

Energy Design Criteria Examples for EcoSmart™ Stud, Energy-Star, ZERH Wall Systems

Wall section R value calculations, 16" on center studs, Double top plate.
Insulation and Framing only

Wall Type	Chamber R-Value 75%	Studs R-Value 20.4%	Plates R-Value 4.6%*	Embodied Carbon Insulation only. No framing**	Wall Type	Framing and insulation ASHRAE Handbook 27 1.2 Effective Wall U-Factor		Wall Effective R-Value
						Parallel Path	Isothermal- Planes	
2x8 ESS- SPF 7.25"	49	20.47	15	3451	2x8 ESS All SPF	0.028	0.028	35.48
2x8 ESS 3" SPF 4.25" BLWN	38	20.47	15	743	2x8 ESS 3"	0.033	0.033	30.66
2x8 Eco-1" SPF 6.25" BLWN	32	18.31	15	-530	2x8 ESS 1"	0.038	0.038	26.64
2x8 ESS -PF SPF 7.25" BLWN	29	16.37	8.7	-1072	2x8 ESS PF	0.043	0.044	23.17
2x6 ESS-All SPF	37.4	13	6.6	2618	2x6 ESS All SPF	0.042	0.043	23.76
2x6 ESS 2"SPF 3.5" BLWN	29	14.79	8	389	2x6 ESS 2"	0.045	0.045	22.26
2x6 ESS-1"SPF 4.5" BLWN	25.5	14.79	6.6	-248	2x6 ESS 1"	0.049	0.050	20.22
2x6 ESS PF SPF 5.5" BLWN	22	13	8	-790	2x6 ESS PF	0.055	0.056	18.14
2x6-R20+10 BCP PH	30	16.6	16.6	1771	20+10	0.040	0.040	24.96
2x4 0+20CI E-Star, ZERH	20	24.2	24.2	2860	0+20	0.048	0.048	20.91
2x6 R20+5CI E-Star, ZERH	25	11.6	11.6	1056	20+5	0.052	0.052	19.40
2x4 R13+10CI E-Star, ZERH	23	14.2	14.2	1647	13+10	0.050	0.050	19.91
2x6 SPF 5.5"	37.4	6.6	6.6	2618	2x6 All SPF	0.058	0.058	17.26
2x6 R20	20	6.6	6.6	341	REFERENCE	0.075	0.075	13.27

Key

- ESS: EcoSmart™ Stud
- SPF: Closed Cell Spray Foam Insulation
- BLWN: Blown in insulation
- PF: Picture Frame Chamber with SPF
- CI: Continuous Insulation
- E-Star: DOE Energy Star Program
- ZERH: DOE Zero Energy Ready Home Program
- BCP PH: British Columbia Passive House Standards
- DOE: Department of Energy

Wall section R value calculations, 24" OC Studs, single top plate.
Insulation and Framing only

Wall Type	Chamber R-Value 85%	Studs R-Value 11.9%	Plates R-Value 3.1%*	Embodied Carbon Insulation only. No framing**	Wall Type	Framing and insulation ASHRAE Handbook 27 1.2 Effective Wall U-Factor		Wall Effective R-Value
						Parallel Path	Isothermal- Planes	
2x8 ESS SPF 7.25"	49	20.47	8.7	3451	2x8 ESS	0.026	0.027	38.22
2x8 ESS-3"SPF/5.25" BLWN	38	20.47	15	743	2x8 ESS 3"	0.030	0.030	33.23
2x8 ESS 1" SPF 6.25 BLWN	32	18.31	15	-530	2x8 ESS 1"	0.035	0.035	28.55
2x8 ESS-PF SPF 7.25" BLWN	29	16.37	8.7	-1072	2x8 ESS PF	0.040	0.040	25.20
2x6 ESS-All SPF	37.4	14.79	6.6	2618	2x6 ESS All SPF	0.035	0.035	28.77
2x6 ESS 2"SPF 3.5" BLWN	28	14.79	6.6	389	ESS 2"	0.042	0.043	23.59
2x6 ESS-1"SPF/3.5"BLWN	25	13	6.6	-248	ESS 1"	0.047	0.048	21.18
2x6 ESS-PF SPF /5.5"BLWN	22	13	6.6	-790	ESS PF	0.052	0.052	19.29
2x6 R20+10 BCP PH	30	16	16	1771	20+10	0.038	0.038	26.52
2x4 0+20 E-Star, ZERH	20	24.2	24.2	2860	0+20	0.049	0.049	20.53
2x6 R20+5 E-Star, ZERH	25	11.6	11.6	1056	20+5	0.047	0.047	21.31
2x4 R13+10 E-Star, ZERH	23	14.2	14.2	1647	13+10	0.048	0.048	21.04
2x6 SPF 5.5"	37.4	6.6	6.6	2618	2x6 All SPF	0.045	0.045	22.00
2x6 R20	20	6.6	6.6	341	REFERENCE	0.065	0.065	15.33

Works cited: ASHRAE Handbook-Fundamentals: Chapter 27 section 1.2 , Two-Dimensional Assembly U-factor Calculations

- ASHRAE Handbook-Fundamentals: Chapter 26 Material Properties
- 2021 International Energy and Conservation Code
- DOE Energy Star Program
- DOE ZERH Program
- BASF SPRAYTITE 81206 Series ESR-2642
- XLS2000 TER CCR-0397
- City of Nelson Material Carbon Emissions Guide March 2022

Notes: For both of the DOE programs the 2021 Energy Code is a listed as a requirement for the thermal envelope. In the 2021 Energy Code if you are using a non CI wall system you must use section R402.1.5 "Total UA Alternative" that uses table R402.1.2. All values are given in U-Factor. For the "Wood Frame Wall U-Factor" section the total U- factor for climate zones 4-8 is U-0.045 or R-22. This is for ALL insulating elements in the exterior wall system. If the insulation and framing is at or above R-20 the wall system will qualify to be used since when all wall elements are added in you gain another R2-3 from those additions.

- * Some ESS examples have thermally broken plates assemblies
- ** Based on most commonly used insulation for that wall assembly
- **Embodied carbon units in kg of CO2e/m2