



Recommendations for Energy-Efficient Design for Low-Rise Residential Construction

The following are recommended measures for an energy-efficient design. At a minimum, measures should comply with local building codes, which may address energy efficiency. The recommended measures are based on information available as of July 2012 and the age of these recommendations should be considered when comparing to new information that becomes available.

The information in Table 1 is referenced from the 2012 International Energy Conservation Code and will be explained throughout the recommendations. This information is not meant to be inclusive of all construction methods that may be used but a guideline for common residential practices. Missouri is divided into two zones by county and the proper zone should be considered based on the list below.

Table 1

	Windows			Insulation				Foundation		
	Fenestration U-Factor	Skylight U-Factor	Glazed Fenestration SHGC	Ceiling R-Value	Wood Frame Wall R-Value	Mass Wall R-Value	Floor R-Value	Basement Wall R-Value	Slab R-Value and Depth	Craw Space Wall R-Value
	(Maximum)	(Maximum)	(Maximum)	(Minimum)	(Minimum)	(Minimum)	(Minimum)	(Minimum)	(Minimum)	(Minimum)
Zone 5	0.32	0.55	No Requirement	49	20 or 13 + 5	13/17	30	15/19	10, 2ft	15/19
Zone 4	0.35	0.55	0.40	49	20 or 13 + 5	8/13	19	10/13	10, 2ft	10/13

(International Code Council, Inc. and American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., July 2011)

Climate Zone 4				
Audrain	Cole	Jasper	Newton	Shannon
Barry	Cooper	Jefferson	Oregon	St. Charles
Barton	Crawford	Johnson	Osage	ST. Clair
Bates	Dade	Laclede	Ozark	St. Francois
Benton	Dallas	Lafayette	Pemiscot	St. Louis
Bollinger	Dent	Lawrence	Perry	St. Louis City
Boone	Douglas	Lincoln	Pettis	Ste. Genevieve
Butler	Dunklin	Madison	Phelps	Stoddard
Callaway	Franklin	Maries	Platte	Stone
Camden	Gasconade	McDonald	Polk	Taney
Cape Girardeau	Greene	Miller	Pulaski	Texas
Carroll	Henry	Mississippi	Randolph	Vernon
Carter	Hickory	Moniteau	Ray	Warren
Cass	Howard	Monroe	Reynolds	Washington
Cedar	Howell	Montgomery	Ripley	Wayne
Christian	Iron	Morgan	Saline	Webster
Clay	Jackson	New Madrid	Scott	Wright

Climate Zone 5			
Adair	Daviess	Linn	Ralls
Andrew	De Kalb	Livingston	Schuyler
Atchison	Gentry	Macon	Scotland
Buchanan	Grundy	Marion	Shelby
Caldwell	Harrison	Mercer	Sullivan
Chariton	Holt	Nodaway	Worth
Clark	Knox	Pike	
Clinton	Lewis	Putnam	

I. Insulation

- Wood Frame Walls 2 x 4 R-20*
2 x 6 R-20*
 - * The walls should have cavity insulation at the stated minimum, R-20, but the requirement can also be met with a cavity insulating R-Value at R-13 and a continuous layer of insulation at R-5 over the entire wall surface.
- Ceiling R-49
- Floor:
 - There are different recommendations depending on the county of the home and should be referenced from above.
- Mass Wall:
 - The second number in Table 1 under mass walls applies if more than half of the insulation is on the interior of the wall. There are different recommendations depending on the county of the home and should be referenced from above.
- Foundations:
 - Around Missouri, administrators are reviewing codes involving exterior slab insulation, crawl space foundation insulation (interior and exterior), and exterior basement wall insulation because of potential hidden termite pathways. Insulation installed on the exterior foundation (and on the interior for crawl spaces) should include a break below the sill plate to expose the masonry wall allowing a visual inspection for the termite pathways.
 - Basement:
 - There are different recommendations depending on the county of the home and should be referenced from above. Two values are listed for basement walls; the first value is for continuous insulation and the second value is for cavity insulation values.
 - Slab-on- Grade:
 - Continuous R-10 at least 24" deep along the entire perimeter
 - Crawl Space Walls:
 - Two values are listed for basement walls; the first value is for continuous insulation and the second value is for cavity insulation. There are different recommendations depending on the county of the home and should be referenced from above.
- Air Ducts:
 - Ducts located in unconditioned attic space should have a minimum R-value of R-8 and ducts located in other unconditioned space should have a minimum R-value of R-6.
- Water Pipes:
 - Insulate hot and cold water pipes in unconditioned space; and insulate hot water pipes in conditioned space where possible.

II. Windows / Doors

- Windows and doors with windows should meet the U-Factor and Solar Heat Gain Coefficient (SHGC) listed in Table 1. The U-Factor and SHGC are listed as maximum values and are provided by the manufacture. Each energy star rated window should be marked with this information.
 - Doors should also be solid core insulated
- Passive Solar Design Considerations for Doors and Windows:
 - Total glass area should be limited to 14% of the total wall area
 - Concentrate most of the glass area on the south wall, with overhangs placed to allow the winter sun and block the summer sun
 - Avoid using windows on the east and west walls
 - Avoid excessive windows on the north wall

III. Mechanical

- Heating Systems (*Use equipment that is Energy Star Qualified*)
 - Gas
High-efficiency - Minimum 90% Annual Fuel Utilization Efficiency (AFUE) or, Consider a high-efficiency (condensing) heating system up to 96% AFUE
- Electric Heat Pumps
 - Air source 9.25 HSPF minimum
 - Ground source 3.1 COP minimum
- Water Heater
 - Gas Minimum 62% Energy Factor (EF)
 - Electric Minimum 90% EF
 - Heat Pump Water Heater Energy Star Qualified
- Air Conditioner
 - Whole House Energy Star Qualified (Currently 14.5 SEER)
 - Window Energy Star Qualified
- Thermostat
 - Programmable thermostat with automatic setbacks
- Ductwork
 - Seal all duct joints (supply and return) with duct mastic or appropriate metallic tape.

Use the Model Energy Code for other types of mechanical equipment.

Contact your local utility representative and heating contractors for additional information on mechanical systems.

IV. Water Conservation

- Use water-saving devices (2.5 gallons per minute) on shower heads and aerators on faucets
- Gravity tank toilets shall use no more than 1.6 gallons per flush
- Consider the use of rain water collection systems for yard irrigation

V. Lighting

- Refer to Division of Energy fact sheet "[Energy Efficient Lighting](#)"

VI. Appliances

- Consider purchasing ENERGY STAR labeled appliances.

VII. Passive Solar Heating Design

- Passive solar strategies must be incorporated early in the design stage. "Passive Solar Design Strategies: Guidelines for Homebuilders," available from the Sustainable Buildings Industries Council is an excellent resource for solar planning ideas.

The information contained herein should be considered as general recommendations for the construction/remodeling of low-rise residential buildings where energy-efficient design is being considered and should be allowed to be superseded by more stringent code and industry standards. Additional guidance can be found within the New Home Energy Star Program.

Works Cited

International Code Council, Inc. and American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (July 2011). *2012 International Energy Conservation Code and ANSI/ASHRAE/IES Standard 90.1-2012: Energy Standard for Buildings Except Low-Rise Residential Building*. Washington, D.C. and Atlanta, GA: International Code Council, Inc.

U.S. Environmental Protection Agency. (2012, July 10). *Energy Star New Homes*. Retrieved July 10, 2012, from Energy Star: http://www.energystar.gov/index.cfm?c=new_homes.hm_index

For More Information

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