

PHIUS+ 2021

Prescriptive Design Review Checklist v1.0



0. Project Information

PHIUS Project Name:		Project Submitter Name:	
PHIUS Project Number		Builder Name:	
Date:		PHIUS+ Rater Name:	
Project Address:			

Orange highlight indicates calculated value based on [PHIUS+ 2021 Prescriptive Calculator](#)

1. General

	Designer Verified	Rater Verified	N/A
1.1 Scope			
1.1.1 The proposed building is a new, single-family detached or attached residence (one dwelling unit where the occupants are primarily permanent in nature.)			-
1.1.2 The iCFA divided by the number of bedrooms shall be less than 900 square feet.			-
1.1.3 No fossil fuel combustion equipment is to be installed.			-
1.1.4 No jetted tubs or indoor pools are planned.			-
1.1.4 Natural draft fireplaces are not to be installed.			-
1.1.6 At above-grade walls separating conditioned from unconditioned space, one of the following options is used:			-
1.1.6.1 Continuous rigid insulation, insulated siding, or combination of the two OR			
1.1.6.2 Structural insulated panels or; insulated concrete forms or; interior-load bearing double-wall framing [1]. See also "Reduced Thermal Bridging" below.			
1.2 Co-Requisites			
1.2.1 Energy Star Certified Homes			
1.2.2 DOE Zero Energy Ready Homes			
1.2.3 EPA Indoor airPLUS			

2. Air-Tightness

	Designer Verified	Rater Verified	N/A
2.1 Measured building airtightness $q_{50} \leq 0.04$ cfm/ft ² enclosure area [2] [3] [4].			-

3. Compactness

	Designer Verified	Rater Verified	N/A
3.1 Building compactness requirement is achieved by either 3.1.1 or 3.1.2 below:			
3.1.1 Simple Form			
3.1.1.1 Building shape has the same floor area on all levels, floor plates aligned in plan, and there are no reentrant wall corners.			
3.1.2 Unique Form			

3.1.2.1 Compactness in Section			
3.1.2.1a Standard deviation of the floor areas at different levels is no more than 35% of the mean floor area over the different levels (including conditioned basements)			
3.1.2.1b The combined projected area of roof-over-living-space and floor-cantilevered-over-unconditioned space is no more than 35% of the floor area at any intermediate (above grade) floor level			
3.1.2.2 Compactness in Plan			
3.1.2.2a In plan view, at each level, the sum of the areas of reentrant corners $\text{Sum(ACR)} < 25\%$ of the average floor area per level (iCFA/#stories.) Adjacent reentrant corners (forming an alcove or court) each count towards the limit [18]			
4. Solar Protection			Designer Verified Rater Verified N/A
4.1 Glazed Fenestration SHGC			
4.1.1 Does not exceed the calculated minimum requirement. [5]			-
4.2 Glazed fenestration area			
4.2.1 The overall window-to-wall area ratio is no more than 18%.			-
4.2.2 The skylight to roof area ratio is no more than 3%			
4.3 Fenestration orientation: The design complies with option A or J below [6]			
4.3.1 Option A			
4.3.1.1 The vertical fenestration area on the north-facing facades (within 45 degrees) is no more than 40% of the total fenestration area.			
4.3.1.2 The vertical fenestration area on the south-facing facades (within 45 degrees) is no more than 40% of the total fenestration area.			
4.3.1.3 The vertical fenestration area on the west-facing (within 45 degrees) facade is no more than 20% of the total fenestration area.			
4.3.1.4 In CZ 4B and below, the vertical fenestration area on the east-facing (within 45 degrees) facade is no more than 20% of the total fenestration area.			
4.3.2 Option J			
4.3.2.1 ACCA Manual J calculation indicates adequate exposure diversity.			
4.4 Fixed Overhangs			
4.4.1 In Climate Zones 0-2, glazed fenestration for bedrooms and living spaces (not circulation areas), equator-facing within 45° is protected by fixed overhangs with a projection factor PF of $\tan(\text{latitude})$, as calculated. [19]			
5. Heat Transmission			Designer Verified Rater Verified N/A
5.1 Enclosure meets 5.1.1 or 5.1.2 below. [7]			
5.1.1 Individual Component Compliance			
5.1.1a Fenestration U-Values do not exceed calculated maximum U-value.			-
5.1.1b Above-grade walls and cantilevered floors effective R-Value [8] meets calculated minimum.			-
5.1.1c Roof or ceiling effective R-Value [9] meets calculated minimum.			-

5.1.1d Slab foundations, below-grade walls, conditioned basement or crawlspace floors, unconditioned basement or crawlspace ceilings, pier and beam effective R-Value [10] meets calculated minimum.			-
5.1.1e Slab edge insulation meets requirements of IECC 2009 [11] and Energy Star for Homes			
5.1.2 Total UA Alternative [12]			
5.1.2a Total building thermal envelope UA that is less than or equal to the total UA resulting from the U-factors in 2.2.2 - 2.2.4 also complies.			
5.2 Reduced Thermal Bridging			
5.2.1 The thermal envelope must be continuous and at least R-10 everywhere. Structural cantilevers and columns may not penetrate the thermal envelope. [13]			
5.2.2 No materials of conductivity > 0.17 Btu/h.ft.F (0.3 W/mK) bridge from the inside to the outside at windows, doors, skylights. See NFRC 101 for material properties.			
5.2.3 Fenestration metal frames and thresholds are thermally broken.			
6. Moisture Risk Limitation			Designer Verified
			Rater Verified
			N/A
6.1 Opaque Enclosure			
6.1.1 Meets requirements found in PHIUS+ Certification Guidebook Appendix B [14]			-
6.2 Fenestration			
6.2.1 Condensation Resistance minimum fRsi, as calculated, is met by one of the following methods:			-
6.2.1.1 General Frame Type U-Value			
6.2.1.2 U-frame Inferred by Window U-value and Center of Glass U-Value			
6.2.1.3 AAMA CRF Rating			
6.2.1.4 NFRC 500-2020 Condensation Resistance			
6.2.1.5 CAN/CSA A440.2 Temperature Index			
7. Mechanical Ventilation			Designer Verified
			Rater Verified
			N/A
7.1 Mechanical Ventilation Efficiency			
7.1.1 The adjusted sensible recovery efficiency in heating mode is greater than or equal to the calculated minimum required value.			-
7.1.2 The heating-mode COP of the ventilation device is greater than or equal to 15. [15]			-
7.1.3 The total recovery efficiency in cooling mode is greater than or equal to the calculated minimum required value.			-
7.1.4 The ventilation ducts between the recovery device and the enclosure are insulated to at least R-8. Air-sealed, class I vapor retarder shall be installed over all air-permeable insulation (such as fiberglass duct wrap) on ventilation ducts connected to outside.			-
7.1.5 The length of each of the fresh air ventilation ducts between the recovery device and the enclosure is less than or equal to the project-specific calculated maximum.			-
8. Mechanical Systems			Designer Verified
			Rater Verified
			N/A
8.1 The space heating system does not rely primarily on electric resistance.			
8.2 Minimum required heating/cooling equipment efficiency is met based on climate zone and system			-

type as calculated.			
8.3 Ventilation Fans meet Energy Star Most Efficient 2020 [20]			
8.4 Dehumidifiers meet Energy Star Most Efficient 2020 [21]			
9. Lighting, Appliances & Water Heating	Designer Verified	Rater Verified	N/A
9.1 Builder-installed lighting, appliances, and water heating comply with 9.1.1 or 9.1.2 outlined below:			
9.1.1 Individual Component Compliance			
9.1.1.1 Lighting			
9.1.1.1a: Light fixtures meet or exceed minimum required average efficacy as calculated.			
9.1.1.2 Appliances			
9.1.1.2a Clothes Washer LER is less than or equal to 135 kWh.yr.			
9.1.1.2b Clothes Dryer			
9.1.1.2b.1 LER is less than or equal to 245 kWh/yr.			
9.1.1.2b.2 Condensation dryers are not installed in conditioned space, in climate zones 4B and below.			
9.1.1.2c Dishwasher LER is less than or equal to 239 kWh/yr.			
9.1.1.2d Refrigerator LER is less than or equal to 315 kWh/yr.			
9.1.1.2e Freezer LER is less than or equal to 450 kWh/yr.			
9.1.1.2f Ceiling Fan efficiency is greater than or equal to 220.1 cfm/W.			
9.1.1.2g Pool Pump WEF efficiency is greater than or equal to 9.3 kgal/kWh.			
9.1.1.2h Electric Vehicle Charger standby power is less than or equal to 1.81 Watts.			
9.1.1.2i Smart Home Energy Management Systems (“Thermostat”) standby power is less than or equal to 0.17 W.			
9.1.1.3 Water Heating			
9.1.1.3a Water heater is installed in conditioned space.			
9.1.1.3b Water heater UEF or SEF is greater than or equal to 1.975.			
9.1.2 Performance Tradeoff Calculation			
9.1.2.1 Performance tradeoff calculation for the proposed design shows energy use no higher than the reference design [17].			
10. Electric Vehicle Ready	Designer Verified	Rater Verified	N/A
10.1 New construction shall facilitate future installation and use of Electric Vehicle Supply Equipment (EVSE) in accordance with the National Electrical Code (NFPA 70) [22]			
10.2 The number of EV Ready Spaces and EV Capable Spaces shall meet the required minimum. [22]			

Administration

See PHIUS+ Certification Guidebook Chapter 4: Process.

Items pertaining to energy modeling and WUFI Passive do not apply.

Footnotes

- 1** This aligns with Energy Star for homes Field checklist section 3.4, except that option 3.4.3 "Advanced framing" does not apply, rim/band joists are not exempted, footnote 18 does not apply, and with respect to footnote 21, there is a structural sheathing layer attached to the inner framing, that is more vapor-closed than the exterior sheathing.)
- 2** For additional requirements see PHIUS+ Certification Guidebook Sections 3.2, 3.6.1, 3.8, 4.4.1, Appendix G-2.3, Energy Star Certified Homes National Rater Field Checklist Sections 2 and 4, PHIUS+ Single-Family QA Workbook Sections, Building Envelope, Sections 3 and 4.
- 3** For emphasis: "Airtight details must be comprehensible and show a continuous uninterrupted barrier that forms from the different materials and components at all junctions."
- 4** Preliminary blower door test, as outlined in PHIUS+ Single Family QA Workbook Section 4.1, is required (not optional)
- 5** Aligns with ZERH requirements. Exception c of footnote 26 does not apply ("15 square feet of glazed fenestration per dwelling unit shall be exempt from the U-factor and SHGC requirements, and shall be excluded from area-weighted averages calculated using a) and b), above")
- 6** Exception: attached housing.
- 7** Per DOE Zero Energy Ready Home requirements, item 2, Footnote 12, "Insulation levels in a home shall meet or exceed the component insulation requirements in the 2015 International Energy Conservation Code (IECC) – Table R402.1.2."
- 8** For effective U-values of wood-framed base wall assemblies, see ASHRAE 90.1-2019 Table A3.4.3.1. For effective U-values of steel-framed base wall assemblies, see ASHRAE 90.1-2019 Table A3.3.3.1. Alternate: Use the listed framing factors in the calculation of R-values for wood construction: Framing factor 25% for 2x4, 16 inches on center, framing factor 22% for 2x6, 24 inches on center.
- 9** For effective U-values of attic roofs with wood joists, see ASHRAE 90.1-2019 Table A2.4.3. Alternate: Use the listed framing factors in the calculation of R-values for wood construction: Framing factor 7%, ceilings below unconditioned space, 24 inches on center. Framing factor 7% when insulated at roof, 24 inches on center.
- 10** For effective U-values of wood-joint floors, see ASHRAE 90.1-2019 Table A5.4.3.1. Alternate: Use the listed framing factors in the calculation of R-values for wood construction: Framing factor 18%, 2x4 walls below grade, 16 inches on center. Framing factor 13% for floor/basement ceiling, 16 inches on center.
- 11** For slabs on grade in CZ 4-8, 100% of slab edge insulated to \geq R-5 at the depth specified by the 2009 IECC and aligned with the thermal boundary of the walls.
- 11a** Consistent with the 2009 IECC, slab edge insulation is only required for slab-on-grade floors with a floor surface less than 12 inches below grade. Slab insulation shall extend to the top of the slab to provide a complete thermal break. If the top edge of the insulation is installed between the exterior wall and the edge of the interior slab, it shall be permitted to be cut at a 45-degree angle away from the exterior wall. Alternatively, the thermal break is permitted to be created using \geq R-3 rigid insulation on top of an existing slab (e.g., in a home undergoing gut rehabilitation). In such cases, up to 10% of the slab surface is permitted to not be insulated (e.g., for sleepers, for sill plates). Insulation installed on top of slab shall be covered by a durable floor surface (e.g., hardwood, tile, carpet).
- 11b** Where an insulated wall separates a garage, patio, porch, or other unconditioned space from the conditioned space of the house, slab insulation shall also be installed at this interface to provide a thermal break between the conditioned and unconditioned slab. Where specific details cannot meet this requirement, partners shall provide the detail to EPA to request an exemption prior to the home's certification. EPA will compile exempted details and work with industry to develop feasible details for use in future revisions to the program. A list of currently exempted details is available at: energystar.gov/slabeledge.
- 12** While ceiling and slab insulation can be included in trade-off calculations, Items 3.1 through 3.3 of the ENERGY STAR Rev09 Rater Field Checklist shall be met regardless of the UA tradeoffs calculated. The UA calculation shall be done using a method consistent with the ASHRAE Handbook of Fundamentals and shall include the thermal bridging effects of framing materials. The calculation for a steel-frame envelope assembly shall use the ASHRAE zone method or a method providing equivalent results, and not a series-parallel path calculation method.

13 Exceptions: does not apply to point penetrations for plumbing, electrical, ventilation, makeup air, combustion supply air, and flues/chimneys.

14 DOE Zero Energy Ready Home Footnote 12, "Building envelope assemblies, including exterior walls and unvented attic assemblies (where used), shall comply with the relevant vapor retarder provisions of the 2015 International Residential Code (IRC)."

15 The COP is defined as the ratio of heat recovered to the electrical energy input. See HVI Winter Ratings Spreadsheet from PHIUS' Calculators and Protocols resource page.

16 Calculation of maximum length based on equation $[0.4 \times \text{Square Root} (iCFA/(\text{Stories}))]$.

17 Tradeoffs can be made between lighting, major appliances, and water heating to achieve a proposed source energy use less than the reference building source energy use. See PHIUS+ 2021 Prescriptive Path Compliance Tool for further details.

18 The area of a reentrant corner (ACR) is the product of the two distances to the corners on either side. (For reentrant corners that are not at right angles, multiply ACR by the absolute value of the cosine of the angle between the walls forming the corner.)

19 Projection Factor (PF) is the Horizontal depth out from the glazing surface divided by height from window sill to bottom of overhang.

20 <https://www.energystar.gov/most-efficient/me-certified-ventilating-fans/>

21 [Recognition Criteria Dehumidifiers: Energy Star Most Efficient 2020](#)

22 Electric Vehicle Definitions and Requirements

<https://www.phius.org/phius-certification-for-buildings-products/project-certification/phius-2021>