

For panels not vertical or horizontal, such as sloped glass in some types of skylights, calculation procedures such as those shown in Tables 5 through 15 should be used. Since data are presented for only vertical, horizontal, and 45 degree sloped surfaces and air spaces, an orientation which most closely approximates the application condition should be used.

WIND VELOCITY EFFECT ON U VALUES

Table 20 shows comparative values of U for other wind velocities. When this table is used for summer U values, it is necessary to enter the table at 7.5 mph, which can be interpolated between 5 and 10 mph. Any value taken from this table should be rounded to two significant figures.

Example 9: Find the coefficient of transmission U of a frame wall consisting of stucco, 25/32-in. insulation board sheathing, 2 x 4-in. studs, gypsum lath and plaster, and with 2-in. blanket insulation between studs, for 25 mph wind velocity.

Solution: From Table 5, this wall, F37, with no insulation between studs, has a value of $U = 0.22$. From Table 16, Part A, Col. 4, this wall, with 2-in. insulation added, has a value of $U = 0.084$. Entering Table 20 in the 15 mph column, interpolate between 0.080 and 0.090 in 15 mph column and proceed horizontally to the 25 mph column, where the U value is found by interpolation to be 0.085.

CALCULATING SURFACE TEMPERATURES

In many heating and cooling load calculations it is necessary to determine the inside surface temperature or the temperature of the surfaces within the structure. As the resistance of any path of heat flow is expressed in Fahrenheit degrees per (Btu)/(hour) (square foot), the resistances through any two paths of heat flow would be proportional to the temperature drop through these paths, and can be expressed as follows:

$$\frac{R_1}{R_2} = \frac{(t_i - t_o)}{(t_i - t_o)} \quad (9)$$

where

R_1 = the resistance from the indoor air to any point in the structure at which the temperature is to be determined.

R_2 = the overall resistance of the wall from indoor air to outdoor air.

t_i = indoor air temperature.

t_o = temperature to be determined.

t_o = outdoor air temperature.

Example 10: Determine the inside surface temperature for a wall having an overall coefficient of heat transmission $U = 0.25$, indoor air temperature 70 F, and outdoor air temperature -20 F.

Solution:

$$R = 1/f = 1/0.25 = 4.00$$

$$R_2 = 1/U = 1/0.25 = 4.00$$

Then, by Equation 9:

$$\frac{0.684}{4.00} = \frac{70 - t_o}{4.00 - (-20)}$$

$$t_o = 54.6 \text{ F}$$

Example 11: Determine the temperature of the bottom of a 4-in. insulated concrete roof slab to which has been glued 1/2-in. acoustical tile ($C = 0.84$) as the interior finish. The roof-ceiling overall coefficient of heat transmission U is 0.14 for heat flow up. The indoor air temperature is assumed to be 70 F and the outdoor air temperature -20 F.

Table 19 Coefficients of Transmission (U) for Solid Wood Doors

Btu per (sq ft) (F Deg)				
Thickness ^a	Winter			Summer No Storm Door
	No Storm Door	Storm Door ^b		
		Wood	Metal	
1 in.	0.64	0.30	0.39	0.61
1 1/2 in.	0.55	0.28	0.34	0.53
1 3/4 in.	0.49	0.27	0.33	0.47
2 in.	0.43	0.24	0.29	0.42

^a Nominal thickness.

^b Values for wood storm doors are for approximately 50 percent glass; for metal storm doors values apply for any percent of glass.

Table 20 Conversion Table for Wall Coefficient U for Various Wind Velocities

U for 15 mph ^a	U for 0 to 30 mph Wind Velocities					
	0	5	10	20	25	30
0.050	0.049	0.050	0.050	0.050	0.050	0.050
0.060	0.059	0.059	0.060	0.060	0.060	0.060
0.070	0.068	0.069	0.070	0.070	0.070	0.070
0.080	0.078	0.079	0.080	0.080	0.080	0.080
0.090	0.087	0.089	0.090	0.090	0.091	0.091
0.100	0.096	0.099	0.100	0.100	0.101	0.101
0.110	0.105	0.108	0.109	0.110	0.111	0.111
0.120	0.113	0.117	0.119	0.121	0.123	0.123
0.130	0.123	0.127	0.129	0.131	0.133	0.133
0.140	0.131	0.136	0.139	0.141	0.143	0.143
0.150	0.141	0.147	0.149	0.151	0.153	0.153
0.160	0.150	0.156	0.159	0.161	0.163	0.163
0.170	0.158	0.166	0.169	0.171	0.173	0.173
0.180	0.167	0.175	0.179	0.181	0.183	0.183
0.190	0.175	0.184	0.188	0.191	0.192	0.193
0.200	0.184	0.193	0.197	0.200	0.202	0.203
0.210	0.192	0.201	0.205	0.208	0.210	0.211
0.220	0.200	0.210	0.214	0.217	0.219	0.220
0.230	0.209	0.219	0.223	0.226	0.228	0.229
0.240	0.217	0.227	0.231	0.234	0.236	0.237
0.250	0.226	0.236	0.240	0.243	0.245	0.246
0.260	0.234	0.244	0.248	0.251	0.253	0.254
0.270	0.241	0.251	0.255	0.258	0.260	0.261
0.280	0.249	0.259	0.263	0.266	0.268	0.269
0.290	0.257	0.267	0.271	0.274	0.276	0.277
0.300	0.265	0.275	0.279	0.282	0.284	0.285
0.310	0.273	0.283	0.287	0.290	0.292	0.293
0.320	0.281	0.291	0.295	0.298	0.300	0.301
0.330	0.289	0.299	0.303	0.306	0.308	0.309
0.340	0.297	0.307	0.311	0.314	0.316	0.317
0.350	0.305	0.315	0.319	0.322	0.324	0.325
0.360	0.313	0.323	0.327	0.330	0.332	0.333
0.370	0.321	0.331	0.335	0.338	0.340	0.341
0.380	0.329	0.339	0.343	0.346	0.348	0.349
0.390	0.337	0.347	0.351	0.354	0.356	0.357
0.400	0.345	0.355	0.359	0.362	0.364	0.365
0.410	0.353	0.363	0.367	0.370	0.372	0.373
0.420	0.361	0.371	0.375	0.378	0.380	0.381
0.430	0.369	0.379	0.383	0.386	0.388	0.389
0.440	0.377	0.387	0.391	0.394	0.396	0.397
0.450	0.385	0.395	0.399	0.402	0.404	0.405
0.460	0.393	0.403	0.407	0.410	0.412	0.413
0.470	0.401	0.411	0.415	0.418	0.420	0.421
0.480	0.409	0.419	0.423	0.426	0.428	0.429
0.490	0.417	0.427	0.431	0.434	0.436	0.437
0.500	0.425	0.435	0.439	0.442	0.444	0.445
0.510	0.433	0.443	0.447	0.450	0.452	0.453
0.520	0.441	0.451	0.455	0.458	0.460	0.461
0.530	0.449	0.459	0.463	0.466	0.468	0.469
0.540	0.457	0.467	0.471	0.474	0.476	0.477
0.550	0.465	0.475	0.479	0.482	0.484	0.485
0.560	0.473	0.483	0.487	0.490	0.492	0.493
0.570	0.481	0.491	0.495	0.498	0.500	0.501
0.580	0.489	0.499	0.503	0.506	0.508	0.509
0.590	0.497	0.507	0.511	0.514	0.516	0.517
0.600	0.505	0.515	0.519	0.522	0.524	0.525
0.610	0.513	0.523	0.527	0.530	0.532	0.533
0.620	0.521	0.531	0.535	0.538	0.540	0.541
0.630	0.529	0.539	0.543	0.546	0.548	0.549
0.640	0.537	0.547	0.551	0.554	0.556	0.557
0.650	0.545	0.555	0.559	0.562	0.564	0.565
0.660	0.553	0.563	0.567	0.570	0.572	0.573
0.670	0.561	0.571	0.575	0.578	0.580	0.581
0.680	0.569	0.579	0.583	0.586	0.588	0.589
0.690	0.577	0.587	0.591	0.594	0.596	0.597
0.700	0.585	0.595	0.599	0.602	0.604	0.605
0.710	0.593	0.603	0.607	0.610	0.612	0.613
0.720	0.601	0.611	0.615	0.618	0.620	0.621
0.730	0.609	0.619	0.623	0.626	0.628	0.629
0.740	0.617	0.627	0.631	0.634	0.636	0.637
0.750	0.625	0.635	0.639	0.642	0.644	0.645
0.760	0.633	0.643	0.647	0.650	0.652	0.653
0.770	0.641	0.651	0.655	0.658	0.660	0.661
0.780	0.649	0.659	0.663	0.666	0.668	0.669
0.790	0.657	0.667	0.671	0.674	0.676	0.677
0.800	0.665	0.675	0.679	0.682	0.684	0.685
0.810	0.673	0.683	0.687	0.690	0.692	0.693
0.820	0.681	0.691	0.695	0.698	0.700	0.701
0.830	0.689	0.699	0.703	0.706	0.708	0.709
0.840	0.697	0.707	0.711	0.714	0.716	0.717
0.850	0.705	0.715	0.719	0.722	0.724	0.725
0.860	0.713	0.723	0.727	0.730	0.732	0.733
0.870	0.721	0.731	0.735	0.738	0.740	0.741
0.880	0.729	0.739	0.743	0.746	0.748	0.749
0.890	0.737	0.747	0.751	0.754	0.756	0.757
0.900	0.745	0.755	0.759	0.762	0.764	0.765
0.910	0.753	0.763	0.767	0.770	0.772	0.773
0.920	0.761	0.771	0.775	0.778	0.780	0.781
0.930	0.769	0.779	0.783	0.786	0.788	0.789
0.940	0.777	0.787	0.791	0.794	0.796	0.797
0.950	0.785	0.795	0.799	0.802	0.804	0.805
0.960	0.793	0.803	0.807	0.810	0.812	0.813
0.970	0.801	0.811	0.815	0.818	0.820	0.821
0.980	0.809	0.819	0.823	0.826	0.828	0.829
0.990	0.817	0.827	0.831	0.834	0.836	0.837
1.000	0.825	0.835	0.839	0.842	0.844	0.845

^a U in first column is from previous tables or as calculated for 15 mph wind velocity.

Design Heat Transmission Coefficients

Table 21 Thermal Conductivity (k) of Industrial Insulation Design Values (For Mean Temperatures Indicated)
Expressed in Btu per (hour) (square foot) (Fahrenheit degree temperature difference per in.)

Form	Material (Composition)	Ac- cepted Max Temp for Use, ° F	Typical Density lb/cu ft	Typical Conductivity k at Mean Temp F.										
				25	50	75	100	200	300	500	700	900		
BLANKETS & FELTS	MINERAL FIBER	1200	6-15	—	—	—	—	0.29	0.35	0.42	0.56			
	Blanket-Mesh Metal													
	Blanket-Flexible Type													
	(Fine Fiber Glass Organic Bonded)	370	0.65	0.25	0.27	0.30	0.32	0.43	0.59					
			0.75	0.24	0.26	0.28	0.30	0.41	0.54					
			1.0	0.23	0.25	0.27	0.28	0.36	0.48					
			1.5	0.22	0.24	0.25	0.26	0.33	0.42					
			3.0	0.21	0.22	0.23	0.24	0.30	0.36					
	Blanket-Flexible Type													
	(Textile Glass Fibers, Organic Bonded)	370	0.65	0.28	0.30	0.32	0.35	0.49	0.67					
		0.75	0.27	0.29	0.31	0.34	0.48	0.65						
		1.0	0.26	0.28	0.30	0.33	0.46	0.61						
		1.5	0.24	0.26	0.28	0.30	0.40	0.52						
		3.0	0.22	0.23	0.24	0.25	0.33	0.42						
	Felt-Semi-Rigid Type													
	(Organic Bonded)	400	3-8	0.23	0.25	0.26	0.27	0.35	0.44					
	VEGETABLE & ANIMAL FIBER													
	Hair Felt or Hair Felt plus Jute	180	10	0.26	0.28	0.29	0.30							
BLOCKS, BOARDS & PIPE INSULATION	ASBESTOS	1200	15-18	—	—	—	—	0.32	0.37	0.41	0.52	0.62		
	Molded Asbestos & Binder													
	Corrugated Asbestos Paper													
	4 ply	300	11-13	—	—	0.54	0.57	0.68						
	6 ply	300	15-17	—	—	0.49	0.51	0.59						
	8 ply	300	18-20	—	—	0.47	0.49	0.57						
	Laminated Asbestos Paper 40													
	Laminations	700	27-29	—	—	—	—	0.34	0.39	0.44	0.54			
	CALCIUM SILICATE	1200	11-13	—	—	—	—	0.32	0.37	0.42	0.51	0.61		
	CELLULAR GLASS	800	9	0.36	0.38	0.40	0.42	0.48	0.55					
	CORKBOARD (Without Added Binder)	200	6.5-8	0.26	0.26	0.27	0.28							
	CORK (Without Added Binder, Pipe Insulation)	200	7-10	0.26	0.27	0.28	0.29							
	DIATOMACEOUS SILICA	1600	21-22	—	—	—	—	—	—	0.65	0.68	0.72		
		2000	23-25	—	—	—	—	—	—	0.70	0.75	0.80		
	85% MAGNESIA	600	11-12	—	—	—	—	0.35	0.38	0.42				
	MINERAL FIBER, High Temp (Organic Bonded, Block Insulation)	400	6-10	—	—	—	—	0.28	0.35	0.43				
	High Temp (Fine Fiber, Organic Bonded Insulation)	370	3½	0.20	0.21	0.22	0.23	0.29						
	High Temp (Inorganic Bonded, Block Insulation)	1800	16-24	0.22	0.23	0.24	0.25	0.29						
	Blanket-Type Pipe Insulation	1200	6-15	—	—	—	—	0.34	0.36	0.40	0.50	0.63	0.78	
PLASTICS							0.29	0.35	0.42	0.56				
Expanded polystyrene	175	1.6	0.25	0.27	0.28	0.30								
Expanded polyurethane														
** Refrigerant, 11 Expanded Urethane (Thickness—1 in. and greater)	210	1.5-2.5	0.17	0.16	0.17	0.18	0.21							
RUBBER (Foamed, Rigid)	150	4.5	0.20	0.21	0.22	0.23								
VEGETABLE & ANIMAL FIBER														
Wool Felt (Pipe Insulation)	180	20	0.28	0.30	0.31	0.33								
Hair Felt or Hair Felt plus Jute (Pipe Insulation)	180	10	0.26	0.28	0.29	0.30								
INSULATING CEMENTS	85% MAGNESIA	600	15-18	—	—	—	—	0.50	0.55	0.60				
	MINERAL FIBER													
	With Colloidal Clay Binder	1800	24-30	—	—	—	—	0.49	0.55	0.61	0.73			
	With Hydraulic Setting Binder	1200	30-40	—	—	—	—	0.80	0.85	0.95				