

# 2015 & 2018 International Energy Conservation Code

The 2015 was the big change.

The changes for 2018 have little effect on most of us in roofing

**Colorado Roofing Association**  
**Webinar July 23, 2020**

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## Video Conference Courtesies:

- ★ Thank you for being on-time.
- ★ PLEASE STAY MUTED!
- ★ Use the Q&A at the bottom your screen to send your questions to Debbie. She can then relay them to me.
- ★ Due to the number of participants, we may not get to all the questions, but we will try.
- ★ In order to earn CIUs, you will be required to answer a final poll question at the end of today's presentation.

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## 2015/2018 Energy Code Issues

- \* Originally presented in 2016
- \* Presented by Richard Boon, P.E.
  - ★ 40 years in roofing
  - ★ Former Director: The Roofing Industry Educational institute
  - ★ Walked almost 200 million sq. ft. of roofing in career
  - ★ Umpire for roofing-related disputes over \$1 million

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## Background

- Why does R-value matter?
  - Reduction in building energy consumed
- Is there a limit?
  - Yes based on local climate and interior building usage

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Can we see the difference?



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Explain these



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### Radiant Barriers are in the 2015 and 2018 IBC

- No R-value equivalent
- No mention about moisture
- Most of the data is pure hokum
- Mostly aluminum foil sheets

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Is more better?



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## What goes into Energy Consumption?

- Heat loss through:
  - Walls
  - Roof
  - Windows
  - Floors
  - Air changes

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## Is Extra R-Value Worth it?

- Office Warehouse showroom
- 43,000 Square Feet
- Old Roof single layer perlite
- Added a layer of ISO
- Old R-value approx 10
- New R-value 20

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## Marginal Cost

- \$25,000

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Poll Question:  
Is it always a good investment to add insulation?

- Ⓒ Yes
- Ⓒ No

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Fast Forward 1-  
year

- Ⓒ Call from Owner
- Ⓒ Energy Bill the same as the prior year
- Ⓒ \$2,000 per month

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Good Customer  
Service

- Ⓒ Drove to the office
- Ⓒ Bills almost identical cost at \$2,000 for the month of December

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What Changed?

- Ⓒ This was the year when Denver's Natural Gas price doubled
- Ⓒ Energy consumed was half of the prior year
- Ⓒ His return on the insulation was almost \$2,000 in one month
- Ⓒ Higher Percentage return on the insulation than on the products in the warehouse.

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## How about the NO answer?

- 200,000 Square foot paint storage warehouse.
- 20-ft storage racks filled with paint.
- Kept above freezing.
- One wall of truck loading doors.

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## Lots of calculations later....

- R-30 from R-10 saves about \$4,000 year.
- How much does 4-inches of Iso cost for a 200,000 sq ft building?
- What is the payback?

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## Some information

- In Colorado we have several "climates"
  - Alamosa 6B
  - Clear Creek 7
  - Denver and the surrounds 5B
- The different "climates" put different values on what is required

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## In Hot Climates

- Roofs have to be reflective
- Roofs have to be emissive
- R-values are still high

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### Section 402.3

#### Roof solar reflectance and thermal emittance

Low-sloped roofs directly above cooled conditioned spaces in Climate ones 1, 2 and 3 shall comply with one or more of the options in table C402.3.

- This does not apply to us!

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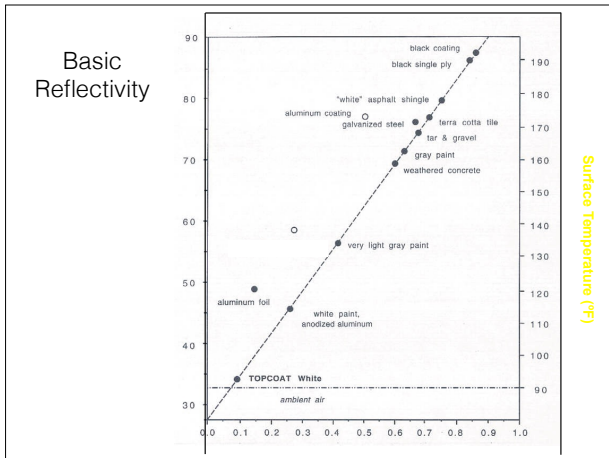
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## Residential: New Construction

- Table R402.1.2 Insulation requirements
- Ceiling R-value
  - Climate 5B 49
  - Climate 7 49

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## Section 402.2 Specific Insulation Requirements( Prescriptive)

- Section 402.2.1 Ceilings with Attic Spaces
- "...Similarly, where Section R402.1.2 would require R-49 insulation in the ceiling, installing R-38 over 100 percent of the ceiling area requiring insulation shall be deemed to satisfy the requirement for R-49 insulation wherever the full height uncompressed R-38 extends over the wall top plate at the eaves."

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What R-value is required?



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And how about now?



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- Where Section R402.1.2 would require insulation levels above R-30 and the design of the roof ceiling assembly does not allow sufficient space for the required insulation, the minimum required insulation for such roof/ceiling assemblies shall be R-30. This reduction of insulation from the requirement of Section R402.1.2 shall be limited to 500 square feet or 20 percent of the total insulated ceiling whichever is less. ....

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## Chapter 5: Existing Buildings

- Special rules for existing buildings
- Some of these will affect the roofing community

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## R501.1.1 Additions, Alterations, or Repairs

- General. Additions, alterations or repairs to an existing building, building system or portion thereof shall comply with Section R502, R503, or R504. **Unaltered portions of the existing building or building supply system shall not be required to comply with this code.**

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## Section R502: Additions

- New stuff has to meet the requirements

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## Section R503: Alterations

- R503, 1, 1 Building Envelope. Building envelope assemblies that are part of the alteration shall comply with Section R402.1.2 etc.....

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## Section R402.1.2 Insulation ...Criteria

- The building thermal envelope shall meet the requirements of Table R402.1.2, based on climate zone...

TABLE R402.1.2  
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT\*

CLIMATE ZONE	FENESTRATION U-FACTOR <sup>1</sup>	SKYLIGHT <sup>2</sup> U-FACTOR	GLAZED FENESTRATION SHGC <sup>3,4</sup>	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE	FLOOR R-VALUE	BASEMENT WALL R-VALUE	SLAB <sup>5</sup> R-VALUE & DEPTH	CRAWL SPACE WALL R-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.35	0.55	0.25	38	20 or 13+5 <sup>6</sup>	8/13	19	5/13 <sup>7</sup>	0	5/13
4 except Marine	0.35	0.55	0.40	49	20 or 13+5 <sup>6</sup>	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5 <sup>6</sup>	13/17	30 <sup>8</sup>	15/19	10, 2 ft	15/19
6	0.32	0.55	NR	49	20+5 or 13+10 <sup>9</sup>	15/20	30 <sup>8</sup>	15/19	10, 4 ft	15/19
7 and 8	0.32	0.55	NR	49	20+5 or 13+10 <sup>9</sup>	19/21	38 <sup>8</sup>	15/19	10, 4 ft	15/19

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# The Owner wants a Dormer

- Adding a dormer is an alteration
- Alterations require compliance with the new code
- The alteration does not touch the insulation beneath it
- Does the insulation in the attic have to be brought up to an R-38 continuous or just the area under the dormer?

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## Section 503.1.1 Building Envelope

- Building envelope assemblies that are part of the alteration shall comply with Sections....

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## Exceptions:

- EXCEPTION: the following alterations need not comply with the requirements for new construction provided the energy use of the building is not increased:
- 4. Roof recover
- 5. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.

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## Did you get that!

- 5. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.

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## This is where it gets interesting

- You have a house that is 100 years old
- For all that time it did not have any insulation
- You just added R-38→R-49
- Now it shows.....

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## Time to digress

- Temperature changes linearly with distance in a homogeneous layer



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## Thermal basics

- The change in temperature is always from the bulk temperature on one side to the bulk temperature on the other, but the rate of heat flow is higher the lower the R-value.

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## What This Means

- Snow has an R-value of approximately 1 per inch
- If the R-value in the house is an R-5
- When the R-value of the snow equals the R-value of the insulation the temperature at the interface is 1/2 of the total temperature change

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## Now it gets cool or warm depending on view point

- It the outside air temperature is 0°F
  - In Denver it rarely ever snows at less than 20°F
- And the inside air temperature of the house is 70°F
- Then the temperature at the interface is 35°F

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## And This Means...

- For an old poorly insulated house the snow starts to melt when there is 5 inches on the roof.
- The more it snows the warmer the bottom of the snow layer and the faster it melts.

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## SO...

- You may never see more than a 5 psf snow load on the house.
- (About 10 inches of Denver snow)

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But you just increased the R-value to 49  
And  
You added ventilation to keep the attic cold



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## Did You:

- Follow the code requirements?
- What is not in the code BUT should be checked?
- Guess what when I asked code officials about this one I was told. "We never thought about that."

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Poll Question:  
Does the code require you  
to get a permit to add  
insulation?

- Yes
- No

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## Section 504 Repairs

### Section R504 REPAIRS

R504.1 General. Buildings, structures and parts thereof shall be repaired in compliance with Section R501.3 and this section. Work on non-damaged components necessary for the required repair of damaged components shall be considered part of the repair and shall not be subject to the requirements for alterations of this chapter. Routine maintenance required by Section R501.3, ordinary repairs exempt from permit, and abatement of wear due to normal service conditions shall not be subject to the requirements for repairs in this section.

R504.2 Application. For the purposes of this code, the following shall be considered repairs:

2. Roof Repairs

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## What is a repair?

- Does not require a permit
- Routine maintenance
- Small area
- Normal Service

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## Chapter 4: Commercial Energy Efficiency

- Section C402 Building Envelope Requirements
- Section C402.1
  - 1. The opaque portions of the building thermal envelope shall comply with the specific insulation requirements of Section C402.2 and the thermal requirements of the R-value method...
  - 2. Solar reflectance
    - Not Our Problem

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## What are the R-value requirements?

- Insulation above the roof deck R-30
- Metal Buildings R-19 + R-11 liner
- Attic and other R-38

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## Section C402.1.1 Low-Energy Buildings

- The following low-energy building or portions thereof separated from the remainder of the building by thermal envelope assemblies complying with this section, shall be exempt from the Building Thermal Envelope provision of C402

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## Exemptions:

- Those with a peak design rate of energy usage of 3.4 BTU/hr-sq.ft or 1 watt per square foot of floor area for space conditioning
- Those that do not contain conditioned space
- Greenhouses

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## How Much Heat?

Example:

**house area = 2,500 ft<sup>2</sup>**  
**heating factor = 40 BTU/ft<sup>2</sup>**

**2,500 × 40**  
**= 100,000 BTU/hr**

with How to Calculate BTU Per Square Foot

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## What is 1 watt per square foot

- The equivalent of a 100 watt light bulb per 100 square feet of floor space. This is the total energy consumed, not just for lighting.

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## C402.2.1 Some Notes About Insulation

- Continuous layers must have the joints staggered
- Follow manufacturer's requirements
- Follow and other requirements from the IBC

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## C 402.2.2 Roof Assembly

- The minimum thermal resistance (R-value) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Table C402.1.3, based on construction materials used in the roof assembly. Skylight curbs shall be insulated to the level of roofs with insulation above the deck or R-5 whichever is less.

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- The minimum thermal resistance (R-value) of the insulating material installed either between the roof framing or
- continuously on the roof assembly shall be as specified in Table C402.1.3, based on construction materials used in the roof assembly.

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What about the church building that has wood framing below and a board stock above the roof deck?

- The code does not allow the two layers to be added.
- The IECC prohibits counting insulation that is laid on top of ceiling tiles.
- I would push this. Most Code officials can understand just adding above to supplement what is below for reroofing.

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Why does the Code not allow these combo systems?

- Situations like this



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## The first exception MAY handle this

- Continuously insulated roof assemblies where the thickness of insulation varies 1-inch or less and where the area weighted U-factor is equivalent to the same assembly with the R-value specified in Table C402.1.3.
- This means that the overall heat transfer coefficient can be used.

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## Second Exception: Tapered

- Where tapered insulation is used with insulation entirely above deck, the R-value where the insulation thickness varies 1 inch or less from the minimum thickness of tapered insulation shall comply with the R-value specified in Table 402.1.3.
- WAIT, What does this say? The minimum is the basis for the value.

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## This does not make sense!

- Heat loss is linear based on area weighted average, so this last requirement will caused a lot of extra insulation to be installed so the minimum meets the R-30 value.

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## Exceptions:

1. Continuously insulated roof assemblies where the thickness of insulation varies 1-inch or less and where the area weighted U-factor is equivalent to the same assembly with the R-value specified in table C402.1.3
2. Where tapered insulation is used with insulation entirely above the deck, the R-value where the insulation thickness varies 1-inch or less from the minimum thickness of tapered insulation shall comply with the R-value Specified in table C402.1.3

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## What Should you do?

1. You now have more training than many of the plans examiners
2. When asked for R-value provide the average R-value from the tapered supplier.
3. Remind the desk person that you want to comply by providing an R-30 for the project using insulation above the deck.

(many may not understand the literal interpretation of the code)

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## For Combo Systems

- They are allowed using the U-factor.
- U is the reciprocal of R, basically
- At worst you may need an engineer to write a letter

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## You have a 30,000 sq ft warehouse to reroof

- Minimal heating, just above freezing
- No Cooling
- Owner plans a long term hold as a warehouse
- Tapered system average  $R=23.06$
- Code guy will accept  $R=25$

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## R-value of Layers

- Inside air film 0.94
- Steel Roof Deck Negligible
- Insulation (accounted for above)
- Membrane 0.33
- Outside air film (outdoor winter) 0.17
- Total R-value of additional components 1.44

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## New R-Value = 24.5

- The roof has an area of 30,000 sq ft
- The Walls have an area of 14,000 sq.ft
- Wall R-value=3
- There are 108,000 cu. ft. of air in the building.

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- For a warehouse the air changes are 0.06 cfm/sq.ft.
- For this warehouse there is 1 air change per hour
- Heat lost through the walls and air changes 6,472 BTUs/hr/ $\Delta T^{\circ}F$
- The difference between the R-24.5 and R-25 is 25 BTUs/hr/ $\Delta T^{\circ}F$  for the building.

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This is the same as leaving a door open

- for about 2 minutes per hour



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## Energy Calculations:

- Have to consider a lot of factors
- Usually make assumptions that need to be checked.
- Can help owners make good financial decisions.

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For the average homeowner: IS is worth it to go from R-20 to R-49?

- Yes
- No
- Only if my company gets the contract.

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Thank you

- Make sure to sign up now for the CRA Fall Classes.
- The classes are small, but the learning is large.

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