**TABLE ~~C402.1.4~~C402.1.2**
**OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, U-FACTOR METHOD[a,f]**

| | CLIMATE ZONE 5 AND MARINE 4 | |
|---|---|---|
| | All Other | Group R |
| **Roofs** | | |
| Insulation entirely above deck | U-0.027 | U-0.027 |
| Metal buildings | U-0.031 | U-0.031 |
| Attic and other | U-0.021 | U-0.021 |
| Joist or single rafter | U-0.027 | U-0.027 |
| **Walls, Above Grade[k]** | | |
| Mass[g] | U-0.104[d] | U-0.078 |
| Mass transfer deck slab[j] | U-0.20 | U-0.20 |
| Metal building | U-0.050 | U-0.050 |
| Steel framed | U-0.055 | U-0.055 |

**TABLE C402.1.3**
**OPAQUE BUILDING THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD~~a,f~~ a,k,l**

| CLIMATE ZONE | 5 AND MARINE 4 | | | | NOTES |
|---|---|---|---|---|---|
| | All Other | App A Default U-factor | Group R | App A Default U-factor | |
| **Roofs** | | | | | |
| Insulation entirely above deck | R-38ci | U = 0.025 (WSEC Table CA102.1)<br>U = 0.027 (90.1 Table A2.2.3) | R-38ci | U = 0.025 (WSEC Table CA102.1)<br>U = 0.027 (90.1 Table A2.2.3) | R-37.5 insulation value in WSEC table (close enough) |
| Metal buildings[b] | R-25 + R-22 LS | U = 0.026 (WSEC Table CA102.5)<br>U = 0.026 (90.1 Table A2.3.3) | R-25 + R-22 LS | U = 0.026 (WSEC Table CA102.5)<br>U = 0.026 (90.1 Table A2.3.3) | No exact look up for R-25 + R-22 LS, used R-25 +R-11 +R11 LS |
| Attic and other | R-49 | U = 0.020 w/Adv Frame (WSEC Table CA102.1)<br>U = 0.021 w/Std Frame (90.1 Table A2.4.2) | R-49 | U = 0.020 w/Adv Frame (WSEC Table CA102.1)<br>U = 0.021 w/Std Frame (90.1 Table A2.4.2) | WSEC table with Std Frame U = 0.027, doesn't meet prescriptive performance.<br>Also, why do we force attic and other to hit a superior U-factor? Impacts projects that split insulation between above deck and below deck. |
| *Joist or Single Rafter not included in R-value Table* | | | | | |
| **Walls, Above Grade** | | | | | |
| ~~Mass~~[b]Mass[j] | R-9.5[c] ci | **U = 0.093 (WSEC Table CA103.3.7.1(2))**<br>**U = 0.093 (90.1 Table A3.1-1)** | R-13.3ci | **U = 0.067 (WSEC Table CA103.3.7.1(2))**<br>**U = 0.067 (90.1 Table A3.1-1)** | Used Solid Concrete construction (most conservative)., CI insultion target on mass walls seems to overshoot the mark compared to prescriptive U-factor. Why go to the decimal place in accuracy and not actually be correct? |
| Mass transfer deck slab edge[g] | See Table ~~C402.1.4~~C402.1.2 | *NA* | See Table ~~C402.1.4~~C402.1.2 | *NA* | No precriptive performance allowed, forces Component Performance (is this really being enforced?) |
| Metal building | R-13 + R-14ci | U = 0.050 (WSEC Table CA103.3.6.3)<br>U = 0.050 (90.1 Table A3.2.3) | R-13 + R-14ci | U = 0.050 (WSEC Table CA103.3.6.3)<br>U = 0.050 (90.1 Table A3.2.3) | |
| Steel framed[h,i] | | | R-19 + R-8.5ci | U = 0.057 (WSEC Table CA103.3.6.1(1))<br>U = 0.056 (90.1 Table A3.3.3.1) | Odd guidance, both tables clearly intdicate it takes R-19 + R-9ci to hit U = 0.55, not clear why it was indicated as R-19 + R-8.5ci. |
| | R-0 + R-15.2ci or | U = 0.056 (WSEC Table CA103.3.6.1(1))<br>U = 0.056 (90.1 Table A3.3.3.1) | | | With linear interpolation, it seems to require R-0 + R-15.2 doesn't quite get there. Seems weird to be that specific (to the tenths place) and not have it actually hit the target. |
| | R-13 + R-10ci or | U = 0.055 (WSEC Table CA103.3.6.1(1))<br>U = 0.055 (90.1 Table A3.3.3.1) | | | |

| | CLIMATE ZONE 5 AND MARINE 4 | |
|---|---|---|
| | All Other | Group R |
| | | |
| Wood framed and other | U-0.051 | U-0.051 |
| **Walls, Below Grade** | | |
| Below-grade wall[b,g] | Same as above grade | Same as above grade |
| **Floors** | | |
| Mass[e] | U-0.031 | U-0.031 |
| Joist/framing | U-0.029 | U-0.029 |
| **Slab-on-Grade Floors** | | |
| Unheated slabs | F-0.54 | F-0.54 |

| CLIMATE ZONE | 5 AND MARINE 4 | | | | NOTES |
|---|---|---|---|---|---|
| | All Other | App A Default U-factor | Group R | App A Default U-factor | |
| | R-20 + R-9ci | U = 0.055 (WSEC Table CA103.3.6.1(1)) U = 0.055 (90.1 Table A3.3.3.1) | | | Actually only need R-19 + R-19c.i. |
| Wood framed and other[h,i] | R-0 + R-16ci std or | *Option not in WSEC Appendix A Tables* U = 0.051 (90.1 Table A3.4.3.1) | R-0 + R-16ci std or | *Option not in WSEC Appendix A Tables* U = 0.051 (90.1 Table A3.4.3.1) | |
| | R-13 + R-7.5ci std or | U = 0.050 (WSEC Table CA103.3.1(2)) U = 0.052 (90.1 Table A3.3.3.1) | R-13 + R-7.5ci std or | U = 0.050 (WSEC Table CA103.3.1(2)) U = 0.052 (90.1 Table A3.3.3.1) | |
| | R-20+R-3.8ci std or | U = 0.047 (WSEC Table CA103.3.1(4) + CA103.3.1(5)) U = 0.050 (90.1 Table A3.3.3.1) | R-20 + R-3.8ci std or | U = 0.047 (WSEC Table CA103.3.1(4) + CA103.3.1(5)) U = 0.050 (90.1 Table A3.3.3.1) | Requires double-interpolation. You can see the delta between ASHRAE and WSEC default performance |
| | R-27 std | U = 0.051 (WSEC Table CA103.3.1(8)) *Option not in 90.1 Tables A3.4.3.1* | ~~R-25~~R-27 std | U = 0.051 (WSEC Table CA103.3.1(8)) *Option not in 90.1 Tables A3.4.3.1* | WSEC table does not go to R-27, but R-25 in 2x8 achieves U = 0.051. ASHRAE table only goes up to R-21 cavity insulation (no 2x8 options). |
| **Walls, Below Grade** | | | | | |
| Below-grade wall[d, hj] | Same as above grade | *NA* | Same as above grade | *NA* | |
| **Floors** | | | | | |
| Mass[f] | R-30ci | U = 0.031 (WSEC Table CA105.1(3)) U = 0.030 (90.1 Table A5.2.3.1) | R-30ci | U = 0.031 (WSEC Table CA105.1(3)) U = 0.030 (90.1 Table A5.2.3.1) | |
| Joist/framing (wood) | R-30[e] | **U = 0.040 (WSEC Table CA105.1(3)) U = 0.033 (90.1 Table A5.4.3.1)** | R-30[e] | **U = 0.040 (WSEC Table CA105.1(3)) U = 0.033 (90.1 Table A5.2.3.1)** | WSEC wood joist performance is no where near prescriptive U-factor, and ASHRAE table isn't particularly close either. |
| Joist/framing (metal) | R-38 + R-10c.i. | **U = 0.044 (WSEC Table CA105.1(3)) U = 0.024 (90.1 Table A5.3.3.1)** | R-38 + R-10c.i. | **U = 0.044 (WSEC Table CA105.1(3)) U = 0.024 (90.1 Table A5.3.3.1)** | The R-value target is from footnote e of the table, seems like it should just be added formally to the table. WSEC Default table does not include c.i., that was mannually added to the R-38 look up value. |
| **Slab-on-Grade Floors** | | | | | |
| Unheated slabs | R-10 for 24" below | F = 0.54 (WSEC Table CA106.1) F = 0.54 (90.1 Table A6.3.1.1) | R-10 for 24" below | F = 0.54 (WSEC Table CA106.1) F = 0.54 (90.1 Table A6.3.1.1) | |

| | CLIMATE ZONE 5 AND MARINE 4 | |
|---|---|---|
| | All Other | Group R |
| Heated slabs[c] | F-0.55 | F-0.55 |
| **Opaque Doors** | | |
| Nonswinging door | U-0.31 | U-0.31 |
| Swinging door | U-0.37 | U-0.37 |
| Garage door <14% glazing | U-0.31 | U-0.31 |
| Garage door ≥14% glazing and <50% glazing[i] | U-0.34 | U-0.34 |

| CLIMATE ZONE | 5 AND MARINE 4 | | | | NOTES |
|---|---|---|---|---|---|
| | All Other | App A Default U-factor | Group R | App A Default U-factor | |
| Heated slabs[d] | R-10 perimeter & under entire slab | F = 0.55 (WSEC Table CA106.1)<br><br>F = 0.55 (90.1 Table A6.3.1.1) | R-10 perimeter & under entire slab | F = 0.55 (WSEC Table CA106.1)<br><br>F = 0.55 (90.1 Table A6.3.1.1) | |
| *Doors not included in prescriptive R-value table.* | | | | | |

**Summary:** Document compares the assembly-by-assembly prescriptive U-factor requirements (Table C402.1.2) with the equivalent thermal performance of the prescriptive R-value table (Table C402.1.3). This is related to a conversation that came up in our last meeting about if the two tables result in equal performance. The white columns are copy-and-pasted from the draft 2024 WSEC, and the green columns indicate the default U-factors for the assemblies based on both Appendix A of ASHRAE 90.1-2022 and Appendix A of the 2024 WSEC working draft.

**Take Aways:**

In most, but not all cases thermal performance is equivalent (or almost identical) between the two tables.

Following the R-value table for mass walls results in relative "over" insulating compared to the U-factor table.

Following the R-value table for joist floors results in relative "under" insulating compared to the U-factor table.

It is strange to me that in some cases the R-value table prescribes very specific insulation levels (down to the decimal place, such as "R-15.2c.i."), and yet those seemingly precise R-value callouts don't always end up actually fully aligning with the target U-factor. Why pretend to be so precise?

There are also some odd examples of providing prescriptive R-value options that don't seem to correspond to any typical insulating product (such as an R-27 cavity insulated wood stud wall).

I personally feel like the R-value table is a legacy from a time when we didn't as many insulation combinations to consider, and it seems a little silly at this point to try to guess at what sort of insulation configurations would be the "standard" approach.