STANDARD

ANSI/ASHRAE/IES Addendum aw to
ANSI/ASHRAE/IES Standard 90.1-2022

Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings

Approved by ASHRAE and the American National Standards Institute on October 31, 2024, and by the Illuminating Engineering Society on October 15, 2024.

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FOREWORD

The current calculation methods for steel-framed wall assembly U-factors are based on ideal or clear-field wall assemblies. For example, the current cavity correction factor method in Table A9.2-2 (effective R-values for framing/cavity insulation layer) includes only layout studs at specified spacing and top and bottom tracks. The AISI S250 calculation method includes just studs without top and bottom tracks. These represent idealized center-of wall U-factors that are not necessarily representative of many common construction and framing conditions. The precalculated U-factors in Table A3.3.3.1 have the same limitation because they are based on the approach in Table A9.2-2.

Addendum aw resolves this inconsistency by evaluating the available hot-box test data to derive a consistent linear thermal bridge Psi-factor for steel framing members. The psi-factor approach is consistent with current Table A9.2-2 and AISI S250 for walls where the framing factor is about 10% (which is consistent with the clear-wall framing factor of tested wall assemblies used to derive Table A9.2-2). The framing factor is based on the area of a typical steel framing flange (taken as 1.625 in. wide) to the gross opaque wall area, which is consistent with the framing factor applied to wood framing. However, for U-factor calculation purposes, the framing factor is then associated with a length of steel framing per square foot of wall assembly to which the derived Psi-factor (linear thermal bridge transmittance) is applied to provide a correct U-factor for the assembly based on the amount of framing (framing factor) that includes layout studs, top and bottom tracks, and other framing elements as commonly included in wall assemblies (e.g., built-up stud columns, through cavity bridging, jamb/king studs at wall openings, and headers). Based on the hot-box test data, this approach results in better than ±10% accuracy. More importantly, it properly accounts for the variation in framing factor, which, as currently ignored, can have as much as a 35% nonconservative (underprediction) bias relative to typical wall framing factors.

Finally, the calculation approach in Section A9.2(b)(3)(ii) is updated to an equation format for improved clarity on how to calculate U-factors for steel-framed wall assemblies, whether using the Psi-factor approach or the AISI S250 standard to determine the U-factor for the base wall assembly. This equation format is the basis for updates to Table A3.3.3.1 and also follows more closely the equation form used for the same purpose in Section C402.1.4.2 of the 2021 IECC.

Note: In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and ~~strikethrough~~ (for deletions) unless the instructions specifically mention some other means of indicating the changes.

Addendum aw to Standard 90.1-2022

Delete Existing Tables A3.3.3.1 (I-P and SI) and insert new Table A3.3.3.1(I-P and SI, respectively) as shown.

Table A3.3.3.1 Assembly U-Factors for Steel-Frame Walls by Stud Spacing and Framing Factor[a,b]

Cavity Insulation Value	Base Wall U-Factor at Framing	Overall U-Factor for Assembly of Base Wall Plus Continuous Insulation (uninterrupted by framing or furring)																			
		Rated R-Value of Continuous Insulation																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	20	25	30	35	40
Steel Framing at 12 in. on Center (25% Framing Factor)—includes framing for tracks, blocking, headers, and jamb and king studs																					
0.9	0.477	0.323	0.244	0.196	0.164	0.141	0.124	0.110	0.099	0.090	0.083	0.076	0.071	0.066	0.062	0.058	0.045	0.037	0.031	0.027	0.024
11	0.215	0.177	0.150	0.131	0.116	0.104	0.094	0.086	0.079	0.073	0.068	0.064	0.060	0.057	0.054	0.051	0.041	0.034	0.029	0.025	0.022
13	0.205	0.170	0.145	0.127	0.113	0.101	0.092	0.084	0.078	0.072	0.067	0.063	0.059	0.056	0.053	0.050	0.040	0.033	0.029	0.025	0.022
15	0.197	0.165	0.141	0.124	0.110	0.099	0.090	0.083	0.076	0.071	0.066	0.062	0.059	0.055	0.052	0.050	0.040	0.033	0.029	0.025	0.022
19	0.186	0.157	0.136	0.119	0.107	0.096	0.088	0.081	0.075	0.070	0.065	0.061	0.058	0.054	0.052	0.049	0.039	0.033	0.028	0.025	0.022
21	0.182	0.154	0.133	0.118	0.105	0.095	0.087	0.080	0.074	0.069	0.065	0.061	0.057	0.054	0.051	0.049	0.039	0.033	0.028	0.025	0.022
25	0.175	0.149	0.130	0.115	0.103	0.093	0.085	0.079	0.073	0.068	0.064	0.060	0.056	0.053	0.051	0.048	0.039	0.033	0.028	0.025	0.022
30	0.170	0.145	0.127	0.112	0.101	0.092	0.084	0.078	0.072	0.067	0.063	0.059	0.056	0.053	0.050	0.048	0.039	0.032	0.028	0.024	0.022
Steel Framing at 16 in. on Center (22% Framing Factor)—includes framing for tracks, blocking, headers, and jamb and king studs																					
0.9	0.461	0.315	0.240	0.193	0.162	0.139	0.122	0.109	0.098	0.090	0.082	0.076	0.071	0.066	0.062	0.058	0.045	0.037	0.031	0.027	0.024
11	0.198	0.166	0.142	0.124	0.111	0.100	0.091	0.083	0.077	0.071	0.066	0.062	0.059	0.055	0.053	0.050	0.040	0.033	0.029	0.025	0.022
13	0.188	0.158	0.137	0.120	0.107	0.097	0.088	0.081	0.075	0.070	0.065	0.061	0.058	0.055	0.052	0.049	0.040	0.033	0.028	0.025	0.022
15	0.180	0.153	0.133	0.117	0.105	0.095	0.087	0.080	0.074	0.069	0.064	0.060	0.057	0.054	0.051	0.049	0.039	0.033	0.028	0.025	0.022
19	0.169	0.145	0.127	0.112	0.101	0.092	0.084	0.077	0.072	0.067	0.063	0.059	0.056	0.053	0.050	0.048	0.039	0.032	0.028	0.024	0.022
21	0.165	0.142	0.124	0.110	0.099	0.090	0.083	0.077	0.071	0.066	0.062	0.059	0.055	0.052	0.050	0.048	0.038	0.032	0.028	0.024	0.022
25	0.159	0.137	0.121	0.108	0.097	0.089	0.081	0.075	0.070	0.065	0.061	0.058	0.055	0.052	0.049	0.047	0.038	0.032	0.028	0.024	0.022
30	0.153	0.133	0.117	0.105	0.095	0.087	0.080	0.074	0.069	0.064	0.060	0.057	0.054	0.051	0.049	0.046	0.038	0.032	0.027	0.024	0.021
Steel Framing at 24 in. on Center (18% Framing Factor)—includes framing for tracks, blocking, headers, and jamb and king studs																					
0.9	0.439	0.305	0.234	0.189	0.159	0.137	0.121	0.108	0.097	0.089	0.081	0.075	0.070	0.065	0.061	0.058	0.045	0.037	0.031	0.027	0.024
11	0.176	0.150	0.130	0.115	0.103	0.094	0.086	0.079	0.073	0.068	0.064	0.060	0.057	0.054	0.051	0.048	0.039	0.033	0.028	0.025	0.022
13	0.166	0.142	0.125	0.111	0.100	0.091	0.083	0.077	0.071	0.067	0.062	0.059	0.055	0.053	0.050	0.048	0.038	0.032	0.028	0.024	0.022
15	0.158	0.137	0.120	0.107	0.097	0.088	0.081	0.075	0.070	0.065	0.061	0.058	0.055	0.052	0.049	0.047	0.038	0.032	0.028	0.024	0.022
19	0.147	0.128	0.114	0.102	0.093	0.085	0.078	0.072	0.068	0.063	0.060	0.056	0.053	0.051	0.048	0.046	0.037	0.031	0.027	0.024	0.021
21	0.143	0.125	0.111	0.100	0.091	0.083	0.077	0.071	0.067	0.063	0.059	0.056	0.053	0.050	0.048	0.045	0.037	0.031	0.027	0.024	0.021
25	0.137	0.120	0.107	0.097	0.088	0.081	0.075	0.070	0.065	0.061	0.058	0.055	0.052	0.049	0.047	0.045	0.037	0.031	0.027	0.024	0.021
30	0.131	0.116	0.104	0.094	0.086	0.079	0.073	0.068	0.064	0.060	0.057	0.054	0.051	0.048	0.046	0.044	0.036	0.031	0.027	0.023	0.021

a Refer to Section A9.2(b)(3)(i) for calculation method used to generate table values.

b The cavity insulation rated R-value of 0.9 corresponds to no cavity insulation.

Table A3.3.3.1 Assembly U-Factors for Steel-Frame Walls by Stud Spacing and Framing Factor[a,b]

Cavity Insulation Value	Base Wall U-Factor at Framing	Overall U-Factor for Assembly of Base Wall Plus Continuous Insulation (uninterrupted by framing or furring)																				
		Rated R-Value of Continuous Insulation																				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	20	25	30	35	40
Steel Framing at 12 in. on Center (18% Framing Factor)—includes only studs at 12 in. on center and top and bottom tracks																						
0.9	0.439	0.305	0.234	0.189	0.159	0.137	0.121	0.108	0.097	0.089	0.081	0.075	0.070	0.065	0.061	0.058	0.045	0.037	0.031	0.027	0.024
11	0.176	0.150	0.130	0.115	0.103	0.094	0.086	0.079	0.073	0.068	0.064	0.060	0.057	0.054	0.051	0.048	0.039	0.033	0.028	0.025	0.022
13	0.166	0.142	0.125	0.111	0.100	0.091	0.083	0.077	0.071	0.067	0.062	0.059	0.055	0.053	0.050	0.048	0.038	0.032	0.028	0.024	0.022
15	0.158	0.137	0.120	0.107	0.097	0.088	0.081	0.075	0.070	0.065	0.061	0.058	0.055	0.052	0.049	0.047	0.038	0.032	0.028	0.024	0.022
19	0.147	0.128	0.114	0.102	0.093	0.085	0.078	0.072	0.068	0.063	0.060	0.056	0.053	0.051	0.048	0.046	0.037	0.031	0.027	0.024	0.021
21	0.143	0.125	0.111	0.100	0.091	0.083	0.077	0.071	0.067	0.063	0.059	0.056	0.053	0.050	0.048	0.045	0.037	0.031	0.027	0.024	0.021
25	0.137	0.120	0.107	0.097	0.088	0.081	0.075	0.070	0.065	0.061	0.058	0.055	0.052	0.049	0.047	0.045	0.037	0.031	0.027	0.024	0.021
30	0.131	0.116	0.104	0.094	0.086	0.079	0.073	0.068	0.064	0.060	0.057	0.054	0.051	0.048	0.046	0.044	0.036	0.031	0.027	0.023	0.021
Steel Framing at 16 in. on Center (14% Framing Factor)—includes only studs at 16 in. on center and top and bottom tracks																						
0.9	0.417	0.294	0.227	0.185	0.156	0.135	0.119	0.106	0.096	0.088	0.081	0.075	0.069	0.065	0.061	0.057	0.045	0.036	0.031	0.027	0.024
11	0.154	0.134	0.118	0.105	0.095	0.087	0.080	0.074	0.069	0.065	0.061	0.057	0.054	0.051	0.049	0.047	0.038	0.032	0.027	0.024	0.022
13	0.144	0.126	0.112	0.101	0.091	0.084	0.077	0.072	0.067	0.063	0.059	0.056	0.053	0.050	0.048	0.046	0.037	0.031	0.027	0.024	0.021
15	0.136	0.120	0.107	0.097	0.088	0.081	0.075	0.070	0.065	0.061	0.058	0.055	0.052	0.049	0.047	0.045	0.037	0.031	0.027	0.024	0.021
19	0.125	0.111	0.100	0.091	0.083	0.077	0.071	0.067	0.063	0.059	0.056	0.053	0.050	0.048	0.045	0.043	0.036	0.030	0.026	0.023	0.021
21	0.121	0.108	0.097	0.089	0.082	0.075	0.070	0.065	0.061	0.058	0.055	0.052	0.049	0.047	0.045	0.043	0.035	0.030	0.026	0.023	0.021
25	0.115	0.103	0.093	0.085	0.079	0.073	0.068	0.064	0.060	0.056	0.053	0.051	0.048	0.046	0.044	0.042	0.035	0.030	0.026	0.023	0.021
30	0.109	0.098	0.089	0.082	0.076	0.070	0.066	0.062	0.058	0.055	0.052	0.050	0.047	0.045	0.043	0.041	0.034	0.029	0.026	0.023	0.020
Steel Framing at 24 in. on Center (10% Framing Factor)—includes only studs at 24 in. on center and top and bottom tracks																						
0.9	0.394	0.283	0.220	0.181	0.153	0.133	0.117	0.105	0.095	0.087	0.080	0.074	0.069	0.064	0.060	0.057	0.044	0.036	0.031	0.027	0.024
11	0.132	0.117	0.104	0.095	0.086	0.080	0.074	0.069	0.064	0.060	0.057	0.054	0.051	0.049	0.046	0.044	0.036	0.031	0.027	0.023	0.021
13	0.122	0.109	0.098	0.089	0.082	0.076	0.070	0.066	0.062	0.058	0.055	0.052	0.049	0.047	0.045	0.043	0.035	0.030	0.026	0.023	0.021
15	0.114	0.102	0.093	0.085	0.078	0.073	0.068	0.063	0.060	0.056	0.053	0.051	0.048	0.046	0.044	0.042	0.035	0.030	0.026	0.023	0.021
19	0.103	0.093	0.085	0.079	0.073	0.068	0.064	0.060	0.056	0.053	0.051	0.048	0.046	0.044	0.042	0.040	0.034	0.029	0.025	0.022	0.020
21	0.099	0.090	0.082	0.076	0.071	0.066	0.062	0.058	0.055	0.052	0.050	0.047	0.045	0.043	0.041	0.040	0.033	0.028	0.025	0.022	0.020
25	0.092	0.085	0.078	0.072	0.067	0.063	0.059	0.056	0.053	0.050	0.048	0.046	0.044	0.042	0.040	0.039	0.032	0.028	0.024	0.022	0.020
30	0.087	0.080	0.074	0.069	0.064	0.060	0.057	0.054	0.051	0.049	0.046	0.044	0.042	0.041	0.039	0.038	0.032	0.027	0.024	0.021	0.019

a Refer to Section A9.2(b)(3)(i) for calculation method used to generate table values.
b The cavity insulation rated R-value of 0.9 corresponds to no cavity insulation.

Table A3.3.3.1 Assembly U-factors for Steel-Frame Walls by Stud Spacing and Framing Factor[a,b]

Cavity Insulation Value	Base Wall U-Factor at Framing	Overall U-Factor for Assembly of Base Wall Plus Continuous Insulation (Uninterrupted by Framing or Furring)																			
		Rated R-Value of Continuous Insulation																			
		0.18	0.35	0.53	0.70	0.88	1.06	1.23	1.41	1.59	1.76	1.94	2.11	2.29	2.47	2.64	3.52	4.40	5.28	6.16	7.04
Steel Framing at 300 mm on Center (25% Framing Factor)—includes framing for tracks, blocking, headers, and jamb and king studs																					
0.16	2.71	1.83	1.39	1.11	0.93	0.80	0.70	0.62	0.56	0.51	0.47	0.43	0.40	0.38	0.35	0.33	0.26	0.21	0.18	0.15	0.13
1.94	1.22	1.01	0.85	0.74	0.66	0.59	0.53	0.49	0.45	0.42	0.39	0.36	0.34	0.32	0.30	0.29	0.23	0.19	0.16	0.14	0.13
2.29	1.16	0.97	0.83	0.72	0.64	0.57	0.52	0.48	0.44	0.41	0.38	0.36	0.34	0.32	0.30	0.29	0.23	0.19	0.16	0.14	0.13
2.64	1.12	0.93	0.80	0.70	0.63	0.56	0.51	0.47	0.43	0.40	0.38	0.35	0.33	0.31	0.30	0.28	0.23	0.19	0.16	0.14	0.13
3.35	1.06	0.89	0.77	0.68	0.61	0.55	0.50	0.46	0.42	0.39	0.37	0.35	0.33	0.31	0.29	0.28	0.22	0.19	0.16	0.14	0.13
3.70	1.03	0.87	0.76	0.67	0.60	0.54	0.49	0.45	0.42	0.39	0.37	0.34	0.32	0.31	0.29	0.28	0.22	0.19	0.16	0.14	0.12
4.40	1.00	0.85	0.74	0.65	0.59	0.53	0.49	0.45	0.41	0.39	0.36	0.34	0.32	0.30	0.29	0.27	0.22	0.18	0.16	0.14	0.12
5.28	0.96	0.82	0.72	0.64	0.57	0.52	0.48	0.44	0.41	0.38	0.36	0.34	0.32	0.30	0.29	0.27	0.22	0.18	0.16	0.14	0.12
Steel Framing at 400 mm on Center (22% Framing Factor)—includes framing for tracks, blocking, headers, and jamb and king studs																					
0.16	2.62	1.79	1.36	1.10	0.92	0.79	0.69	0.62	0.56	0.51	0.47	0.43	0.40	0.37	0.35	0.33	0.26	0.21	0.18	0.15	0.13
1.94	1.13	0.94	0.81	0.71	0.63	0.57	0.51	0.47	0.44	0.40	0.38	0.35	0.33	0.31	0.30	0.28	0.23	0.19	0.16	0.14	0.13
2.29	1.07	0.90	0.78	0.68	0.61	0.55	0.50	0.46	0.43	0.40	0.37	0.35	0.33	0.31	0.29	0.28	0.22	0.19	0.16	0.14	0.13
2.64	1.02	0.87	0.75	0.66	0.60	0.54	0.49	0.45	0.42	0.39	0.37	0.34	0.32	0.31	0.29	0.28	0.22	0.19	0.16	0.14	0.12
3.35	0.96	0.82	0.72	0.64	0.57	0.52	0.48	0.44	0.41	0.38	0.36	0.34	0.32	0.30	0.29	0.27	0.22	0.18	0.16	0.14	0.12
3.70	0.94	0.81	0.71	0.63	0.56	0.51	0.47	0.44	0.40	0.38	0.35	0.33	0.31	0.30	0.28	0.27	0.22	0.18	0.16	0.14	0.12
4.40	0.90	0.78	0.68	0.61	0.55	0.50	0.46	0.43	0.40	0.37	0.35	0.33	0.31	0.29	0.28	0.27	0.22	0.18	0.16	0.14	0.12
5.28	0.87	0.75	0.67	0.60	0.54	0.49	0.45	0.42	0.39	0.37	0.34	0.32	0.31	0.29	0.28	0.26	0.21	0.18	0.16	0.14	0.12
Steel Framing at 600 mm on Center (18% Framing Factor)—includes framing for tracks, blocking, headers, and jamb and king studs																					
0.16	2.49	1.73	1.33	1.08	0.90	0.78	0.69	0.61	0.55	0.50	0.46	0.43	0.40	0.37	0.35	0.33	0.25	0.21	0.18	0.15	0.13
1.94	1.00	0.85	0.74	0.65	0.59	0.53	0.49	0.45	0.42	0.39	0.36	0.34	0.32	0.30	0.29	0.27	0.22	0.19	0.16	0.14	0.12
2.29	0.94	0.81	0.71	0.63	0.57	0.52	0.47	0.44	0.41	0.38	0.35	0.33	0.32	0.30	0.28	0.27	0.22	0.18	0.16	0.14	0.12
2.64	0.90	0.78	0.68	0.61	0.55	0.50	0.46	0.43	0.40	0.37	0.35	0.33	0.31	0.29	0.28	0.27	0.22	0.18	0.16	0.14	0.12
3.35	0.84	0.73	0.65	0.58	0.53	0.48	0.44	0.41	0.38	0.36	0.34	0.32	0.30	0.29	0.27	0.26	0.21	0.18	0.15	0.14	0.12
3.70	0.81	0.71	0.63	0.57	0.52	0.47	0.44	0.41	0.38	0.36	0.33	0.32	0.30	0.28	0.27	0.26	0.21	0.18	0.15	0.14	0.12
4.40	0.78	0.68	0.61	0.55	0.50	0.46	0.43	0.40	0.37	0.35	0.33	0.31	0.29	0.28	0.27	0.25	0.21	0.18	0.15	0.13	0.12
5.28	0.74	0.66	0.59	0.53	0.49	0.45	0.42	0.39	0.36	0.34	0.32	0.30	0.29	0.28	0.26	0.25	0.21	0.17	0.15	0.13	0.12

a Refer to Section A9.2(b)(3)(i) for calculation method used to generate table values.
b The cavity insulation rated R-value of 0.16 corresponds to no cavity insulation.

Table A3.3.3.1 Assembly U-factors for Steel-Frame Walls by Stud Spacing and Framing Factor[a,b]

Cavity Insulation Value	Base Wall U-Factor at Framing	Overall U-Factor for Assembly of Base Wall Plus Continuous Insulation (Uninterrupted by Framing or Furring)																			
		Rated R-Value of Continuous Insulation																			
		0.18	0.35	0.53	0.70	0.88	1.06	1.23	1.41	1.59	1.76	1.94	2.11	2.29	2.47	2.64	3.52	4.40	5.28	6.16	7.04
Steel Framing at 300 mm on Center (18% Framing Factor)—includes only studs at 300 mm on center and top and bottom tracks																					
0.16	2.49	1.73	1.33	1.08	0.90	0.78	0.69	0.61	0.55	0.50	0.46	0.43	0.40	0.37	0.35	0.33	0.25	0.21	0.18	0.15	0.13
1.94	1.00	0.85	0.74	0.65	0.59	0.53	0.49	0.45	0.42	0.39	0.36	0.34	0.32	0.30	0.29	0.27	0.22	0.19	0.16	0.14	0.12
2.29	0.94	0.81	0.71	0.63	0.57	0.52	0.47	0.44	0.41	0.38	0.35	0.33	0.32	0.30	0.28	0.27	0.22	0.18	0.16	0.14	0.12
2.64	0.90	0.78	0.68	0.61	0.55	0.50	0.46	0.43	0.40	0.37	0.35	0.33	0.31	0.29	0.28	0.27	0.22	0.18	0.16	0.14	0.12
3.35	0.84	0.73	0.65	0.58	0.53	0.48	0.44	0.41	0.38	0.36	0.34	0.32	0.30	0.29	0.27	0.26	0.21	0.18	0.15	0.14	0.12
3.70	0.81	0.71	0.63	0.57	0.52	0.47	0.44	0.41	0.38	0.36	0.33	0.32	0.30	0.28	0.27	0.26	0.21	0.18	0.15	0.14	0.12
4.40	0.78	0.68	0.61	0.55	0.50	0.46	0.43	0.40	0.37	0.35	0.33	0.31	0.29	0.28	0.27	0.25	0.21	0.18	0.15	0.13	0.12
5.28	0.74	0.66	0.59	0.53	0.49	0.45	0.42	0.39	0.36	0.34	0.32	0.30	0.29	0.28	0.26	0.25	0.21	0.17	0.15	0.13	0.12
Steel Framing at 400 mm on Center (14% Framing Factor)—includes only studs at 400 mm on center and top and bottom tracks																					
0.16	2.37	1.67	1.29	1.05	0.89	0.77	0.68	0.60	0.55	0.50	0.46	0.42	0.39	0.37	0.35	0.33	0.25	0.21	0.18	0.15	0.13
1.94	0.88	0.76	0.67	0.60	0.54	0.49	0.45	0.42	0.39	0.37	0.34	0.32	0.31	0.29	0.28	0.26	0.21	0.18	0.16	0.14	0.12
2.29	0.82	0.71	0.63	0.57	0.52	0.48	0.44	0.41	0.38	0.36	0.34	0.32	0.30	0.28	0.27	0.26	0.21	0.18	0.15	0.14	0.12
2.64	0.77	0.68	0.61	0.55	0.50	0.46	0.43	0.40	0.37	0.35	0.33	0.31	0.29	0.28	0.27	0.25	0.21	0.18	0.15	0.13	0.12
3.35	0.71	0.63	0.57	0.52	0.47	0.44	0.41	0.38	0.35	0.33	0.32	0.30	0.28	0.27	0.26	0.25	0.20	0.17	0.15	0.13	0.12
3.70	0.69	0.61	0.55	0.50	0.46	0.43	0.40	0.37	0.35	0.33	0.31	0.29	0.28	0.27	0.25	0.24	0.20	0.17	0.15	0.13	0.12
4.40	0.65	0.58	0.53	0.48	0.45	0.41	0.39	0.36	0.34	0.32	0.30	0.29	0.27	0.26	0.25	0.24	0.20	0.17	0.15	0.13	0.12
5.28	0.62	0.56	0.51	0.47	0.43	0.40	0.37	0.35	0.33	0.31	0.30	0.28	0.27	0.26	0.24	0.23	0.19	0.17	0.14	0.13	0.12
Steel Framing at 600 mm on Center (10% Framing Factor)—includes only studs at 600 mm on center and top and bottom tracks																					
0.16	2.37	1.61	1.25	1.03	0.87	0.75	0.67	0.60	0.54	0.49	0.45	0.42	0.39	0.37	0.34	0.32	0.25	0.21	0.17	0.15	0.13
1.94	0.88	0.66	0.59	0.54	0.49	0.45	0.42	0.39	0.36	0.34	0.32	0.31	0.29	0.28	0.26	0.25	0.21	0.17	0.15	0.13	0.12
2.29	0.82	0.62	0.56	0.51	0.47	0.43	0.40	0.37	0.35	0.33	0.31	0.30	0.28	0.27	0.26	0.24	0.20	0.17	0.15	0.13	0.12
2.64	0.77	0.58	0.53	0.48	0.44	0.41	0.38	0.36	0.34	0.32	0.30	0.29	0.27	0.26	0.25	0.24	0.20	0.17	0.15	0.13	0.12
3.35	0.71	0.53	0.48	0.45	0.41	0.39	0.36	0.34	0.32	0.30	0.29	0.27	0.26	0.25	0.24	0.23	0.19	0.16	0.14	0.13	0.11
3.70	0.69	0.51	0.47	0.43	0.40	0.38	0.35	0.33	0.31	0.30	0.28	0.27	0.26	0.25	0.24	0.23	0.19	0.16	0.14	0.13	0.11
4.40	0.65	0.48	0.44	0.41	0.38	0.36	0.34	0.32	0.30	0.29	0.27	0.26	0.25	0.24	0.23	0.22	0.18	0.16	0.14	0.12	0.11
5.28	0.62	0.45	0.42	0.39	0.37	0.34	0.32	0.31	0.29	0.28	0.26	0.25	0.24	0.23	0.22	0.21	0.18	0.16	0.14	0.12	0.11

a Refer to Section A9.2(b)(3)(i) for calculation method used to generate table values.
b The cavity insulation rated R-value of 0.16 corresponds to no cavity insulation.

Revise Section A9.2 as shown (I-P and SI)). Delete Table A9.2-2 from the standard (I-P and SI).

A9.2 Required Procedures. Two- or three-dimensional finite difference and finite volume computer models shall be an acceptable alternative method to calculating the thermal performance values for all assemblies and constructions listed below. The following procedures shall also be permitted to determine all alternative *U-factors*, *F-factors*, and *C-factors*:

a. Roofs [. . .]
b. Above-Grade Walls
   1. *Mass walls*: [. . .]
   2. *Metal building walls*: [. . .]
   3. *Steel-framed walls*: Determined by testing, or ~~series path calculation method using the insulation/framing layer adjustment factors in Table A9.2-2, or in accordance with AISI S250 as modified herein:~~one of the following calculation methods:
      ~~i. Where the *steel-framed wall* contains no cavity insulation and uses *continuous insulation* to satisfy the *U-factor* maximum, the *steel-framed wall* member spacing is permitted to be installed at any on-center spacing.~~
      ~~ii. Where the *steel-framed wall* contains framing at 24 in. on center with a 23% framing factor or framing at 16 in. on-center with a 25% framing factor, the next lower framing member spacing input values shall be used when calculating using AISI S250.~~
      ~~iii. Where the *steel-framed wall* contains less than 23% framing factors, AISI S250 shall be used without any modifications.~~
      ~~iv. Where the *steel-framed wall* contains other than standard C-shape framing members, the AISI S250 calculation option for other than standard C-shape framing is permitted to be used.~~
      i. *Psi-factor* method:

$$R_{eff,assembly} = 1/[(1/R_{cav}) + (Psi)(L_f)] + R_s + R_{af} \quad \text{(A9.2[b][3][i]-1)}$$

$$U = 1/R_{eff,assembly} \quad \text{(A9.2[b][3][i]-2)}$$

where

$R_{eff,assembly}$ = the effective *R-value* for the overall *steel-framed wall* assembly

R_{cav} = the *rated R-value of insulation* for cavity insulation located between *wall* framing members

Psi = 0.075 Btu/ft·h·°F (0.130 W/m·K) linear *thermal transmittance* for cold-formed steel framing members

The following part of the above list is I-P only.

L_f = $12 \times (FF/W_f)$, the length of steel framing per unit area of *opaque wall* assembly, ft/ft^2

The following part of the above list is SI only.

L_f = $1000 \times (FF/W_f)$, m/m^2

The remaining text, as follows, includes combined I-P and SI units.

FF = framing fraction, which is the ratio of steel framing flange area to gross *opaque wall* area

W_f = steel framing flange width taken as a nominal 1.625 in. (41.3 mm)

R_s = *R-value* of *continuous insulation* and all other continuous material layers on the interior and exterior surfaces of the *steel-framed wall* assembly.

R_{af} = *R-value* of interior and exterior air surface films, taken as R-0.17 + R-0.68 = R-0.85 (R-0.030 + R-0.120 = R-0.150).

ii. Modified AISI S250 calculation method: Determine the *U-factor* of the base wall assembly, including only steel studs at a specified spacing and cavity insulation *R-value* between the studs in accordance with AISI S250, and excluding the *R-value* of all other material layers on the *steel-framed wall* assembly, including air-film *R-values*. The calculated *U-factor* shall be substituted for $1/R_{cav}$ in Equation A9.2(b)(3)(i)-1 to determine $R_{eff\_assembly}$ of the overall *steel-framed wall* assembly, including R_s and R_{af}. The term L_f in Equation A9.2(b)(3)(i)-1 shall include only the

additional length of framing other than the studs that are spaced in accordance with the AISI S250 calculation procedure. The *U-factor* for the overall assembly shall be determined in accordance with Equation A9.2(b)(3)(i)-2.

[. . .]

~~**Table A9.2-2 Effective Insulation/Framing Layer R-values for Wall Insulation Installed Between Steel-Framing**~~

POLICY STATEMENT DEFINING ASHRAE'S CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES

ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted Standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the Standards and Guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive Technical Committee structure, continue to generate up-to-date Standards and Guidelines where appropriate and adopt, recommend, and promote those new and revised Standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date Standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating Standards and Guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.

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