



# How to implement roof insulation

As much as a quarter of a building's heat loss is straight through the roof. Insulating your roof can reduce that loss by up to 90%.

For air-conditioned buildings, there's another benefit too. Roof insulation reduces solar thermal gain during the warmest months of the year and cuts the need for cooling.

## The business case

Installing 250mm of rock wool blanket insulation in an office with an uninsulated 100m<sup>2</sup> pitched roof would cost between £600 and £800, excluding labour costs. Assuming an energy price of 4p/kWh, you would save around £150 a year and recoup the costs in around 5 years.

To keep the payback period under five years, it's a good idea to insulate flat roofs at the same time as doing other work – replacing the waterproof membrane, for example.

## The technology

There are many different types of insulating materials and installation methods. These are summarised in *Table 1*. Each material has a different thermal performance. Some products are made up of layers of materials, each with its own thermal and physical properties. Your choice of product depends on the type of roof, the available space for insulation, and ease of access.

Choosing a product can be fairly straightforward, but you may want to get advice and guidance from a specialist contractor or consultant. A flow chart to assist you in choosing your product is shown in *Figure 1*.

**Table 1** Roof insulation methods

Method	Material	Attributes	DIY?	Comments
Between wooden frame members and laterally across the frame members	Glass wool and rock wool blanket.	Average thermal insulation properties.	Yes	Insulate to a thickness of 250mm to 300mm. Costs around £6/m <sup>2</sup> for 270mm depth.
	Sheep wool and cellulose fibre blanket.	Average thermal insulation properties.	Yes	Renewable/recyclable option as a direct replacement for glass or rock wool blanket. Insulate to a thickness of 250mm to 300mm. Costs around £20/m <sup>2</sup> for 270mm depth.
	High-density slabs. Mineral and rock wool.	Good thermal insulation properties.	Yes – but requires measuring and cutting skills	Insulate to a thickness of 150mm. The amount of insulation needed depends on existing insulation. Costs around £14/m <sup>2</sup> .

Method	Material	Attributes	DIY?	Comments
<b>Blown into gaps and cavities and difficult to reach areas</b>	Glass wool and rock wool loose fill.	Average thermal insulation properties.	No	Insulate to a thickness of 250mm to 300mm. The amount of insulation needed depends on existing insulation. Costs around £10/m <sup>2</sup> for 250mm depth.
<b>Sprayed in place</b>	Foam-in-place, usually polyurethane.	Good thermal insulation properties.	Yes – but does take some skill.	Mainly for difficult to insulate, smaller areas and to prevent thermal bridging.  Can be combustible and emit toxic gases, although modern products usually have an added flame retardant. Fire rated expandable polyurethane foam can cost around £14 for a 750ml canister.
<b>Between wooden frame members and rafters</b>	High-density slabs. Mineral and rock wool.	Good thermal insulation properties.	Yes – but requires measuring and cutting skills.	Insulate to a thickness of 150mm.  The amount of insulation needed depends on existing insulation.  Costs around £14/m <sup>2</sup> .
	Rigid urethane boards with silver foil backing.	Good thermal insulation properties.	No	Insulate to a thickness of 80mm to 100mm. May need to insulate to a thickness of 150mm depending on the product and existing insulation. 80mm board costs around £14/m <sup>2</sup> .
<b>Stapled or battened to the underside of rafters</b>	Multilayer quilted foil system.	Good thermal insulation properties.	Yes – but does take some skill.	Requires fixings and accurate cutting.  Costs for a single layer are around £12/m <sup>2</sup> .
<b>Extra layer of insulation applied to the underside of flat roof using studs or other fixing method</b>	50mm insulated plasterboard lining.	Good thermal insulation properties.	No	Very effective at reducing the U-value of a roof, but will not – on its own – achieve a U-value of 0.3 W/m <sup>2</sup> .K. This method will reduce the height of a room and involves extra costs for re-decorating and electrical work. Vents may also need to be relocated. Costs around £17/m <sup>2</sup> .
	Rigid insulating boards: polyurethane, polystyrene foam, polyisocyanurate foam, phenolic foam and so on.	Very good thermal insulation properties.	No	Very effective at reducing the U-value of a roof. One layer may be enough to achieve a U-value of 0.3 W/ m <sup>2</sup> .K.  This method will reduce the height of a room and involves extra costs for re-decorating and electrical work. Aesthetics could be an issue. Vents may also need to be relocated. Costs around £9/m <sup>2</sup> for 75mm board.
<b>Insulating layer fixed to the outer surface of the flat roof</b>	Rigid insulating boards, probably load-bearing with weatherproof membrane cover.	Good thermal insulation properties.	No	Probably the most expensive type of roof insulation, both in materials and installation costs, but often the only solution for many flat roofs. Insulate to a thickness of 80mm to 100mm. May need to insulate to a thickness of 150mm, depending on product and existing insulation. Costs of installation could be from £70/m <sup>2</sup> to £140/m <sup>2</sup> .

**Figure 1** Product selection flowchart.

Please note – This will be presented as a flowchart once the contents are agreed.

Roof Insulation	Roof Insulation	Insulation at rafter.	High density slabs; glass wool and rock wool.
			Rigid urethane boards with silver foil backing.
			Multilayer quilted foil system.
		Insulation at joist.	Glass wool and rock wool blanket.
			High density slabs; glass wool and rock wool.
			Sheep wool.
		Poor Access.	Glass wool and rock wool loose fill.
	Difficult to insulate.	Foam in place; polyurethane.	
	Flat	Internal insulation.	50mm insulated plasterboard lining.
			Rigid insulation boards; polyurethane, polystyrene foam, polyisocyanurate foam, phenolic foam etc.
External insulation.		Rigid insulation boards, probably loadbearing with weatherproof membrane cover.	

## Applications

The following table outlines insulating methods for particular locations within the roof.

**Table 2** Placement of roof insulation within a range of roof structures

Location	Method	Advantages	Disadvantages
Above and on top of the ceiling level	Blankets or rigid boards between wooden frame members and laterally across the frame members.	Even levels of insulation achieved between wooden frame members.	Quality and effectiveness can be installation dependent.
		Thermal bridging reduced through lateral insulation. Additional lateral layer reduces the potential for gaps that allow heat loss.	Poorly sized or cut insulation leaves gaps that allow heat loss.
	Blown into gaps and cavities and difficult to reach areas.	Allows difficult to reach areas to be insulated.	Difficult to ensure even coverage when there are obstructions.
	Sprayed in place.	Wide coverage with the potential for an even finish.	Quality and effectiveness can be installation dependent. Overspray and different levels of insulation possible. Services can be covered by insulation which can lead to overheating.

Location	Method	Advantages	Disadvantages
Between rafters	Rigid boards between wooden frame members and rafters.	Ease of installation. Even levels of insulation achieved between wooden frame members.	Quality and effectiveness can be installation dependent. Poorly sized or cut insulation leaves gaps that allow heat loss. Thermal bridging through wooden frame members and rafters not addressed.
	Stapled or battened to the underside of rafters.	Thermal bridging reduced.	Potential to reduce available height within the room.
Between the wooden frame or joists of a flat roof	Blankets or rigid boards between wooden frame members.	Ease of installation. Even levels of insulation achieved between wooden frame members.	Thermal bridging through joists not addressed.
	Blown into gaps and cavities and difficult to reach areas.	Allows difficult to reach areas to be insulated.	Difficult to ensure even coverage when there are obstructions.
Underside of a flat roof	Extra layer of insulation applied to the underside of flat roof using studs or other fixing method.	Ease of installation.	Potentially an increased risk of interstitial condensation. Potential to reduce available height within the room.
External surface of the roof	Insulating layer fixed to the outer surface of the flat roof.	Reduced risk of interstitial condensation. Potential for flat roof to be paved and used for services or outside space.	Fatigue of weatherproof membrane through increased surface temperature fluctuations. Insulant damaged by heat during construction.

## Specification checklist

The following table details what you need to consider and what preparatory work is required before installing insulation.

Considerations/Actions	Comments
Type of roof.	
Dimensions of roof.	So that you can calculate costs and energy savings.
Condition of roof.	If the roof is in poor condition, insulation work could be carried out alongside other repair work.
Estimated U-value and existing insulating materials.	So that you can calculate costs and energy savings.
The amount of energy used to heat the building; any complaints from users of the building.	Insulation work may be needed to keep users of the building comfortable.
Access to roof.	
Possible complications: items stored in roof space, water tanks, pipework, electrics, lighting and health and safety aspects.	Extra work will add to the overall cost.
Any disruption to activities.	You may have to temporarily move occupants or activities to other parts of the building.
Assess the best type of insulation based on target U-values and other considerations, such as load bearing, weatherproofing, fire retardant properties and so on.	What will give you the best energy savings and ensure you reach target U-value? Get advice from specialists.
Assess the best installation method.	See Applications section and, if necessary, get advice from specialists.
Get quotes and compare expected benefits with costs.	
Take images with a thermal imaging camera before and after the roof insulation is installed to check its effectiveness.	

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## Commissioning checklist

As long as an experienced and professionally registered contractor carries out the work, there should be no problem with installation.

A thorough visual examination is usually enough, but it's a good idea to take a thermal image with a thermal imaging camera before and after the roof insulation is installed to check its effectiveness. This needs to be done during the colder months when the heating is switched on. The before and after images should be taken in similar weather conditions.

## Common problems

- There are nearly always access issues to some parts of a roof. Getting safe access can add cost to the work and may call for a different insulation solution.
- The risks of working at heights need to be dealt with properly and thoroughly. Use a professional contractor to carry out the work where working at heights is an issue.
- Your day-to-day activities in the building could be disrupted, but this tends not to be too problematic. Most of the work is carried out in areas not used by occupants.
- Insulating flat or low sloping roofs is very much more expensive and should be carried out by professional contractors. One of the main costs is accommodating skylights, access hatches, vent outlets, ducting, drainage channels, aerials and masts.
- Pitched roofs need ventilation to prevent condensation. Pipes and ducting also need to be insulated to avoid condensation and freezing.

## Finding a supplier

Your local builder should be able to insulate a pitched roof. On a roof of 100m<sup>2</sup>, costs will be between around £800 and £1,000 for ceiling level insulation and £3,000 to £4,000 for insulating between the roof rafters. Insulating a flat or low sloping roof costs more and you will need to get quote to get a better idea of prices. As a rough guide, though, it could cost between around £80/m<sup>2</sup> to £130/m<sup>2</sup> for 100mm thick, high-density insulation blocks covered with an impermeable membrane.

Useful contacts for further information include:

### **The National Insulation Association (NIA)**

08451 636363

[www.nationalinsulationassociation.org.uk](http://www.nationalinsulationassociation.org.uk)

### **Thermal Insulation Manufacturers & Suppliers Association**

01420 471624

[www.timsa.org.uk](http://www.timsa.org.uk)

### **Federation of Master Builders (FMB)**

020 7242 7583

[www.fmb.org.uk](http://www.fmb.org.uk)

[T-Zero](#)