CALIFORNIA ENERGY COMMISSION
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NOTIFICATION OF APPROVAL OF STANDARD U-FACTOR DATA FOR WOOD FRAMED ATTIC ROOFS

As part of the adoption of the 2005 Building Energy Efficiency Standards, the California Energy Commission adopted Joint Appendix IV, which contains standard U-factor, C-factor and Thermal Mass data for roof, wall and floor construction assemblies (see page IV-1 of the Joint Appendices at: http://www.energy.ca.gov/title24/2005standards/2004-10-06_400-03-001-JAF.PDF). The data in Joint Appendix IV must be used for all residential and nonresidential compliance approaches, including the mandatory requirements, prescriptive envelope component approach, prescriptive overall envelope approach and performance approach for nonresidential, high-rise residential and hotel/motel buildings, and the mandatory requirements, prescriptive and performance approaches for low-rise residential buildings.

If a construction assembly is not adequately represented in Joint Appendix IV, an applicant may request approval by the Energy Commission's Executive Director for different data for that construction assembly. The approval of the Executive Director is based on the technical justification submitted by the applicant. Approved standard data for the construction assembly will be published as an addendum to Joint Appendix IV for use in all compliance approaches.

This Notice of Approval of Standard U-factor data for Wood-Framed Roofs and Ceilings in Low-Rise Residential Buildings and for Type V Nonresidential Buildings authorizes the use of the data shown in the attached Table IV.1a with the limitations in the description following the table. Table IV.1a is officially added as an addendum to Joint Appendix IV.

Approved by:

B. B. BLEVINS
Executive Director

Dated 8-31-05

IV.2 Roofs and Ceilings

Table IV.1a – U-factors of Wood Framed Attic Roofs

Truss Spacing	R-value of Attic Insulation		Rated R-value of Continuous Insulation[1,2]							
			None	R-2	R-4	R-6	R-7	R-8	R-10	R-14
			A	B	C	D	E	F	G	H
16 in. OC	None	1	0.300	0.186	0.135	0.106	0.096	0.087	0.074	0.057
	R-11	2	0.079	0.067	0.059	0.053	0.050	0.047	0.043	0.037
	R-13	3	0.071	0.061	0.054	0.049	0.046	0.044	0.040	0.035
	R-19	4	0.049	0.045	0.041	0.038	0.036	0.035	0.033	0.029
	R-22	5	0.043	0.039	0.036	0.034	0.033	0.032	0.030	0.026
	R-25	6	0.038	0.035	0.033	0.031	0.030	0.029	0.027	0.024
	R-30	7	0.032	0.030	0.028	0.027	0.026	0.025	0.024	0.022
	R-38	8	0.026	0.024	0.023	0.022	0.022	0.021	0.020	0.019
	R-44	8a	0.021	0.021	0.020	0.019	0.019	0.018	0.018	0.016
	R-49	9	0.020	0.019	0.019	0.018	0.018	0.017	0.017	0.015
	R-60	10	0.017	0.016	0.016	0.015	0.015	0.015	0.014	0.013
24 in. OC	None	11	0.305	0.188	0.136	0.107	0.097	0.088	0.075	0.058
	R-11	12	0.076	0.066	0.058	0.052	0.049	0.047	0.043	0.036
	R-13	13	0.068	0.059	0.053	0.048	0.045	0.043	0.040	0.034
	R-19	14	0.048	0.044	0.040	0.037	0.036	0.034	0.032	0.028
	R-22	15	0.042	0.039	0.036	0.033	0.032	0.031	0.029	0.026
	R-25	16	0.037	0.035	0.032	0.030	0.030	0.029	0.027	0.024
	R-30	17	0.032	0.030	0.028	0.027	0.026	0.025	0.024	0.022
	R-38	18	0.025	0.024	0.023	0.022	0.022	0.021	0.020	0.018
	R-44	18a	0.021	0.020	0.019	0.019	0.019	0.018	0.018	0.016
	R-49	19	0.020	0.019	0.019	0.018	0.018	0.017	0.017	0.015
	R-60	20	0.016	0.016	0.015	0.015	0.015	0.015	0.014	0.013

Notes:

1. Continuous insulation shall be located at the ceiling, below the bottom chord of the truss and be uninterrupted by framing.
2. In climate zones 1 and 16 the insulating R-value of continuous insulation materials installed above the roof waterproof membrane shall be multiplied times 0.8 before choosing the table column for determining assembly U-factor.

This table contains thermal performance data (U-factors) for wood framed attics where the ceiling provides the air barrier and the attic is ventilated. This table shall not be used for cases where insulation is located at the underside of the roof. Wood trusses are the most common construction for low-rise residential buildings and for Type V nonresidential buildings. While the sketch shows a truss system with a flat ceiling, the data in this table may be used for scissor trusses and other non-flat trusses. If the bottom chord is not flat, then the slope should not exceed 3:12 if blown insulation is used. This table may also be used with composite trusses that have a wood top and bottom chord and metal struts connecting them.

For the majority of cases, values will be selected from column A of this table. Column A shall be used for the common situation where either batt or blown insulation is placed directly over the ceiling (and tapered at the edges). Builders or designers may increase thermal performance by adding a continuous insulation layer at the ceiling. The continuous insulation is typically a rigid polystyrene or polyisocyanurate foam insulation. Continuous insulation does not include the blown or batt insulation that is over the bottom chord of the truss (this is already accounted for in the U-factors published in Column A).

When this table is used manually, the R-value of continuous insulation shall be equal to or greater than the R-value published in the continuous insulation columns. For instance if the insulation is R-3, the R-2 column shall be used. No interpolation is permitted when data from the table is selected manually. California Energy Commission approved ACMs, including those used for prescriptive compliance, may accurately account for any amount of continuous insulation or for unusual construction assemblies using Equation IV-1 and Equation IV-2.

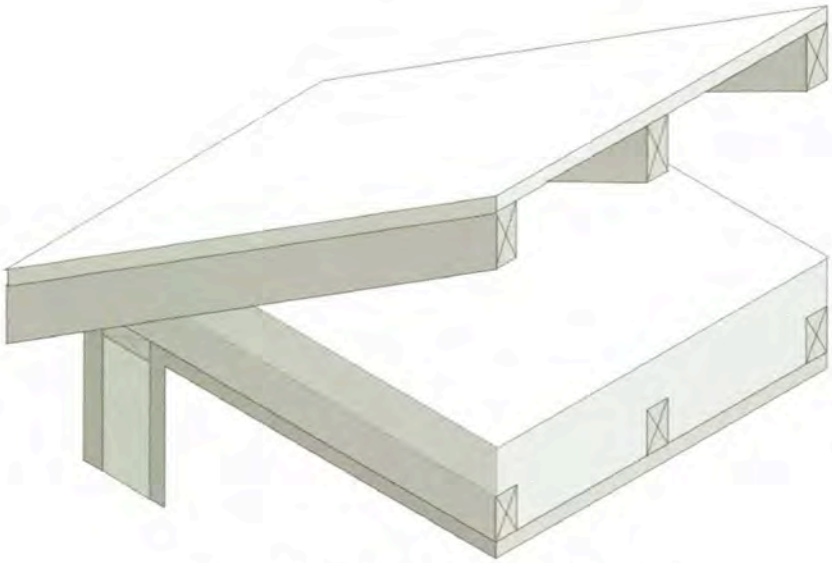

Figure IV.1 – Wood Framed Attic Roofs

Assumptions. These data are calculated using the parallel path method documented in the 2001 ASHRAE Fundamentals. These calculations assume an exterior air film of R-0.17, asphalt shingles of R-0.44 (AR02), building paper of R-0.06 (BP01), ½" of plywood of R-0.63 (PW03), an attic air space (greater than 3.5") with a R-0.80, the insulation / framing layer, continuous insulation (if any) 1/2" gypsum board (GP01) of R-0.45, and an interior air film (heat flow up) of R-0.61. Wood 2x4 framing is assumed at the ceiling level. R-13 of attic insulation is assumed between the framing members; above that level, attic insulation is uninterrupted by framing. The framing percentage is assumed to be 10% for 16 in. OC and 7% for 24 in. OC. 7.25% of the attic insulation above the framing members is assumed to be at half depth, due to decreased depth of insulation at the eaves.