General Recommendations Envelope New Construction

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Contents

DESIGN GUIDELINES FOR ENERGY EFFICIENT BUILDING ENVELOPES

In many ways, a building is defined by its envelope—the interface between the interior of the building and the outdoor environment. This includes the walls, roof, foundation, doors, windows, and insulation. The envelope plays an enormous role in determining the amount of energy necessary to maintain a comfortable indoor environment. This document presents a set of best practices and general recommendations for improving the building envelope in new construction buildings, aligning with the guidelines of the International Energy Conservation Code (IECC) 2021.

Through energy efficiency programs provided by your electric utility, CLEAResult assists building owners, architects, and engineers in evaluating the benefits of energy efficiency. Building owners are encouraged to assess and address their energy use through various program-related services, ranging from energy performance benchmarking and energy master planning to technical assistance and public relations support. These third-party recommendations are offered at no cost through your electric utility and are not intended to substitute for the services of paid professionals.

Roofing

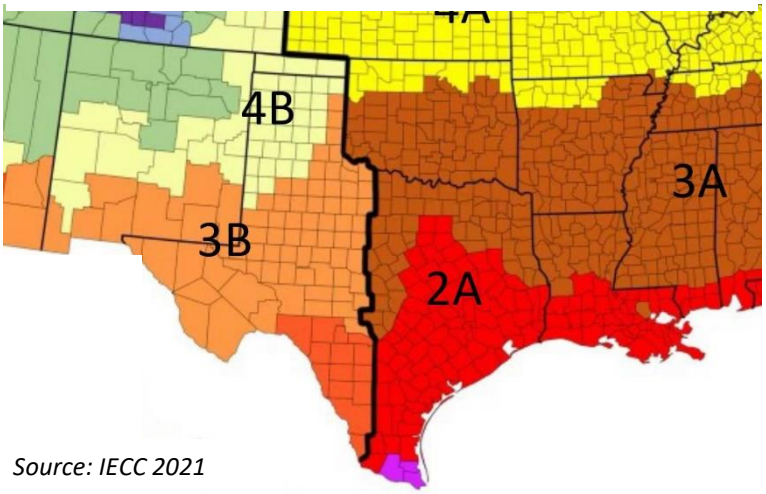
Roof design and materials can reduce the amount of air conditioning required in hot climates by increasing the reflection of solar heat, rather than its absorption, by the roof. The Cool Roof Rating Council (CRRC) certifies a variety of "cool roof" products that are estimated to decrease the demand for peak cooling by 10 to 15 percent compared to a typical roof. We recommend installing CRRC-qualified cool roof products, as many utility incentive programs require them to be eligible for incentives. For more information on cool roofs, please visit https://coolroofs.org/resources.

Insulation

The design and construction materials of a building influence the amount of energy lost or retained through its walls. While the air barrier impedes airflow, insulation provides resistance to heat flow, reducing the energy needed to keep a building warm in the winter and cool in the summer. Insulation is often discussed in terms of its ability to resist heat flow, known as its R-value. Please reference the ASHRAE fundamentals handbook to learn more about materials and their R-values.

Local building codes across the country mandate insulation in roofs, walls, and floors. The following minimum insulation requirements are advocated by the International Energy Conservation Code (IECC) 2021, one of the most progressive codes available. These guidelines should be cross-checked against local building codes because some more stringent local codes may surpass these values. We recommend the

Southern Climate Zones



Source: IECC 2021

following insulation requirements when surpassing local building codes. These recommendations are based on the building's climate zone location (refer to the map for climate zones).

1A – Very Hot Humid (purple)
2A – Hot Humid
3A – Warm Humid
3B – Warm Dry
4B – Mixed Dry

MINIMUM INSULATION RECOMMENDATIONS

Climate Zone (see map):	2	3	4	5
Roofing				
Insulation Entirely Above Deck	R-25 ci*	R-25 ci	R-30ci	R-30 ci
Metal Buildings	R-19 + R-11 LS**	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS
Attic and Other	R-38	R-38	R-49	R-49
Walls				
Mass, Exterior Insulation	R-5.7 ci	R-7.6 ci	R-9.5 ci	R-11.4 ci
Metal Buildings	R-13 +R-6.5 ci	R-13 + R-6.5 ci	R-13 + R-13 ci	R-13 + R-14 ci
Metal Framed	R-13 + R-5 ci	R-13 + R-7.5 ci	R-13 + R-7.5 ci	R-13 + R-10 ci
Wood Framed and Other	R-13 + R-3.8 ci or R-20	R-13 + R-3.8 ci or R-20	R-13 + R-3.8 ci or R-20	R-13 + R-7.5 ci or R20 + R3.8 ci
Floors				
Mass	R-6.3 ci	R-10 ci	R-14.6 ci	R-14.6 ci
Joist/framing	R-30	R-30	R-30	R-30
Heated Slabs	R-7.5 for 12in. Below + R-5 full slab	R-10 for 24in. Below + R-5 full slab	R-15 for 24in. Below + R-5 full slab	R-15 for 36in. Below + R-5 full slab

*CI - Continuous Installation

**LS - Linear System

Source: IECC 2021

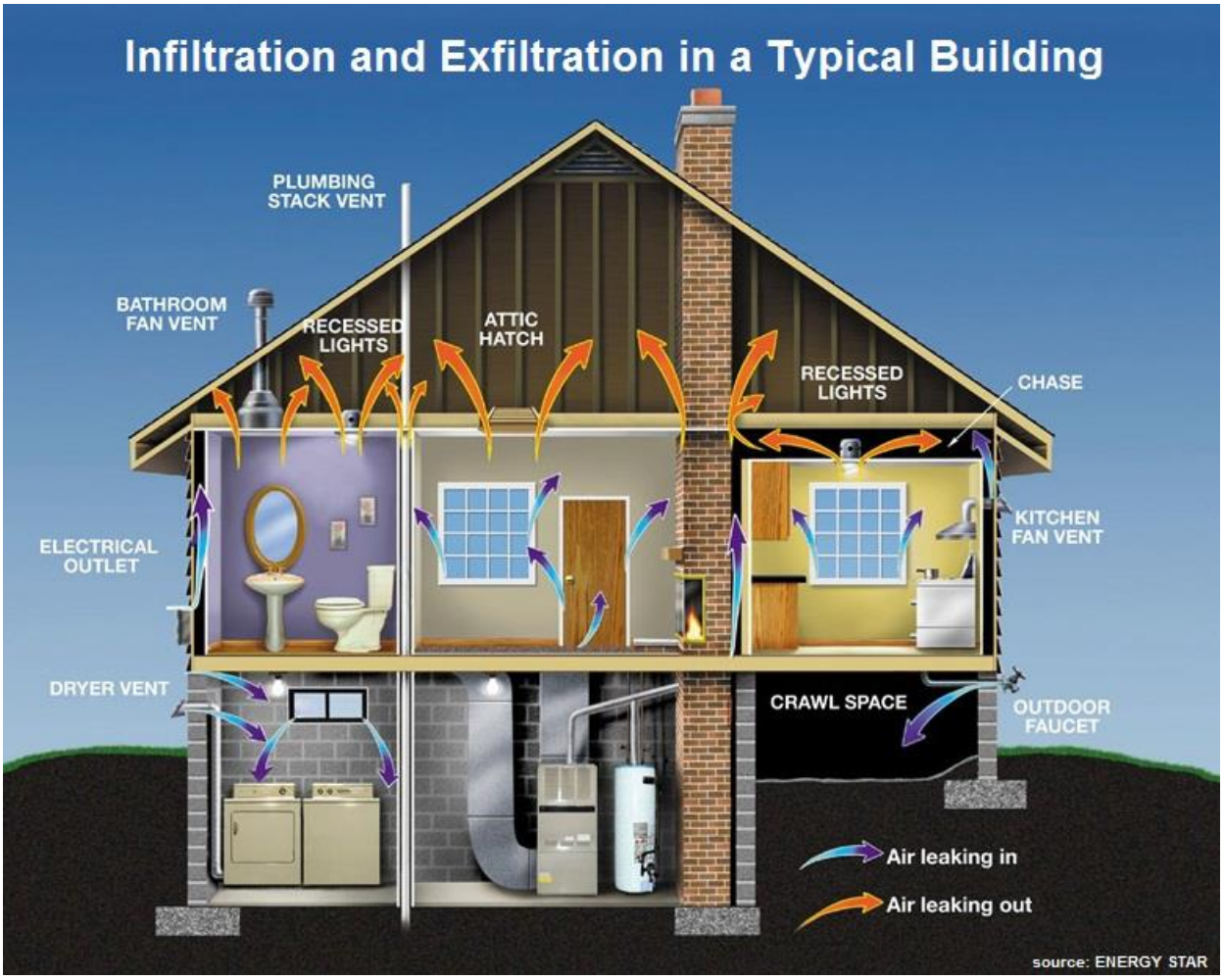
Below-Grade Exterior Insulation:

According to IECC 2021, slab-on-grade floors and below-grade floors and walls should be insulated from ground temperatures with a minimum R-7.5 layer of rigid insulation on the exterior side of the construction, especially in hot and humid climate zones. Decoupling the temperature of slab-on-grade or below-grade masonry from the ground reduces the potential for condensation on those surfaces.

Air Barrier Performance:

The building envelope should incorporate a continuous air barrier system to control air leakage into and out of the conditioned space. Additionally, air barrier systems should be provided for interior separations when the temperature and/or humidity differential exceeds 50 percent between the conditioned space and design ambient conditions.

Air barrier materials in a building should be joined in an airtight and flexible manner, allowing for heat and moisture deflection while restricting airflow between conditioned and non-conditioned spaces. All penetrations of the air barrier system should be made airtight to conserve the energy used to condition indoor air. To maintain the air barrier, all ducts in unconditioned spaces should be insulated and sealed at joints with mastic. The accompanying picture demonstrates various ways that air can leak into and out of a building.



Indoor Air Quality:

In accordance with building codes, indoor air must undergo ventilation to be replaced by fresh outdoor air, effectively removing contaminants and replenishing oxygen. It is recommended that any outdoor air introduced into a space should be brought in through the heating, ventilation, or air conditioning (HVAC) system rather than through infiltration.

Fenestration

Fenestration refers to windows, skylights, and doors, all of which are rated by the National Fenestration Rating Council (NFRC). Whole window and door assemblies are rated for air leakage and U-Factor, a measure of heat conductance (which is the inverse of R-value). Translucent glazing is also rated for Solar Heat Gain Coefficient (SHGC), the percentage of solar radiation transmitted through the material, and Visible Light Transmittance (VT), a measure of the visible light transmitted through the material. High-performance windows and doors have special coatings that allow visible wavelengths to pass through but block ultraviolet and infrared wavelengths, maintaining energy efficiency. Buildings where above-grade walls comprise more than 40 percent glazing, or where more than 5 percent of the roof area is skylight, should undergo assessment using energy modeling software to ensure that the glazing area will not result in significant energy costs. For buildings with walls containing less than 40 percent glazing and roofing with less than 5 percent skylight, we recommend ensuring that all fenestration meets the requirements presented in the following table.

MINIMUM INSULATION RECOMMENDATIONS

Climate Zone (see map):	2		3		4		5	
Vertical Fenestration U-Factor								
Fixed Fenestration	0.45		0.42		0.36		0.36	
Operable Fenestratin	0.6		0.54		0.45		0.45	
Entrance Doors	0.77		0.68		0.63		0.63	
Vertical Fenestration SHGC								
Type*	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable
Projection Factor (PF) < 0.2	0.25	0.23	0.25	0.23	0.36	0.33	0.38	0.33
0.2 ≤ PF <0.5	0.3	0.28	0.3	0.28	0.43	0.4	0.46	0.4
PF ≥ 0.5	0.4	0.37	0.4	0.37	0.58	0.53	0.61	0.53
Skylights								
U-factor	0.65		0.55		0.5		0.5	
SHGC	0.3		0.3		0.4		0.4	

*Operable indicates the window can open, fixed means it cannot.

Source: IECC 2021

Window Treatments:

In air-conditioning-dominated climates, it is beneficial to consider the heat gain from south- and west-facing windows. The installation of window films and solar screens reduces the heat transmitted into the building space, saving energy on air-conditioning. We recommend using window films and solar screens for both new and existing windows. If installed on single-pane clear glass windows without any other shading, deemed savings are available for south- and west-facing windows in Texas.

Entrance and Exit Doors:

Entrance and exit doors often have clearance gaps to allow for proper operation. These gaps around the doors permit the infiltration of unconditioned air into the building, contributing to the cooling and heating loads of the HVAC system. Weatherstripping and brush-style door sweeps installed along door jambs can prevent this air infiltration. Texas offers a deemed savings approach to incentivize weatherstripping and/or door sweeps on exterior doors with visible gaps ranging from 1/8 to 3/4 inches.

Example Building Envelope Specifications

New Construction and Retrofit:

A. The building construction shall maintain a continuous air barrier between conditioned and non-conditioned spaces. Materials used for the air barrier system should have an air permeability not exceeding 0.004 cfm/ft2 under a pressure differential of 0.3 inches of water (1.57 psf).
B. Roof Reflectivity:
    a. Low-slope roofs must have an initial solar reflectance of ≥ 0.65. After 3 years, the solar reflectance must be ≥ 0.50.
    b. Steep-slope roofs must have an initial solar reflectance of ≥ 0.25. After 3 years, the solar reflectance must be ≥ 0.15.
C. Insulation values shall meet or exceed those presented in IECC 2021 for roofing, walls, and floors.
D. All fenestration shall comply with IECC 2021.