) of the location of the future exterior space-heating heat pump equipment.

8.4.5.1.2 Dedicated branch circuits for future electric space-heating equipment. Spaces containing combustion space-heating equipment with a capacity not more than 65,000 Btu/h (19 kW) shall be provided with a dedicated 240-volt branch circuit with ampacity of not less than 50. The branch circuit shall terminate within 6 feet (1829 mm) of the space heating equipment and be in a location with ready *access*. Both ends of the branch circuit shall be *labeled* "Spare" and be electrically isolated. Spaces containing combustion equipment for space heating with a capacity of not less than 65,000 Btu/h (19 kW) shall be provided with a dedicated branch circuit rated and sized in accordance with **Section 8.4.5.1.3**, and terminating in a junction box within 3 feet (914 mm) of the location the space heating equipment in a location with ready *access*. Both ends of the branch circuit shall be *labeled* "Spare."

Exceptions:

1. Where a branch circuit provides electricity to the space heating combustion equipment and is rated and sized in accordance with **Section 8.4.5.1.3**.

2. Where a branch circuit provides electricity to space cooling equipment and is rated and sized in accordance with **Section 8.4.5.1.3**.

3. Where future electric space heating equipment would require three-phase power and the space containing combustion equipment for space heating is provided with an electrical panel with a label stating "Spare" and a bus bar rated and sized in accordance with **Section 8.4.5.1.3**.

4. *Buildings* where the 99.6 percent design heating temperature is not less than 50°F (10°C).

TABLE 8.4.5.1

ALTERNATE ELECTRIC SPACE HEATING EQUIPMENT CONVERSION FACTORS (VA/kBtu/h)

99.6% HEATING DESIGN TEMPERATURE		P_s
Greater Than (°F)	**Not Greater Than**	**VA/kBtu/h**
50	N/A	N/A
45	50	94
40	45	100
35	40	107
30	35	115
25	30	124
20	25	135
15	20	149
10	15	164
5	10	184
0	5	210
-5	0	243
-10	-5	289
-15	-10	293

For SI: °C = [(° F) – 32]/1.8, 1 British thermal unit per hour = 0.2931 kW.

8.4.5.1.3 Additional space heating electric infrastructure sizing. Electric infrastructure for future electric space heating equipment shall be sized to accommodate not less than one of the following:

1. An electrical capacity not less than the nameplate space heating combustion equipment heating capacity multiplied by the value in **Table 8.4.5.1**, in accordance with **Equation 8.4.5.1**.

   $VA_s = Q_{com} \times P_s$ **Equation 8.4.5.1**

   where

   VA_s = The required electrical capacity of the electrical infrastructure in volt-amps.

   Q_{com} = The nameplate heating capacity of the combustion equipment in kBtu/h.

   P_s = The VA per kBtu/h from **Table 8.4.5.1** in VA/kBtu/h.

2. An electrical capacity not less than the peak space heating load of the *building* areas served by the space heating combustion equipment, calculated in accordance with **Section 6.4.2.1**, multiplied by the value for the 99.6 percent design heating temperature in **Table 8.4.5.1**, in accordance with **Equation 8.4.5.2.**

   $VA_s = Q_{design} \times P_s$ **Equation 8.4.5.2**

   where

   VA_s = The required electrical capacity of the electrical infrastructure in volt-amps.

   Q_{design} = The 99.6 percent design heating load of the spaces served by the combustion equipment in kBtu/h.

   P_s = The VA per kBtu/h from **Table 8.4.5.1** in VA/kBtu/h.

8.4.5.2 Combustion service water heating Spaces containing combustion equipment for *service water heating* shall comply with **Sections 8.4.5.2.1**, **8.4.5.2.2** and **8.4.5.2.3**.

8.4.5.2.1 Combustion service water heating electrical infrastructure. For each piece of combustion equipment for water heating with an input capacity of not more than 75,000 Btu/h (22 kW), the following electrical infrastructure is required:

1. An individual 240-volt branch circuit with an ampacity of not less than 30 shall be provided and terminate within 6 feet (1829 mm) of the *water heater* and shall be in a location with ready *access*.
2. The branch circuit overcurrent protection device and the termination of the branch circuit shall be *labeled* "Spare."
3. The space for containing the future *water heater* shall include the space occupied by the combustion equipment and shall have a height of not less than 7 feet (2134 mm), a width of not less than 3 feet (914 mm), a depth of not less than 3 feet (914 mm) and with a volume of not less than 700 cubic feet (20 m3).

Exceptions:

1. Where the space containing the *water heater* provides for air circulation sufficient for the operation of a heat pump *water heater*, the minimum room volume shall not be required.
2. Water heaters service multiple dwelling units in a R-2 occupancy.

8.4.5.2.2 Designated locations for future electric heat pump water heating equipment. Designated locations for future electric heat pump water heating equipment shall be in accordance with one of the following:

1. Designated exterior location(s) shown on the plans, of sufficient size for outdoor water heating heat pump equipment and with a chase that is sized to accommodate refrigerant lines between the exterior location and the interior location of the water heating equipment.
2. An interior location with a minimum volume the greater of 700 cubic feet (19 822 L) or 7 cubic feet (198 L) per 1,000 Btu/h (293 W) combustion equipment water heating capacity. The interior location shall include the space occupied by the combustion equipment.
3. An interior location with sufficient airflow to exhaust cool air from future water heating heat pump equipment provided by not fewer than one 16-inch (406 mm) by 24-inch (610 mm) grill to a heated space and one 8-inch (203 mm) *duct* of not more than 10 feet (3048 mm) in length for cool exhaust air.

8.4.5.2.3 Dedicated branch circuits for future electric heat pump water heating equipment. Spaces containing combustion equipment for water heating with a capacity of greater than 75,000 Btu/h (21 980 W) shall be provided with a dedicated branch circuit rated and sized in accordance with **Section 8.4.5.2.4** and terminating in a junction box within 3 feet (914 mm) of the location the water heating equipment in a location with ready *access*. Both ends of the branch circuit shall be *labeled* "Spare."

Exceptions:

1. Where future electric water heating equipment would require three-phase power and the main electrical service panel has a reserved space for a bus bar rated and sized in accordance with **Section 8.4.5.2.4** and *labeled* "Spare."
2. Water heaters serving multiple dwelling units in a R-2 occupancy.

8.4.5.2.4 Additional water heating electric infrastructure sizing. Electric infrastructure water heating equipment with a capacity of greater than 75,000 Btu/h (21 980 W) shall be sized to accommodate one of the following:

1. An electrical capacity not less than the combustion equipment water heating capacity multiplied by the value in **Table 8.4.5.2** plus electrical capacity to serve recirculating loads as shown in **Equation 8.4.5.3**.

$VA_w = (Q_{capacity} \times P_w) + [Q_{recirc} \times 293\ (VA/(Btu/h))]$ **Equation 8.4.5.3**

where

VA_w = The required electrical capacity of the electrical infrastructure for water heating in volt-amps

$Q_{capacity}$ = The water heating capacity of the combustion equipment in kBtu/h

P_w = The VA per kBtu/h from **Table 8.4.5.2** in VA/kBtu/h

Q_{recirc} = The capacity required for temperature

e maintenance by recirculation, if applicable, in Btu/h

2. An alternate design that complies with this code, is *approved* by the authority having jurisdiction and uses no energy source other than electricity or *on-site renewable energy.*

TABLE 8.4.5.2

ALTERNATE ELECTRIC WATER HEATING EQUIPMENT CONVERSION FACTORS (VA/kBtu/h)

99.6% HEATING DESIGN TEMPERATURE		Ps
Greater Than (°F)	Not Greater Than	VA/kBtu/h
55	60	118
50	55	123
45	50	129
40	45	136
35	40	144
30	35	152
25	30	162
20	25	173
15	20	185
10	15	293
5	10	293
0	5	293
Less than 0°F		293

For SI: °C = [(° F) – 32]/1.8, 1 British thermal unit per hour = 0.2931 kW.

8.4.5.3 Combustion cooking. Spaces containing combustion equipment for cooking shall comply with **Section 8.4.5.3.1** or **8.4.5.3.2**.

8.4.5.3.1 Commercial cooking. Spaces containing commercial cooking appliances shall be provided with a dedicated branch circuit with a minimum electrical capacity in accordance with **Table 8.4.5.3.1** based on the appliance in the space. The branch circuit shall terminate within 3 feet (914 mm) of the appliance in a location with ready *access*. Both ends of the branch circuit shall be *labeled* "Spare" and be electrically isolated.

8.4.5.3.2 All other cooking. Spaces containing all other cooking equipment not designated as commercial cooking appliances shall be provided with a dedicated branch circuit in compliance with **NFPA 70** Section 422.10. The branch circuit shall terminate within 6 feet (1829 mm) of fossil fuel ranges, cooktops and ovens and be in a location with ready *access*. Both ends of the branch circuit shall be *labeled* "Spare" and be electrically isolated.

TABLE 8.4.5.3.1

COMMERCIAL COOKING MINIMUM BRANCH CIRCUIT CAPACITY

COMMERCIAL COOKING APPLIANCE	MINIMUM BRANCH CIRCUIT CAPACITY

DRAFT

Range	469 VA/kBtu/h
Steamer	114 VA/kBtu/h
Fryer	200 VA/kBtu/h
Oven	266 VA/kBtu/h
Griddle	195 VA/kBtu/h
All other commercial cooking appliances	114 VA/kBtu/h

For SI: 1 British thermal unit per hour = 0.2931 kW.

8.4.5.4 Combustion clothes drying. Spaces containing combustion equipment for clothes drying shall comply with **Section 8.4.5.4.1** or **8.4.5.4.2**.

8.4.5.4.1 Commercial drying. Spaces containing clothes drying equipment and end uses for commercial laundry applications shall be provided with conduit that is continuous between a junction box located within 3 feet (914 mm) of the equipment and an electrical panel. The junction box, conduit and bus bar in the electrical panel shall be rated and sized to accommodate a branch circuit with sufficient capacity for equivalent electric equipment with equivalent equipment capacity. The electrical junction box and electrical panel shall have labels stating, “Spare.”

8.4.5.4.2 Residential drying. Spaces containing clothes drying equipment, appliances and end uses serving multiple *dwelling units* or sleeping areas with a capacity less than or equal to 9.2 cubic feet (0.26 m3) shall be provided with a dedicated 240-volt branch circuit with a minimum capacity of 30 amperes, shall terminate within 6 feet (1829 mm) of fossil fuel clothes dryers and shall be in a location with ready *access*. Both ends of the branch circuit shall be *labeled* with the words “Spare” and be electrically isolated.

8.4.6 On-site transformers. *Enclosed spaces* and underground vaults containing onsite electric transformers on the *building* side of the electric utility meter shall have sufficient space to accommodate transformers sized to serve the additional electric loads identified in **Sections 8.4.5.1**, **8.4.5.2**, **8.4.5.3** and **8.4.5.4**.

8.7.3.1 Record Documents. *Construction documents* shall require that within 90 days after the date of *system* acceptance, *record documents* shall be provided to the *property* owner, including

a. a *single-line diagram* of the *property* electrical *distribution system*,

b. *floor* plans indicating location and area served for all distribution,

c. *site* plans indicating location and area served for all distribution, and

d. details for additional electric infrastructure, including branch circuits, conduit, prewiring, panel capacity and electrical service capacity for heating, water heating, cooking and clothes drying equipment, as well as interior and exterior spaces designated for future electric equipment.

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 responsive lighting controls. Interior general lighting in Group B, E, M and S occupancies shall have demand responsive controls complying with **Section 9.4.1.5.1** in not less than 75 percent of the interior floor area.

Exceptions:

1. Where the combined interior floor area of Group B, E, M and S occupancies is less than 10,000 square feet (929 m2).

2. *Buildings* where a *demand response signal* is not available from a controlling entity other than the *owner*.

3. Parking garages.

4. Ambulatory care facilities.

5. Outpatient clinics.

6. Physician or dental offices.

9.4.1.5.1 Demand responsive lighting controls function. Demand responsive controls for lighting shall be capable of the following:

1. Automatically reducing the output of controlled lighting to 80 percent or less of full power or light output upon receipt of a *demand response signal*.

2. Where high-end trim has been set, automatically reducing the output of controlled lighting to 80 percent or less of the high-end trim setpoint upon receipt of a *demand response signal*.

3. Dimming controlled lights gradually and continuously over a period of not longer than 15 minutes to achieve their demand response setpoint.

4. Returning controlled lighting to its normal operational settings at the end of the demand response period.

Exception: Storage rooms and warehouse storage areas shall be permitted to switch off 25 percent or more of general lighting power rather than dimming.

10.4.9 Electrical energy storage system. *Buildings* shall comply with **Section 10.4.9.1** or **10.4.9.2**.

10.4.9.1 Electrical energy storage system (ESS) capacity. Each *building* shall have one or more ESS with a total rated energy capacity and rated power capacity as follows:

1. ESS-rated energy capacity (kWh) ≥ 1.0 × installed on-site renewable electric energy system rated power (kWDC).

2. ESS-rated power capacity (kW) ≥ 0.25 × installed on-site renewable electric energy system rated power (kWDC).

Where installed, DC-coupled battery systems shall meet the requirements for rated energy capacity alone.

10.4.9.2 Electrical energy storage system (ESS) ready. Each *building* shall have one or more reserved ESS-ready areas to accommodate future electrical storage in accordance with **Sections 10.4.9.2.1** through **10.4.9.2.4**.

10.4.9.2.1 ESS-ready location. Each ESS-ready area shall be located in accordance with Section 1207 of the *International Fire Code*.

10.4.9.2.2 ESS-ready minimum area requirements. Each ESS-ready area shall be sized in accordance with the spacing requirements of Section 1207 of the *International Fire Code* and the UL 9540 or UL 9540A designated rating of the planned system. Where rated to UL 9540A, the area shall be sized in accordance with the *manufacturer's* instructions.

10.4.9.2.3 Electrical distribution equipment. The on-site electrical distribution equipment shall have sufficient capacity, rating and space to allow the installation of overcurrent devices and circuit wiring in accordance with NFPA 70 for future electrical ESS complying with the capacity criteria of **Section 10.4.9.2.4**.

10.4.9.2.4 ESS-ready minimum system capacity. Compliance with ESS-ready requirements in **Sections 10.4.9.2.1** through **10.4.9.2.3** shall be based on a minimum total energy capacity and minimum rated power capacity as follows:

1. ESS-rated energy capacity (kWh) ≥ *gross conditioned floor area* of the three largest *floors* (ft2) × 0.0008 kWh/ft2.

2. ESS-rated power capacity (kW) ≥ *gross conditioned floor area* of the three largest *floors* (ft2) × 0.0002 kW/ft2.

10.4.10 Electric vehicle power transfer infrastructure. Parking facilities shall be provided with electric vehicle power transfer infrastructure in accordance with **Sections 10.4.10.1** through **10.4.10.6**.

DRAFT

10.4.10.1 Quantity. The number of required electric vehicle (EV) spaces, *EV capable spaces* and *EV ready spaces* shall be determined in accordance with this section and either **Table 10.4.10-1 or Table 10.4.10-2** based on the total number of *automobile parking spaces* and shall be rounded up to the nearest whole number. For R-2 *buildings*, the **Table 10.4.10-1 or Table 10.4.10-2** requirements shall be based on the total number of *dwelling units* or the total number of *automobile parking spaces*, whichever is less.

1. Where more than one parking facility is provided on a *building* site, the number of required *automobile parking spaces* required to have EV power transfer infrastructure shall be calculated separately for each parking facility.
2. Where one shared parking facility serves multiple *building* occupancies, the required number of spaces shall be determined proportionally based on the floor area of each *building* occupancy.
3. Installed electric vehicle supply equipment installed spaces (*EVSE spaces*) that exceed the minimum requirements of this section may be used to meet the minimum requirements for *EV ready spaces* and *EV capable spaces*.
4. Installed *EV ready spaces* that exceed the minimum requirements of this section may be used to meet the minimum requirements for *EV capable spaces*.
5. Where the number of EV ready spaces allocated for R-2 occupancies is equal to the number of *dwelling units* or to the number of *automobile parking spaces* allocated to R-2 occupancies, whichever is less, requirements for *EVSE* spaces for R-2 occupancies shall not apply.
6. Requirements for a Group S-2 parking garage shall be determined by the occupancies served by that parking garage. Where new automobile spaces do not serve specific occupancies, the values for Group S-2 parking garage in Table 10.4.10.1 shall be used.
7. Group S-2 parking garages with no less than 50% long term parking spaces shall provide no less than 10% EV capable spaces. Long term parking spaces are considered as parking spaces where users generally park for more than 8 hours at a time, including overnight, at places such as airports, transit hubs, etc.
8. The installation of each DCFC EVSE shall be permitted to reduce the minimum number of required EV capable spaces without EVSE or EVCS with Level 2 EVSE by five and reduce proportionally the required electrical load capacity to the service panel or subpanel.
9. The installation of two Low Power Level 2 EV charging receptacles shall be permitted to reduce the minimum number of required EV capable spaces without EVSE in **Table CG101.2.1** by one in Group R-1 and Group R-2 occupancies.

Exception: Parking facilities serving occupancies other than R2 with fewer than 10 *automobile parking spaces*.

TABLE 10.4.10-1

REQUIRED EV POWER TRANSFER INFRASTRUCTURE

OCCUPANCY	EVSE SPACES	EV READY SPACES	EV CAPABLE SPACES
Group A	0%	0%	10%
Group B	0%	0%	30%
Group E	0%	0%	30%
Group F	0%	0%	5%
Group H	0%	0%	0%
Group I	0%	0%	30%
Group M	0%	0%	30%
Group R-1	0%	5%	35%
Group R-2	0%	5%	35%
Group R-3 and R-4	0%	0%	5%

DRAFT

Group S exclusive of parking garages	0%	0%	0%
Group S-2 parking garages	0%	0%	30%

TABLE 10.4.10-2

REQUIRED EV POWER TRANSFER INFRASTRUCTURE – POWER ALLOCATION METHOD

TOTAL NUMBER OF ACTUAL PARKING SPACES	MINIMUM TOTAL kVA @ 6.6 kVA	TOTAL kVA REQUIRED IN ANY COMBINATION OF EV CAPABLE,[3,4] LOW POWER LEVEL 2, LEVEL 2,[1,2] OR DCFC
0 - 9	0	0
10 - 25	26.4	26.4
26 – 50	52.8	52.8
51 – 75	85.8	85.8
76 – 100	112.2	112.2
101 – 150	165	165
151 – 200	231	231
201 and over	20 percent of actual parking spaces x 6.6	Total required kVA = P x .20 x 6.6 Where P = Parking spaces in facility

1. Level 2 EVSE @ 6.6 kVA minimum.
2. At least one Level 2 EVSE shall be provided.
3. Maximum allowed kVA to be utilized for EV capable spaces is 75 percent.
4. If EV capable spaces are utilized, they shall meet the requirements of section CG101.2.2.

10.4.10.2 EV capable spaces. Each *EV capable space* used to meet the requirements of **Section 10.4.10.1** shall comply with the following:

1. A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within 3 feet (914 mm) of the *EV capable space* and electrical distribution equipment.

2. Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with **Section 10.4.10.5**.

3. The electrical distribution equipment to which the raceway or cable assembly connects shall have dedicated overcurrent protection device space and electrical capacity to supply a calculated load in accordance with **Section 10.4.10.5**.

4. The enclosure or outlet and the electrical distribution equipment directory shall be marked: “For electric vehicle supply equipment (EVSE).”

Exception: In parking garages, the conduit required for *EV capable spaces* may be omitted.

10.4.10.3 EV ready spaces. Each branch circuit serving *EV ready spaces* used to meet the requirements of **Section 10.4.10.1** shall comply with the following:

1. Terminate at an outlet or enclosure located within 3 feet (914 mm) of each *EV ready space* it serves.

2. Have a minimum system and circuit capacity in accordance with **Section 10.4.10.5**.

3. The electrical distribution equipment directory shall designate the branch circuit as “For electric vehicle supply equipment (EVSE)” and the outlet or enclosure shall be marked “For electric vehicle supply equipment (EVSE).”

10.4.10.4 EVSE spaces. An installed EVSE with multiple output connections shall be permitted to serve multiple *EVSE spaces*. Each EVSE installed to meet the requirements of **Section 10.4.10.1**, serving either a single *EVSE space* or multiple *EVSE spaces*, shall comply with the following:

1. Have a minimum system and circuit capacity in accordance with **Section 10.4.10.5**.

2. Have a nameplate rating not less than 6.2 kW.

3. Be located within 3 feet (914 mm) of each *EVSE space* it serves.

4. Be installed in accordance with **Section 10.4.10.6**.

10.4.10.5 System and circuit capacity. The system and circuit capacity shall comply with **Sections 10.4.10.5.1** and **10.4.10.5.2**. Group S-2 parking garages with no less than 50% long term parking spaces shall meet **Section 10.4.10.5.4**. Long term parking spaces are considered as parking spaces where users generally park for more than 8 hours at a time, including overnight, at places such as airports, transit hubs, etc.

10.4.10.5.1 System capacity. The electrical distribution equipment supplying the branch circuit(s) serving each *EV capable space*, *EV ready space* and *EVSE space* shall comply with one of the following:

1. Have a calculated load of 7.2 kVA or the nameplate rating of the equipment, whichever is larger, for each *EV capable space*, *EV ready space* and *EVSE space*.

2. Meets the requirements of **Section 10.4.10.5.3.1**.

10.4.10.5.2 Circuit capacity. The branch circuit serving each *EV capable space*, *EV ready space* and *EVSE space* shall comply with one of the following:

1. Have a rated capacity not less than 50 amperes or the nameplate rating of the equipment, whichever is larger.

2. Meets the requirements of **Section 10.4.10.5.3.2**.

10.4.10.5.3 System and circuit capacity management. Where system and circuit capacity management is selected in **Section 10.4.10.5.1** or **10.4.10.5.2**, the installation shall comply with **Sections 10.4.10.5.3.1** and **10.4.10.5.3.2**.

10.4.10.5.3.1 System capacity management. The maximum equipment load on the electrical distribution equipment supplying the branch circuits(s) serving *EV capable spaces*, *EV ready spaces* and *EVSE spaces* controlled by an energy management system shall be the maximum load permitted by the energy management system, but not less than 3.3 kVA per space.

10.4.10.5.3.2 Circuit capacity management. Each branch circuit serving multiple *EVSE spaces*, *EV ready spaces* or *EV capable spaces* controlled by an energy management system shall comply with one of the following:

1. Have a minimum capacity of 25 amperes per space.

2. Have a minimum capacity of 20 amperes per space for R-2 occupancies where all *automobile parking spaces* are *EV ready spaces* or *EVSE spaces*.

10.4.10.5.4 Long-term parking garages system and circuit capacity. Provide a minimum electrical panel capacity of at least 1.8 kVA (120V/15A) per *EV capable space*.

10.4.10.6 EVSE installation. *EVSE* shall be installed in accordance with **NFPA 70** and shall be *listed* and *labeled* in accordance with **UL 2202** or **UL 2594**. *EVSE* shall be accessible in accordance with **Section 1107** of the *International Building Code*.

10.5.1.1 On-Site Renewable Energy. The *building* site shall have equipment for on-site renewable energy with a rated capacity of not less than 0.50 W/ft2 or 1.7 Btu/ft2 multiplied by the sum of the *gross conditioned floor area* for all floors up to the three largest floors.

Exceptions to 10.5.1.1:

1. Any *building* located where an unshaded flat plate collector oriented toward the equator and tilted at an angle from horizontal equal to the latitude receives an annual daily average incident solar radiation less than 1.1 kBtu/ft2·day.
2. Any *building* where more than 80% of the *roof* area is covered by any combination of equipment other than for *on-site renewable energy systems*, planters, vegetated *space*, *skylights*, or occupied *roof* deck.
3. Any *building* where more than 50% of *roof* area is shaded from direct-beam sunlight by natural objects or by *structures* that are not part of the *building* for more than 2500 annual hours between 8:00 a.m. and 4:00 p.m.
4. New *construction* or *additions* in which the sum of the *gross conditioned floor area* of the three largest *floors* of the new construction or addition is less than 10,000 ft2.
5. *Alterations.*
6. A *building* with Potential Solar Area of less than 2,000 square feet (185.8 square meters).
7. High hazard *buildings* (Group H).
8. *Buildings* located within the downtown network, as identified by Austin Energy.

10.7.3.1 Record Documents. *Construction documents* shall require that within 90 days after the date of *system* acceptance, *record documents* shall be provided to the *building* owner. Record documents shall include, as a minimum, the location of pathways for routing of raceways or cable from the renewable energy system to the electrical service panel and electrical energy storage system area, location and layout of a designated area for electrical energy storage system, and location of designated *EVSE spaces*, *EV-Ready spaces*, and *EV-Capable spaces* in parking facilities.

G2.4.2 Annual Energy Costs.

G2.4.2.1 The *design energy cost* and baseline *energy* cost shall be determined using actual rates for purchased energy.

G2.4.2.2 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, except where the baseline *energy* source is prescribed in Tables G3.1.1-2 and G3.1.1-3. Where the *proposed design* includes *onsite 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 2024 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.

R101.2 Scope. This code applies to the design and construction of detached one- and two-family dwellings and multiple single-family dwellings (townhouses) and Group R-2, R-3 and R-4 *buildings* four stories or less in height above *grade plane*.

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=[(°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 or *F-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	2
VERTICAL FENESTRATION *U*-FACTOR	0.40
SKYLIGHT *U*-FACTOR	0.60
GLAZED VERTICAL FENESTRATION SHGC	0.25
SKYLIGHT SHGC	0.28
CEILING *U*-FACTOR	0.030
ATTIC ROOFLINE *U*-FACTOR	0.045
WOOD FRAME WALL *U*-FACTOR	0.075
MASS WALL *U*-FACTOR [c]	0.165
FLOOR *U*-FACTOR	0.064
BASEMENT WALL *U*-FACTOR [d]	0.360
UNHEATED SLAB *F*-FACTOR [e]	0.73
HEATED SLAB *F*-FACTOR [e]	0.74
CRAWL SPACE *U*-FACTOR	0.477

For SI: 1 foot = 304.8 mm.

[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 and *F*-factors shall be obtained from measurement, calculation or an *approved* source.
[c] Mass walls shall be in accordance with **Section R402.2.6**. 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] In Warm Humid locations as defined by **Figure R301.1** and **Table R301.1**, the *basement wall* U-factor shall not exceed 0.360.
[e] F-factors for slabs correspond to the R-values of **Table R402.1.3(1)** and the installation conditions of **Section R402.2.10.1**.

DRAFT

TABLE R402.1.2(2) MAXIMUM ASSEMBLY *U*-FACTORS AND FENESTRATION REQUIREMENTS FOR NEW CONSTRUCTION[a]

CLIMATE ZONE	2
VERTICAL FENESTRATION *U*-FACTOR	0.35
SKYLIGHT *U*-FACTOR	0.60
GLAZED VERTICAL FENESTRATION SHGC	0.25
SKYLIGHT SHGC	0.28
CEILING *U*-FACTOR	0.030
ATTIC ROOFLINE *U*-FACTOR	0.045
WOOD FRAME WALL *U*-FACTOR [b]	0.066
MASS WALL *U*-FACTOR	0.165
FLOOR *U*-FACTOR	0.064
BASEMENT WALL *U*-FACTOR [c]	0.360
UNHEATED SLAB *F*-FACTOR [d]	0.73
HEATED SLAB *F*-FACTOR [d]	0.74
CRAWL SPACE *U*-FACTOR	0.477

For SI: 1 foot = 304.8 mm.

[a] Non-*fenestration U*-factors and *F*-factors shall be obtained from measurement, calculation, or an *approved* source or Appendix RF where such appendix is adopted or *approved*.

[b] Mass walls shall be in accordance with **Section R402.2.6**. 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] In Warm Humid locations as defined by **Figure R301.1** and **Table R301.1**, the *basement wall* U-factor shall not exceed 0.360.

[d] *F*-factors for slabs correspond to the *R*-values of **Table R402.1.3(2)** and the installation conditions of **Section R402.2.10.1**.

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 or *F*-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	2
VERTICAL FENESTRATION *U*-FACTOR	0.40
SKYLIGHT *U*-FACTOR	0.60
GLAZED VERTICAL FENESTRATION SHGC	0.25
SKYLIGHT SHGC	0.28
CEILING *R*-VALUE	38
ATTIC ROOFLINE *R*-VALUE [c,d,g,h]	25&0ci or 0&25ci
WOOD FRAME WALL *R*-VALUE [c,d]	15, 13&2ci, or 0&10ci
MASS WALL *R*-VALUE [i]	4/6
FLOOR *R*-VALUE [c, d]	13 OR 7&5ci or 0&10ci
BASEMENT WALL *R*-VALUE [f]	0
UNHEATED SLAB *R*-VALUE & DEPTH [e]	0

DRAFT

HEATED SLAB *R*-VALUE & DEPTH [c,d,e]	R-5ci edge and R-5 full slab
CRAWL SPACE WALL *R*-VALUE [c,d]	0

For SI: 1 foot = 304.8 mm
NR = Not Required.
ci = continuous insulation.
[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] "5ci or 13" means R-5 *continuous insulation* (ci) on the interior or exterior surface of the wall or R-13 *cavity insulation* on the interior side of the wall. "10ci or 13" means R-10 *continuous insulation* (ci) on the interior or exterior surface of the wall or R-13 *cavity insulation* on the interior side of the wall. "15ci or 19 or 13&5ci" means R-15 *continuous insulation* (ci) on the interior or exterior surface of the wall; or R-19 *cavity insulation* on the interior side of the wall; or R-13 *cavity insulation* on the interior of the wall in addition to R-5 *continuous insulation* on the interior or exterior surface of the wall.
[d] The 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.
[e] Slab insulation shall be installed in accordance with **Section R402.2.10.1**.
[f] *Basement wall* insulation is not required in Warm Humid locations as defined by **Figure R301.1** and **Table R301.1**.
[g] 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-m^2 at 75 Pa pressure differential tested according to ASTM E 2178 or ASTM E 283.
[h] R-0&25ci *continuous insulation* can be used where the insulation is completely above the roof framing and sub-roofing.
[i] Mass walls shall be in accordance with **Section R402.2.6**. 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	2
VERTICAL FENESTRATION *U*-FACTOR	0.35
SKYLIGHT *U*-FACTOR	0.60
GLAZED VERTICAL FENESTRATION SHGC	0.25
SKYLIGHT SHGC	0.28
CEILING *R*-VALUE	38
ATTIC ROOFLINE *R*-VALUE [b,c,f,g]	25&0ci or 0&25ci
WOOD FRAME WALL *R*-VALUE [b,c]	19, 15&2ci, 13&3ci, or 0&15ci
MASS WALL *R*-VALUE [h]	4/6
FLOOR *R*-VALUE [b,c]	13 OR 7&5ci OR 0&10ci
BASEMENT WALL *R*-VALUE [b,e]	0
UNHEATED SLAB *R*-VALUE & DEPTH [d]	0
HEATED SLAB *R*-VALUE & DEPTH [b,c,d]	R-5ci edge and R-5 full slab
CRAWL SPACE WALL *R*-VALUE [b,c]	0

For SI: 1 foot = 304.8 mm
NR = Not Required.
ci = continuous insulation.
[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] "5ci or13" means R-5 *continuous insulation* (ci) on the interior or exterior surface of the wall or R-13 *cavity insulation* on the interior side of the wall. "10ci or 13" means R-10 *continuous insulation* (ci) on the interior or exterior surface of the wall or R-13 *cavity insulation* on the interior side of the wall. "15ci or 19 or 13&5ci" means R-15 *continuous insulation* (ci) on the

interior or exterior surface of the wall; or R-19 *cavity insulation* on the interior side of the wall; or R-13 *cavity insulation* on the interior of the wall in addition to R-5 *continuous insulation* on the interior or exterior surface of the wall.
[c] The 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.
[d] Slab insulation shall be installed in accordance with **Section R402.2.10.1**.
[e] *Basement wall* insulation is not required in Warm Humid locations as defined by **Figure R301.1** and **Table R301.1**.
[f] 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-m^2 at 75 Pa pressure differential tested according to ASTM E 2178 or ASTM E 283.
[g] R-0&25ci *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 R402.2.6**. The second R-value applies where more than half of the insulation is on the interior of the mass wall.

R402.3 Radiant Barriers. *Radiant barriers* shall be installed in accordance with ASTM C1743.

Exceptions:

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 *ductwork* located wholly within the *conditioned space*.
5. Existing construction where there is no modification to the roof framing structure.

R402.5.1.2 Air Leakage Testing. The *building* or each *dwelling unit* or *sleeping unit* in the *building* shall be tested for air leakage. Testing shall be conducted in accordance with **ANSI/RESNET/ICC 380, ASTM E 779, ASTM E 1827** or **ASTM E3158** and reported at a pressure differential of 0.2 inches water gauge (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* 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. For heated, attached private garages and heated, detached private garages accessory to one- and two-family dwellings and townhouses not more than three stories above *grade plane* in height, *building thermal envelope* tightness and insulation installation shall be considered acceptable where the items in **Table R402.5.1.1**, applicable to the method of construction, are field verified. Where required by the *code official*,

an approved third party from the installer shall inspect both *air barrier* and insulation installation criteria. Heated, attached private garage space and heated, detached private garage space shall be thermally isolated from all other habitable, *conditioned spaces* in accordance with **Sections R402.2.13** and **R402.4.5**, as applicable.

3. Where tested in accordance with **Section R403.3.13**, testing of each *dwelling unit* or *sleeping unit* is not required.

R402.5.1.3 Maximum Air Leakage Rate. Where tested in accordance with **Section R402.5.1.2**, the air leakage rate for *buildings, dwelling units* or *sleeping units* shall be as follows:

1. Where complying with **Section R401.2.1**, the *building, dwelling units* or *sleeping units* in the *building* shall have an air leakage rate not greater than 4.0 air changes per hour in Climate Zone 2.

2. Where complying with **Section R401.2.2** or **R401.2.3**, the *building, dwelling units* or *sleeping units* in the *building* shall have an air leakage rate not greater than 4.0 air changes per hour, or 0.22 cfm/ft^2 (1.1 L/s x m^2) of the *building thermal envelope* area or *testing unit enclosure area*, as applicable.

Exceptions:

1. Where *dwelling units or sleeping units* are attached or located in an R-2 occupancy and are tested without simultaneously testing adjacent *dwelling units or sleeping units*, the air leakage rate is permitted to be not greater than 0.27 cfm/ft^2 (1.35 L/s x m^2) of the *testing unit enclosure area*. Where adjacent *dwelling units or sleeping units* are simultaneously tested in accordance with ASTM E779, the air leakage rate is permitted to be not greater than 0.27 cfm/ft^2 (1.35 L/s x m^2) of the *testing unit enclosure area* that separates *conditioned space* from the exterior.

2. Where *buildings* have 1,500 square feet (139.4 m^2) or less of *conditioned floor area*, the air leakage rate is permitted to be not greater than 0.27 cfm/ft^2 (1.35 L/s x m^2).

R402.6 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 R402.6.1** is applied. Glazed *fenestration* facing within 45 degrees of North shall not be included in the area-weighted SHGC calculation.

TABLE R402.6.1 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.

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.

R403.3.7 Duct System Testing. Each *duct system* shall be tested for air leakage in accordance with **ANSI/RESNET/ICC 380** or **ASTM E1554**. Total leakage shall be measured with a pressure differential of 0.1 inch water gauge (25 Pa) across the *duct system* and shall include the measured leakage from the supply and return *ductwork*. A written report of the test results shall be signed by the party conducting the test and provided to the *code official*. *Duct system* leakage testing at either rough-in or post-construction shall be permitted with or without the installation of registers or grilles. Where installed, registers and grilles shall be sealed during the test. Where registers and grilles are not installed, the face of the register boots shall be sealed during the test.

Exceptions:

1. Testing shall not be required for *duct systems* serving *ventilation* systems that are not integrated with *duct systems* serving heating or cooling systems.
2. Testing shall not be required where there is not more than 10 feet (3.03 m) of total *ductwork* external to the *space conditioning equipment* and both the following are met:
   2.1. The *duct system* is located entirely within *conditioned space*.
   2.2. The *ductwork* does not include plenums constructed of *building* cavities or gypsum board.
3. Where the *space conditioning equipment* is not installed, testing shall be permitted. The total measured leakage of the supply and return *ductwork* shall be less than or equal to 3.0 cubic feet per minute (85 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area*.
4. Where tested in accordance with **Section R403.3.13**, testing of each *duct system* is not required.

R403.3.8 Duct System Leakage. The total measured *duct system* leakage shall not be greater than the values in **Table R403.3.8**, based on the location of the *duct system*. For *buildings* complying with **Section R405** or **R406**, where *duct system* leakage to outside is tested in accordance with **ANSI/RESNET/ICC 380** or **ASTM E1554**, the leakage to outside value shall not be used for compliance with this section but shall be permitted to be used in the calculation procedures of **Section R405** and **R406**.

TABLE R403.3.8 MAXIMUM TOTAL DUCT SYSTEM LEAKAGE

	Total leakage cfm/100 ft^2(LPM/9.29 m^2)	Total leakage cfm (LPM)
Space conditioning equipment is not installed [b,c]	3 (85)	30 (850)
All components of the *duct system* are installed [c] *Space conditioning equipment* is not installed, but the *ductwork* is located entirely in *conditioned space* [c,d] All components of the *duct system* are installed and entirely located in *conditioned space* [c]	4 (113)	42 (1189)
[a.] A ducted return is a *duct* made of sheet metal or flexible *duct* that connects one or more return grilles to the return-side inlet of the *air-handling* unit. Any other method to convey air from return or transfer grille(s) to the *air-handling* unit does not constitute a ducted return for the purpose of determining maximum total *duct system* leakage allowance.		

DRAFT

[b.] *Duct system* testing is permitted where *space conditioning equipment* is not installed, provided the return *ductwork* is installed, and the measured leakage from the supply and return *ductwork* is included.
[c.] For *duct systems* to be considered inside a *conditioned space*, where the *ductwork* is located in ventilated attic spaces or unvented attics with vapor diffusion ports, *duct system* leakage to outside must comply with Item 2.1 of **Section R403.3.4**.
[d.] Prior to the issuance of a certificate of occupancy, where the *air-handling* unit is not verified as being located in *conditioned space*, the total *duct system* leakage must be re-tested.

R403.3.10 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 a 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.

R403.3.11 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 a 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.

R403.3.12 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 a 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.

DRAFT

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.

R403.3.13 Batch Testing. For *buildings* having eight or more *dwelling units* or *sleeping units*, seven or 20 percent of the *dwelling units* or *sleeping units*, whichever is greater shall be tested as required by **Sections R402.5.1.2**, **R403.3.7**, **R403.3.8**, **R403.3.10**, **R403.3.11**, **R403.3.12**, and **R403.6.3**. If each tested *dwelling unit* or *sleeping unit* within the batch meets code requirements, then all *dwelling units* or *sleeping 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* or *sleeping units*. Test results must meet code requirements before batch testing is allowed. Initial testing is required for each new multifamily project. *Dwelling units* or *sleeping 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* or *sleeping units* are completed and ready for testing. The third-party testing contractor randomly selects the *dwelling units* and*/or sleeping units* from a batch for testing. A batch shall include a top floor *dwelling unit*, a ground floor *dwelling unit*, a middle floor *dwelling unit*, and the *dwelling unit* with the largest *conditioned floor area*. Where *buildings* have fewer than eight *dwelling units* or *sleeping units*, each *dwelling unit* or *sleeping units* shall be tested. All *dwelling units* or *sleeping 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* or *sleeping 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* or *sleeping 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* or *sleeping units*, all remaining *dwelling units* or *sleeping 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* or *sleeping units* are individually verified to meet all code requirements.

d. No *dwelling unit* or *sleeping units* in a batch may be issued a Certificate of Occupancy until testing has been performed and passed on the *dwelling units* or *sleeping units* 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.

R403.6.3 Testing. Mechanical *ventilation* systems shall be tested and verified to provide the minimum *ventilation* flow rates required by **Section R403.6**, in accordance with **ANSI/RESNET/ICC 380**. Where required by the *code*

official, testing shall be conducted by an *approved* 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*.

Exceptions:

1. Kitchen range hoods that are ducted to the outside with ducting having a diameter of 6 inches (152 mm) or larger, a length of 10 feet (3048 mm) or less, and not more than two 90-degree (1.57 rad) elbows or equivalent shall not require testing.
2. A third-party test shall not be required where the *ventilation* system has an integrated diagnostic tool used for airflow measurement, and a user interface that communicates the installed airflow rate.
3. Where tested in accordance with **Section R403.3.13**, testing of each mechanical *ventilation* system is not required.

R403.7.2 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.

R403.14 Space Heating. The use of electric resistance as a primary source of space heating is prohibited in all *dwelling units* or *sleeping units* having a *conditioned floor area* in excess of 500 square feet.

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

R405.2 Simulated Building Performance Compliance. Compliance based on *simulated building performance* requires that a *building* comply with the following:

1. The requirements of the sections indicated within **Table R405.2**.
2. The proposed total *building thermal envelope* thermal conductance (TC) shall be ~~greater~~ less than or equal to the required total *building thermal envelope* TC using the prescriptive *U*-factors and *F*-factors from **Table R402.1.2(1)** for *existing buildings* and **Table R402.1.2(2)** for new construction multiplied by 1.08 in *Climate Zone* 2 in accordance with **Equation 4-2** and **Section R402.1.5**. The area-weighted maximum *fenestration* SHGC permitted in *Climate Zone* 2 shall be 0.30.

   Equation 4-2: $TC_{Proposed\ design} \leq 1.08 \times TC_{Prescriptive\ reference\ design}$

3. For each *dwelling unit* with one or more fuel-burning appliances for space heating, water heating, or both, the annual energy use of the *dwelling unit* shall be less than or equal to 80 percent of the annual energy use of the *standard reference design*. For all other *dwelling units*, the annual energy use of the *proposed design* shall be less than or equal to 85 percent of the annual energy use of the *standard reference design*. For each *dwelling unit* with greater than 5,000 square feet (465 m^2) of *living space*

located above *grade plane*, the annual energy use of the *dwelling unit* shall be reduced by an additional 5 percent of annual energy use of the *standard reference design*.

Exceptions:

1. The energy use based on site energy expressed in Btu or Btu per square foot of *conditioned floor area* shall be permitted to be substituted for the *energy cost*.

Table R405.2 REQUIREMENTS FOR SIMULATED BUILDING PERFORMANCE

SECTION[a]	TITLE
General	
R401.3	Certificate
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.1.6	Rooms containing fuel burning appliances
R402.2.3	Attic knee wall
R402.2.4	Eave baffle
R402.2.5.1	Access hatches and door insulation installation and retention
R402.2.10	Slab-on-grade floors
R402.2.11	Crawl space walls
R402.3	Radiant barriers
R402.5.1.1	Installation
R402.5.1.2	Air leakage testing
R402.5.1.3	Maximum air leakage rate
R402.5.2	Fireplaces
R402.5.3	Fenestration air leakage
R402.5.4	Recessed lighting
R402.5.5	Air-sealed electrical and communication outlet boxes
R402.6	Maximum fenestration U-factor and SHGC
Mechanical	
R403.1	Controls
R403.2	Hot water boiler temperature reset
R403.3	Duct systems and Additional HVAC Testing
R403.4	Mechanical system piping insulation
R403.5	Service hot water system
R403.6	Mechanical ventilation
R403.7, except **Section R403.7.1**	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
R403.13	Gas fireplaces
R403.15	Snow melt and ice system controls
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
R404.2	Interior lighting controls
Chapter 7 [RE]	Residential Solar Ready

DRAFT

Appendix RE	Electric Vehicle Power Transfer
Appendix RJ	Demand Responsive Controls
Appendix RK	Electric Readiness
[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	As proposed
	Gross area: same as proposed	As proposed
	U-factor: from **Table R402.1.2(2)**	As proposed
	Solar reflectance = 0.25	As proposed
	Emittance = 0.90	As proposed
Basement and crawl space walls	Type: same as proposed	As proposed
	Gross area: same as proposed	As proposed
	U-factor: from **Table R402.1.2(2)**, with insulation layer on interior side of walls.	As proposed
Above-grade floors	Type: wood frame	As proposed
	Gross area: same as proposed	As proposed
	U-factor: from **Table R402.1.2(2)**	As proposed
Ceilings	Type: wood frame	As proposed
	Gross area: same as proposed	As proposed
	U-factor: from **Table R402.1.2(2)**	As proposed
Roofs	Type: composition shingle on wood sheathing	As proposed
	Gross area: same as proposed	As proposed
	Solar reflectance = 0.25	As proposed
	Emittance = 0.90	As proposed
	Radiant barrier per R402.3	As proposed
Attics	Type: vented with an aperture of 1 ft^2 per 300 ft^2 of ceiling area.	As proposed
Foundations	Type: same as proposed	As proposed
	Foundation wall extension above and below grade: same as proposed. Foundation wall or slab perimeter length: same as proposed. Soil characteristics: same as proposed	As proposed
	Foundation wall *U*-factor and slab-on-grade *F*-factor: as specified in **Table R402.1.2(2)**	As proposed

DRAFT

Opaque doors	Area: 40 ft^2	As proposed
	Orientation: North	As proposed
	U-factor: same as *fenestration* from **Table R402.1.2(2)**	As proposed
Vertical fenestration other than opaque doors	Total area[h] = 15% of *conditioned floor area*	As proposed
	Orientation: equally distributed to four cardinal compass orientations (N, E, S & W)	As proposed
	U-factor: area-weighted average of 0.35	As proposed
	SHGC: 0.25	As proposed
	Interior shade fraction: 0.92 – (0.21 x SHGC for the *standard reference design*)	Interior shade fraction: 0.92 – (0.21 x SHGC as proposed
	External shading: none	As proposed
Skylights	None	As proposed
Thermally isolated sunrooms	None	As proposed
Air leakage rate	For detached one-family dwellings, the air leakage rate at a pressure of 0.2 inch w.g. water gauge (50 Pa) shall be 4 air changes per hour. For detached one-family dwellings that are 1,500 ft^2 (139.4 m^2) or smaller and attached *dwelling units* or *sleeping units*, the air leakage rate at a pressure of 0.2 inch water gauge (50 Pa) shall be 0.27 cfm/ft^2 of the *testing unit enclosure area*.	The measured air leakage rate.[a]
Mechanical ventilation rate	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 B x M where: $B = 0.01 \times CFA + 7.5 \times (N_{br} + 1)$, cfm. M = 1.0 where the measured air leakage rate is ≥ 3.0 air changes per hour at 50 Pascals, and otherwise, M = minimum (1.7, Q/B) Q = the proposed mechanical *ventilation* rate, cfm. CFA = conditioned floor area, ft^2 N_{br} = number of bedrooms.	The measured mechanical *ventilation* rate[b], Q, shall be in addition to the measured air leakage rate
Mechanical ventilation fan energy	The mechanical *ventilation* system type shall be the same as in the *proposed design*. Heat recovery or energy recovery shall be modeled for mechanical *ventilation* where required by **Section R403.6.1**. Heat recovery or energy recovery shall not be modeled for mechanical *ventilation* where not required by **Section R403.6.1**. Where mechanical *ventilation* is not specified in the *proposed design*: None	As proposed

DRAFT

	Where mechanical *ventilation* is specified in the *proposed design*, annual vent fan energy use, in units of kWh/yr, shall equal: $(8.76 \times B \times M)/e_f$ where: B and M are determined in accordance with the air exchange mechanical ventilation rate row of this table. e_f = the minimum exhaust fan efficacy, as specified in **Table R403.6.2**, corresponding to the system type at a flow rate of B x M	
Internal gains	IGain, in units of Btu/day per *dwelling unit*, shall equal $17{,}900 + 23.8 \times CFA + 4{,}104 \times N_{br}$ where: CFA = conditioned floor area, ft^2. N_{br} = number of bedrooms.	Same as *standard reference design*.
Internal Mass	An internal mass for furniture and contents of 8 pounds per square foot of floor area	Same as standard reference, plus any additional mass specifically designed as a thermal storage element[c] but not integral to the *building thermal 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 masonry *basement wall*s: as proposed, but with insulation as specified in **Table R402.1.3**, located on the interior side of the walls.	As proposed
	For other walls, for ceilings, floors, and interior walls, wood frame construction.	As proposed
Heating systems[d, e, j, k]	Fuel Type: Same as *proposed design* Capacity: same as *proposed design* and in accordance with **Section R403.7**	As proposed
	Product class: Same as *proposed design*	As proposed
	Efficiencies:	As proposed
	Heat pump: Complying with **10 CFR §430.32**	As proposed
	Fuel gas and *liquid fuel* furnaces: Complying with **10 CFR §430.32**	As proposed
Cooling systems[d, f, k]	Fuel Type: Electric Capacity: same as *proposed design* and in accordance with **Section R403.7**	As proposed
	Efficiencies: Complying with **10 CFR §430.32**	As proposed
Service water heating[d, g, k]	Use, in units of gal/day = $25.5 + (8.5 \times N_{br})$ Where N_{br} = number of bedrooms	Use, in units of gal/day = $(25.5 + (8.5 \times N_{br}))*(1\text{-HWDS})$ Where:

DRAFT

<table>
<tr><td></td><td></td><td colspan="4">N_{br} = number of bedrooms.
HWDS = factor for the compactness of the hot water distribution system<table><tr><td colspan="2">Compactness ratio[i] factor</td><td>HWDS</td></tr><tr><td>1 story</td><td>2 or more stories</td><td></td></tr><tr><td>> 60%</td><td>> 30%</td><td>0</td></tr><tr><td>> 30% to ≤ 60%</td><td>> 15% to ≤ 30%</td><td>0.05</td></tr><tr><td>> 15% to ≤ 30%</td><td>> 7.5% to ≤ 15%</td><td>0.10</td></tr><tr><td>≤ 15%</td><td>≤ 7.5%</td><td>0.15</td></tr></table></td></tr>
<tr><td></td><td>Fuel Type: Same as proposed design</td><td colspan="4">As proposed</td></tr>
<tr><td></td><td>Rated Storage Volume: Same as proposed design</td><td colspan="4">As proposed</td></tr>
<tr><td></td><td>Draw Pattern: Same as proposed design</td><td colspan="4">As proposed</td></tr>
<tr><td></td><td>Efficiencies: Uniform Energy Factor complying with 10 CFR §430.32</td><td colspan="4">As proposed</td></tr>
<tr><td></td><td>Tank Temperature: 120° F (48.9° C)</td><td colspan="4">Same as standard reference design</td></tr>
<tr><td>Thermal distribution systems</td><td>Duct insulation: in accordance with Section R403.3.3.</td><td colspan="4">Duct insulation: as proposed[m].</td></tr>
<tr><td></td><td>Duct location:</td><td colspan="4">Duct location: as proposed[l]</td></tr>
<tr><td></td><td><table><tr><td>Foundation Type</td><td>Slab on grade</td><td>Unconditioned crawl space</td><td>Basement or conditioned crawl space</td></tr><tr><td>Duct location (supply and return)</td><td>One-story building: 100% in unconditioned attic. All other: 75% in unconditioned attic and 25% inside conditioned space</td><td>One-story building: 100% in unconditioned crawlspace. All other: 75% in unconditioned crawlspace and 25% inside</td><td>75% inside conditioned space 25% unconditioned attic</td></tr></table></td><td colspan="4"></td></tr>
</table>

DRAFT

			conditioned space		
	Duct system leakage to outside: For *duct systems* serving > 1,000 ft^2 (92.9 m^2) of *conditioned floor area*, the duct leakage to outside rate shall be 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m2) of *conditioned floor area*. For *duct systems* serving ≤ 1,000 ft^2 (92.9 m^2) of *conditioned floor area*, the *duct* leakage to outside rate shall be 42 cfm (1189 L/min).				*Duct System* Leakage to Outside: The measured total *duct system* leakage rate shall be entered into the software as the *duct system* leakage to outside rate. Exceptions: 1. Where *duct system* leakage to outside is tested in Accordance **ANSI/ RESNET/ICC 380** or **ASTM E1554**, the measured value shall be permitted to be entered. 2. Where total *duct system* leakage is measured without the *space conditioning equipment* installed, the simulation value shall be 4 cfm (113.3 L/ min) per 100 ft^2 (9.29 m^2) of *conditioned floor area*.
	Distribution System Efficiency (DSE): For hydronic systems and ductless systems a thermal *distribution system efficiency* (DSE) of 0.88 shall be applied to both the heating and cooling system efficiencies.				*Distribution System Efficiency* (DSE): For hydronic systems and ductless systems, DSE shall be as specified in **Table R405.4.2(2).**
Thermostat	Type: Programmable, cooling temperature setpoint = 75°F Heating temperature setpoint = 72°F				Same as *standard reference design*.
Dehumidistat	Where a mechanical *ventilation* system with latent heat recovery is not specified in the *proposed design*: None. Where the *proposed design* utilizes a mechanical *ventilation* system with latent heat recovery: Dehumidistat type: Manual, setpoint = 60% relative humidity. Dehumidifier: whole-dwelling with integrated energy factor = 1.77 liters/kWh.				Same as *standard reference design*.

DRAFT

Table R406.2 REQUIREMENTS FOR ENERGY RATING INDEX

SECTION[a]	TITLE
General	
R401.3	Certificate
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.1.6	Rooms containing fuel burning appliances
R402.2.4	Eave baffle
R402.2.5.1	Access hatches and door insulation installation and retention
R402.2.10	Slab-on-grade floors
R402.2.11	Crawl space walls
R402.3	Radiant barriers
R402.5.1.1	Installation
R402.5.1.2	Air Leakage testing
R402.5.1.3	Maximum air leakage rate
R402.5.2	Fireplaces
R402.5.3	Fenestration air leakage
R402.5.4	Recessed lighting
R402.5.5	Air-sealed electrical and communication outlet boxes (air sealed boxes)
R402.6	Maximum fenestration U-factor and SHGC
R406.3	Building thermal envelope
Mechanical	
R403.1	Controls
R403.2	Hot water boiler temperature reset
R403.3	Duct systems and Additional HVAC Testing
R403.4	Mechanical system piping insulation
R403.5	Service hot water systems
R403.5.5	Demand responsive water heating
R403.6	Mechanical ventilation
R403.7, except **Section R403.7.1**	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
R403.14	Gas fireplaces
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
R404.2	Interior lighting controls
Chapter 7 [RE]	Residential Solar Ready
Appendix RE	Electric Vehicle Power Transfer
Appendix RJ	Demand Responsive Controls
Appendix RK	Electric Readiness
[a] Reference to a code section includes all the relative subsections except as indicated in the table.	

DRAFT

R503.1.1.1 Fenestration Alterations. Where new *fenestration* area is added to an *existing building*, the new *fenestration* shall comply with **Section R402.4**. 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*. The *Solar-Ready Zone* must not include areas shaded by parts of the *building* or other obstructions.

R701.2 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.

R701.3 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. Wall area must have a reserved space to allow installation of an Austin Energy PV meter per the Austin Energy Design Criteria manual.

R701.4 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 m^2) 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 m^2) exclusive of any required access or set back areas.

Exceptions:

1. A *Building* with less than 800 square feet (74.32 m^2) 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 m^2) of *conditioned floor area*, or an *on-site renewable energy* system with a total output of at least two kilowatts.

R701.5 Townhouses. New *Townhouses* must have a total *Solar-Ready Zone* area of not less than 160 square feet (14.86 m^2) per *townhouse 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 m^2) exclusive of required access or set back areas.

Exceptions:

1. Townhouses with less than 600 square feet (55.74 m^2) of roof area per *townhouse 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.

R701.6 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:

DRAFT

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.

RJ101.1 Demand Responsive Water Heating. Electric storage water heaters with a rated water storage volume of 40 gallons (150 L) to 120 gallons (450 L) and a nameplate input rating equal to or less than 12 kW shall be provided with *demand responsive controls* in accordance with **Table RJ101.1**.

Exceptions:

1. Water heaters that are controlled by 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. 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.
2. Water heaters that are capable of delivering water at a temperature of 180°F (82°C) or greater.
3. Water heaters that comply with **Section IV, Part HLW** or **Section X** of the **ASME** Boiler and Pressure Vessel Code.
4. Water heaters that use 3-phase electric power.

RK101.1 Electric readiness. Water heaters, household clothes dryers and cooking appliances that use fuel gas or liquid fuel shall comply with **Sections RK101.1.1** through **RK101.1.5**.

RK101.1.5 Water Heater Space. A space that is at least 3 feet (0.91 m) by 3 feet (0.91 m) wide by 7 feet (2.13) high shall be available surrounding or within 3 feet (0.91 m) of the installed water heater.

Exceptions:

1. Installed heat pump water heaters.
2. Water heaters serving multiple dwelling units in a R-2 occupancy.

DRAFT