2018-2021 Washington State Energy Code-Residential FAQs:

Compliance Paths in 2021 WSEC-R

May 2024

What is a Compliance Path?

The Washington State Energy Code, Residential (WSEC-R) permits designers to select between several alternatives in meeting the code. A home designer may choose, for example, to follow U-factor requirements in selecting insulation materials and construction types for building components, which may allow greater flexibility of design. Alternatively, they may choose to select from pre-defined prescriptive constructions that meet requirements, for example, which may be more straightforward but less flexible.

Compliance paths are defined in the energy code in Section R401.2 "Compliance". Three distinct alternatives for compliance are specified by reference to the code sections where corresponding requirements for each path are found, as shown in Figure 1.

Figure 1. Screenshot of 2021 WSEC-R Section R401.2

R401.2 Compliance. Projects shall comply with one of the following:

1. Sections R401 through R404. In addition, *dwelling units* and *sleeping units* in a *residential building* shall comply with Section R406.
2. Section R405.
3. Section R407.

Within the first Sections R401 through R404, however, three distinct alternatives are further defined, splitting Path 1 into three. In reality, therefore, there are a total of **five** compliance paths. In 2021 WSEC-R these are:

1. *Sections R401 through R404. In addition dwelling units and sleeping units plus R406 for dwelling and sleeping units shall comply with Section R406*
    a. **U-factor Path:** Section R401.2 "*Insulation and fenestration criteria*" refers to U-factor requirements in Table R402.1.2. For example, if following this path, a floor must be insulated such that its U-factor is 0.029 or less. For convenience, we nickname this the "U-factor Path".
    b. **R-value Alternative or Prescriptive Path:** Sections R401.3 "*R-value alternative*" refers to prescriptive requirements for building components in Table R402.1.3 and to requirements for R-value computation in Section R401.4. For example, if following this path, the joist cavities of framed floors must be insulated with R-30 insulation. This path may be referred to by the section title as the "R-Value Alternative". It is also nicknamed the "Prescriptive Path".
    c. **Total UA Alternative:** Section R401.4 *"Total UA alternative"* the proposed UA of your design must be equal to or less than the target UA. The proposed UA of the building's thermal envelope is calculated according to WSEC-R Equation 2 and compared to the target UA, which is calculated according to WSEC-R Equation 1. We refer to this path by the section title as the "Total UA Alternative".

2. **Total Building Performance Path:** *Section R405 "Total Building Performance"* establishes criteria for compliance using total building performance software to simulate the energy use of your proposed design and compare it to the simulated energy use of a standard reference design. This path does not require achieving additional credits per Section R406 in 2021

WSEC-R. Instead, the simulated energy use of your proposed design must be a certain percentage or less of the simulated energy use of the standard reference design or less, per Section R405.2. This percentage depends on the conditioned floor area of the structure for R-3 occupancies. We refer to this path by the section title as the "Total Building Performance Path". It may also be nicknamed the "Simulated Performance Path".

3. **Passive House Certification Path:** *Section R407 "Certified Passive House"* requires compliance with PHIUS+ Passive Building Standard. For more information, refer to the website of the Passive House Institute of the United States (PHIUS) at https://www.phius.org/.

Table 1. Summary of five compliance paths in 2021 WSEC-R

Path No.*	Description	Defining Section	Referenced Summary Table, Equations or Standard	Section R406 Credits Required?
1a	U-Factor Path	R402.1.2	Table R402.1.2 (U-factors)	For dwelling units and sleeping units
1b	R-value Alternative or Prescriptive Path	R402.1.3 and R402.1.4	Table R402.1.3	
1c	Total UA Alternative	R402.1.5	Table R402.1.2 (U-factors), Eq. 1 for Target UA, Eq. 2 for Proposed UA	
2	Total Building Performance Path or Simulated Performance Path	R405	Table R402.1.2 (U-factors), Table R405.2(1) for Standard Reference	No
3	Passive House Certification	R407	PHIUS+ 2018 Passive Building Standard **	No

* Per Section 401.2 "Compliance". Path 1 has three distinct paths defined within it, which can be numbered 1a, 1b and 1c, for convenience.
** PHIUS+ 2018 Passive Building Standard, https://www.phius.org/

Has 2021 WSEC-R added a compliance path?

Technically, no. But in effect, yes.

In 2018 WSEC-R, there were also three distinct paths defined within Sections R401 to R404, just as there is for 2021 WSEC-R. These were:

a. Section R402.1.1 "Insulation and fenestration criteria", which defines prescriptive requirements for building components per Table R402.1.1. This was nicknamed the **Prescriptive Path.**
b. Section R402.1.3 "U-factor alternative", which defines U-factors that are equivalent to the prescriptive requirements in Table R402.1.1. Because there was correspondence between the required U-factors and the prescriptive constructions, this was not thought of as distinct from the Prescriptive Path.
c. Section R401.4 *"Total UA alternative"*

In 2018 WSEC-R, (a) and (b) above are equivalent. For example, under 2018 WSEC-R an above-grade wall with R-21 cavity insulation and intermediate framing per Table R402.1.3 also meets the U-factor requirement of 0.056 in Table R402.1.3, and vice versa, although there are other constructions that will also meet this U-factor requirement. Because these two requirements are equivalent, there was no need to distinguish between them. Designers could choose to follow the Prescriptive R-value constructions for some building components and meet the U-factor requirement for others without changing the total UA of the building.

In 2021 WSEC-R, the required U-factors for ceilings and above-grade walls are not equivalent to the R-value requirements in the Prescriptive Path in 2021 WSEC-R (Tables R402.1.2 and R402.1.3). The word "equivalent" is no longer used to equate them. For example, for above-grade walls the U-factor requirement is 0.056, but the R-value requirement is either R-20 cavity plus R-5ci or R13 cavity plus R-10ci, which have U-factors of 0.045.

The effect of the non-equivalence of prescriptive and U-factor requirements is that in the **U-factor path** and the **R-value alternative path** must now be considered distinct. If you select the U-factor path, you must meet the U-factor requirements in Table R402.1.2 for all building components. If you choose to use the R-value alternative, you have to use the prescriptive requirements for all building components. You cannot pick and choose from the two tables, meeting some of the R-value Alternative requirements for some building components and U-factor requirements for the others, as was done under 2018 WSEC-R.

Is it an error that the Tables R401.2 and R401.3 are not consistent in 2021 WSEC-R? No.

Initially, we were inclined to treat this pair of tables in the 2021 energy code in the same way we did in the 2018 version and assume it was an error that they are not consistent. But this is not the case and the use of these two tables as equivalent requirements that can be interchanged is no longer valid.

Which of the compliance paths use U-factors in Table R402.1.2?

The U-factor path (Section R402.1.2), the Total UA Alternative path (Section R402.1.5) and the Total Building Performance path (Section R405) all refer to the U-factors in Table R402.1.2 to define the baseline, rather than the prescriptive assemblies in Table R402.1.3. These three paths all require determining U-factors for your building assemblies as part of your permit submittals.

Does the Total Building Performance Path require credits per Section R406? No

2021 WSEC-R Section R401.2 has been modified to make clear that the Total Building Performance Path does not require achieving credits per Section R406. Only the three alternatives within Path 1 require that "dwelling units and sleeping units in a residential building shall comply with Section R406".

In 2018 WSEC-R, this requirement also applied to Section R405, as shown in Figure 2. However, a careful reading of Section R405 makes clear that it is not consistent with achieving energy credits per Section R406. Instead Section R405 contains within it an alternative to credit requirements that, like

Section R406, depends on the size of the home per Section R405.3 "Performance-based Compliance". This section is summarized in Table 2.

For medium-sized residential structures with conditioned floor area of 1,500 to 5,000 square feet, the annual energy use of your proposed design must be no more than 47% that of the standard reference design. The percentage is 64% for small structures and 41% for larger structures greater than 5,000 square feet. The percentage for R-2 occupancies is 61%. Notice there is no distinction between residential buildings with and without dwelling units in this path. If following this path, all residential building designs, even if they do not include a dwelling unit such as a heated workshop, must achieve the required reduction in energy use relative to the standard reference design.

This inconsistency was not a concern until recently because previously interest in this compliance path was very low.

Table 2. Summary of 2021 WSEC-R Section R405.2 "Performance-based Compliance"

Occupancy	Structure Size Label	Conditioned Floor Area	Percent Annual Energy Use of Proposed Design relative to Standard Reference Design
R3	Small	Less than 1500 sq. ft.	64%
R3	Medium	1500 to 5000 sq. ft.	47%
R3	Large	Greater than 5000 sq. ft.	41%
R2	Any	N/A	61%

Figure 2. Screenshot of 2018 WSEC-R Section R401.2

R401.2 Compliance. Projects shall comply with one of the following:

1. Sections R401 through R404. In addition, *dwelling units* and *sleeping units* in a *residential building* shall comply with Section R406.
2. Section R405. In addition, *dwelling units* and *sleeping units* in a *residential building* shall comply with Section R406.
3. Section R407.

How are above-grade walls treated in the U-factor path versus the R-value Alternative path?

In the U-factor compliance path, a 0.056 U-factor is allowed for above-grade walls per Table R402.1.2. This is equivalent to a wood-framed wall with intermediate framing and R-21 cavity insulation. Therefore, continuous insulation is not required on above-grade walls if using this path.

In contrast, the R-value Alternative path requires continuous insulation. Prescriptive constructions with minimum R-value and fenestration requirements are specified for building components in Table R402.1.3. There are two prescriptive options for above-grade walls:

- "20+5" in Table R402.1.3 refers to R-20 cavity insulation plus R-5 continuous insulation

- "13+10" in Table R402.1.3 refers to R-13 cavity insulation plus R-10 continuous insulation[1]

Note it is clearly stated in Section R402.1.3 that "continuous insulation alone shall be used to determine compliance with the continuous insulation R-value requirements in Table R402.1.3." Therefore, if you select the prescriptive path, above-grade walls are required to have continuous insulation.

How are ceilings and roofs treated in the "U-factor" path versus the R-value Alternative path?

In the U-factor compliance path, a maximum U-factor of 0.024 is required for ceiling insulation. This is equivalent to R-49 ***advanced*** ceiling insulation or better. Standard-frame R-60 ceiling insulation has a U-factor of 0.025, which does not meet this requirement (See Table A102.1 below).

If you use the default U-factors tabulated in Appendix A to determine your U-factors, a limited set of ceiling/roof constructions can meet a U-factor of 0.024. These include:

(1) R49 with raised heel trusses (U-factor of 0.020)
(2) R-49 2x16 vaulted ceilings (U-factor of 0.024)
(3) R-50 rigid insulation (8") on the roof deck (U-factor of 0.019)

[1] In 2021 WSEC there is not a requirement for intermediate framing. Descriptions of standard, intermediate and advanced framing are given in Appendix A Section A103.2.

Figure 3. Table R302.1.2 in 2021 WSEC-R, which tabulates maximum U-factor requirements for each building component and is referred to in Section R402.1.2 "Insulation and fenestration criteria" *

TABLE R402.1.2
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE 5 AND MARINE 4	
Fenestration U-Factor[b]	0.30
Skylight U-Factor	0.50
Ceiling U-Factor	0.024
Above-Grade Wall U-Factor	0.056
Floor U-Factor	0.029
Slab on Grade F-Factor	0.54
Below Grade 2' Depth	
Wall *U*-Factor	0.042
Slab *F*-Factor	0.59
Below Grade 3.5' Depth	
Wall *U*-Factor	0.040
Slab *F*-Factor	0.56
Below Grade 7' Depth	
Wall *U*-Factor	0.035
Slab *F*-Factor	0.50

* See also the footnotes to Table R402.1.2

Figure 4. Table R302.1.3 in 2021 WSEC-R, which tabulates prescriptive requirements for each building component and is referred to in Section R402.1.3 "R-value alternative"*

TABLE R402.1.3
INSULATION MINIMUM R-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENTS[a]

CLIMATE ZONE 5 AND MARINE 4	
Fenestration U-Factor[b, j]	0.30
Skylight[b] U-Factor	0.50
Ceiling R-Value[e]	60
Wood Frame Wall[g, j] R-Value	20+5 or 13+10
Floor R-Value	30
Below-Grade[c, h] Wall R-value	10/15/21 int + 5TB
Slab[d, f] R-Value & Depth	10, 4 ft

* See also the footnotes to Table R402.1.3

What U-factors are used in the Total UA Alternative compliance pathway?

The Total UA Alternative path is defined in Section R402.1.5 and R402.1.6. In this approach, calculations of the UA value are based on the home's proposed design and are compared to the code baseline of the same home with U-factors as summarized in Table R402.1.2.

Because this section refers to the U-factors defined in Table R402.1.2 as the baseline, a U-factor of 0.056 for above-grade walls and a U-factor of 0.024 for ceiling insulation are used in the baseline of this path. The Total UA Alternative baseline includes a maximum glazing area of 15% of the conditioned floor area. Your proposed design may exceed this glazing area, but to do so you must reduce the UA of the rest of the envelope in some way that offsets the excess glazing.

How do the U-factor path and the prescriptive path affect Option 1 energy credits?

Energy credit Options 1.2 to 1.4 are written each have two methods of compliance. The prescriptive compliance is based on the R-value alternative path and refers to Table R402.1.3. The second method of meeting these Options is to reduce the UA by a certain percentage. The text specifying the required UA reduction – 15% for Option 1.2, for example – refers to Section R402.1.5 and hence to the U-factor requirements in Table R402.1.2.

If you are using the prescriptive or R-value alternative path, you will use the prescriptive descriptions in Option 1. When calculating a UA reduction to meet Option 1, you will use the U-factors in Table R402.1.2 as your baseline. (This enables you to trade away the requirement for advanced ceiling insulation.)

Figure 5. Excerpt from Table RR406.3 in 2021 WSEC-R showing the two methods of achieving Option 1.2 energy credits.

1.2	Prescriptive compliance is based on Table R402.1.3 with the following modifications: Vertical fenestration U = 0.25 FloorR-38 Slab on grade R-10 perimeter and under entire slab Below grade slab R-10 perimeter and under entire slab **or** Compliance based on Section R402.1.5: Reduce the Total conductive UA by 15%.

What U-factor baseline does the Code Compliance Calculator (C3) use?

The Code Compliance Calculator is used to perform the UA calculations for three purposes:

- The Option 1 percent UA reductions in Table R406.3 if the **U-Factor Path** is selected, and
- The **Total UA Alternative path**
- UA trade-offs for additions, per the exception to Section R502.1.1.1.

These calculations make use of the U-factors in Table R402.1.2 for the baseline. Therefore, to calculate the target UA value, a U-factor of 0.056 is used for above-grade walls and a U-factor of 0.024 is used for ceilings.

Does a partition wall separating a home from an attached garage require continuous insulation? Does a knee wall require continuous insulation?

Yes, if you select the R-value Alternative Path, the partition wall between the conditioned space and any unconditioned space, such as an unheated garage or attic space behind a knee wall, must be insulated in the same manner as exterior walls. Therefore if you are following the R-value Alternative Path in Sections R402.1.3 and R402.1.4 then the wall must include continuous insulation.

If you are following the U-factor compliance path in Section R402.1.2, then you just need to meet the U-value requirements in Table R402.1.2 of 0.056 for above-grade walls. Keep in mind though if you choose to use the U-factor compliance path, you must also meet the ceiling U-factor of 0.024 and the default U-factor for standard R-49 ceiling insulation is greater than 0.024.

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