



Building Science Bootcamp

Best Practices and Energy Codes

Attic Temperatures and Roof Ventilation



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Attic Temperatures Impact on Efficiency and Comfort



Traditional Building Methods:

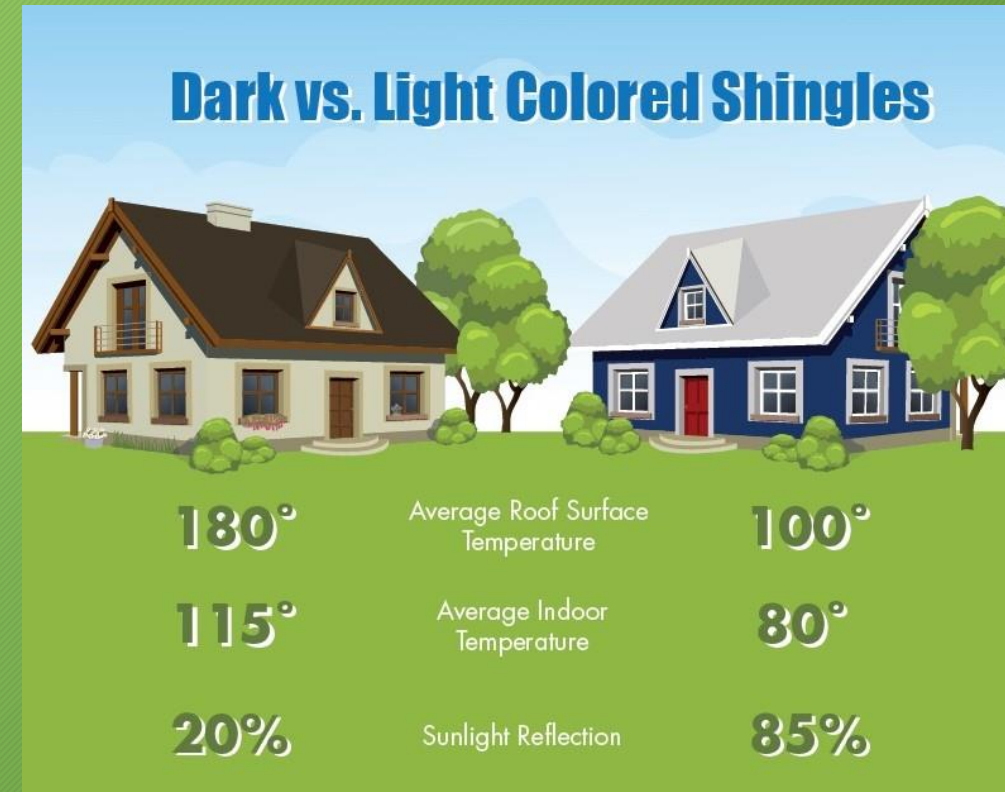
Summer Attic Temps = 125° to 150° F

Causes:

- Dark asphalt shingles,
- Inadequate ventilation,

Effects:

- Increases cooling load on building,
- Upper floors over-heating in summer,
- Reduces air-conditioning efficiency when HVAC is located in attic.



Attic Temperatures Impact on Efficiency and Comfort



The greater the difference in temperature between the indoors vs. outdoors and adjoining building cavities, the less-effective the insulation, and the harder the HVAC has to work:

The biggest difference in temperatures is between the house and the attic, and ductwork in cooling mode and the attic.

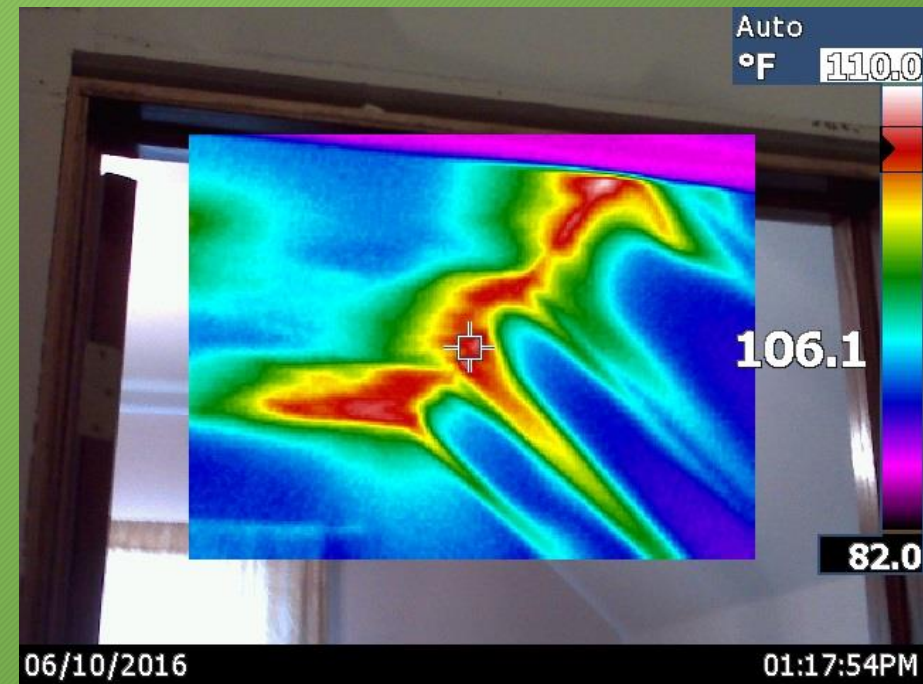
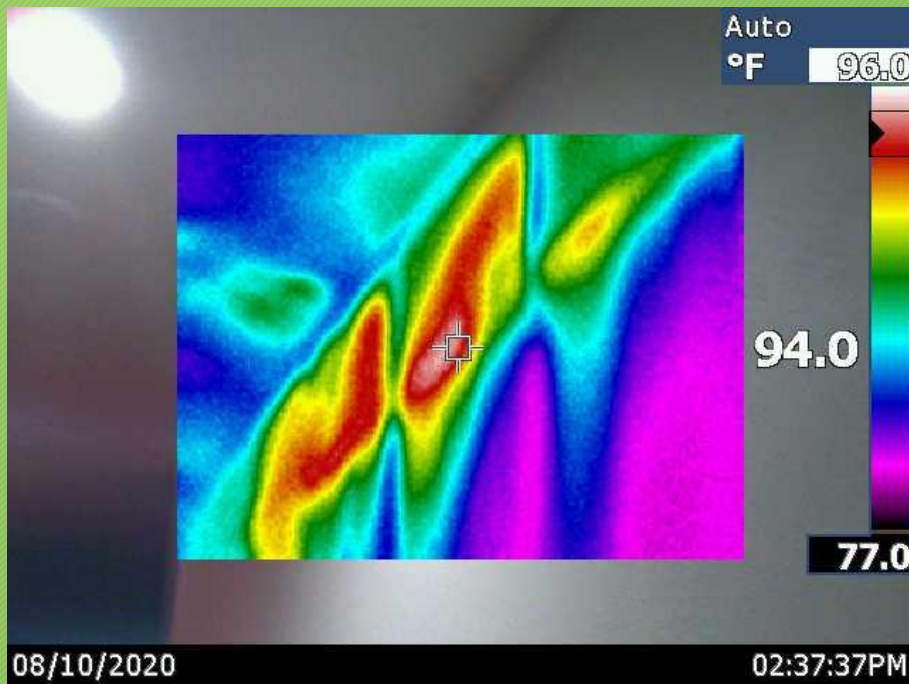
Component	R-value	Temp's	ΔT
Exterior Wall	13	92-75	18° F
Attic Kneewall	18	120-75	45° F
Floor Over Crawl Space	19	85-75	10° F
Ceiling	30	120-75	45° F
Duct in Attic	8	120-58	62° F

▲ T = temperature difference between 75° interior and temp range of the outdoors and adjoining building cavities.

Attic Temperatures Impact on Efficiency and Comfort



Infrared camera picture showing high attic temps affecting interior comfort and efficiency...



Attic Temperatures Impact on Efficiency and Comfort



Building Energy-Code Requires:

“One square foot net-free ventilation per 150 square feet of attic”

- This is twice the ventilation required by previous building codes,
- Typical Roof Vent = only 44 sq inches of net-free ventilation each,
- Three standard roof-vents equal less than 1 sq ft net-free ventilation,
- Larger vents = 1 sq ft ventilation each.



This large attic needs much more ventilation than seen here.

Attic Temperatures Impact on Efficiency and Comfort



Ridge Vent Approach:

- Ridge Vents provide 20 square inches net-free ventilation per linear foot,
- That's nearly twice as much ventilation as traditional roof-vents, in the same footprint.

Example: 40 foot ridge line =
20" net-free per foot x 40 ft =
5.5 sq ft net-free ventilation.



Attic Temperatures Impact on Efficiency and Comfort



Hip Roof Challenges:

- Builders like to hide vents on the back of the home,
- Hip roofs are hard to ventilate, due to minimal rear-facing roofing,

Solution:

Ridge-vents solve the hip-roof ventilation issue, and greatly reduce attic temps.



Attic Temperatures In Winter... Soffit-Venting and Low Insulation

2019 Fort Collins Thanksgiving Storm:

- Major Ice-damming event caused widespread damage to interior ceilings, walls and flooring,
- Inadequate insulation at eaves allows heat to escape home and melt snow, which then re-freezes as ice build up,
- Eaves (roof/wall junction) must **insulate and ventilate** within the tight space/height of 3.5 inches.



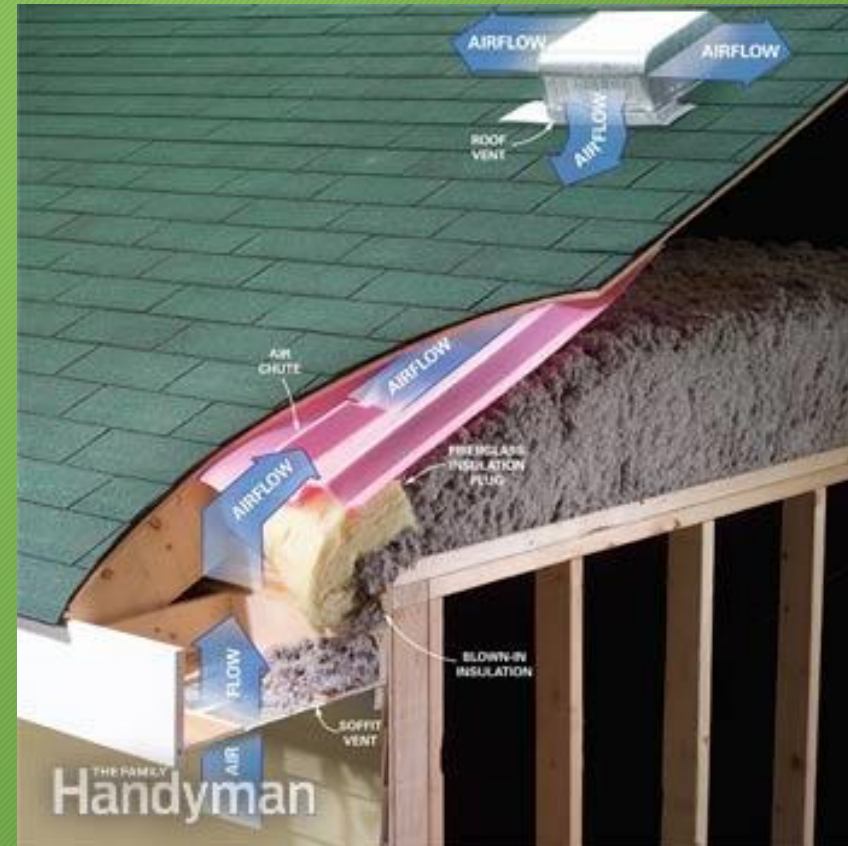
Restoration companies were overwhelmed with insurance claims and mitigation projects.

Attic Temperatures Impact on Efficiency and Comfort



Soffit-Vent Question:

In practice, do current methods & materials used in new construction meet building code requirements for durability, efficiency & occupant comfort?



Attic Temperatures

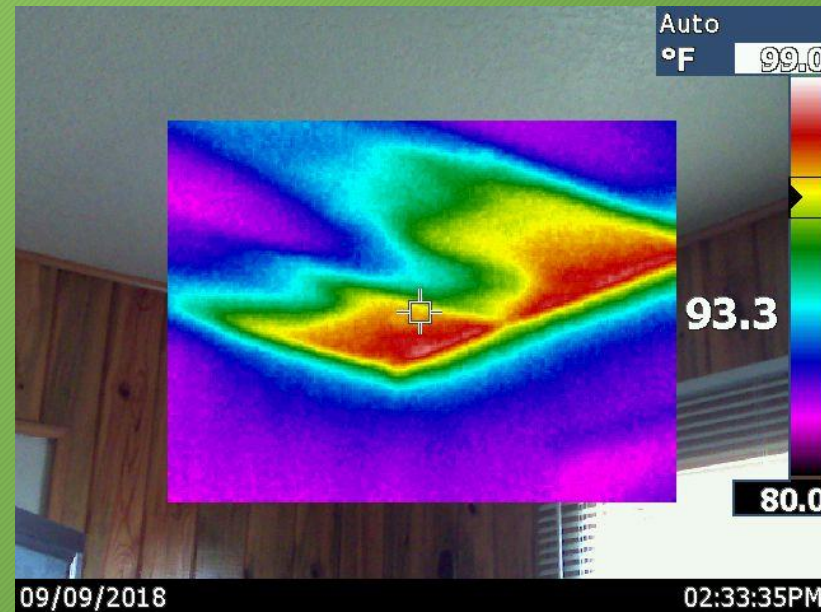
Soffit-Vent Wind-washing of Insulation



Fallen, ineffective cardboard baffles, allowing insulation to blow away.



Hot spots at every soffit vent are very common, especially in windy areas.



Attic Temperatures: Soffit-Vents Ideal vs. Typical Installation



Typical Problems:

- Seldom properly installed,
- Ineffective long-term, as foam and cardboard baffles degrade and fall down or blow away from soffit,
- Resulting in wind-washing at eaves (20% - 30% of homes),
- Blocked soffit vents (50% of homes),
- Risk of Ice-damming.



Attic Temperatures: Soffit-Vents Ideal vs. Typical Installation



Better than Average...

- Spray foam is an effective approach to isolate insulation from wind washing, and holds baffles in place,
- But thin-insulation coverage at the eaves is obvious and more common than expected.
- Note: Insulation machines must be turned down to avoid blowing fiberglass away from tight eaves, but installation crews are paid by the square foot and reluctant to sacrifice speed.



Spray-foam at bottom of soffit-vents
secures baffle and better isolates
ventilation from insulation.

Attic Temperatures: Impact on Efficiency and Comfort



“Deck-Vent” Advantages;

Better ventilation, durable, easier to install correctly, does not compromise insulation over time.



Deck-Vents ventilate above eaves and do not interfere with, nor affect insulation levels.

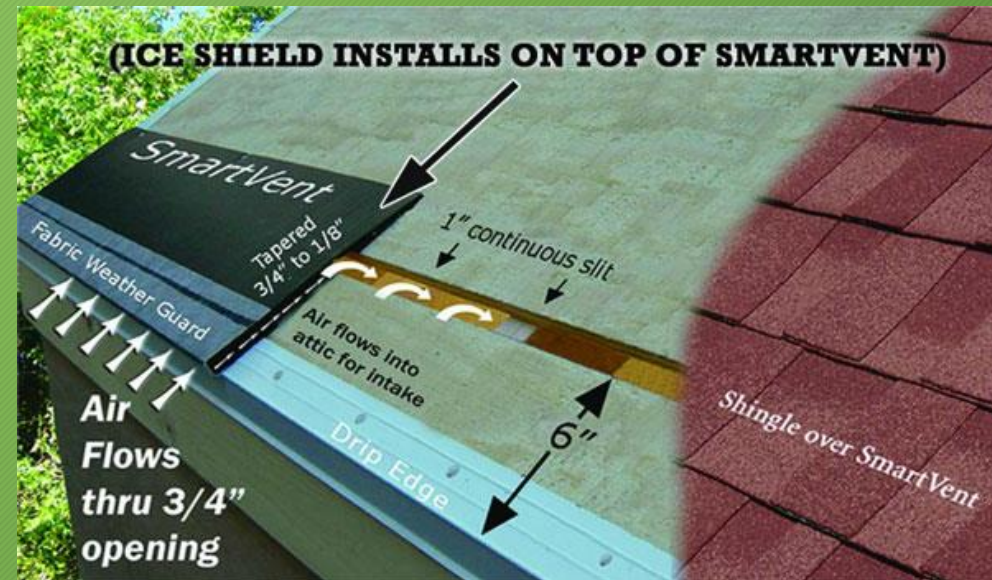
Attic Temperatures Impact on Efficiency and Comfort



New Deck-Vent Technology:

Eliminates need for hard to install poor performing soffit vents altogether.

Provides ample, and continuous ventilation to match ridge-vent,
Venting occurs above the level of insulation in attic.

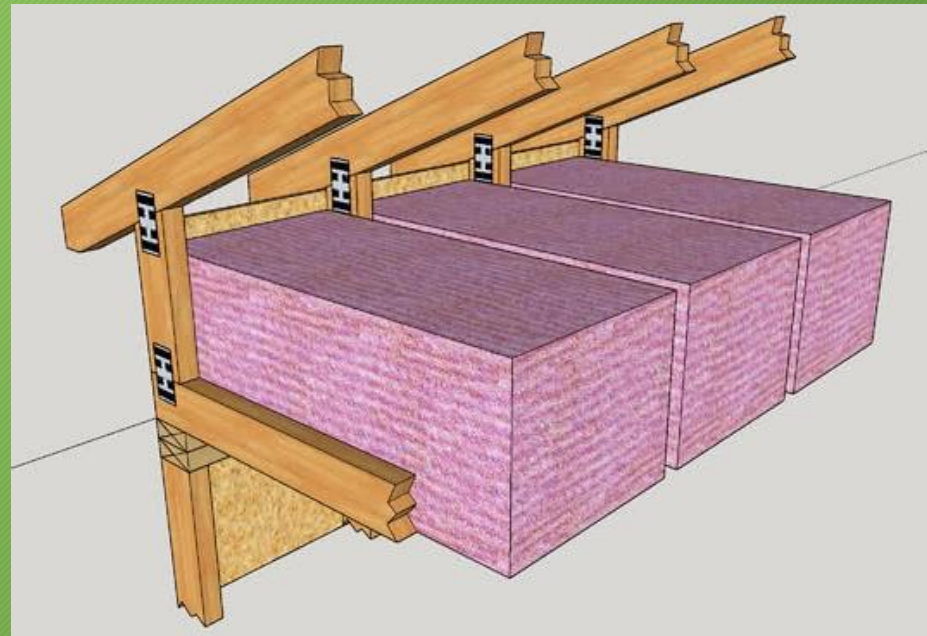


Attic Temperatures Impact on Efficiency and Comfort



Energy-Heel Trusses: Advantages include...

Allow for full-depth insulation at eaves/exterior walls, and allow for ample ventilation too, with OSB sheeting for “baffles”. It all works perfectly together!



Attic Temperatures Impact on Efficiency and Comfort



Attic knee-wall insulation mistakes are fairly common: Insulation needs “six-sided encapsulation” and no gaps between interior drywall and insulation surface. Architects and framers need to build 2 x 6 knee-walls.

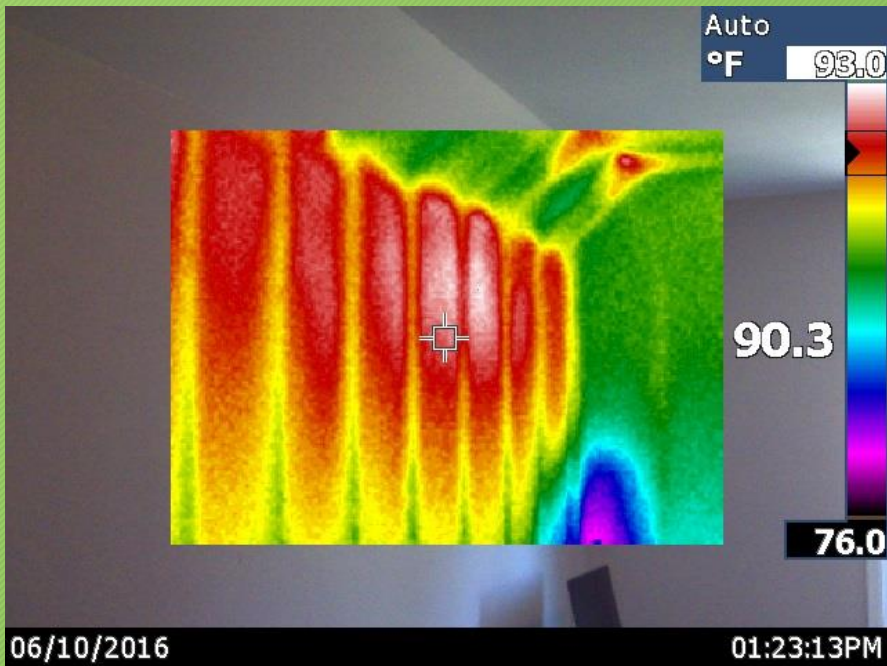


Looking down from the top of the knee-wall, at gaps between drywall and insulation:

Attic Temperatures Impact on Efficiency and Comfort



Incorrectly insulated knee-walls viewed with infrared camera on a hot summer day:



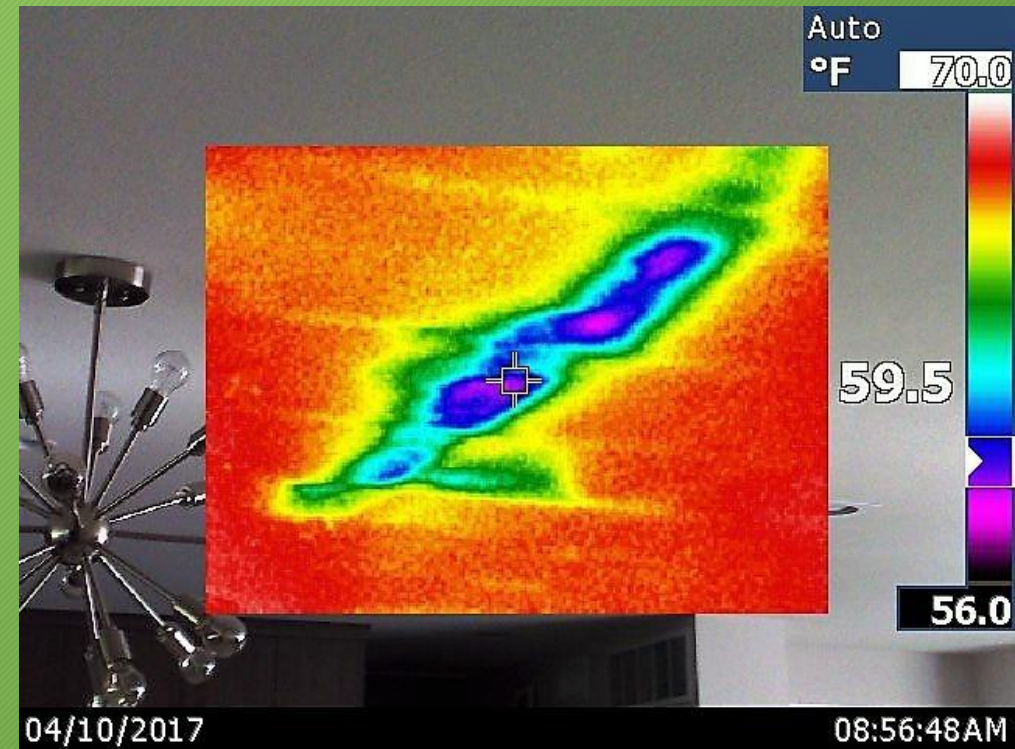
Elevated attic-temps amplify any installation mistakes, *for many years to come*:

Attic Temperatures Impact on Efficiency and Comfort



Disturbed insulation from service and home improvement contractors is inevitable;

- Electrical work like: ceiling fans, lighting fixtures, recessed lights,
- Solar tubes, whole house fans,
- Security systems, speakers, cable, entertainment,
- Attic-based HVAC system service,
- Kitchen & bath remodels, etc.



Be sure your contractor re-establishes insulation levels after completing projects.

Attic Temperatures and Ventilation Impact on Efficiency and Comfort

To Learn More about Energy Codes or
Green Building, please contact:

Community Development

<https://www.larimer.org/building>

Building: 970-498-7700 or

Planning: 970-498-7683



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