

ENERGY STAR[®] Home Sealing Specification

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Version 1.0



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Scope:

This ENERGY STAR residential envelope retrofit specification covers the requirements for insulation, air infiltration, and windows in existing homes.

(a) Insulation levels are specified for wall, ceiling, and floors based on climate and type of heating source.

(b) Air infiltration levels are specified based on house measurement and calculations to approximate natural ventilation.

(c) Windows must meet ENERGY STAR labeling criteria.

The intent of this ENERGY STAR program is to encourage consumers to increase the energy efficiency of the building envelope in existing homes. This program is primarily intended for residential one- and two-family dwellings.

Definitions:

Air-Sealing - The process of reducing the air leakage (infiltration and exfiltration) of a building.

Air Changes per Hour (ACH) - The air within a building exchanged with the outdoor air through leakage and ventilation expressed as a percent of the total volume of air in the building.

ACH₅₀ - The air changes per hour in a building, induced by a 50 Pascal pressure from blower door operation.

ACH_{nat} - The natural air changes per hour in a building, as calculated by dividing ACH₅₀ by the LBL Factor.

Infiltration/Exfiltration - Infiltration is the flow of air into a building. Exfiltration is the flow of air out of a building.

Insulation - Any material which is always marketed and sold as a product primarily used to slow down heat flow within a building structure. For purposes of this specification, Insulation shall be defined to include only those products whose insulating capacities (i.e., R-values) have been tested according to the test procedures outlined in the Federal Trade Commission (FTC) Trade Regulation Rule on Labeling and Advertising of Home Insulation, Title 16 CFR Part 460.

LBL Factor - A factor based on climate region, number of stories of a building, and sheltering from wind which is used to convert to estimated air changes in a building by natural means, without a fan.

R-value - A measure signifying a material's ability to resist the flow of heat. The higher the number, the higher the resistance, and the greater the insulation. FTC Home Insulation Rule 460 requires contractors and sellers of new homes to give buyers a receipt showing the coverage area, thickness, and R-value of the insulation installed.

Specification:

EPA ENERGY STAR Home Sealing specification addresses insulation, infiltration, the suitability of windows, ventilation, and combustion safety.

Insulation

Insulation R-value must meet recommends levels in the U.S. Department of Energy (DOE) *Insulation Fact Sheet* tables (attached or available electronically at <http://www.ornl.gov/roofs+walls/insulation/> .) Note that these are based are both climate region and type of heating equipment.

While not required, if siding is being removed for another reason, in some climate zones the use of additional rigid exterior insulation is recommended, as discussed in the *Insulation Fact Sheet*.

Infiltration

Natural Air Changes per Hour (ACH_{nat}) shall be less than or equal to .50 Air Changes per Hour

(ACH_{50}), where, $ACH_{nat} = \frac{ACH_{50}}{LBL\ Factor}$. ACH_{50} shall be determined by a blower door test

in accordance with ASTM Standard E779-87, "Test Method for Determining Air Leakage by Fan Pressurization", ASTM Book of Standards, American Society of Testing and Materials, or CGSB Standard 149, "Determination of the Airtightness of Building Envelopes by Fan Depressurization Method, Canadian General Standards Board", 1986.

The LBL Factor is based on climate region, number of stories, and sheltering from wind and can be determined from the table in Appendix 1.

The home shall meet minimum ventilation requirements of ASHRAE 62-1999, "Ventilation for Acceptable Indoor Air Quality". (.35 ACH by natural or mechanical ventilation)

The combustion safety of combustion appliances shall be verified. (ASTM Standard E1998-99, "Standard Guide for Assessing Depressurization-Induced Backdrafting and Spillage from Vented Combustion Appliances"; Section H of the National Fuel Gas Code (ANSI Z223.1/NFPA 54); or Canada General Standards Board- 51.71-95, "The Spillage Test Method to Determine The Potential for Pressure Induced Spillage from Vented, Fuel-fired, Space Heating Appliances, Water Heaters and Fireplaces") Exception: "Sealed combustion" appliances, which draw their combustion air from outdoors and exhaust combustion products directly outdoors, with no connection because combustion air and the indoors, do not have to be tested.

Windows

80% of the windows in the home must meet or exceed the ENERGY STAR Windows criteria for the home's climate region. In Southern (mostly cooling) climates, non-ENERGY STAR windows are permitted only on the north side of the home or in locations with permanent shading.

Certification

Service providers shall certify that the home improvement measures have met the required safety and performance tests and that the FTC Home Insulation Rule 460 receipt requirements have been satisfied.

APPENDIX: Insulation Tables and LBL Conversion Factor Table

Table 1: Zip Codes and Corresponding Insulation Zones [For use with recommendations in Table 2]

Data from Dept. of Energy Insulation Fact Sheet, DOE/CE-0180, August 1997

* For Hawaii, Puerto Rico, and the Virgin Islands, the Insulation Zone is 1

If Your Zip Code Begins With These Three Numbers	Your Insulation Zone is:																				
073	6	164	9	246	9	328	3	417	5	502	9	599	8	689	7	782	3	879	4	976	7
074	6	165	9	247	7	329	3	418	5	503	9	690	7	690	7	783	3	880	3	977	7
075	6	166	9	248	7	330	3	420	5	504	9	691	9	691	9	784	3	881	6	978	5
076	6	167	9	249	7	331	3	421	5	505	9	692	9	692	9	785	3	882	3	979	5
077	6	168	8	250	7	332	3	422	5	506	9	693	9	693	9	786	4	883	6	980	5
078	8	169	9	251	7	333	3	423	5	507	9	600	8	600	8	787	4	884	4	981	5
079	8	170	8	252	7	334	3	424	5	508	9	601	8	601	8	788	3	890	7	982	5
080	6	171	8	253	7	335	3	425	5	510	9	602	6	602	6	789	3	891	4	983	5
081	6	172	8	254	7	336	3	426	5	511	9	603	6	603	6	790	5	893	9	984	5
082	6	173	8	255	7	337	3	427	5	512	9	604	6	604	6	700	3	791	5	894	8
083	6	174	8	256	7	338	3	430	8	513	9	605	6	605	6	701	3	792	5	895	8
084	6	175	8	257	7	339	3	431	8	514	9	606	6	606	6	703	3	793	5	896	8
085	6	176	8	258	7	342	3	432	8	515	8	607	6	607	6	704	3	794	5	897	7
086	6	177	8	259	7			433	8	516	8	609	6	609	6	705	3	795	4	898	9
087	6	178	8	260	7	344	3	434	8	520	9	610	8	610	8	706	3	796	4	990	7
088	6	179	8	261	7	346	3	435	8	521	9	611	8	611	8	707	3	797	4	992	7
089	6	180	8	262	7	347	3	436	8	522	9	612	6	612	6	708	3	798	4	993	5
		181	8	263	7	349	3	437	8	523	9	613	6	613	6	710	4	799	4	994	5
010	6	182	9	264	7	350	5	438	8	524	9	614	6	614	6	711	4			900	1
011	6	183	8	265	7	351	5	439	8	525	8	615	6	615	6	712	4			901	1
012	8	184	8	266	7	352	5	440	8	526	8	616	6	616	6	713	4			902	1
013	8	185	8	267	7	354	5	441	8	527	8	617	6	617	6	714	4			903	1
014	8	186	8	268	7	355	7	442	8	528	8	618	6	618	6	716	4	800	6	904	1
015	8	187	8	270	7	356	7	443	8	530	8	619	6	619	6	717	4	801	6	905	1
016	8	188	9	271	7	357	7	444	8	531	8	620	6	620	6	718	5	802	6	906	3
017	8	189	8	272	8	358	7	445	8	532	8	622	6	622	6	719	4	803	6	907	1
018	8	190	8	273	8	359	7	446	8	533	8	623	6	623	6	720	5	804	9	908	1
019	6	191	8	274	8	360	5	447	8	534	8	624	6	624	6	721	5	805	6	910	2
		193	8	275	7	361	5	448	8	535	8	625	6	625	6	722	5	806	6	911	2
		194	8	276	7	362	5	449	8	536	8	626	6	626	6	723	5	807	6	912	2
		195	8	277	7	363	4	450	5	537	8	627	6	627	6	724	5	808	6	913	2
		196	8	278	7	364	4	451	5	538	8	628	6	628	6	725	5	809	6	914	2
		197	7	279	7	365	4	452	5	539	8	629	6	629	6	726	5	810	6	915	2
020	6	198	7	280	7	366	4	453	8	540	8	630	7	630	7	727	7	811	8	916	2
021	6	199	7	281	7	367	4	454	8	541	8	631	7	631	7	728	5	812	9	917	3
022	6			282	7	368	5	455	8	542	8	633	7	633	7	729	5	813	6	918	2
023	6			283	7	369	5	456	5	543	8	634	7	634	7	730	5	814	6	919	1
024	6	115	8	284	5	370	5	457	7	544	8	635	7	635	7	731	5	815	6	920	1
025	8	116	8	285	7	371	5	458	8	545	9	636	7	636	7	734	4	816	6	921	1
026	6	117	8			372	5	460	7	546	8	637	5	637	5	735	5	820	9	922	4
027	6	118	8	200	7	286	8	461	7	547	8	638	5	638	5	736	5	821	9	923	3
028	8	119	8	201	7	287	9	462	7	548	9	639	5	639	5	737	7	822	8	924	3
029	8	120	9	202	7	288	9	463	8	549	8	640	7	640	7	738	8	823	9	925	3
030	9	121	9	203	7	289	9	464	8	550	8	641	7	641	7	739	7	824	9	926	1
031	9	122	9	204	7	290	5	465	8	551	8	644	7	644	7	740	5	825	9	927	1
032	9	123	9	205	7	291	5	466	8	553	8	645	7	645	7	741	5	826	9	928	1
033	9	124	9	206	8	292	5	467	8	554	8	646	7	646	7	743	7	827	9	930	1
034	9	125	9	207	8	293	5	468	8	556	8	647	7	647	7	744	5	828	9	931	2
035	9	126	9	208	8	294	4	469	8	557	8	648	5	648	5	745	5	829	9	932	3
036	9	127	9	209	8	295	5	470	5	558	8	650	7	650	7	746	8	830	9	933	3
037	9	128	9	210	8	296	5	471	5	559	8	651	7	651	7	747	5	831	9	934	2
038	9	129	9	211	8	297	5	472	5	560	8	652	7	652	7	748	5	832	7	935	3
039	9	130	9	212	8	298	4	473	8	561	8	653	7	653	7	749	5	833	5	936	3
040	9	131	9	213	8	299	4	474	5	562	8	654	7	654	7	750	4	834	8	937	3
041	9	132	9	214	8			475	5	563	8	655	7	655	7	751	4	835	5	939	3
042	9	133	9	215	9			476	5	564	8	656	7	656	7	752	4	836	5	940	3
043	9	134	9	216	8	300	5	477	5	565	8	657	7	657	7	753	4	837	5	941	3
044	9	135	9	217	9			478	5	566	8	658	7	658	7	754	4	838	5	942	4
045	9	136	9	218	7	301	5	479	8	567	8	660	7	660	7	755	4	840	6	943	2
046	9	137	9	219	9	302	5	480	6	570	9	661	7	661	7	756	4	841	6	944	2
047	9	138	9	220	8	303	5	481	6	571	9	662	7	662	7	757	4	843	6	945	3
048	9	139	9	221	8	304	4	482	6	572	9	664	7	664	7	758	4	844	6	946	2
049	9	140	9	222	8	305	5	483	6	573	9	665	7	665	7	759	3	845	6	947	3
050	9	141	9	223	8	306	5	484	8	574	9	666	7	666	7	760	4	846	6	948	2
051	9	142	9	224	8	307	5	485	8	575	9	667	5	667	5	761	4	847	6	949	2
052	9	143	9	225	8	308	5	486	8	576	9	668	7	668	7	762	4	850	4	950	3
053	9	144	9	226	9	309	5	487	8	577	9	669	8	669	8	763	4	851	4	951	1
054	9	145	9	227	8	310	4	488	8	580	9	670	5	670	5	764	4	852	4	952	3
055	9	146	9	228	9	311	4	489	8	581	9	671	5	671	5	765	4	853	4	953	3
056	9	147	9	229	8	312	4	490	6	582	9	672	5	672	5	766	4	855	4	954	3
057	9	148	9	230	8	313	4	491	6	583	9	673	5	673	5	767	4	856	4	955	6
058	9	149	9	231	8	314	4	492	6	584	9	674	7	674	7	768	4	857	4	956	4
059	9	150	8	232	8	315	4	493	8	585	9	675	5	675	5	769	4	859	4	957	6
060	9	151	8	233	7	316	3	494	8	586	9	676	8	676	8	770	3	860	9	958	3
061	9	152	8	234	7	317	4	495	8	587	9	677	8	677	8	771	3	863	8	959	3
062	9	153	8	235	7	318	4	496	8	588	9	678	7	678	7	772	3	864	5	960	3
063	9	154	8	236	7																

Table 2: Insulation Groups for Each Insulation Zone for Six Heating System Types in Existing Houses

[Use with Table 3 to Determine Recommended Insulation Levels ^{a]}

Insulation Zone	Gas Heat	Electric Furnace	Electric Baseboard ^b	Heat Pump	LPG	Fuel Oil
1	E1	E4	E3	E3	E2	E2
2	E2	E4	E4	E3	E2	E3
3	E3	E4	E3	E3	E2	E3
4	E3	E6	E4	E3	E4	E3
5	E4	E6	E5	E4	E6	E5
6	E4	E6	E6	E6	E6	E5
7	E5	E6	E6	E5	E6	E5
8	E5	E6	E6	E6	E6	E5
9	E6	E6	E6	E6	E6	E6

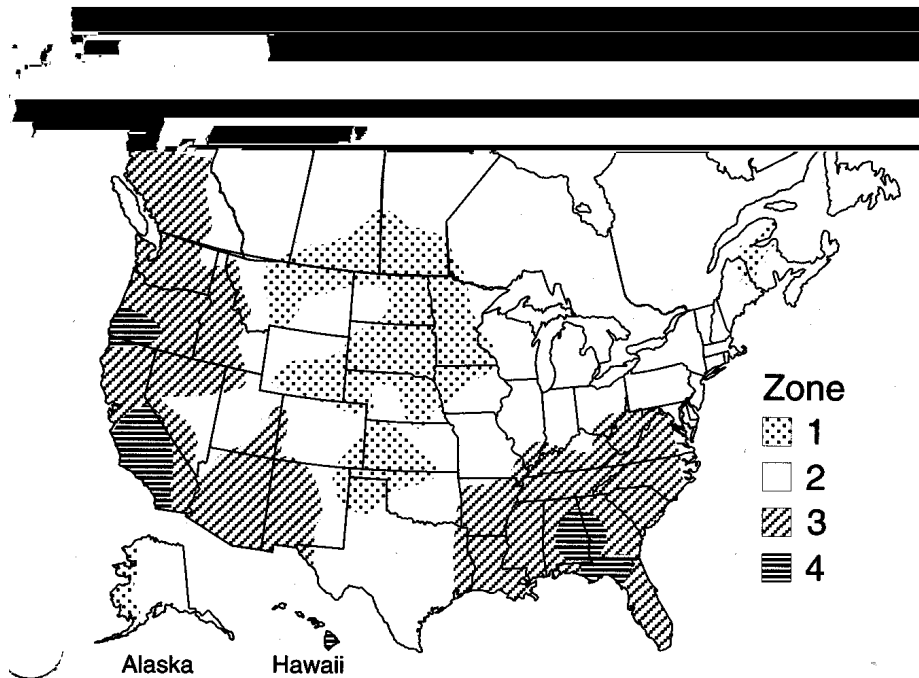
- (a) Electric air conditioning is assumed for all heating system types
- (b) Use for any electric resistance heating system without ducts, and for a central electric furnace if the ducts are totally within the conditioned part of the house.

Table 3: Total R-values for Existing Houses ^a

Insulation Group	Attic	Floor over unconditioned space	Wall Cavity	Crawlspace wall ^b	Basement wall ^c	Add insulated sheathing to uninsulated wall ^d	Add insulated sheathing to insulated wall ^d
E1	19	11	0	11	11	5	0
E2	30	11	11	11	11	5	0
E3	38	11	11	19	11	5	0
E4	38	19	11	19	11	5	0
E5	38	25	11	19	11	5	5
E6	49	25	11	25	11-13	5	5

- (a) R-values have units of °F•ft²•h/Btu. This table, when used with Tables 1 and 2, provides recommended total R-values for existing houses and was produced using the ZIP-Code computer program. The recommendations are based on an analysis of cost-effectiveness, using average local energy prices, regional average insulation costs, equipment efficiencies, climate factors, and energy savings for both the heating and cooling seasons.
- (b) Use only if floor is uninsulated and the crawlspace is unventilated - see the discussion about unventilated crawlspaces in the DOE Insulation Fact Sheet.
- (c) Recommendation assumes fiberglass insulation is placed in cavity behind drywall or paneling built out from wall. Alternatively, 1.5-inches of foam sheathing may be used.
- (d) Recommendation assumes that the exterior siding was removed for other purposes, i.e., does not include any consideration of the cost of removing and replacing the exterior siding. The R-values shown here represent 1-inch of foam sheathing. Foam sheathing with R-values up to R-7 could be used.

Table 4: LBL Factor to convert ACH_{50} to Natural Air Changes per Hour (ACH_{nat})



Zone	# of stories →	1	1.5	2	3
1	Well-shielded	18.6	16.7	14.9	13.0
	Normal	15.5	14.0	12.4	10.9
	Exposed	14.0	12.6	11.2	9.8
2	Well-shielded	22.2	20.0	17.8	15.5
	Normal	18.5	16.7	14.8	13.0
	Exposed	16.7	15.0	13.3	11.7
3	Well-shielded	25.8	23.2	20.6	18.1
	Normal	21.5	19.4	17.2	15.1
	Exposed	19.4	17.4	15.5	13.5
4	Well-shielded	29.4	26.5	23.5	20.6
	Normal	24.5	22.1	19.6	17.2
	Exposed	22.1	19.8	17.6	15.4

$$ACH_{nat} = \frac{ACH_{50}}{LBL \text{ Factor}}$$