

NYCECC—RESIDENTIAL PROVISIONS

APPENDIX RF

ALTERNATIVE BUILDING THERMAL ENVELOPE INSULATION R-VALUE OPTIONS

About this appendix: *The purpose of this appendix is to provide expanded R-value options for determining compliance with the U-factor criteria prescribed in Section R402.1.2. It also supplements the limited selection of common insulation conditions addressed in the R-value approach of Table R402.1.3.*

SECTION ECC RF101 GENERAL

RF101.1 General. This appendix shall be used as a basis to determine alternative building assembly and insulation component *R-value* solutions that comply with the maximum *U*-factors and *F*-factors in Table R402.1.2. Alternative building assembly insulation solutions determined in accordance with this appendix also shall comply with the requirements of *The New York City Building Code*.

SECTION RF102 ABOVE-GRADE WALL ASSEMBLIES

RF102.1 Wood-framed walls. Wood-framed *above-grade wall* assemblies shall comply with both the *cavity insulation* and *continuous insulation R-values* and framing conditions specified by Table RF102.1 where the tabulated *U*-factors are less than or equal to those needed for compliance with Section R402.1.2. For assemblies not addressed by the conditions of Table RF102.1, *U*-factors shall be determined by using accepted engineering practice or by testing in accordance with ASTM C1363 and shall be subject to approval by the *building official* in accordance with Section R104.1. Use of a lesser framing fraction than the indicated maximums in Table RF102.1 shall require wall framing layout details on *approved construction documents* for each *above-grade wall* elevation and shall be inspected for compliance.

TABLE RF102.1—ASSEMBLY U-FACTORS FOR WOOD-FRAMED WALLS^{a, b, c, d, e, f}

WOOD STUD SIZE AND SPACING	CAVITY INSULATION INSTALLED R-VALUE	CONTINUOUS INSULATION R-VALUE																		
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	20	25	30
2 × 4 (12 inches o.c.)	0	0.324	0.239	0.190	0.158	0.136	0.119	0.106	0.096	0.087	0.080	0.074	0.069	0.064	0.060	0.057	0.054	0.042	0.035	0.030
	11	0.094	0.085	0.078	0.072	0.067	0.062	0.059	0.055	0.052	0.050	0.047	0.045	0.043	0.041	0.040	0.038	0.032	0.027	0.024
	12	0.090	0.082	0.075	0.069	0.064	0.060	0.057	0.054	0.051	0.048	0.046	0.044	0.042	0.040	0.039	0.037	0.031	0.027	0.024
	13	0.087	0.079	0.072	0.067	0.063	0.059	0.055	0.052	0.049	0.047	0.045	0.043	0.041	0.039	0.038	0.036	0.031	0.027	0.023
	14	0.084	0.076	0.070	0.065	0.061	0.057	0.054	0.051	0.048	0.046	0.044	0.042	0.040	0.038	0.037	0.036	0.030	0.026	0.023
	15	0.082	0.074	0.068	0.063	0.059	0.055	0.052	0.049	0.047	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.030	0.026	0.023
	16	0.079	0.072	0.066	0.062	0.058	0.054	0.051	0.048	0.046	0.044	0.042	0.040	0.038	0.037	0.036	0.034	0.029	0.025	0.022
	17	0.077	0.070	0.065	0.060	0.056	0.053	0.050	0.047	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.029	0.025	0.022
	18	0.076	0.069	0.063	0.059	0.055	0.052	0.049	0.046	0.044	0.042	0.040	0.038	0.037	0.036	0.034	0.033	0.028	0.025	0.022
	19	0.074	0.067	0.062	0.058	0.054	0.051	0.048	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.032	0.028	0.024	0.022
20	0.072	0.066	0.061	0.056	0.053	0.050	0.047	0.044	0.042	0.040	0.039	0.037	0.036	0.034	0.033	0.032	0.027	0.024	0.021	
2 × 6 (12 inches o.c.)	0	0.0313	0.230	0.183	0.153	0.131	0.115	0.102	0.093	0.084	0.078	0.072	0.067	0.063	0.059	0.055	0.053	0.041	0.034	0.029
	18	0.065	0.060	0.056	0.053	0.050	0.048	0.045	0.043	0.041	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.027	0.024
	19	0.063	0.059	0.055	0.052	0.049	0.047	0.044	0.042	0.040	0.039	0.037	0.036	0.035	0.033	0.032	0.031	0.027	0.024	0.021
	20	0.062	0.057	0.054	0.051	0.048	0.046	0.043	0.041	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.031	0.026	0.023
	21	0.060	0.056	0.053	0.050	0.047	0.045	0.043	0.041	0.039	0.037	0.036	0.035	0.033	0.032	0.031	0.030	0.026	0.023	0.021
	22	0.059	0.055	0.052	0.049	0.046	0.044	0.042	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.026	0.023	0.020
	23	0.058	0.054	0.051	0.048	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.025	0.022	0.020
	24	0.057	0.053	0.050	0.047	0.044	0.042	0.040	0.039	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.025	0.022	0.020
	25	0.056	0.052	0.049	0.046	0.044	0.042	0.040	0.038	0.036	0.035	0.034	0.032	0.031	0.030	0.029	0.028	0.025	0.022	0.020
	30	0.052	0.048	0.045	0.043	0.041	0.039	0.037	0.035	0.034	0.033	0.031	0.030	0.029	0.028	0.027	0.027	0.023	0.021	0.019
35	0.049	0.046	0.043	0.040	0.038	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.026	0.025	0.022	0.020	0.018	
2 × 8 (12 inches o.c.)	0	0.308	0.226	0.179	0.149	0.128	0.112	0.100	0.091	0.083	0.076	0.070	0.066	0.061	0.058	0.054	0.052	0.041	0.034	0.029
	20	0.056	0.053	0.050	0.047	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.033	0.032	0.031	0.030	0.026	0.023	0.020
	21	0.055	0.052	0.049	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.034	0.033	0.032	0.031	0.030	0.029	0.025	0.022	0.020
	22	0.053	0.050	0.048	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.025	0.022	0.020
	23	0.052	0.049	0.047	0.044	0.042	0.040	0.039	0.037	0.036	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.025	0.022	0.020
	24	0.051	0.048	0.046	0.044	0.042	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.024	0.022	0.019
	25	0.050	0.047	0.045	0.043	0.041	0.039	0.037	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.024	0.021	0.019
	30	0.046	0.044	0.041	0.039	0.038	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.026	0.026	0.023	0.020	0.018
	35	0.043	0.041	0.039	0.037	0.035	0.034	0.032	0.031	0.030	0.029	0.028	0.027	0.026	0.026	0.025	0.024	0.021	0.019	0.017
40	0.041	0.039	0.037	0.035	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.026	0.025	0.024	0.024	0.023	0.020	0.018	0.017	

TABLE RF102.1—ASSEMBLY U-FACTORS FOR WOOD-FRAMED WALLS^{a, b, c, d, e, f}—continued

WOOD STUD SIZE AND SPACING	CAVITY INSULATION INSTALLED R-VALUE	CONTINUOUS INSULATION R-VALUE																		
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	20	25	30
2 × 4 (16 inches o.c.)	0	0.331	0.243	0.193	0.161	0.138	0.120	0.107	0.097	0.088	0.081	0.075	0.069	0.065	0.061	0.057	0.054	0.043	0.035	0.030
	11	0.092	0.083	0.076	0.071	0.066	0.061	0.058	0.054	0.052	0.049	0.047	0.045	0.043	0.041	0.039	0.038	0.032	0.027	0.024
	12	0.088	0.080	0.073	0.068	0.063	0.059	0.056	0.053	0.050	0.048	0.045	0.043	0.041	0.040	0.038	0.037	0.031	0.027	0.024
	13	0.084	0.077	0.071	0.066	0.061	0.057	0.054	0.051	0.049	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.030	0.026	0.023
	14	0.081	0.074	0.068	0.064	0.059	0.056	0.053	0.050	0.047	0.045	0.043	0.041	0.039	0.038	0.037	0.035	0.030	0.026	0.023
	15	0.079	0.072	0.066	0.062	0.058	0.054	0.051	0.049	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.034	0.029	0.025	0.023
	16	0.077	0.070	0.065	0.060	0.056	0.053	0.050	0.047	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.029	0.025	0.022
	17	0.075	0.068	0.063	0.058	0.055	0.052	0.049	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.034	0.033	0.028	0.025	0.022
	18	0.073	0.066	0.061	0.057	0.053	0.050	0.048	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.033	0.028	0.024	0.022
	19	0.071	0.065	0.060	0.056	0.052	0.049	0.047	0.044	0.042	0.040	0.039	0.037	0.036	0.034	0.033	0.032	0.027	0.024	0.021
20	0.069	0.063	0.059	0.055	0.051	0.048	0.046	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.032	0.031	0.027	0.024	0.021	
2 × 6 (16 inches o.c.)	0	0.322	0.236	0.187	0.156	0.133	0.117	0.104	0.094	0.086	0.079	0.073	0.068	0.063	0.059	0.056	0.053	0.042	0.034	0.029
	18	0.063	0.059	0.055	0.052	0.049	0.047	0.044	0.042	0.041	0.039	0.037	0.036	0.035	0.034	0.032	0.031	0.027	0.024	0.021
	19	0.061	0.057	0.054	0.051	0.048	0.046	0.043	0.042	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.027	0.023	0.021
	20	0.060	0.056	0.052	0.050	0.047	0.045	0.042	0.041	0.039	0.037	0.036	0.035	0.033	0.032	0.031	0.030	0.026	0.023	0.021
	21	0.058	0.055	0.051	0.048	0.046	0.044	0.042	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.026	0.023	0.020
	22	0.057	0.053	0.050	0.047	0.045	0.043	0.041	0.039	0.037	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.025	0.022	0.020
	23	0.056	0.052	0.049	0.046	0.044	0.042	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.025	0.022	0.020
	24	0.055	0.051	0.048	0.046	0.043	0.041	0.039	0.038	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.028	0.025	0.022	0.020
	25	0.054	0.050	0.047	0.045	0.042	0.040	0.039	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.024	0.022	0.019
	30	0.050	0.046	0.044	0.046	0.039	0.037	0.036	0.034	0.033	0.032	0.031	0.029	0.029	0.028	0.027	0.026	0.023	0.020	0.018
35	0.047	0.043	0.041	0.039	0.037	0.035	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.026	0.025	0.025	0.022	0.019	0.017	
2 × 8 (16 inches o.c.)	0	0.317	0.232	0.184	0.152	0.131	0.115	0.102	0.092	0.084	0.077	0.071	0.066	0.062	0.058	0.055	0.052	0.041	0.034	0.029
	20	0.055	0.052	0.049	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.026	0.023	0.020
	21	0.053	0.050	0.048	0.045	0.043	0.041	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.025	0.022	0.020
	22	0.052	0.049	0.047	0.044	0.042	0.040	0.039	0.037	0.036	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.025	0.022	0.020
	23	0.051	0.048	0.046	0.043	0.041	0.040	0.038	0.036	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.024	0.022	0.020
	24	0.050	0.047	0.045	0.043	0.041	0.039	0.037	0.036	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.024	0.021	0.019
	25	0.049	0.046	0.044	0.042	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.024	0.021	0.019
	30	0.045	0.042	0.040	0.038	0.037	0.035	0.034	0.032	0.031	0.030	0.029	0.028	0.027	0.027	0.026	0.025	0.022	0.020	0.018
	35	0.042	0.039	0.037	0.036	0.034	0.033	0.031	0.030	0.029	0.028	0.027	0.027	0.026	0.025	0.024	0.024	0.021	0.019	0.017
40	0.039	0.037	0.035	0.034	0.032	0.031	0.030	0.029	0.028	0.027	0.026	0.025	0.024	0.024	0.023	0.022	0.020	0.018	0.016	

TABLE RF102.1—ASSEMBLY U-FACTORS FOR WOOD-FRAMED WALLS^{a, b, c, d, e, f}—continued

WOOD STUD SIZE AND SPACING	CAVITY INSULATION INSTALLED R-VALUE	CONTINUOUS INSULATION R-VALUE																		
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	20	25	30
2 × 4 (24 inches o.c.)	0	0.339	0.248	0.196	0.163	0.139	0.122	0.108	0.098	0.089	0.081	0.075	0.070	0.065	0.061	0.058	0.055	0.043	0.035	0.030
	11	0.089	0.081	0.075	0.069	0.065	0.061	0.057	0.054	0.051	0.048	0.046	0.044	0.042	0.040	0.039	0.037	0.031	0.027	0.024
	12	0.085	0.078	0.072	0.067	0.062	0.058	0.055	0.052	0.049	0.047	0.045	0.043	0.041	0.039	0.038	0.036	0.031	0.027	0.023
	13	0.082	0.075	0.069	0.064	0.060	0.056	0.053	0.050	0.048	0.046	0.044	0.042	0.040	0.038	0.037	0.036	0.030	0.026	0.023
	14	0.079	0.072	0.067	0.062	0.058	0.055	0.052	0.049	0.047	0.044	0.042	0.041	0.039	0.037	0.036	0.035	0.030	0.026	0.023
	15	0.076	0.070	0.065	0.060	0.056	0.053	0.050	0.048	0.045	0.043	0.041	0.040	0.038	0.037	0.035	0.034	0.029	0.025	0.022
	16	0.074	0.068	0.063	0.058	0.055	0.052	0.049	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.034	0.033	0.028	0.025	0.022
	17	0.072	0.066	0.061	0.057	0.053	0.050	0.048	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.033	0.028	0.024	0.022
	18	0.070	0.064	0.059	0.055	0.052	0.049	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.034	0.033	0.032	0.027	0.024	0.021
	19	0.068	0.062	0.058	0.054	0.051	0.048	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.032	0.031	0.027	0.024	0.021
20	0.066	0.061	0.056	0.053	0.050	0.047	0.044	0.042	0.040	0.039	0.037	0.036	0.034	0.033	0.032	0.031	0.027	0.023	0.021	
2 × 6 (24 inches o.c.)	0	0.330	0.241	0.191	0.159	0.136	0.119	0.106	0.095	0.087	0.080	0.074	0.068	0.064	0.060	0.057	0.053	0.042	0.035	0.030
	18	0.061	0.057	0.054	0.051	0.048	0.046	0.044	0.042	0.040	0.038	0.037	0.036	0.034	0.033	0.032	0.031	0.027	0.024	0.021
	19	0.060	0.056	0.052	0.050	0.047	0.045	0.043	0.041	0.039	0.037	0.036	0.035	0.034	0.032	0.031	0.030	0.026	0.023	0.021
	20	0.058	0.054	0.051	0.048	0.046	0.044	0.042	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.026	0.023	0.020
	21	0.057	0.053	0.050	0.047	0.045	0.043	0.041	0.039	0.037	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.025	0.022	0.020
	22	0.055	0.052	0.049	0.046	0.044	0.042	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.025	0.022	0.020
	23	0.054	0.051	0.048	0.045	0.043	0.041	0.039	0.037	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.028	0.025	0.022	0.020
	24	0.053	0.049	0.047	0.044	0.042	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.024	0.022	0.019
	25	0.052	0.048	0.046	0.043	0.041	0.039	0.038	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.024	0.021	0.019
	30	0.047	0.044	0.042	0.040	0.038	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.026	0.025	0.022	0.020	0.018
35	0.044	0.041	0.039	0.037	0.035	0.034	0.032	0.031	0.030	0.029	0.028	0.027	0.026	0.025	0.025	0.024	0.021	0.019	0.017	
2 × 8 (24 inches o.c.)	0	0.326	0.238	0.188	0.156	0.133	0.117	0.104	0.094	0.085	0.078	0.072	0.067	0.063	0.059	0.056	0.053	0.042	0.034	0.029
	20	0.054	0.051	0.048	0.046	0.043	0.042	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.025	0.022	0.020
	21	0.052	0.049	0.047	0.044	0.042	0.041	0.039	0.037	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.029	0.025	0.022	0.020
	22	0.051	0.048	0.046	0.043	0.041	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.024	0.022	0.020
	23	0.050	0.047	0.044	0.042	0.041	0.039	0.037	0.036	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.028	0.024	0.021	0.019
	24	0.048	0.046	0.044	0.041	0.040	0.038	0.036	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.024	0.021	0.019
	25	0.047	0.045	0.043	0.041	0.040	0.039	0.037	0.036	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.023	0.021	0.019
	30	0.043	0.041	0.039	0.037	0.035	0.034	0.033	0.032	0.030	0.029	0.029	0.028	0.027	0.026	0.025	0.025	0.022	0.020	0.018
	35	0.040	0.038	0.036	0.034	0.033	0.032	0.030	0.029	0.028	0.027	0.027	0.026	0.025	0.024	0.024	0.023	0.021	0.018	0.017
40	0.037	0.035	0.034	0.032	0.031	0.030	0.029	0.028	0.027	0.026	0.025	0.024	0.024	0.023	0.022	0.022	0.019	0.018	0.016	

TABLE RF102.1—ASSEMBLY U-FACTORS FOR WOOD-FRAMED WALLS^{a, b, c, d, e, f}—continued

For SI: 1 British thermal unit per hour per square foot per °Fahrenheit = 5.6783 W/m² × K.

- a. Linear interpolation of *U*-factors shall be permitted between continuous insulation and cavity insulation *R*-values. For nonstandard stud spacing, use the next-lesser stud spacing shown in the table.
- b. Table values are based on the parallel path calculation procedure as applicable to wood-framed assemblies and require compliance with the following assembly conditions:
 1. Framing fractions of not greater than 28 percent (assumed for 12-inch o.c. studs), 25 percent (assumed for 16-inch o.c. studs), and 22 percent (assumed for 24-inch o.c. studs) with 4 percent attributed to headers in all cases. The framing fraction is the percentage of overall opaque wall area occupied by framing members.
 2. Wood framing materials or species with a thermal resistivity of not less than R-1.25 per inch.
 3. Exterior sheathing with an *R*-value of not less than R-0.62 as based on wood structural panel. For walls having no exterior sheathing or sheathing of lesser *R*-value, Note d shall be used to adjust the tabulated *U*-factor.
 4. Siding of not less than R-0.62 as based on the assumption of vinyl siding. For walls with siding having a lower *R*-value, Note d shall be used to adjust the tabulated *U*-factor.
 5. Interior finish of not less than R-0.45 based on 1/2-inch gypsum. For walls having no interior finish or a finish of lesser *R*-value, Note d shall be used to adjust the tabulated *U*-factor.
 6. Cavity insulation with a rated *R*-value installed as required by the manufacturer's installation instructions to satisfy the indicated installed *R*-value, considering a reduced *R*-value for compression in an enclosed cavity where applicable.
 7. Continuous insulation specified in accordance with the indicated rated *R*-value and installed continuously over all exterior wood framing, including studs, plates, headers and rim joists.
 8. Indoor air film *R*-value of 0.68 and outdoor air-film *R*-value of 0.17.
- c. Where any of the building materials that are continuous over the interior or exterior wall surface vary from those stated in Note b, it is permissible to adjust the *U*-factor as follows:
 $U_{adj} = 1/[1/U + Rd]$ where *U* is the *U*-factor from the table and *Rd* is the increase (positive) or decrease (negative) in the cumulative *R*-value of building material layers on the outside and inside faces of the wall, excluding the continuous insulation *R*-value if present.
- d. For a specific continuous insulation *R*-value not addressed in this table, the *U*-factor of the assembly shall be permitted to be determined as follows:
 $U_{adj} = 1/[1/U_{nci} + R_{ci}]$
where *U_{nci}* is the *U*-factor from the table for no continuous insulation (0 *R*-value column) and *R_{ci}* is the specific rated *R*-value of continuous insulation added to the assembly.
- e. For double wall framing, the *U*-factor shall be permitted to be determined by combining the *U*-factors for single-wall framing from the table as follows:
 $U_{combined} = 1/[1/U_1 + 1/U_2]$
where *U₁* and *U₂* are the *U*-factors from the table for each of the adjacent parallel walls in the double-wall assembly.
- f. The use of insulation in accordance with this table does not supersede requirements in Section R702.7 for use of insulation and water vapor retarders to control water vapor.

RF102.2 Mass walls. Reserved.

RF102.3 Cold-formed steel frame walls. Cold-formed above-grade wall assemblies shall comply with both the cavity insulation and continuous insulation R-values and framing conditions specified by Table RF102.3 where the tabulated U-factors are less than or equal to those needed for compliance with Section R402.1.2. For assemblies not addressed by the conditions of Table RF102.3, U-factors shall be determined by using accepted engineering practice, by testing, series path calculation method using the insulation/framing layer adjustment factors in Table RF102.3.1, or in accordance with AISI S250 as modified herein:

- 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.

Table RF102.3 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	0.351	0.260	0.206	0.171	0.146	0.127	0.113	0.102	0.092	0.084	0.078	0.072	0.067	0.063	0.059	0.056	0.044	0.036	0.030	0.026	0.023
11	0.156	0.135	0.119	0.106	0.096	0.088	0.081	0.075	0.069	0.065	0.061	0.057	0.054	0.052	0.049	0.047	0.038	0.032	0.027	0.024	0.022
13	0.149	0.130	0.115	0.103	0.094	0.086	0.079	0.073	0.068	0.064	0.060	0.057	0.053	0.051	0.048	0.046	0.037	0.032	0.027	0.024	0.021
15	0.144	0.126	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	0.046	0.037	0.031	0.027	0.024	0.021
19	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	0.045	0.037	0.031	0.027	0.024	0.021
21	0.135	0.119	0.106	0.096	0.088	0.080	0.074	0.069	0.065	0.061	0.057	0.054	0.051	0.049	0.047	0.045	0.036	0.031	0.027	0.024	0.021
25	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
30	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	0.048	0.046	0.044	0.036	0.030	0.026	0.023	0.021
Steel Framing at 16 in. on Center (22% Framing Factor)—includes framing for tracks, blocking, headers, and jamb and king studs																					
0.9	0.350	0.259	0.206	0.171	0.146	0.127	0.113	0.101	0.092	0.084	0.078	0.072	0.067	0.063	0.059	0.056	0.044	0.036	0.030	0.026	0.023
11	0.148	0.129	0.114	0.103	0.093	0.085	0.078	0.073	0.068	0.063	0.060	0.056	0.053	0.051	0.048	0.046	0.037	0.031	0.027	0.024	0.021
13	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	0.047	0.045	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	0.054	0.052	0.049	0.047	0.045	0.037	0.031	0.027	0.024	0.021
19	0.129	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	0.036	0.031	0.026	0.023	0.021
21	0.126	0.112	0.100	0.091	0.084	0.077	0.072	0.067	0.063	0.059	0.056	0.053	0.050	0.048	0.046	0.044	0.036	0.030	0.026	0.023	0.021
25	0.122	0.108	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
30	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	0.044	0.043	0.035	0.030	0.026	0.023	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	0.348	0.258	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	0.044	0.036	0.030	0.026	0.023
11	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	0.045	0.037	0.031	0.027	0.024	0.021
13	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	0.046	0.044	0.036	0.031	0.027	0.023	0.021
15	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	0.047	0.045	0.043	0.036	0.030	0.026	0.023	0.021
19	0.116	0.104	0.094	0.086	0.079	0.073	0.068	0.064	0.060	0.057	0.054	0.051	0.049	0.046	0.044	0.042	0.035	0.030	0.026	0.023	0.021
21	0.113	0.102	0.092	0.084	0.078	0.072	0.067	0.063	0.059	0.056	0.053	0.050	0.048	0.046	0.044	0.042	0.035	0.030	0.026	0.023	0.020
25	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	0.041	0.034	0.029	0.026	0.023	0.020
30	0.105	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	0.042	0.041	0.034	0.029	0.025	0.022	0.020

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

^b. The cavity insulation rated RSI-value of 0.16 corresponds to no cavity insulation.

Table RF102.3 Assembly U-factors for Steel-Frame Walls by Stud Spacing and Framing Factor^{a,b} (Continued)

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	0.348	0.258	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	0.044	0.036	0.030	0.026	0.023
11	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	0.045	0.037	0.031	0.027	0.024	0.021
13	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	0.046	0.044	0.036	0.031	0.027	0.023	0.021
15	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	0.047	0.045	0.043	0.036	0.030	0.026	0.023	0.021
19	0.116	0.104	0.094	0.086	0.079	0.073	0.068	0.064	0.060	0.057	0.054	0.051	0.049	0.046	0.044	0.042	0.035	0.030	0.026	0.023	0.021
21	0.113	0.102	0.092	0.084	0.078	0.072	0.067	0.063	0.059	0.056	0.053	0.050	0.048	0.046	0.044	0.042	0.035	0.030	0.026	0.023	0.020
25	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	0.041	0.034	0.029	0.026	0.023	0.020
30	0.105	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	0.042	0.041	0.034	0.029	0.025	0.022	0.020
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	0.346	0.257	0.204	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	0.044	0.036	0.030	0.026	0.023
11	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	0.044	0.036	0.030	0.026	0.023	0.021
13	0.117	0.105	0.095	0.087	0.080	0.074	0.069	0.064	0.061	0.057	0.054	0.051	0.049	0.046	0.044	0.043	0.035	0.030	0.026	0.023	0.021
15	0.111	0.100	0.091	0.083	0.077	0.072	0.067	0.063	0.059	0.056	0.053	0.050	0.048	0.045	0.044	0.042	0.035	0.029	0.026	0.023	0.020
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	0.100	0.091	0.083	0.077	0.071	0.066	0.062	0.059	0.055	0.053	0.050	0.048	0.045	0.043	0.042	0.040	0.033	0.029	0.025	0.022	0.020
25	0.095	0.087	0.080	0.074	0.069	0.064	0.060	0.057	0.054	0.051	0.049	0.046	0.044	0.042	0.041	0.039	0.033	0.028	0.025	0.022	0.020
30	0.090	0.083	0.077	0.071	0.066	0.062	0.059	0.055	0.052	0.050	0.047	0.045	0.043	0.042	0.040	0.038	0.032	0.028	0.024	0.022	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	0.344	0.256	0.204	0.169	0.145	0.126	0.112	0.101	0.092	0.084	0.077	0.072	0.067	0.063	0.059	0.056	0.044	0.036	0.030	0.026	0.023
11	0.113	0.101	0.092	0.084	0.078	0.072	0.067	0.063	0.059	0.056	0.053	0.050	0.048	0.046	0.044	0.042	0.035	0.030	0.026	0.023	0.020
13	0.104	0.094	0.086	0.079	0.073	0.068	0.064	0.060	0.057	0.054	0.051	0.049	0.046	0.044	0.042	0.041	0.034	0.029	0.025	0.022	0.020
15	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	0.041	0.040	0.033	0.028	0.025	0.022	0.020
19	0.088	0.081	0.075	0.070	0.065	0.061	0.058	0.055	0.052	0.049	0.047	0.045	0.043	0.041	0.040	0.038	0.032	0.028	0.024	0.022	0.019
21	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	0.040	0.039	0.037	0.031	0.027	0.024	0.021	0.019
25	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	0.036	0.031	0.027	0.024	0.021	0.019
30	0.075	0.070	0.065	0.061	0.058	0.055	0.052	0.049	0.047	0.045	0.043	0.041	0.039	0.038	0.037	0.035	0.030	0.026	0.023	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 RSI-value of 0.16 corresponds to no cavity insulation.

Table RF102.3 Assembly U-factors for Steel-Frame Walls by Stud Spacing and Framing Factor^{a,b} (Continued)

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	1.99	1.47	1.17	0.97	0.83	0.72	0.64	0.58	0.52	0.48	0.44	0.41	0.38	0.36	0.34	0.32	0.25	0.20	0.17	0.15	0.13
1.94	0.89	0.77	0.68	0.60	0.55	0.50	0.46	0.42	0.39	0.37	0.35	0.33	0.31	0.29	0.28	0.27	0.21	0.18	0.16	0.14	0.12
2.29	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	0.26	0.21	0.18	0.15	0.14	0.12
2.64	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	0.28	0.27	0.26	0.21	0.18	0.15	0.14	0.12
3.35	0.78	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	0.21	0.18	0.15	0.13	0.12
3.70	0.76	0.67	0.60	0.54	0.50	0.46	0.42	0.39	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
4.40	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	0.27	0.26	0.25	0.21	0.17	0.15	0.13	0.12
5.28	0.72	0.64	0.58	0.52	0.48	0.44	0.41	0.38	0.36	0.34	0.32	0.30	0.29	0.27	0.26	0.25	0.20	0.17	0.15	0.13	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	1.98	1.47	1.17	0.97	0.83	0.72	0.64	0.58	0.52	0.48	0.44	0.41	0.38	0.36	0.34	0.32	0.25	0.20	0.17	0.15	0.13
1.94	0.84	0.73	0.65	0.58	0.53	0.48	0.45	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
2.29	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	0.27	0.26	0.21	0.18	0.15	0.13	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	0.73	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	0.25	0.20	0.17	0.15	0.13	0.12
3.70	0.71	0.63	0.57	0.52	0.48	0.44	0.41	0.38	0.36	0.33	0.32	0.30	0.28	0.27	0.26	0.25	0.20	0.17	0.15	0.13	0.12
4.40	0.69	0.62	0.56	0.51	0.46	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
5.28	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	0.25	0.24	0.20	0.17	0.15	0.13	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	1.97	1.46	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	0.25	0.20	0.17	0.15	0.13
1.94	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
2.29	0.74	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	0.20	0.17	0.15	0.13	0.12
2.64	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	0.27	0.26	0.25	0.20	0.17	0.15	0.13	0.12
3.35	0.66	0.59	0.53	0.49	0.45	0.42	0.39	0.36	0.34	0.32	0.31	0.29	0.28	0.26	0.25	0.24	0.20	0.17	0.15	0.13	0.12
3.70	0.64	0.58	0.52	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
4.40	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
5.28	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	0.24	0.23	0.19	0.16	0.14	0.13	0.11

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

^b The cavity insulation rated RSI-value of 0.16 corresponds to no cavity insulation.

Table RF102.3 Assembly U-factors for Steel-Frame Walls by Stud Spacing and Framing Factor^{a,b} (Continued)

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	1.97	1.46	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	0.25	0.20	0.17	0.15	0.13
1.94	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
2.29	0.74	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	0.20	0.17	0.15	0.13	0.12
2.64	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	0.27	0.26	0.25	0.20	0.17	0.15	0.13	0.12
3.35	0.66	0.59	0.53	0.49	0.45	0.42	0.39	0.36	0.34	0.32	0.31	0.29	0.28	0.26	0.25	0.24	0.20	0.17	0.15	0.13	0.12
3.70	0.64	0.58	0.52	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
4.40	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
5.28	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	0.24	0.23	0.19	0.16	0.14	0.13	0.11
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	1.96	1.46	1.16	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	0.25	0.20	0.17	0.15	0.13
1.94	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	0.25	0.20	0.17	0.15	0.13	0.12
2.29	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	0.25	0.24	0.20	0.17	0.15	0.13	0.12
2.64	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	0.25	0.24	0.20	0.17	0.15	0.13	0.12
3.35	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	0.23	0.19	0.16	0.14	0.13	0.11
3.70	0.57	0.51	0.47	0.44	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	0.54	0.49	0.45	0.42	0.39	0.36	0.34	0.32	0.31	0.29	0.28	0.26	0.25	0.24	0.23	0.22	0.19	0.16	0.14	0.12	0.11
5.28	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	0.22	0.18	0.16	0.14	0.12	0.11
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	1.95	1.45	1.16	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	0.25	0.20	0.17	0.15	0.13
1.94	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	0.26	0.25	0.24	0.20	0.17	0.15	0.13	0.12
2.29	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	0.24	0.23	0.19	0.16	0.14	0.13	0.11
2.64	0.55	0.51	0.46	0.43	0.40	0.37	0.35	0.33	0.31	0.30	0.28	0.27	0.26	0.24	0.23	0.22	0.19	0.16	0.14	0.13	0.11
3.35	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	0.23	0.22	0.22	0.18	0.16	0.14	0.12	0.11
3.70	0.48	0.45	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	0.21	0.18	0.15	0.14	0.12	0.11
4.40	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	0.21	0.17	0.15	0.13	0.12	0.11
5.28	0.43	0.40	0.37	0.35	0.33	0.31	0.29	0.28	0.27	0.25	0.24	0.23	0.22	0.22	0.21	0.20	0.17	0.15	0.13	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 RSI-value of 0.16 corresponds to no cavity insulation.

Table RF102.3.1
Effective Insulation/Framing Layer R-Values for Wall Insulation Installed Between Steel Framing

Nominal Depth of Cavity, in.	Actual Depth of Cavity, in.	Rated <i>R-Value</i> of Air Space or Insulation	Effective Framing/Cavity <i>R-Value</i> at 16 in. on Center	Effective Framing/Cavity <i>R-Value</i> at 24 in. on Center
Empty Cavity, No Insulation				
4	3.5	R-0.91	0.79	0.91
Insulated Cavity				
4	3.5	R-11	5.5	6.6
4	3.5	R-13	6.0	7.2
4	3.5	R-15	6.4	7.8
6	6.0	R-19	7.1	8.6
6	6.0	R-21	7.4	9.0
8	8.0	R-25	7.8	9.6

SECTION RF103
ROOF AND CEILING ASSEMBLIES—RESERVED SECTION

RF104
FLOOR ASSEMBLIES—RESERVED

**SECTION RF105
BASEMENT AND CRAWL SPACE WALLS**

RF105.1 Basement and crawl space walls. *U*-factors for basement and *crawl space walls* shall be as specified in accordance with Table RF105.1. Effective *U*-factors for the proposed and reference foundation wall design must be used to demonstrate compliance with Section R402.1.5. Effective *U*-factors shall not be used for other compliance methods referenced in Section R401.2.1.

TABLE RF105.1—*U*-FACTORS FOR BASEMENT AND CRAWL SPACE WALLS^a

INSULATION CONFIGURATIONS ^b	WALL <i>U</i> -FACTOR ^c (Btu/h × ft ² × °F)	WALL EFFECTIVE <i>U</i> -FACTOR ^d BY PERCENTAGE OF WALL HEIGHT PROJECTING ABOVE GRADE (Btu/h × ft ² × °F) FOR USE ONLY WITH SECTION R402.1.5			
		50%	35%	20%	5%
Basement walls					
Uninsulated and unfinished basement wall	0.360	0.324	0.288	0.252	0.216
Continuous insulation	—	—	—	—	—
R-5ci	0.122	0.109	0.097	0.085	0.073
R-7.5ci	0.093	0.084	0.075	0.065	0.056
R-10ci	0.076	0.068	0.060	0.053	0.045
R-15ci	0.055	0.049	0.044	0.038	0.033
R-20ci	0.043	0.039	0.034	0.030	0.026
R-25ci	0.035	0.032	0.028	0.025	0.021
Cavity insulation	—	—	—	—	—
R-11	0.076	0.068	0.060	0.053	0.045
R-13	0.067	0.060	0.054	0.047	0.040
R-15	0.060	0.054	0.048	0.042	0.036
R-19	0.050	0.045	0.040	0.035	0.030
R-21	0.045	0.041	0.036	0.032	0.027
Cavity + continuous insulation	—	—	—	—	—
R-13 + R-5ci	0.050	0.045	0.040	0.035	0.030
R-13 + R-7.5ci	0.045	0.040	0.036	0.031	0.027
R-13 + R-10ci	0.040	0.036	0.032	0.028	0.024
R-19 + R-5ci	0.040	0.036	0.032	0.028	0.024
R-19 + R-7.5ci	0.036	0.033	0.029	0.025	0.022
R-19 + R-10ci	0.033	0.030	0.027	0.023	0.020
Crawl space walls					
Uninsulated crawl space wall	0.477	0.429	0.382	0.334	N/A
Continuous insulation	—	—	—	—	—
R-5ci	0.141	0.127	0.113	0.099	N/A
R-7.5ci	0.104	0.094	0.083	0.073	—
R-10ci	0.083	0.074	0.066	0.058	—
R-15ci	0.058	0.053	0.047	0.041	—
R-20ci	0.045	0.041	0.036	0.032	—
R-25ci	0.037	0.033	0.030	0.026	—

TABLE RF105.1—U-FACTORS FOR BASEMENT AND CRAWL SPACE WALLS^a—continued

INSULATION CONFIGURATIONS ^b	WALL U-FACTOR ^c (Btu/h × ft ² × °F)	WALL EFFECTIVE U-FACTOR ^d BY PERCENTAGE OF WALL HEIGHT PROJECTING ABOVE GRADE (Btu/h × ft ² × °F) FOR USE ONLY WITH SECTION R402.1.5			
		Crawl space walls			
Cavity insulation	—	—	—	—	—
R-11	0.083	0.074	0.066	0.058	N/A
R-13	0.072	0.065	0.058	0.051	—
R-15	0.065	0.058	0.052	0.045	—
R-19	0.054	0.049	0.043	0.038	—
R-21	0.048	0.043	0.038	0.033	—
Cavity + continuous insulation	—	—	—	—	—
R-13 + R-5ci	0.053	0.048	0.043	0.037	N/A
R-13 + R-7.5ci	0.047	0.042	0.038	0.033	—
R-13 + R-10ci	0.042	0.038	0.034	0.029	—
R-19 + R-5ci	0.043	0.038	0.034	0.030	—
R-19 + R-7.5ci	0.039	0.035	0.031	0.027	—
R-19 + R-10ci	0.035	0.032	0.028	0.025	—

N/A = Not Applicable.

For SI: 1 British thermal unit per hour per square foot per °Fahrenheit = 5.6783 W/m² × K.

a. The wall U-factor excludes exterior the air-film R-value and, for insulated assemblies, includes the following: R-0.68 for interior air film, R-0.45 for 1/2-inch gypsum panel finish (insulated basement walls only), and R-2.1 for 12-inch block basement wall or R-1.4 for 8-inch block crawl space wall, both with empty cells. Where cavity insulation is included between 2 × 4 or 2 × 6 framing on the interior side of a foundation wall, wood stud material with thermal resistivity of R-1.25/in is assumed to be spaced at not less than 16 inches on center with an assumed framing factor not greater than 0.15.

b. All insulation configurations extend from the top of the foundation wall to the floor of the basement or crawl space. Extrapolation to partial height insulation shall not be permitted; U-factors for such insulation configurations shall be determined by accepted engineering practice for modeling of thermal bridging and ground-coupled assemblies.

c. Applicable to Sections R402.1.2, R405 and R406.

d. Effective U-factors are adjusted to account for ground-coupling effects to provide equivalency to U-factors used for above-grade building thermal envelope assemblies. The effective U-factors are provided for use with Section R402.1.5 for evaluation of trade-offs with above-grade assemblies and other components of the building thermal envelope. The effective U-factor shall apply to the foundation wall area from the interior floor or ground surface to the top of the wall. Interpolation between R-values and percentage of wall height projecting above grade within a given insulation configuration type is permitted.

**SECTION RF106
SLABS-ON-GRADE**

RF106.1 Slabs-on-grade. F-factors for unheated and heated slabs-on-grade shall be as specified in Table RF106.1. All applicable adjustment factors in the table notes shall apply. F-factors for basement floor slabs and crawl space ground surfaces located below exterior grade shall be adjusted in accordance Note f as applicable.

TABLE RF106.1—F-FACTORS FOR SLABS-ON-GRADE^{a, b, c, d, e, f}

UNHEATED SLABS-ON-GRADE: INSULATION CONFIGURATIONS	F-FACTOR (Btu/h × ft × °F)
Uninsulated slab	—
Horizontal insulation under slab at slab perimeter—slab edge not insulated	—
≥ R-5 for 2 ft	0.70
R-5 for 4 ft	0.67
≥ R-10 for 4 ft	0.64
Vertical insulation on exterior face ^g —slab edge insulated ^h	—
R-2.5 for 2 ft	0.66
R-5 for 2 ft	0.58
R-7.5 for 2 ft	0.56
R-10 for 2 ft	0.54
R-15 for 3 ft	0.52
R-5 for 3 ft	0.56
R-7.5 for 3 ft	0.54
R-10 for 3 ft	0.51
R-15 for 3 ft	0.49
R-5 for 4 ft	0.54

TABLE RF106.1—F-FACTORS FOR SLABS-ON-GRADE ^{a, b, c, d, e, f} —continued

UNHEATED SLABS-ON-GRADE: INSULATION CONFIGURATIONS	F-FACTOR (Btu/h × ft × °F)
R-7.5 for 4 ft	0.51
R-10 for 4 ft	0.48
R-15 for 4 ft	0.45
Fully insulated slab—full slab area and slab edge continuously insulated	—
R-5 entire slab area and R-3.5 edge	0.48
R-5 entire slab area and edge	0.46
R-7.5 entire slab area and R-3.5 edge	0.45
R-7.5 entire slab area and edge	0.41
R-10 entire slab area and R-5 edge	0.40
R-10 entire slab area and edge	0.36
R-15 entire slab area and R-5 edge	0.35
R-15 entire slab area and edge	0.30
R-10 slab edge and under slab perimeter inward 4 ft; R-5 remaining slab area	0.42
R-15 slab edge and under slab perimeter inward 4 ft; R-5 remaining slab area	0.40
R-15 slab edge and under slab perimeter inward 4 ft; R-10 remaining slab area	0.34
HEATED SLABS-ON-GRADE: INSULATION CONFIGURATIONS	F-FACTOR (Btu/h × ft × °F)
Uninsulated	1.35
Fully insulated slab—full slab area and slab edge continuously insulated	—
R-5 entire slab area and R-3.5 edge	0.77
R-5 entire slab area and edge	0.74
R-7.5 entire slab area and R-3.5 edge	0.71
R-7.5 entire slab area and edge	0.64
R-10 entire slab area and R-5 edge	0.62
R-10 entire slab area and edge	0.55
R-15 entire slab area and R-5 edge	0.54
R-15 entire slab area and edge	0.44
R-20 entire slab area and R-7.5 edge	0.44
R-20 entire slab area and edge	0.37
R-5 entire slab area and R-10 slab edge extending downward for minimum 3 ft	0.66
R-10 slab edge and under slab perimeter inward 4 ft; R-5 remaining slab area	0.66
R-15 slab edge and under slab perimeter inward 4 ft; R-5 remaining slab area	0.62
R-15 slab edge and under slab perimeter inward 4 ft; R-10 remaining slab area	0.51

For SI: 1 British thermal unit per hour per square foot per °Fahrenheit = 5.6783 W/m² × K.

- a. For alternative slab-on-grade insulation configurations, *F*-factors shall be determined in accordance with accepted engineering practice for modeling three-dimensional ground-coupled building assemblies using project-specific building and site conditions to estimate annual energy use attributed to foundation heat transfer and converting the result to an equivalent air-to-air *F*-factor basis.
- b. Interpolation between *R*-values for a given insulation configuration type is permitted.
- c. Tabulated *F*-factors are based on a typical soil thermal conductivity of 0.75 Btu/h × ft × °F and shall be multiplied by one of the following adjustment factors as applicable to site soil conditions: (1) rock or any soil on sites with poor drainage or high water table, 1.2; (2) sandy soils, 1.1; (3) loam or clay soils on well-drained sites in dry climate zones, 0.85; and (4) for all other soil or site conditions, 1.00. Where soil conditions are unknown, use of 1.00 is permitted.
- d. Tabulated *F*-factors are based on a slab area to perimeter length ratio of 9:1 and shall be multiplied by one of the following adjustment factors as applicable to a slab's area to perimeter length ratio: 5:1, 0.7; 6:1, 0.8; 7:1, 0.9; 8:1, 0.95; 9:1, 1.0; 10:1, 1.05; 15:1, 1.2; 20:1, 1.35; 30:1, 1.5; and for ≥ 40:1, 1.7.
- e. Tabulated *F*-factors are based on a slab perimeter edge projection above exterior finish grade of 6 inches. For portions of slab perimeter projecting 12 inches or more above grade, multiply the tabulated *F*-factors by one of the following adjustment factors as applicable: less than 12 inches, 1.0; 12 inches, 1.05; 18 inches, 1.1; 24 inches, 1.15; and 30 inches, 1.2.
- f. For basement floor slabs, crawl space slabs or gravel floors, the tabulated *F*-factors shall be multiplied by one of the following adjustment factors based on the depth of the floor surface below exterior finish grade: less than 1 foot, 1.0; 1 foot, 0.95; 3 feet, 0.9; and 6 feet or more, 0.8.
- g. Vertical insulation on the exterior shall extend for the indicated depth below finish grade and above grade to the top of the slab or stem wall. Where insulation is placed on the interior side of a foundation stem wall, it shall extend from the top of the slab to the indicated depth below the exterior finish grade and the applicable tabulated *F*-factor shall be multiplied by 1.05.
- h. The *R*-value of the vertical insulation located on the interior side of a stem wall shall be permitted to be reduced to R-2.5 at the slab edge, not exceeding 6 inches thick, provided that the applicable *F*-factor is multiplied by 1.15 where R-5 vertical insulation is specified, 1.2 where R-10 vertical insulation is specified, or 1.25 where R-15 vertical insulation is specified.