Loft insulation isn’t working in 80% of houses – and what you can do about it

One hour CPD training for architecture and construction professionals

Structure of presentation

- Introduction to loft insulation methods and regulations
- Explanation of the significant In-Use Factors which diminish performance, including several items of new research
- Alternative techniques to maximise insulation performance
- Questions

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Loft insulation: why it's needed

On average, 25% of a building's heat is lost through an un-insulated roof

(source: Energy Savings Trust)

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Loft insulation: Buildings Regulations

Type of application	Required U-value for the loft	Required thickness of insulation if laid on the floor of the loft*
New build	U = 0.13 (England and Wales) U = 0.11 (Scotland)	340mm 400mm
Retrofit	U = 0.16	270mm

* This assumes that mineral wool is used, with a thermal conductivity (k) value of 0.044 W/mK (as found in some of the common products). It is possible to have reduced thicknesses by using other products. It is also possible to insulate between the rafters; this creates a 'warm' loft and is not the subject of this presentation.

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Loft insulation: installation method

Step 1: lay insulation between the joists (usually 75 or 100mm tall)

Step 2: roll another layer at 90 degrees, to give the full thickness

Loft insulation: market penetration

- Of the 23 million lofts in the UK, 15 million have >100mm of insulation.
  (Source: DECC, 2016)

- The vast majority have been insulated using mineral wool rolls, though loose (such as blown) insulation or rigid insulation are used too.

So – once a loft is properly insulated, everything is OK right?

Unfortunately not, as there are significant In-Use Factors which mean that loft insulation doesn't work as well as it's meant to.

Assuming that the insulation has been fitted correctly, then some In-Use Factors are shown on the following slides.

Some common In-Use Factors:

- Compression of the loft insulation (e.g. by storage or boarding)
- Safe access paths installed in the loft, usually below the required 270mm of insulation.
- Householder (or maintenance contractor) action, e.g. moving the insulation away to create safe access pathways and then not replacing it properly
- Insulation deterioration after becoming damp from condensation build up in the loft
- Cold bridging through the joists

Some less common In-Use Factors:

- Vermin attack
- Wind scour ('washing') along the top of the insulation
- Accumulation of dust and debris, especially after roofing work
- Damage to the insulation through water ingress from the roof

The biggest issue is loft insulation compression

- Tests undertaken by the National Physical Laboratory showed that squashing loft insulation from 270mm to 100mm (4” joist height) doubled the U-value and the heat lost
- Compression from 270mm to 75mm (3” joist height) increased the U-value by 60%
- This is clearly very significant, and much greater than previously thought

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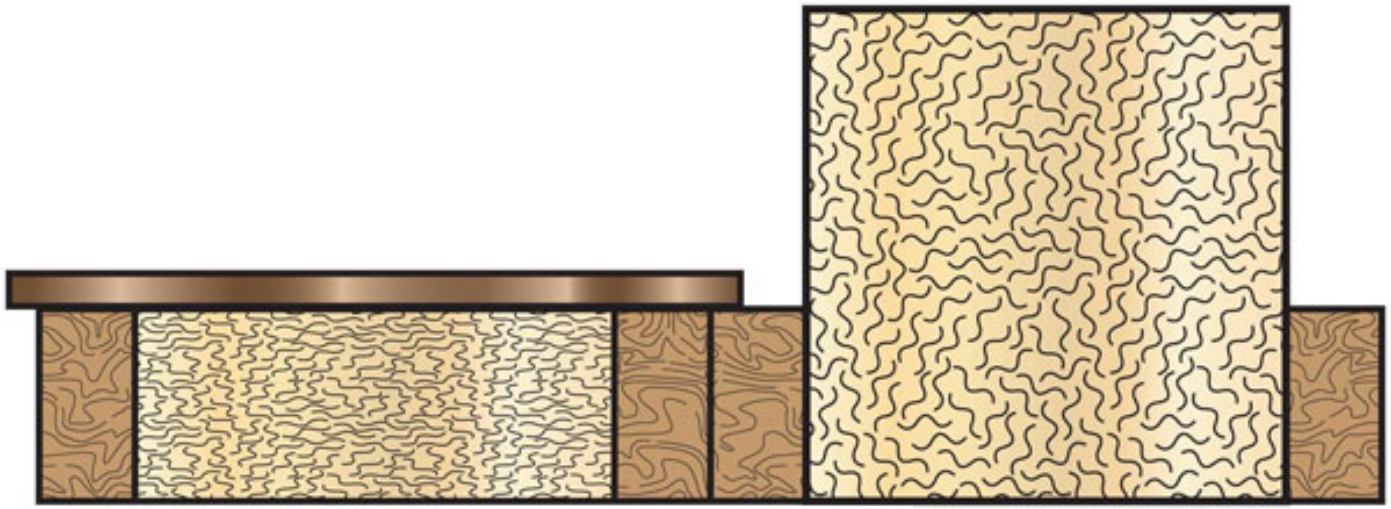
Loft insulation compression

SQUASHED: 100 mm
Thermal resistance: 3.09 $m^2.K/W$

RECOMMENDED: 270 mm
Thermal resistance: 6.11 $m^2.K/W$



NPL
National Physical Laboratory

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- This loft may look tidy, but from an insulation perspective, it is very poor. The insulation is either only 100mm (up to joist height), or has been squashed down to 100mm, thereby at least doubling the U-value

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One of the causes of compression is storage

Most lofts are able to support light storage (even in new build houses)

- The British Standard (BS5268) for modern truss roofs is that the loft floor must be able to support:
  - 25kg/m2 permanent dead load (for example for storage) plus
  - A concentrated point load of 90kg, which can be assumed to be the weight through the foot of one person walking around.
- Many lofts are much stronger than this
- Many building owners and occupiers to want to use their loft, as we shall see on the next slide.

Loft storage is in massive demand

<u>Biggest ever UK survey of loft users (6,000 responses)</u>

- 82% use their lofts for storage
- Of those, 78% say it's more than half full
- 78% say loft storage is important or essential
- Only 26% know that squashing insulation is bad for it

Source: Carbon Trust survey

Safety in lofts is also very important:

- There are more than 200 hospital visits each year in the UK owing to falls from, or through, lofts
  (source: RoSPA)
- Architects and builders have a requirement to design-in safe maintenance under CDM2015
- Landlords have a duty of care to their maintenance staff

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Access is required to items such as:

- Cold water storage tank
- Boiler
- Hot water cylinder
- MVHR
- Solar PV inverter
- Power and data cables
- Pipe work
- TV aerial
- Shower Pumps
- Extractor fans
- Domestic sprinkler systems
- Smoke detectors
- Warden Call
- Solar thermal expansion tank

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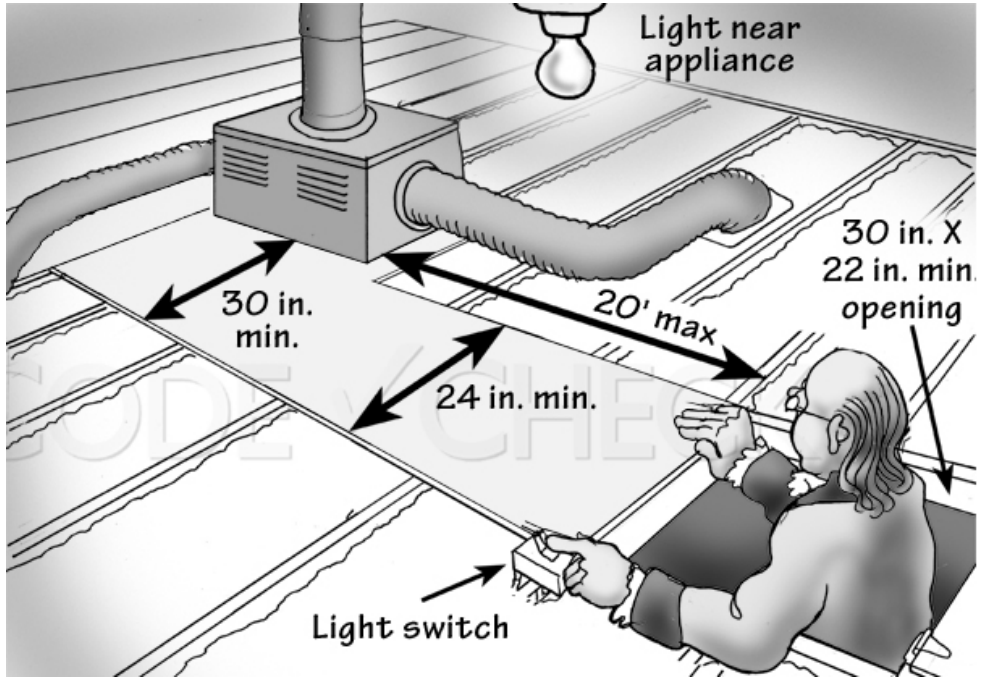
But safe access platforms can also cause the insulation to be compressed (or removed)



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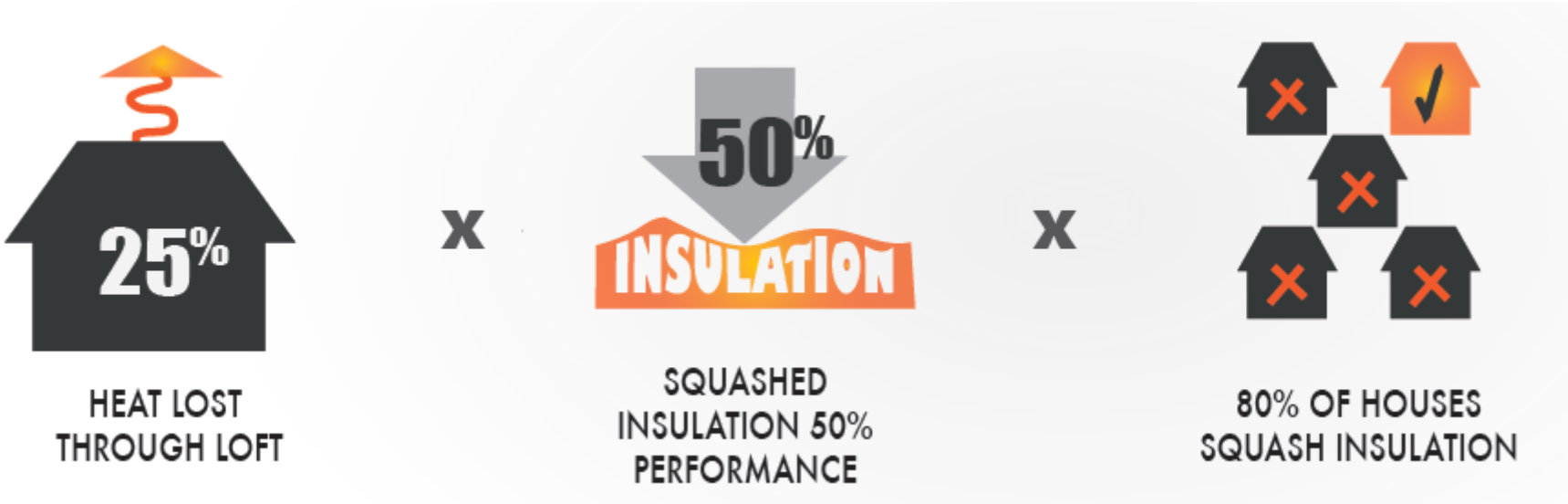
It all adds up….



Ofgem estimates that In-Use Factors reduce the effectiveness of loft insulation by 35%

So what are the alternatives?

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Raising the joists with timber?

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Raising the joists with timber is no longer best practice

1. This used to be common
2. However the extra timber is not only heavy and awkward to fit in a confined space, but also acts as a cold bridge through the insulation
3. If this method is going to be used, then the psi factor for the cold bridge has to be added into the overall U-value calculation for the loft under Part L1A of the 2013 building regulations. This may mean that increases in insulation are needed elsewhere

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Boarding on to rigid insulation?

Boarding on top of rigid insulation has risks

- Installers need to be careful of interstitial condensation, as moist air rising through the insulation will cool and may condense on the underside of the board
- It is recommended that there is at least a 50mm air gap between the top of the insulation and the underside of the board *(source: Buildings Research Establishment)*
- Large sections of rigid insulation are also hard to get through the loft hatch and fit inside a confined loft space
- Polystyrene rigid insulation and must not be allowed to touch electrical cables as they can cause the cable insulation to dissolve away (note this also applied to polyurethane which is often used in spray foam insulation)

New raised loft boarding products

- There are a number of new products on the market
- Only one has been approved by BBA for use in construction, as it is tall enough to meet modern insulation depths, strong enough to withstand the required loading and has enough of a gap to avoid interstitial condensation.
- That product is the LoftZone StoreFloor

LoftZone uses plastic supports and metal beams to raise the deck

The Buildings Research Establishment has calculated the thermal conductivity through the plastic supports to be negligible and they need not be considered in U-value calculations.

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Actual LoftZone storage deck photos

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LoftZone has also been used as a safe access platform, e.g. in schools

Summary

- Loft insulation In-Use Factors, in particular, compression are a major issue, with many houses being significantly affected
- Most traditional means to solve the need for storage space and safe access platforms are no longer appropriate
- The LoftZone StoreFloor is the only product for this purpose that has been approved by BBA for use in construction.

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Questions for the exam:

1. What proportion of households use their loft for storage? (35%, 50%, 82%)
2. If loft insulation is compressed from 270mm to 100m joist height, by how much does the U-value change? (It halves, it doubles, it stays the same)
3. What is the gap recommended by BRE between the top of the insulation and the boards, to prevent interstitial condensation on the underside of the boards (35mm, 50mm, 82mm).
4. What does Ofgem consider the total reduction in the effectiveness of loft insulation owing to In-Use Factors? (35%, 50%, 82%)
5. What is the British Standard for the loading of the bottom of truss roofs? (25kg/m2 permanent load plus a person walking around with a maximum point load of 90kg per leg; 50kg/m2 permanent load plus a person walking around with a maximum point load of 90kg per leg; 82kg/m2 permanent load plus a person walking around with a maximum point load of 90kg per leg).
6. Under which regulations are architects and builders required to design in safe maintenance access for items in the loft? (Part L1A, Working at Height Regulations, CDM 2015)

Answers:

1. 82%
2. It doubles
3. 50mm
4. 35%
5. 25kg/m2 permanent load plus a person walking around with a maximum point load of 90kg per leg
6. CDM 2015