RECD1-12-22

IECC: SECTION 202 (New), R403.1.2, R403.2, R404.5, TABLE R405.4.2(1), APPENDIX RC, SECTION RC101

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2024 International Energy Conservation Code [CE Project]

Add new definition as follows:

BIODIESEL BLEND. A homogeneous mixture of hydrocarbon oils and mono alkyl esters of long chain fatty acids.

FUEL GAS. A natural gas, manufactured gas, liquified petroleum gas or a mixture of these.

FUEL OIL. Kerosene or any hydrocarbon oil having a flash point not less than 100°F (38°C).

LIQUID FUEL. A *fuel oil* or biodiesel blend.

Revise as follows:

R403.1.2 Heat pump supplementary heat. Heat pumps having supplementary electric-resistance, *fuel gas*, or *liquid fuel* ~~fuel oil heat system~~ heating systems shall have controls that are configured to prevent supplemental heat operation when the capacity of the heat pump compressor can meet the heating load. ~~Limit supplemental~~ Supplemental heat operation shall be limited to only ~~those times when~~ where one of the following applies:

1. The vapor compression cycle cannot provide the necessary heating energy to satisfy the thermostat setting.
2. The heat pump is operating in defrost mode.
3. The vapor compression cycle malfunctions.
4. The thermostat malfunctions.

R403.2 Hot water boiler temperature reset. The manufacturer shall equip each gas, *liquid fuel* ~~oil~~ and electric boiler (other than a boiler equipped with a tankless domestic water heating coil) with automatic means of adjusting the water temperature supplied by the boiler to ensure incremental change of the inferred heat load will cause an incremental change in the temperature of the water supplied by the boiler. This can be accomplished with outdoor reset, indoor reset or water temperature sensing.

R404.5 Electric Readiness. Water heaters, household clothes dryers and cooking appliances that use *fuel gas* or *liquid fuel* ~~conventional tops and conventional oven fossil fuelSystems using fossil fuel: water heaters, household clothes dryers, conventional cooking tops or conventional ovens~~ shall comply with ~~the requirements of~~ Sections R404.5.1 through R404.5.4.

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

Portions of table not shown remain unchanged.

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Above-grade walls	Type: mass where the proposed wall is a mass wall; otherwise wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
	Solar absorptance = 0.75.	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: as specified in Table R402.1.2, with the insulation layer on the interior side of the walls.	As proposed
Above-grade floors	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Ceilings	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Roofs	Type: composition shingle on wood sheathing.	As proposed
	Gross area: same as proposed.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	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 area above and below grade and soil characteristics: same as proposed.	As proposed
Opaque doors	Area: 40 ft^2.	As proposed
	Orientation: North.	As proposed
	U-factor: same as fenestration as specified in Table R402.1.2.	As proposed
Vertical fenestration other than opaque doors	Total area[h] = (a) The proposed glazing area, where the proposed glazing area is less than 15 percent of the conditioned floor area. (b) 15 percent of the conditioned floor area, where the proposed glazing area is 15 percent or more of the conditioned floor area.	As proposed
	Orientation: equally distributed to four cardinal compass orientations (N, E, S & W).	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
	SHGC: as specified in Table R402.1.2 except for climate zones without an SHGC requirement, the SHGC shall be equal to 0.40.	As proposed
	Interior shade fraction: 0.92 – (0.21 × SHGC for the standard reference design).	Interior shade fraction: 0.92 – (0.21 × SHGC as proposed)
	External shading: none	As proposed
Skylights	None	As proposed
Thermally isolated sunrooms	None	As proposed
	The air leakage rate at a pressure of 0.2 inch w.g. (50 Pa) shall be Climate Zones 0 through 2: 5.0 air changes per hour. Climate Zones 3 through 8: 3.0 air changes per hour.	The measured air exchange rate.[a]
	The mechanical ventilation rate shall be in addition to the air leakage rate and shall be	

<table>
<tr><td>Air excnange rate</td><td>the same as in the proposed design, but not greater than 0.01 × CFA + 7.5 × (N_{br} + 1)
where:
CFA = conditioned floor area, ft^2.
N_{br} = number of bedrooms.
The mechanical ventilation system type shall be the same as in the proposed design.
Energy recovery shall not be assumed for mechanical ventilation.</td><td>The mechanical ventilation rate[b] shall be in addition to the air leakage rate and shall be as proposed.</td></tr>
<tr><td>Mechanical ventilation</td><td>Where mechanical ventilation is not specified in the proposed design: None
Where mechanical ventilation is specified in the proposed design, the annual vent fan energy use, in units of kWh/yr, shall equal (1/e_f) ×[0.0876 × CFA + 65.7 × (N_{br} + 1)]
where:
e_f = the minimum fan efficacy, as specified in Table 403.6.2, corresponding to the system type at a flow rate of 0.01 × CFA + 7.5 × (N_{br} + 1)
CFA = conditioned floor area, ft^2.
N_{br} = number of bedrooms.</td><td>As proposed</td></tr>
<tr><td>Internal gains</td><td>IGain, in units of Btu/day per dwelling unit, shall equal 17,900 + 23.8 ×CFA + 4,104 × N_{br}
where:
CFA = conditioned floor area, ft^2.
N_{br} = number of bedrooms.</td><td>Same as standard reference design.</td></tr>
<tr><td>Internal mass</td><td>Internal mass for furniture and contents: 8 pounds per square foot of floor area.</td><td>Same as standard reference design, plus any additional mass specifically designed as a thermal storage element[c] but not integral to the building envelope or structure.</td></tr>
<tr><td rowspan="3">Structural mass</td><td>For masonry floor slabs: 80 percent of floor area covered by R-2 carpet and pad, and 20 percent of floor directly exposed to room air.</td><td>As proposed</td></tr>
<tr><td>For masonry basement walls: as proposed, but with insulation as specified in Table R402.1.3, located on the interior side of the walls.</td><td>As proposed</td></tr>
<tr><td>For other walls, ceilings, floors, and interior walls: wood frame construction.</td><td>As proposed</td></tr>
<tr><td>Heating systems[d, e]</td><td>For other than electric heating without a heat pump: as proposed.
Where the proposed design utilizes electric heating without a heat pump, the standard reference design shall be an air source heat pump meeting the requirements of Section C403 of the IECC—Commercial Provisions.
Capacity: sized in accordance with Section R403.7.</td><td>As proposed</td></tr>
<tr><td></td><td><s>Non-electric</s> Natural gas, propane and liquid fuel <s>fuel oil</s> furnaces: Complying with 10 CFR §430.32</td><td>As proposed</td></tr>
<tr><td></td><td><s>Non-electric</s> Natural gas, propane and liquid fuel <s>fuel oil</s> boilers: Complying with 10 CFR §430.32</td><td>As proposed</td></tr>
<tr><td>Cooling systems[d, f]</td><td>As proposed.
Capacity: sized in accordance with Section R403.7.</td><td>As proposed</td></tr>
<tr><td>Service water heating[d, g]</td><td>As proposed.
Use, in units of gal/day = 25.5 + (8.5 × N_{br})
where: N_{br} = number of bedrooms.</td><td>As proposed
Use, in units of gal/day = 25.5 + (8.5 × N_{br}) × (1 – HWDS)
where:
N_{br} = number of bedrooms.
HWDS = factor for the compactness of the hot water distribution system.
<table>
<tr><th colspan="2">Compactness ratio[i] factor</th><th>HWDS</th></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>Thermal distribution</td><td>Duct insulation: in accordance with Section R403.3.1.
A thermal distribution system efficiency (DSE) of 0.88 shall be applied to both the heating and cooling system efficiencies for all systems other than tested duct systems.
Duct location: same as proposed design.</td><td>Duct location: as proposed.
Duct insulation: as proposed.</td></tr>
</table>

distribution systems	**Exception:** For nonducted heating and cooling systems that do not have a fan, the standard reference design thermal distribution system efficiency (DSE) shall be 1. For tested duct systems, the leakage rate shall be 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area at a pressure of differential of 0.1 inch w.g. (25 Pa).	As tested or, where not tested, as specified in Table R405.4.2(2).
Thermostat	Type: Manual, 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.

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L, °C = (°F-32)/1.8, 1 degree = 0.79 rad.

a. Where required by the code official, testing shall be conducted by an approved party. Hourly calculations as specified in the ASHRAE *Handbook of Fundamentals,* or the equivalent, shall be used to determine the energy loads resulting from infiltration.

b. The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with Equation 43 of 2001 ASHRAE *Handbook of Fundamentals,* page 26.24 and the "Whole-house Ventilation" provisions of 2001 ASHRAE *Handbook of Fundamentals,* page 26.19 for intermittent mechanical ventilation.

c. Thermal storage element shall mean a component that is not part of the floors, walls or ceilings that is part of a passive solar system, and that provides thermal storage such as enclosed water columns, rock beds, or phase-change containers. A thermal storage element shall be in the same room as fenestration that faces within 15 degrees (0.26 rad) of true south, or shall be connected to such a room with pipes or ducts that allow the element to be actively charged.

d. For a proposed design with multiple heating, cooling or water heating systems using different fuel types, the applicable standard reference design system capacities and fuel types shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each equipment and fuel type present.

e. For a proposed design without a proposed heating system, a heating system having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and proposed design.

f. For a proposed design home without a proposed cooling system, an electric air conditioner having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and the proposed design.

g. For a proposed design with a nonstorage-type water heater, a 40-gallon storage-type water heater having the prevailing federal minimum energy factor for the same fuel as the predominant heating fuel type shall be assumed. For a proposed design without a proposed water heater, a 40-gallon storage-type water heater having the prevailing federal minimum efficiency for the same fuel as the predominant heating fuel type shall be assumed for both the proposed design and standard reference design.

h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouses, the following formula shall be used to determine glazing area:

$AF = A_s \times FA \times F$

where:

AF = Total glazing area.

A_s = Standard reference design total glazing area.

FA = (Above-grade thermal boundary gross wall area)/(above-grade boundary wall area + 0.5 × below-grade boundary wall area).

F = (above-grade thermal boundary wall area)/(above-grade thermal boundary wall area + common wall area) or 0.56, whichever is greater.

and where:

Thermal boundary wall is any wall that separates conditioned space from unconditioned space or ambient conditions.

Above-grade thermal boundary wall is any thermal boundary wall component not in contact with soil.

Below-grade boundary wall is any thermal boundary wall in soil contact.

Common wall area is the area of walls shared with an adjoining dwelling unit.

i. The factor for the compactness of the hot water distribution system is the ratio of the area of the rectangle that bounds the source of hot water and the fixtures that it serves (the “hot water rectangle”) divided by the floor area of the dwelling.

1. Sources of hot water include water heaters, or in multiple-family buildings with central water heating systems, circulation loops or electric heat traced pipes.
2. The hot water rectangle shall include the source of hot water and the points of termination of all hot water fixture supply piping.
3. The hot water rectangle shall be shown on the floor plans and the area shall be computed to the nearest square foot.
4. Where there is more than one water heater and each water heater serves different plumbing fixtures and appliances, it is permissible to establish a separate hot water rectangle for each hot water distribution system and add the area of these rectangles together to determine the compactness ratio.
5. The basement or attic shall be counted as a story when it contains the water heater.
6. Compliance shall be demonstrated by providing a drawing on the plans that shows the hot water distribution system rectangle(s), comparing the area of the rectangle(s) to the area of the dwelling and identifying the appropriate compactness ratio and *HWDS* factor.

APPENDIX RE
ALL-ELECTRIC RESIDENTIAL BUILDINGS

SECTION RE102
GENERAL DEFINITIONS

COMBUSTION EQUIPMENT. Any equipment or appliance used for space heating, service water heating, cooking, clothes drying and/or lighting that uses *fuel gas* or *liquid fuel* ~~fuel gas or fuel oil~~.

~~**FUEL GAS.** A natural gas, manufactured gas, liquified petroleum gas or a mixture of these.~~

Add new definition as follows:

FUEL OIL. Kerosene or any hydrocarbon oil having a flash point not less than 100°F (38°C).

Reason: Based on multiple approved RED1’s and IRCED1’s in this round (IRCED1-10, 340, 292, 116, 335) and the prior round, there are inconsistencies in how we reference ‘fuels’ that need to be resolved. This proposal resolves those inconsistencies by creating a new term “liquid fuel” that is inclusive of traditional heating oils but also expanded to clearly also include biodiesel blends.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
NONE