

Boulder County BuildSmart User Guide

Project Planning
for Energy Efficiency Under
Boulder County BuildSmart



Project Planning Under BuildSmart



Intent of BuildSmart

To promote and encourage high performing sustainable development and redevelopment in the unincorporated areas of Boulder County. Create cost-effective, energy-efficient structures that reduce both the production of greenhouse gases from residential buildings and conserve and protect water and other natural resources.

Determine the type of structure that you will be constructing:

- New Dwelling?
- Addition?
- Remodel?

Choose your path for compliance:

- Performance Path Option
- Prescriptive Path Option

What is the Performance Path?

A design employing the use of computer software which compares the energy costs of the designed home to that of an IRC-compliant home. This compliance method has some mandatory measures but allows flexibility in choosing what options best suit their needs and desires as they design and build their home.

What is the Prescriptive Path?

A combination of materials and techniques to create a high-efficiency building envelope without the use of computer modeling. This compliance method includes mandatory measures a homeowner must take in order to comply.



Some Terms you will need to be familiar with...

Certified or Accredited Home Energy Rater

A residential energy professional who is certified by the Residential Energy Services Network (RESNET); also referred to as an Energy Rater.

Please see the current list of Certified Home Energy Raters serving Boulder County at our website: www.BoulderCountyBuildSmart.org

Conditioned Floor Area

The floor area of a building that is heated or cooled, measured from the outside face of the exterior wall. Unenclosed unconditioned covered porches, decks, and unconditioned garages are not considered conditioned floor area.

Gross Wall to Floor Area Ratio

The relationship of the total wall area and the total floor area of the conditioned space including the floor area within the outside face of the exterior wall and the wall area measured from the top of the foundation to the bottom of the ceiling including all door and window openings.

Performance Path Option

Construction of conditioned space where compliance is measured using the RESNET system to determine anticipated energy consumption and energy efficiency, (HERS Rating System).

Prescriptive Path Option

Construction of conditioned space where compliance is achieved by applying minimum standards to the dwellings thermal envelope, fenestration, lighting, and air leakage (from Tables N1102.1 & N1102.1.3), plus either Table 3 or 4 if applicable.

Boulder County BuildSmart User Guide Illustrative Flow Charts:

On the following pages you will find a series of Flow Charts to guide you through the path option process.

There are three pairs of flow charts, one pair each for **New Dwellings**, **Additions**, and **Remodels**. Each pair of flow charts consists of one chart showing the **Process of Compliance** with the energy efficiency component of Boulder County BuildSmart and one chart showing an **Example of Compliance**.

After the Flow Charts you will find Figure 1 and Tables 1 through 4 which include information in regards to the steps necessary to achieve compliance.

New Dwelling Process

Determine the
Conditioned Floor Area
(CFA).

**Performance
Option Path**

**Prescriptive
Option Path**

Determine
your path for
compliance.

Obtain a RESNET model
to achieve the required
HERS rating from Table 1.

Plans & construction must
conform to Tables 3,
N1102.1.

During Construction:
An Energy Rater must
conduct the pre-drywall
insulation and duct-
blaster test.

During Construction:
An Energy Rater must
perform a pre-drywall
insulation and duct-
blaster test.

During Construction:
An energy Rater must
conduct a final inspection
including an air-leakage
(blower-door) test.

During Construction:
An energy Rater must
conduct a final inspection
including an air-leakage
(blower-door) test.

New Dwelling Example

Determined conditioned floor area (CFA) is 4,500 sq. ft.

Performance Option Path

Prescriptive Option Path

Determine your path for compliance.

Obtain a RESNET model to achieve the required HERS rating of 45.

Conform to Tables N1102.1
Add PV equal to 5.8 kw.

During Construction:
An Energy Rater must conduct the pre-drywall insulation and duct-blast test.

During Construction:
An Energy Rater must perform a pre-drywall insulation and duct-blast test.

During Construction:
An energy Rater must conduct a final inspection including an air-leakage (blower-door) test.

During Construction:
An energy Rater must conduct a final inspection including an air-leakage (blower-door) test.

Additions Process

Determine the Conditioned Floor Area (CFA) of the Addition.

Performance Option Path

Determine your path for compliance. If CFA is in excess of 6,000 sq. ft. you **must** use the Performance Option Path.

Prescriptive Option Path

Determine the conditioned floor area of the existing dwelling.

Refer to Figure 1 to determine if the HERS thresholds should be taken from Table 1 or Table 2 for the combined new and existing CFA.

Obtain a RESNET model to achieve the required HERS rating from Table 1 or 2 as applicable.

During Construction: An Energy Rater must conduct the pre-drywall insulation and duct-blast test.

During Construction: An energy Rater must conduct a final inspection including an air-leakage (blower-door) test.

Plans & construction must conform to Tables N1102.1.

If Addition results in total CFA of between 3,000 & 6,000 refer to Figure 1 for compliance with PV requirements of Table 3 or 4.

During Construction: An Energy Rater must perform a pre-drywall insulation and duct-blast test.

During Construction: An energy Rater must conduct a final inspection including an air-leakage (blower-door) test.

Upgrade the existing portion of the dwelling to conform to Section N1105.2.5.4.3.

Additions Example

Determined CFA is 4,500.
As a 1,500 sq. ft. Addition
to a 3,000 sq. ft. Dwelling.

Performance Option Path

4,500 sq. ft.
is a 50% increase
in CFA. Determine
your path for
compliance.

Prescriptive Option Path

Determine the conditioned
floor area of the existing
dwelling.

Refer to Figure 1
to determine if the HERS
thresholds should be taken
from Table 1 or Table 2
for the combined new
and existing CFA.

Obtain a RESNET model
to achieve the required
HERS rating from Table 1
or 2 as applicable.

During Construction:
An Energy Rater must
conduct the pre-drywall
insulation and duct-
blaster test.

During Construction:
An energy Rater must
conduct a final inspection
including an air-leakage
(blower-door) test.

Plans & construction must
conform to Tables N1102.1.

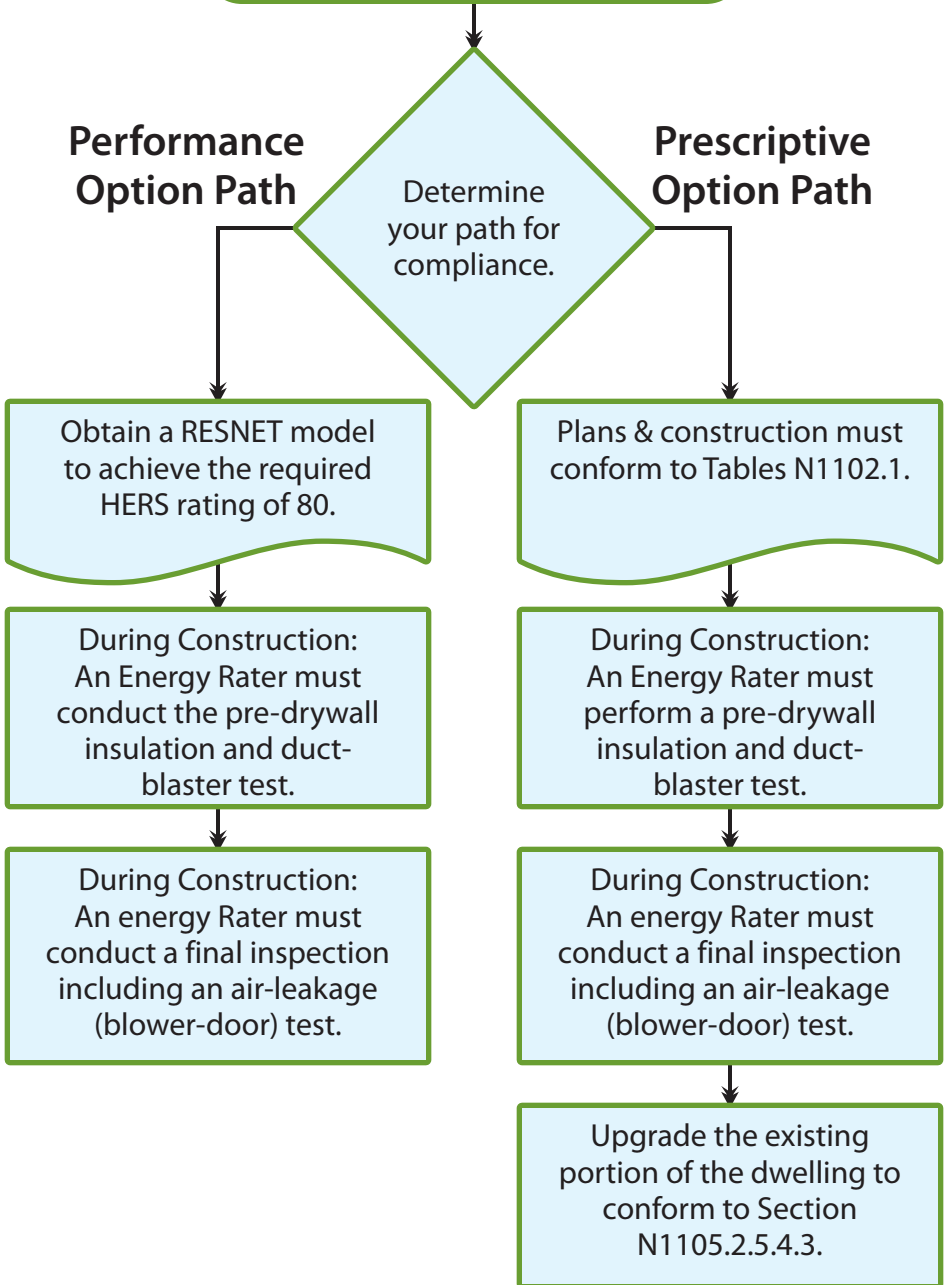
Reference Figure 1
and then to Table 4
for PV Requirement.
For 4,500 sq. ft.,
1kw of PV required.

During Construction:
An Energy Rater must
perform a pre-drywall
insulation and duct-
blaster test.

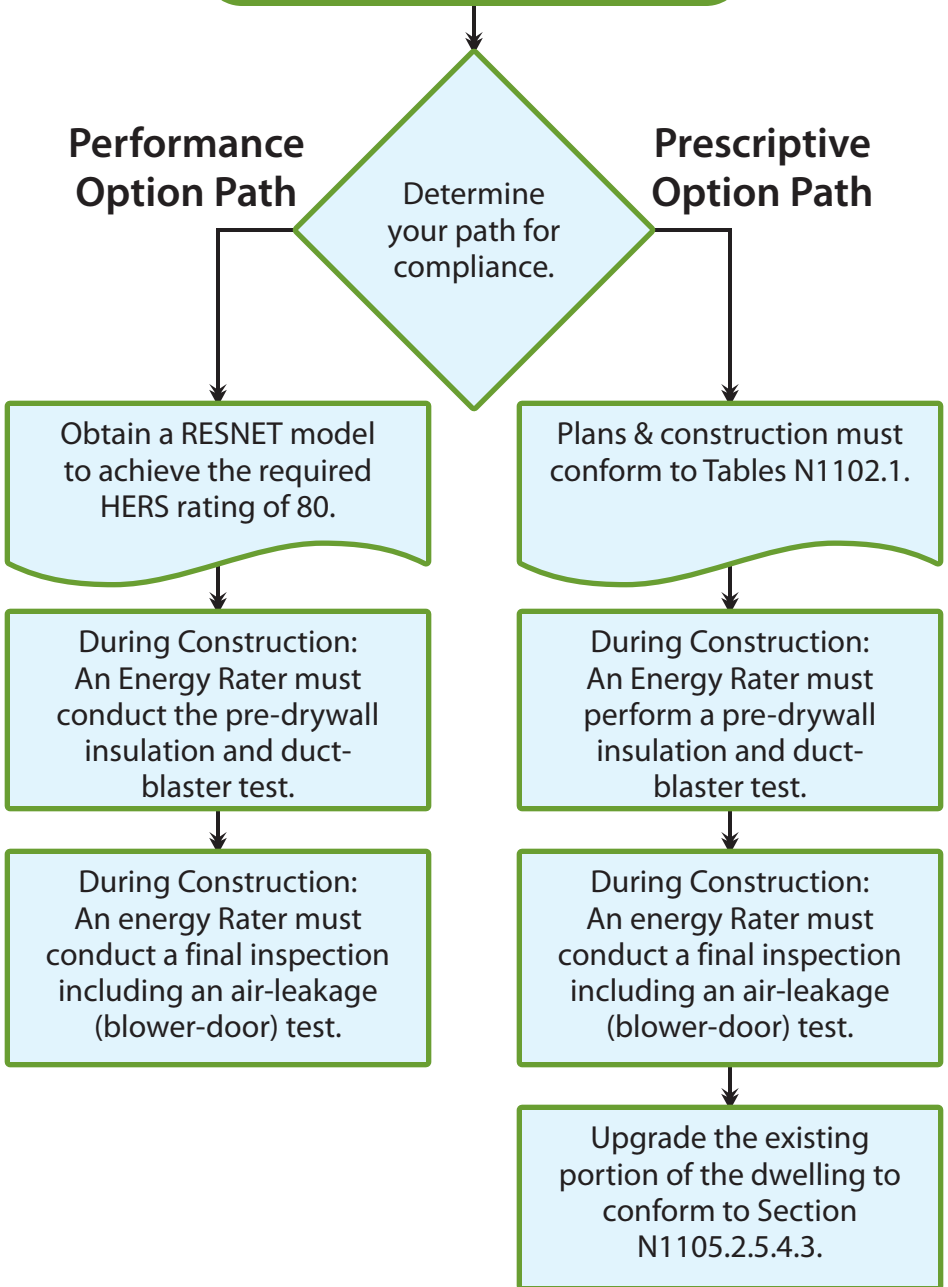
During Construction:
An energy Rater must
conduct a final inspection
including an air-leakage
(blower-door) test.

Upgrade the existing
portion of the dwelling to
conform to Section
N1105.2.5.4.3.

Remodels Process



Remodels Example



Note: For Remodel projects the Example Flow Chart is identical to the Process Flow Chart.

Considerations choosing your path for compliance:

Performance Path Option Advantages:

- ✓ The HERS Rating System is an effective design system which provides a custom energy model and a detailed cost-benefit analysis.
- ✓ Provides flexibility and trade-offs of building elements to maximize the efficiency of the design.
- ✓ Under the Performance Path, each design is custom and unique.
- ✓ Homes constructed using the Performance Path Option receive a certificate.
- ✓ Builders may be eligible for tax credits and preferential lending terms for homes constructed using the the Performance Path Option.

Prescriptive Path Option Advantages:

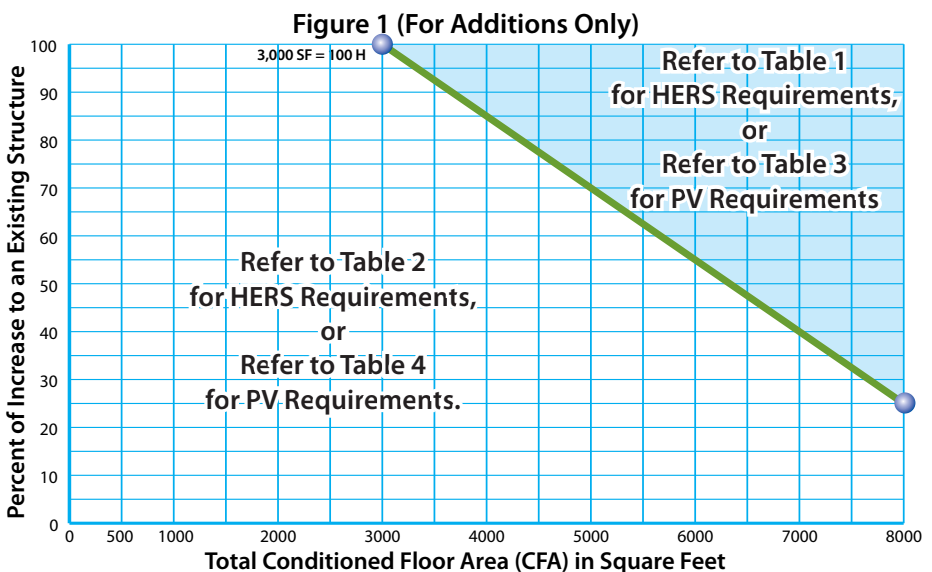
- ✓ Less project planning and cost.
- ✓ Provides a standard path for compliance.
- ✓ Will allow a person with less expertise and technical experience to do the design.
- ✓ The design is simpler and easier to understand.
- ✓ Typically a project can begin sooner.
- ✓ Less 3rd-party design expense.

How To Use Figure 1

Use Figure 1 to determine the correct HERS Rating Requirement Table (Table 1 or Table 2) for addition projects following the Performance Path Option, or to determine the correct PV Requirement Table (Table 3 or Table 4) for addition projects following the Prescriptive Path Option that fall within 3,000 to 6,000 sq. ft. of Total Conditioned Floor Area (CFA).

First calculate the **Total Conditioned Floor Area** of your project by adding the area of the addition to the area of the existing dwelling, then calculate the **Percent of Increase to the Existing Structure** by dividing the area of the addition by the area of the existing dwelling.

Take the results of these two calculations and plot their intersecting point on Figure 1 to determine the next steps for compliance.



Performance Path Option Requirements

HERS Requirements Tables 1 and 2

Table 1: HERS Rating Requirements for New Construction

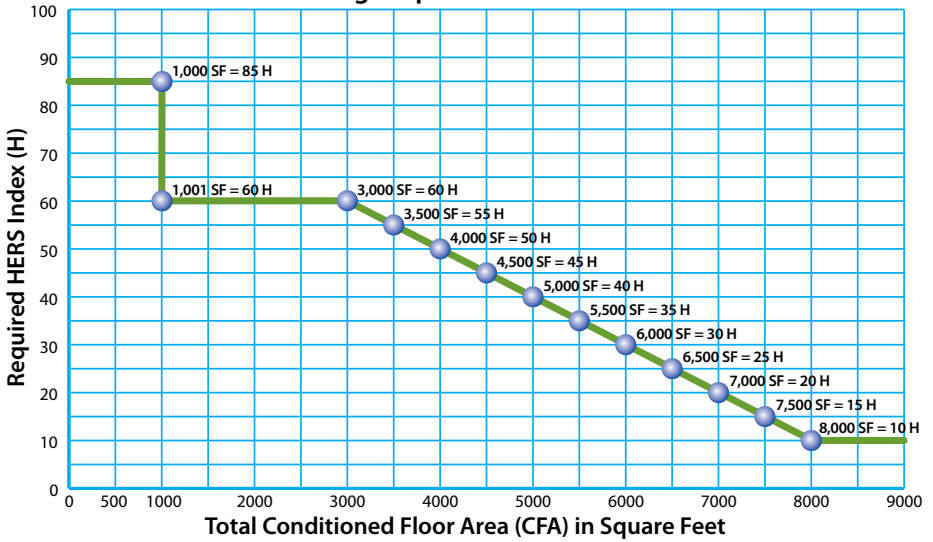
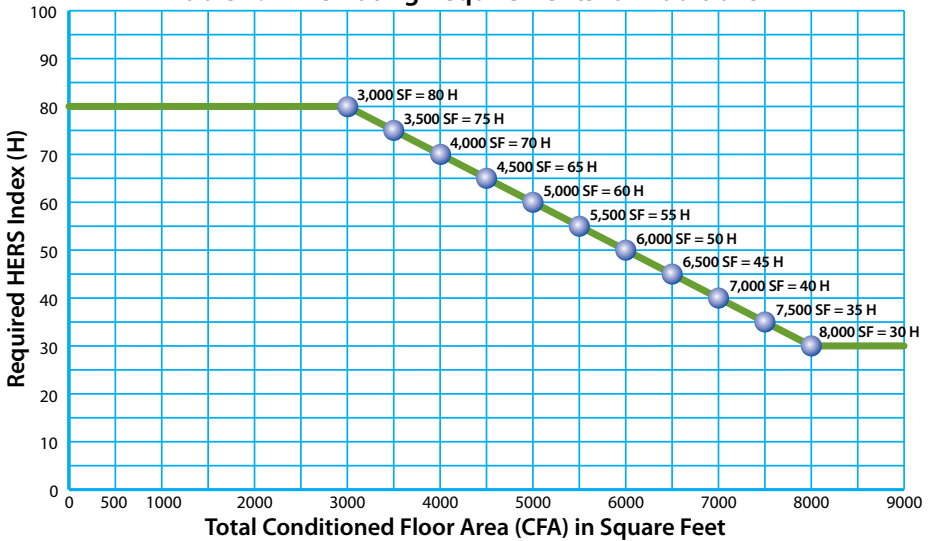


Table 2: HERS Rating Requirements for Additions



Prescriptive Path Option Requirements

PV Requirement Tables 3 and 4:

To use either Table 3 or Table 4 one must first calculate the Gross Wall to Conditioned Floor Area ratio. In calculating the wall to floor area ratio the following must be included:

1. The entire Conditioned Floor Area (CFA).
2. The wall area measured from the top of the foundation to the bottom of the ceiling including all door and window openings.
3. The Gross Wall Area is divided by the Conditioned Floor Area.

Please Note: If the gross wall to floor area ratio is greater than one, the Performance Path Option must be used.

Table 3: PV Requirements for New Dwelling Prescriptive Path Option 3,000 sq. ft. to 6,000 sq. ft.

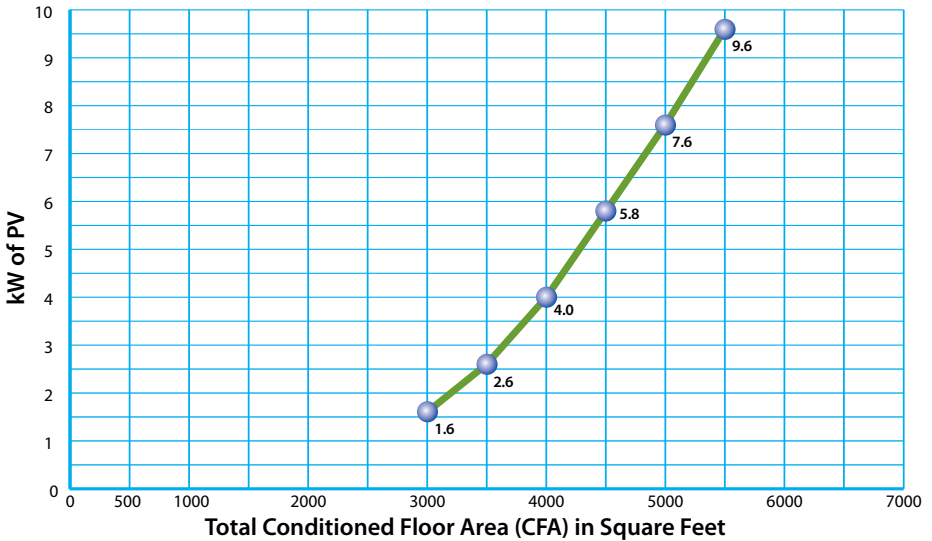
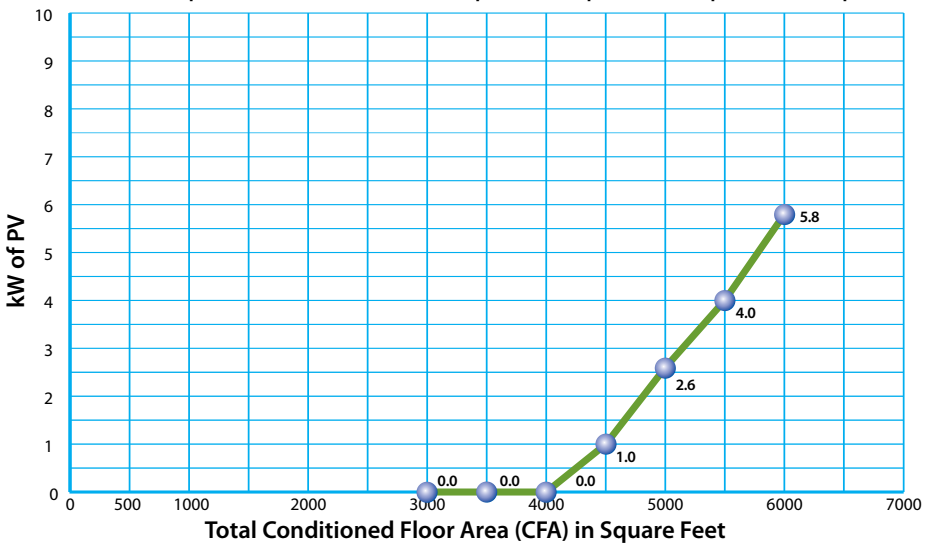


Table 4: PV Requirements for Additions Prescriptive Path Option 3,000 sq. ft. to 6,000 sq. ft.



Prescriptive Path Option Requirements

Table N1102.1: Insulation, Fenestration, and Additional Requirements

Insulation and Fenestration Requirements by Component	
Fenestration U-Factor	0.35
Skylight U-Factor	0.45
Ceiling R-Value	54
Wood Frame Wall R-Value	19+10 ^d
Mass Wall R-Value ^a	18/24
Floor ^f R-Value	42
Basement ^b Wall R-Value	15/20
Slab ^c Edge R-Value and Depth	15, 3 ft.
Crawl Space ^b Wall R-Value	15/20
Additional Requirements	
Maximum Glazing to Floor Area Ratio	18%
Maximum Air Leakage ⁱ	5 ACH at 50 Pascals
Appliances (New or Replaced)	Energy Star Certified
Lighting Fixtures	80% CFL or equal
Insulation Installation Standards	RESNET grade 1 standards
Furnaces And Boilers ^{g,h}	92% AFUE With ECM Blower Motors
Water Heaters ^{g,h}	82 EF

- a. The second R-value applies when more than half the insulation is on the interior.
- b. The first R-value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.
- c. R-5 shall be added to the required slab edge R-values for heated slabs and the entire underside of the heated slab shall be insulated with a minimum R-Value of 10.
- d. "19 + 10" means R-19 cavity insulation plus R-10 insulated sheathing. If structural sheathing covers 25% or less of the exterior, R-10 sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25% of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-5.
- e. When more than half the insulation is on the interior, the mass wall U-factor shall be the same as the frame wall U-factor.
- f. Floors over conditioned space are exempt from this requirement.
- g. Permits issued for the replacement of existing furnaces, boilers, and water heaters are exempt from these requirements.
- h. For projects involving additions and remodels furnace and water heaters only need to meet these requirements if they are replaced.
- i. Seven (7) Air Changes per Hour (ACH) at 50 Pascals for additions and remodels.

Boulder County BuildSmart Code Excerpts

N1103.5 Mechanical ventilation. Mechanical ventilation. Mechanical ventilation of all habitable spaces is required for new dwellings and for additions and remodels/renovations in accordance with this subsection. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

N1103.5.1 Minimum required ventilation. In addition to and in lieu of the requirements of IRC Section R303.1, all residences must be provided with mechanical ventilation. All habitable rooms must be supplied with a mechanical ventilation system capable of producing an air flow in conformance with Table N1103.5.1.

Exception: Additions that result in an increase in conditioned floor area of less than 50% of the pre-existing dwelling and remodels/renovations where less than 50% of the existing finished wall membrane is removed.

IRC Table N1103.5.1 Ventilation Air Requirements in Cubic Feet Per Minute

Floor Area (square feet)	Bedrooms				
	0-1	2-3	4-5	6-7	>7
< 1,500	30	45	60	75	90
1,501-3,000	45	60	75	90	105
3,001-4,500	60	75	90	105	120
4,501-6,000	75	90	105	120	150
6,001-7,500	90	105	120	135	150
>7,500	105	120	135	150	165

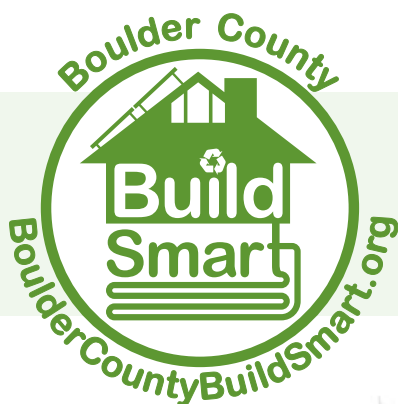
N1105.2.5.4.7.1 Additions that result in an increase in conditioned floor area of 50% or more of the pre-existing dwelling and remodels/renovations where 50% or more of the existing finished wall membrane is removed:

1. The insulation in the existing attic must be upgraded to a value of R-38. Vaulted or cathedral ceiling cavities must be completely filled with insulation.
2. The existing dwelling must achieve a maximum air leakage of 7 air changes per hour measured at 50 pascals.
3. Mechanical ventilation is required in compliance with Section N 1103.5.
4. Crawlspace walls must be insulated in compliance with Table N1102.1 or Table N1102.1.2.
 - a. A Class 1 vapor retarder shall be placed on the crawlspace grade with joints sealed and overlapped a minimum of 6 inches and edges extending at least 6 inches on to the stem wall and sealed.
 - b. The crawlspace must be provided with continuously-operated mechanical exhaust ventilation at a rate of 1 cu. ft./minute for each 50 sq. ft. of crawlspace floor area including an air pathway to the common area such as a duct or transfer grill. (see IRC Section R408) As an alternative to the continuously operated mechanical exhaust ventilation, a conditioned air supply of at least 1 cu. ft./minute for each 50 sq. ft. of crawlspace area and a return air pathway to the common area may be provided (see IRC Section R408).
5. A minimum of 50 percent of the lamps in existing permanently installed lighting fixtures shall be high-efficacy lamps.

N1105.2.5.4.7.2 Additions that result in an increase in conditioned floor area of less than 50% of the pre-existing dwelling and remodels/renovations where less than 50% of the existing finished wall membrane is removed:

1. The insulation in the existing attic must be upgraded to a value of R-38. Vaulted or cathedral ceiling cavities must be completely filled with insulation.
2. The existing dwelling must achieve a maximum air leakage of 7 air changes per hour measured at 50 pascals.
3. A minimum of 50 percent of the lamps in existing permanently installed lighting fixtures shall be high-efficacy lamps (as defined on page 15 of the 2009 International Residential Code).

Exception: Additions and remodels/renovations which result in less than 500 sq. ft. of conditioned floor area must be caulked and weather stripped, but need not be tested for air leakage.



Land Use Department

Courthouse Annex Building • 2045 13th Street • PO Box 471
Boulder, CO 80302

Building Safety & Inspection Services Division:

Phone: 303.441.3925 • Fax: 303.441.4856

Email: building_official@bouldercounty.org

www.bouldercounty.org/lu

