Sustainable Backwell Insulation Workshop

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Contents

- Why insulation is important
- Energy efficient refurbishment
  - inc. costs & payback
- Insulation materials
  - Thermal properties & environmental ratings

Why is insulation important?

- Financial
  - saves money, affordable warmth
- Environmental
  - reduces the burning of fossil fuels & CO_2 emissions
- Social
  - provides warmer, healthier homes

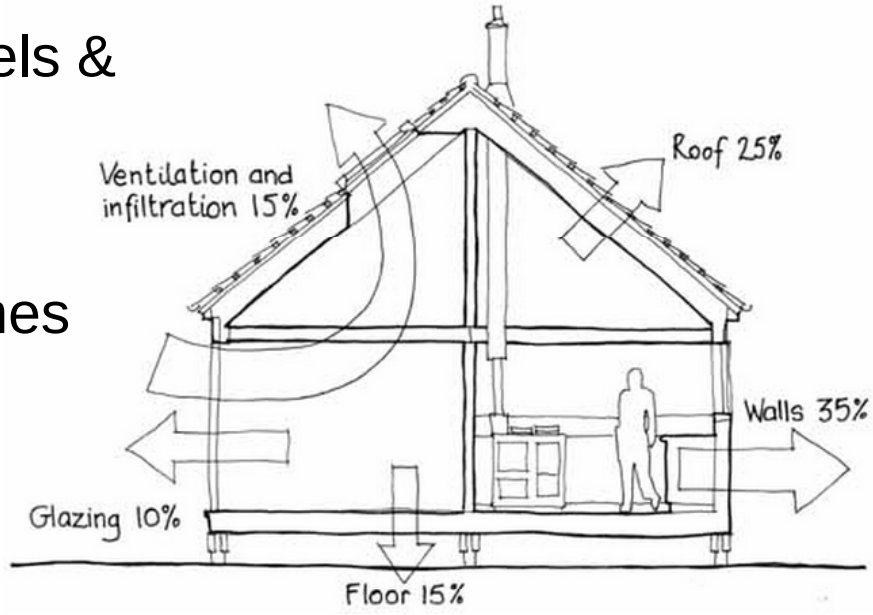


Image source: Reducing heat losses in existing buildings , at: www.action21.co.uk

Financial

- The average UK household spends over £1,300 on fuel every year…
- …but savings of approximately £340 a year could be made by being more energy efficient
- Fuel prices are increasing and this will continue
- Over 3 million households in England are in fuel poverty

Environmental

- Burning fuels releases CO_2 into the atmosphere, the main cause of global warming
- Domestic households are responsible for a quarter of all CO_2 emissions
- We could cut this significantly by being more energy efficient

Social

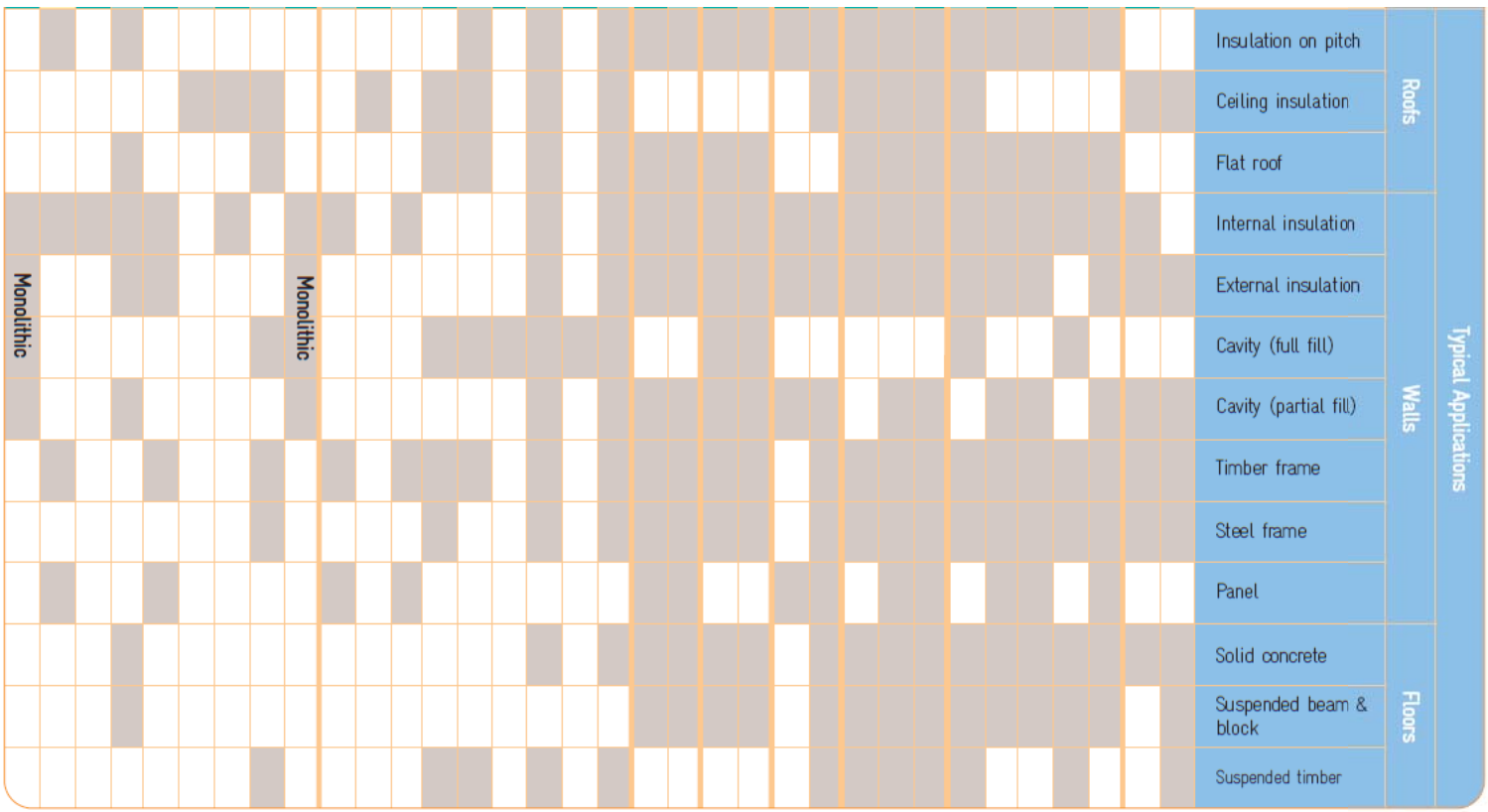
- Improved Health
  - 30 - 40,000 people die of cold-related illnesses every year
  - 1/3 of all housing falls below the decent homes standard
  - Non-decent housing leads to and exacerbates cold and damp-related illnesses e.g. respiratory problems
- Social Exclusion
  - Worry about inviting people round to their house if it is damp and cold

Insulation – thermal properties

- Heat (energy) flows from a warm area to a cold one (e.g. inside to outside a house)
- Insulation is a material or combination of materials that has a low rate of thermal conductivity (i.e. low rate of heat transfer from one area to another)
- The thermal conductivity of a material is measured in: W/mK – Watts (energy) per metre per degree Kelvin (same scale as Celsius)
- The overall heat transfer rate of a building section is measured in: W/m^2K or U-value

Insulation Materials Chart		Environmental Rating[2] (BRE Green Guide)	Insulant thickness (mm) to achieve U-value = 0.25W/m²/k[3]	Range of Thermal Conductivities[4] (W/mK) Lower numbers indicate better thermal performance								
				0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08
Highest performance	Vacuum Insulated Panels	-	30	0.008								
	Aerogel	-	50-55		0.013 0.014							
Polyurethane (PU)	Polyurethane with pentane up to 32kg/m³	A	105-115			0.027	0.03					
	Polyurethane soy-based	-	100-145			0.026	0.038					
	Foil-faced Polyurethane with pentane up to 32kg/m³	A	75[5]			0.02						
	Polyurethane with CO_2	-	130				0.035					
	In-situ applied Polyurethane (sprayed or injected)	-	80-100			0.023 0.028						
Polyisocyanurate (PIR)	Polyisocyanurate up to 32kg/m³	A	95-105			0.025 0.028						
	Foil-faced polyisocyanurate up to 32kg/m³	A	80-85[5]			0.022 0.023						
	In-situ applied polyisocyanurate (sprayed)	-	80-100			0.023 0.028						
Phenolic foam (PF)	Phenolic foam	-	80-95			0.020 0.025						
	Foil-faced phenolic foam	-	75-85[5]			0.020 0.023						
Expanded Polystyrene (EPS)	Expanded Polystyrene up to 30kg/m³	A+	115-165				0.03	0.045				
	Expanded Polystyrene with graphite (grey)	-	115-120				0.03 0.032					
Extruded Polystyrene (XPS)	Extruded Polystyrene with CO_2	-	95-140			0.025	0.037					
	Extruded Polystyrene with HFC 35kg/m³	E	110-120			0.029	0.031					
Wool and fibre	Glass wool [up to 48kg/m³]	A+	135-180				0.03	0.044				
	Glass wool [equal/greater than 48kg/m³]	-	155				0.036					
	Stone wool [less than 160kg/m³]	B to A+	150-160				0.034 0.038					
	Stone wool [160kg/m³]	C	160-170				0.037	0.040				
	Sheep's wool [25kg/m³]	A	150-215				0.034		0.054			
	Cellulose fibre [dry blown 24kg/m³]	A+	150-190				0.035	0.046				
	Hemp fibre	-	165				0.039					
	Polyester fibre	-	150-180				0.035	0.044				
	Wood fibre (WF)	-	145-225				0.039			0.061		
Alternative	Hemp lime (monolithic)	-	260[6]							0.067		
	Cotton	-	165-170				0.039	0.04				
	Cork [120kg/m³]	A	155-200					0.041	0.055			
	Vermiculite	-	235				0.039			0.06		
	Perlite (expanded) board	-	190						0.051			
	Celular glass (CG)	C-D	140-185				0.038		0.05			
	Flexible thermal linings	-	n/a[7]					0.04		0.063		
	Strawboard [420kg/m³]	C	295									0.081
	Straw bale (monolithic)	A	175-235[6]					0.047		0.063		

Source: EST CE71 - Insulation materials chart – thermal properties and environmental ratings



Source: EST CE71 - Insulation materials chart – thermal properties and environmental ratings

Energy efficient refurbishment

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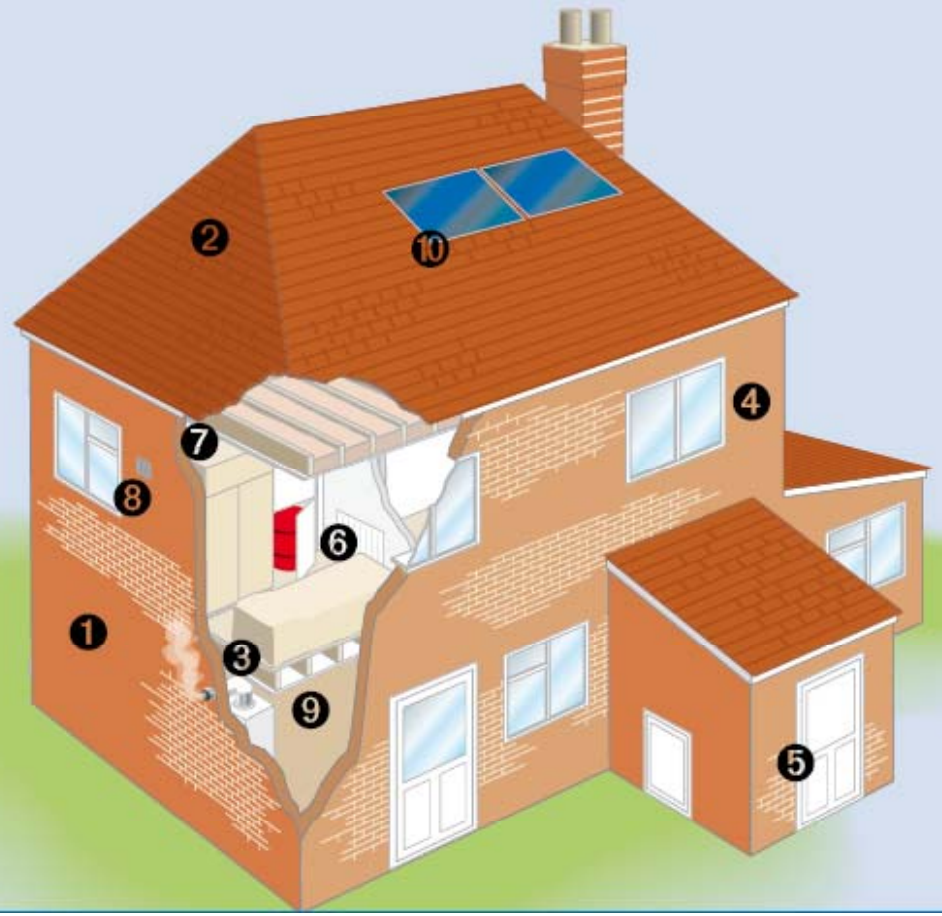
Table 2.1 Recommended improvements

1. Walls
2. Roofs
3. Floors
4. Windows
5. Doors
6. Space heating and hot water
7. Airtightness
8. Ventilation
9. Lights and appliances
10. Renewable and low-carbon technologies



Cavity wall insulation

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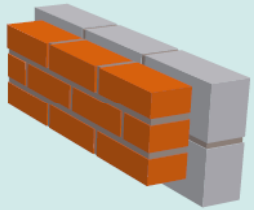
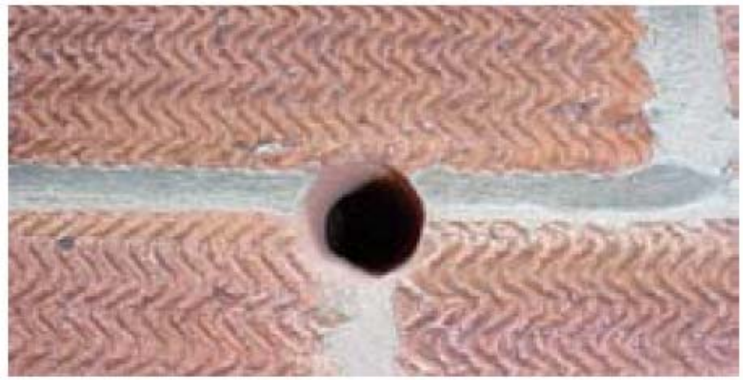
Identifying a cavity wall



- Cavity walls are built using two skins of bricks, or brick and blockwork, with a cavity (gap) in between.
- A brick cavity wall usually has the bricks placed lengthways (stretcher bond).
- The walls are held together using either metal or, more recently plastic, wall ties.
- The cavity is normally 50-60mm wide.

	Typical
Annual saving	£130-160
Installed cost	around £260
Installed payback	less than 2 years

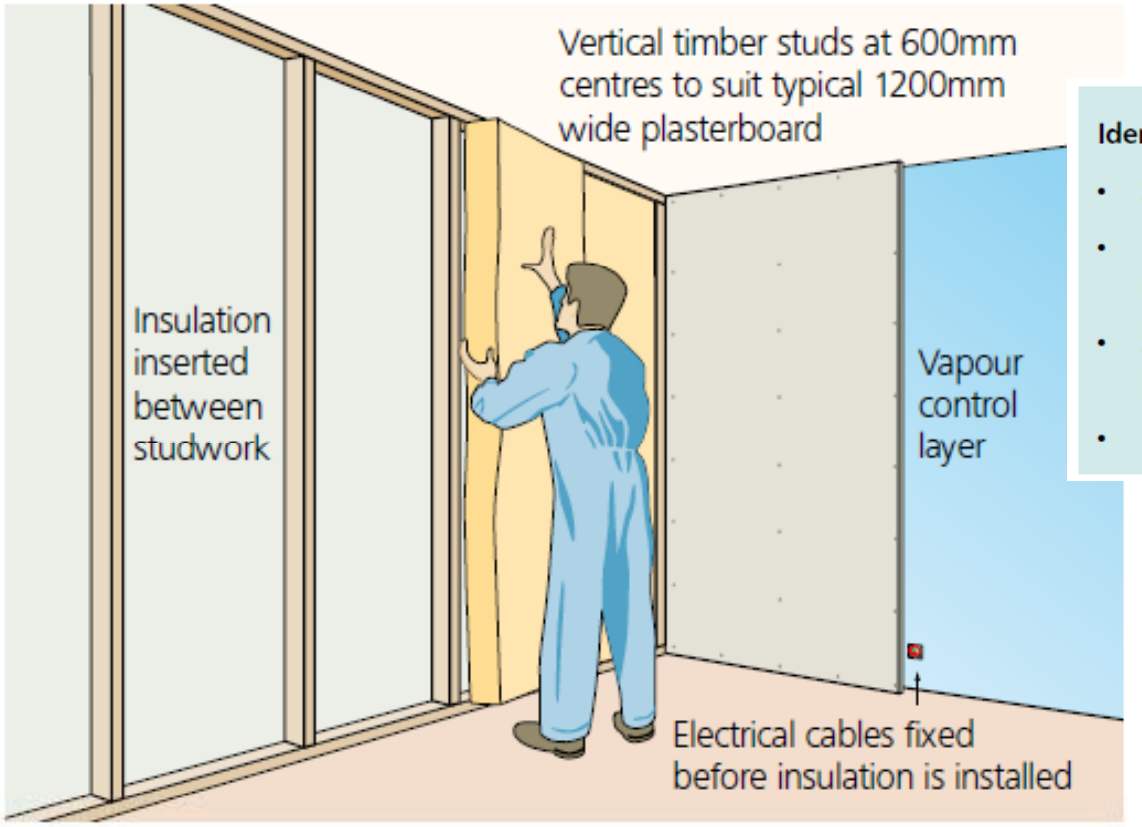


An injection hole prior to filling

Insulation being injected into the wall

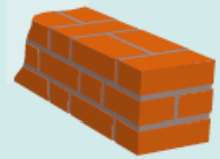
Source: EST GPG171 – Domestic energy primer – an introduction to energy efficiency in existing homes

Solid wall insulation – insulated studwork



Fitting insulated studwork

Identifying a solid wall

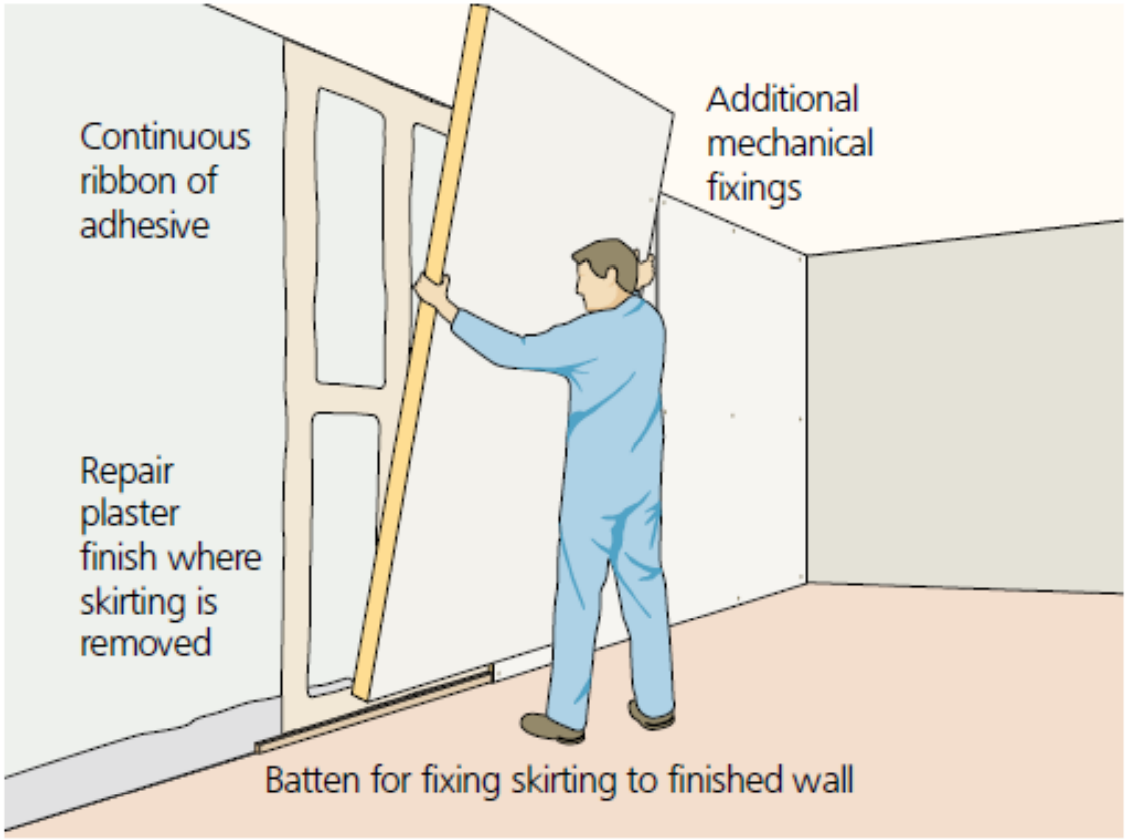


- Solid walls are made mainly of brick or stone.
- Bricks are placed head-on and lengthways (such as Flemish and English bond types).
- Solid brick walls are usually 220-225mm thick; more so for stone walls.
- Most pre-1930 dwellings have solid walls.

	Typical
Annual saving	£270 -£340
Installed cost	from £40/m²

Source: EST GPG171 – Domestic energy primer – an introduction to energy efficiency in existing homes

Solid wall insulation – rigid insulation board

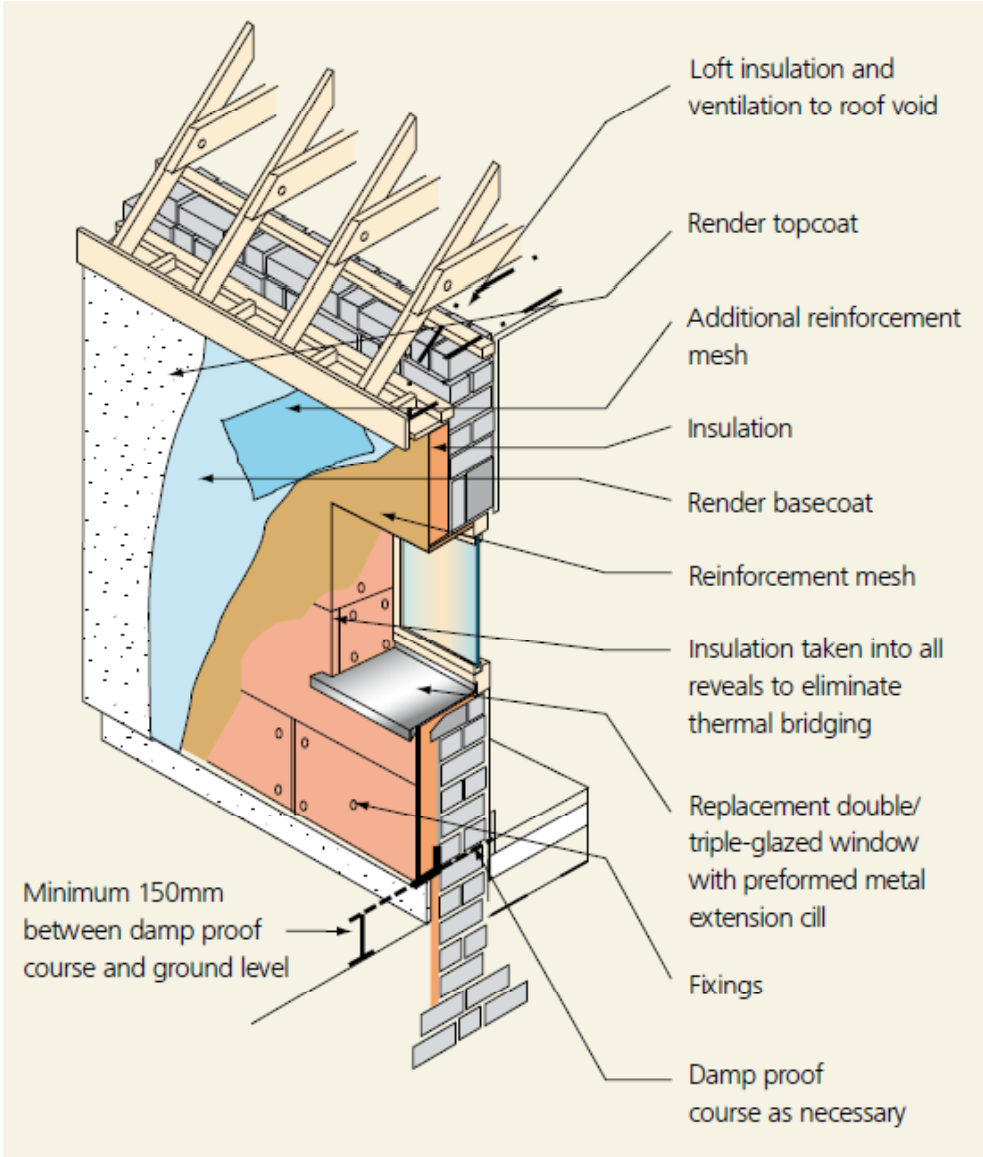


Internal insulation:

- ✓ Is cheaper than external insulation.
- ✓ Is suitable for experienced DIY enthusiasts.
- ✓ External wall appearance is maintained.
- ✓ Easier to install and maintain than external cladding.
- ✓ Room surfaces warm up quickly, so internal insulation is well-suited to houses heated only in the morning and evening.
- ✗ Can leave thermal bridges.
- ✗ Fixing of heavy items can be more difficult (although special fixings can be purchased).
- ✗ Reduced room size can be critical in small rooms.
- ✗ Skirting boards, door frames and electrical fittings need to be re-positioned.
- ✗ Disruptive to the tenants.

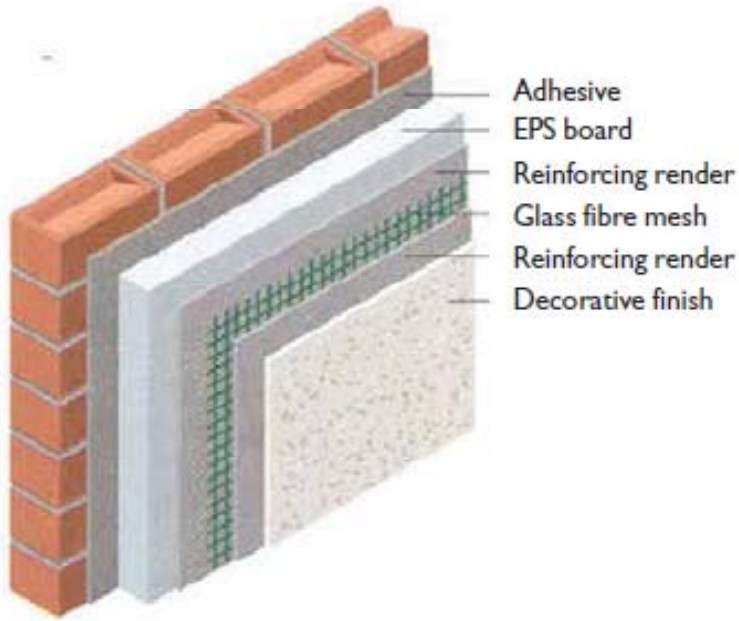
Source: EST GPG171 – Domestic energy primer – an introduction to energy efficiency in existing homes

Solid wall insulation – wet render system



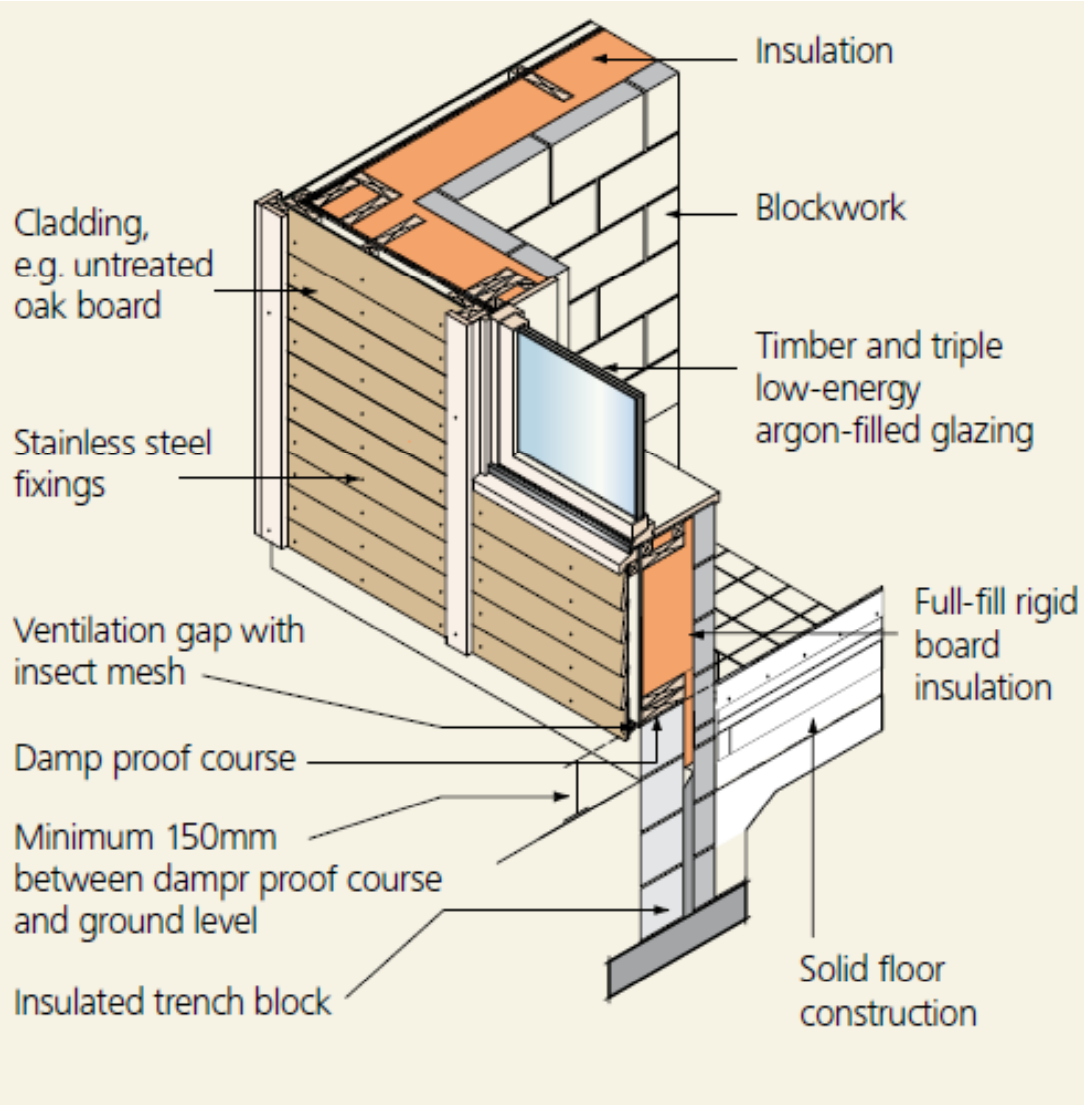
	Typical
Annual saving	£290-£350
Installed cost*	from £1800
Installed payback	5-6 years

*This is a marginal cost, if the walls are being repaired anyway.



Source: EST GPG171 – Domestic energy primer – an introduction to energy efficiency in existing homes and CE97 - Advanced insulation in housing refurbishment

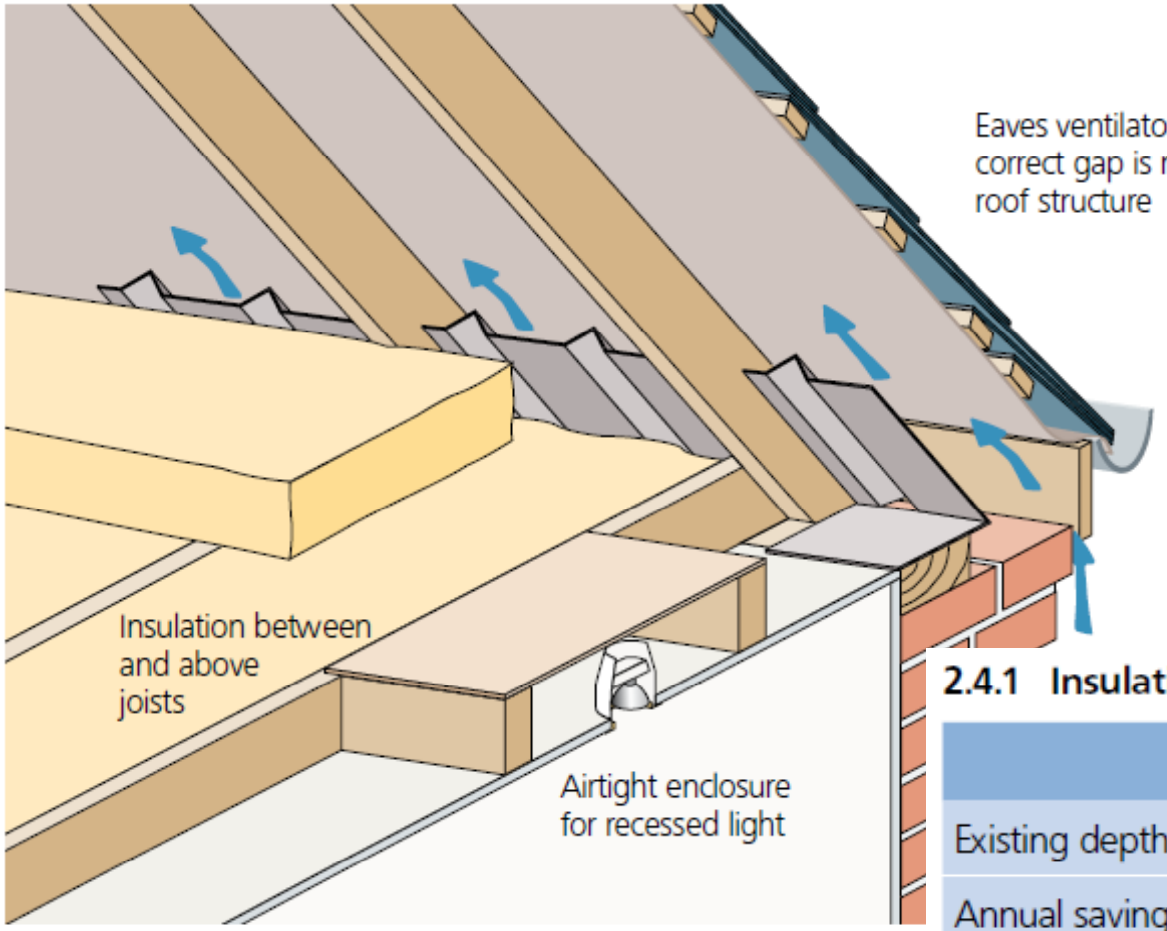
Solid wall insulation – dry-cladding



Brick slip cladding

Source: EST GPG171 – Domestic energy primer – an introduction to energy efficiency in existing homes

Pitched roofs with lofts

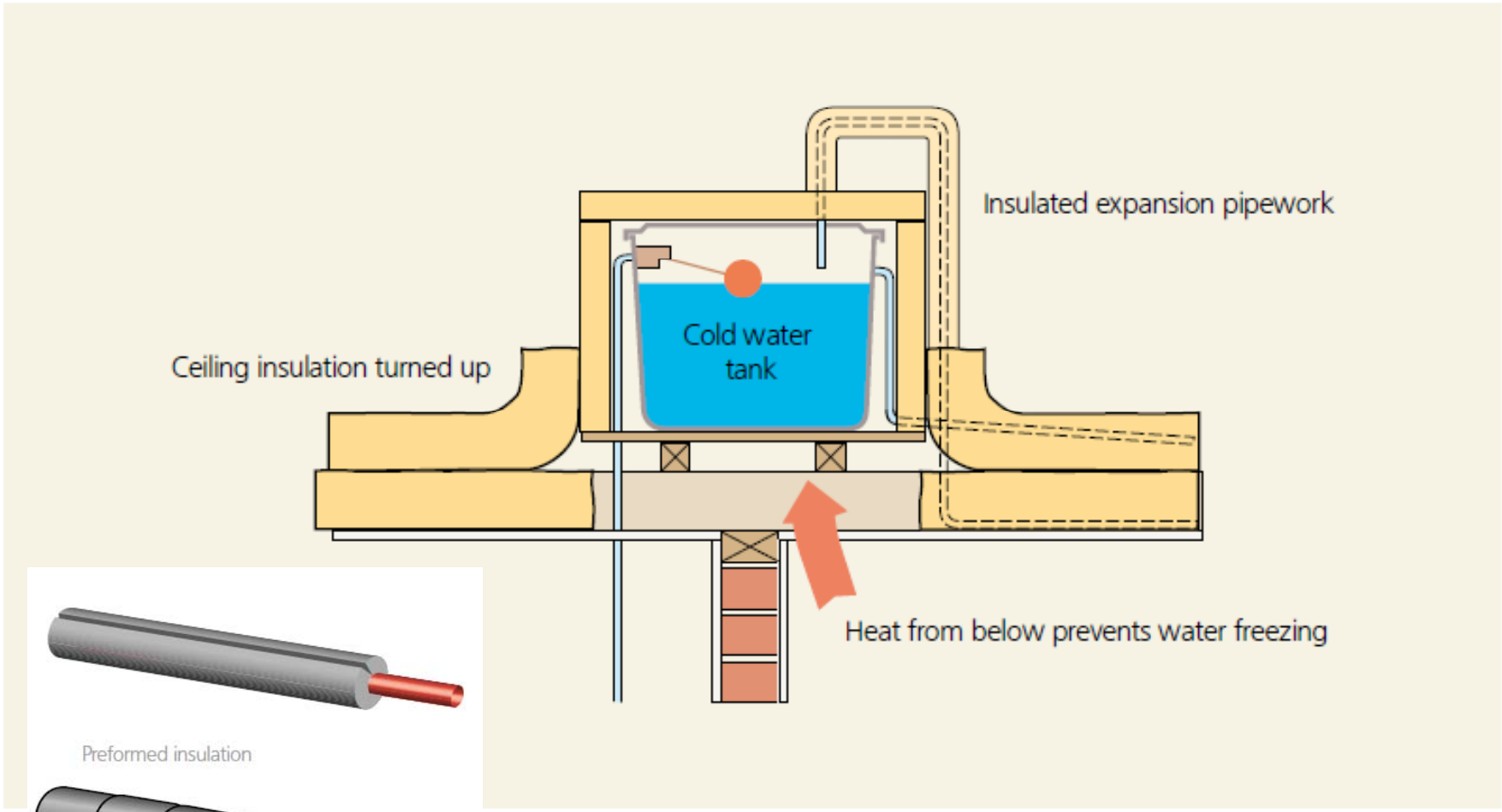


2.4.1 Insulating between joists to 300mm

	Typical	
Existing depth	0mm	50mm
Annual saving	£180-220	£50-60
Installed cost	£230	£240
Installed payback	around 1 year	4-5 years

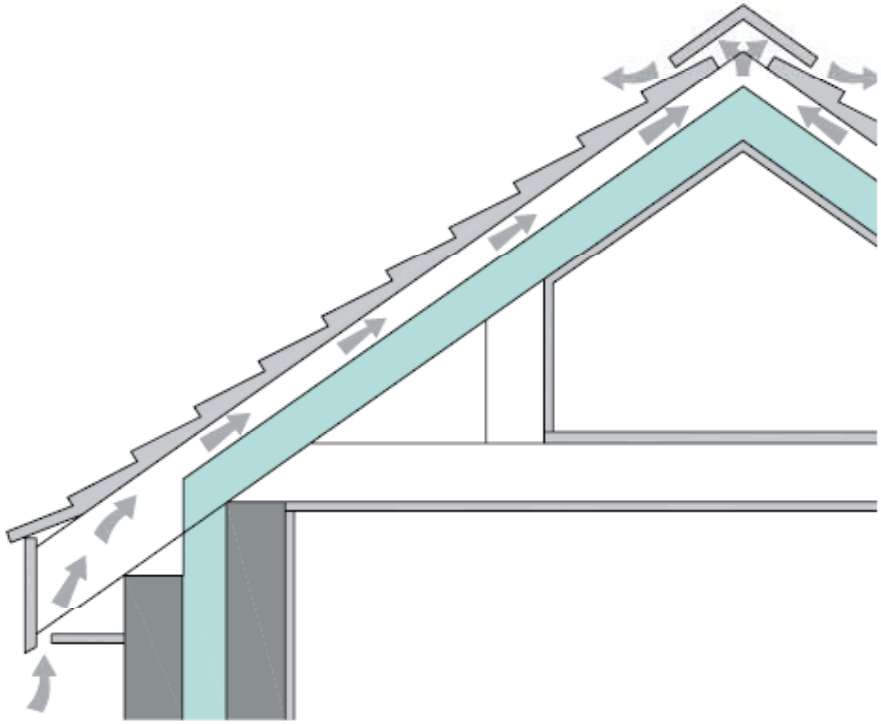
Source: EST GPG171 – Domestic energy primer – an introduction to energy efficiency in existing homes

Roofs with water tank/pipework

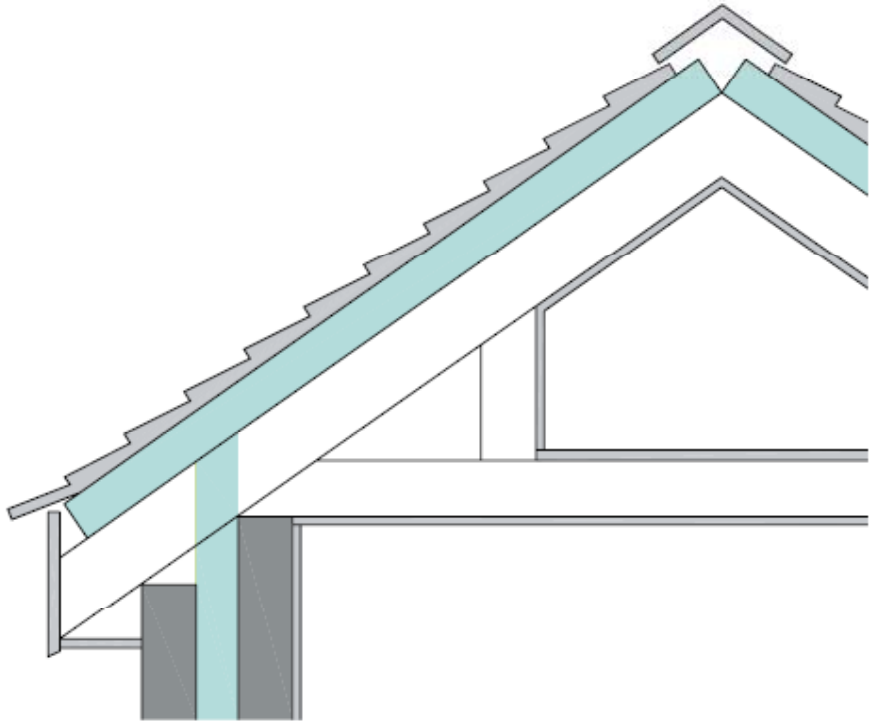


Source: EST GPG171 – Domestic energy primer – an introduction to energy efficiency in existing homes

Pitched roofs with attic rooms



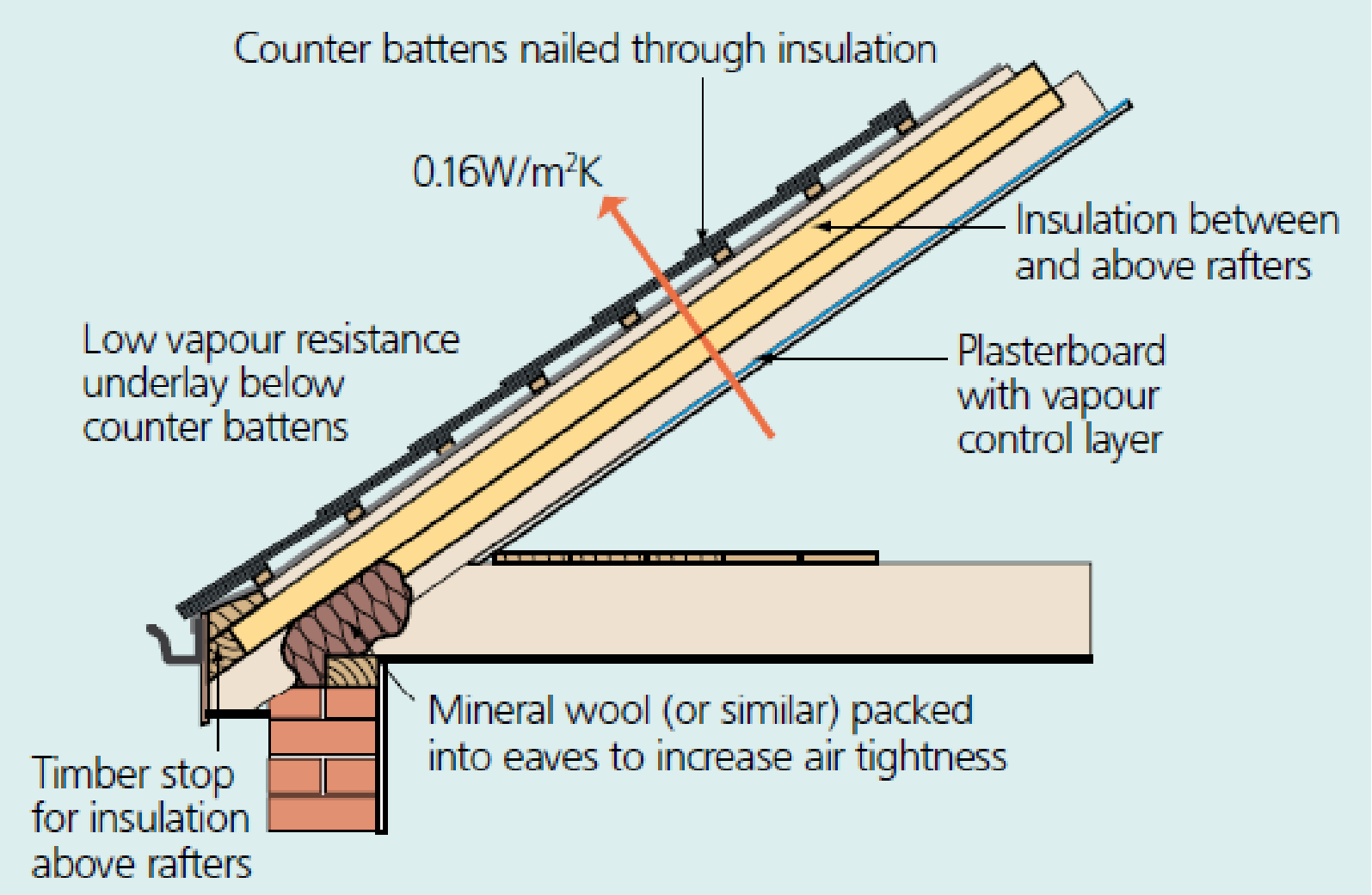
Ventilated roof construction



Sarking insulation

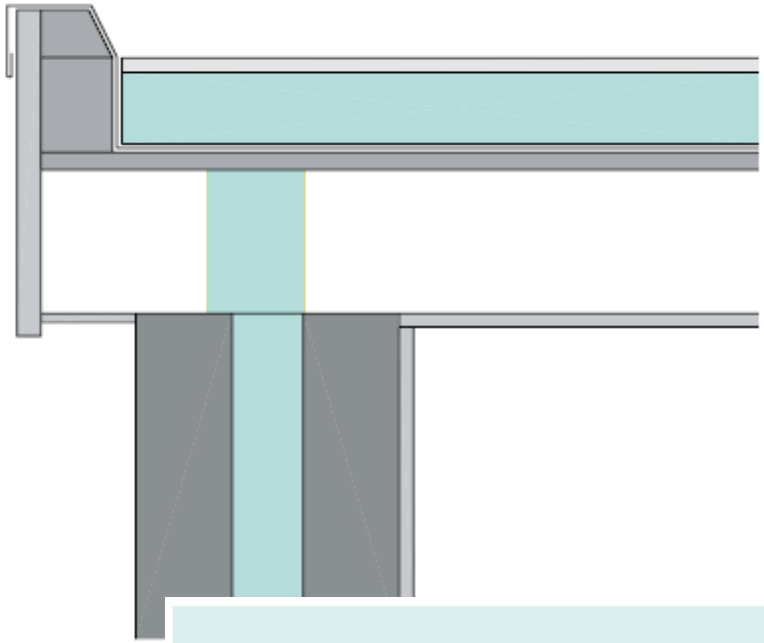
Source: EST GPG171 – Domestic energy primer – an introduction to energy efficiency in existing homes

Roofs insulation between and above rafters



Source: EST CE83 – Energy efficient refurbishment of existing housing

Flat roofs



Warm deck

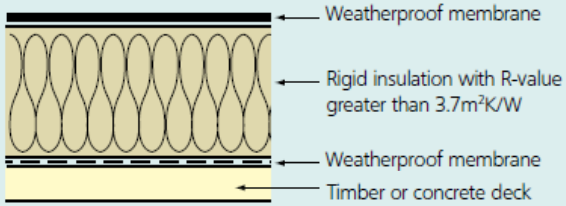
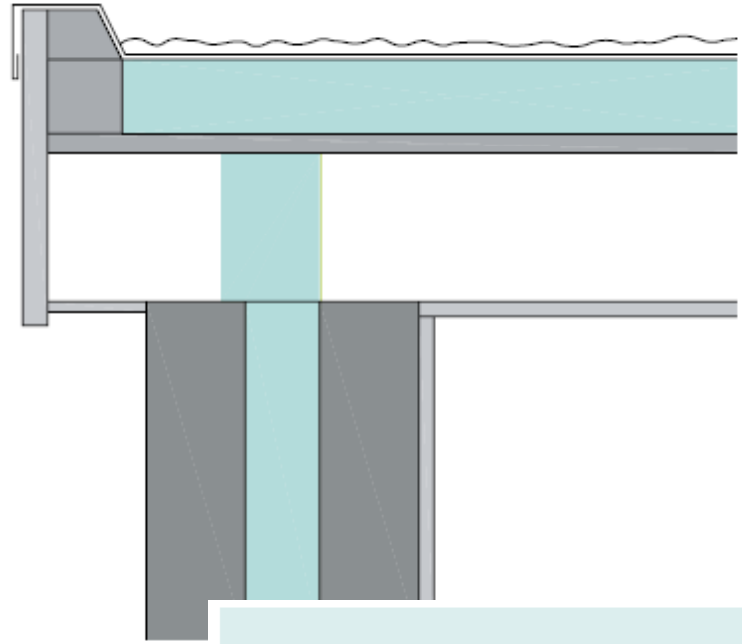


Figure 3.17 Warm deck construction



Inverted

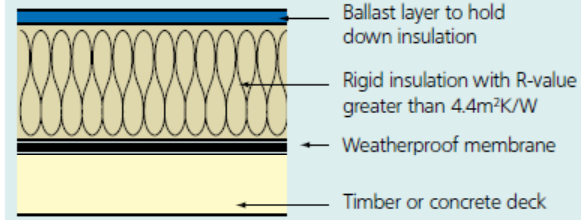
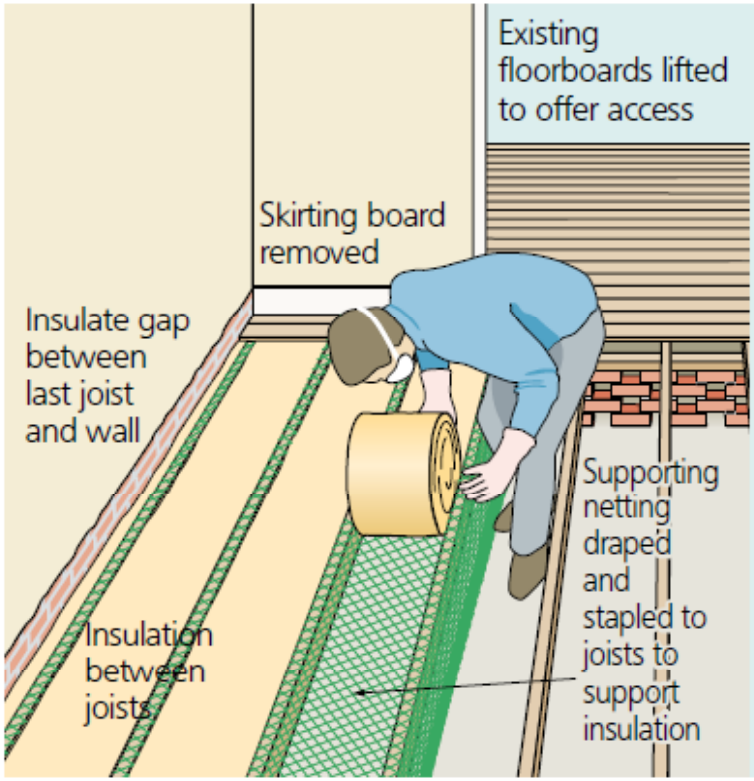
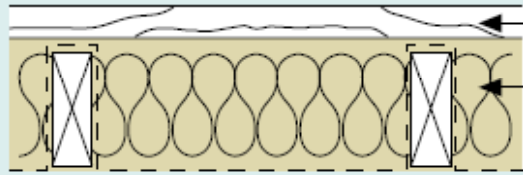


Figure 3.18 Inverted warm deck construction

Source: EST GPG171 – Domestic energy primer – an introduction to energy efficiency in existing homes and CE83 – Energy efficient refurbishment of existing housing

Timber floors – from above



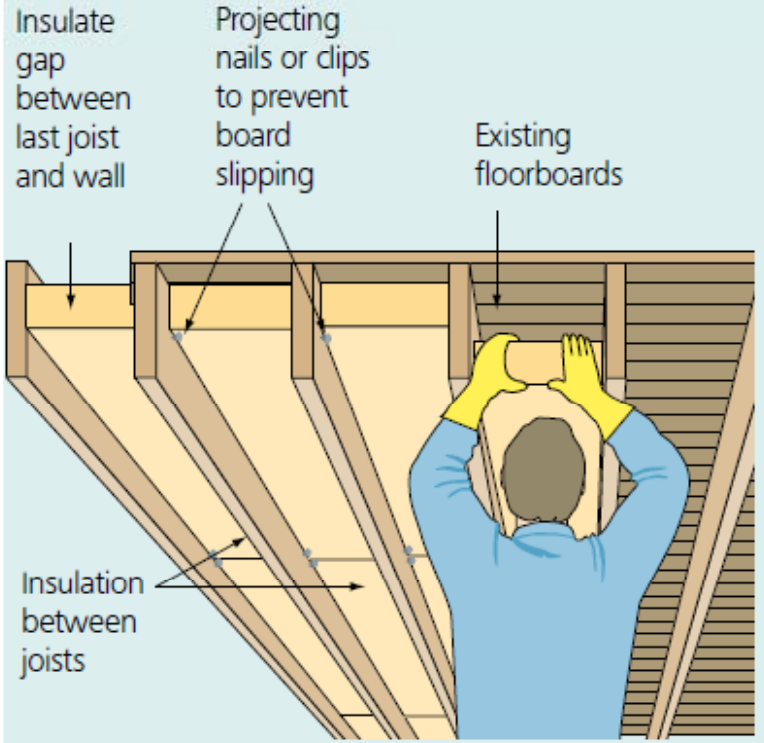


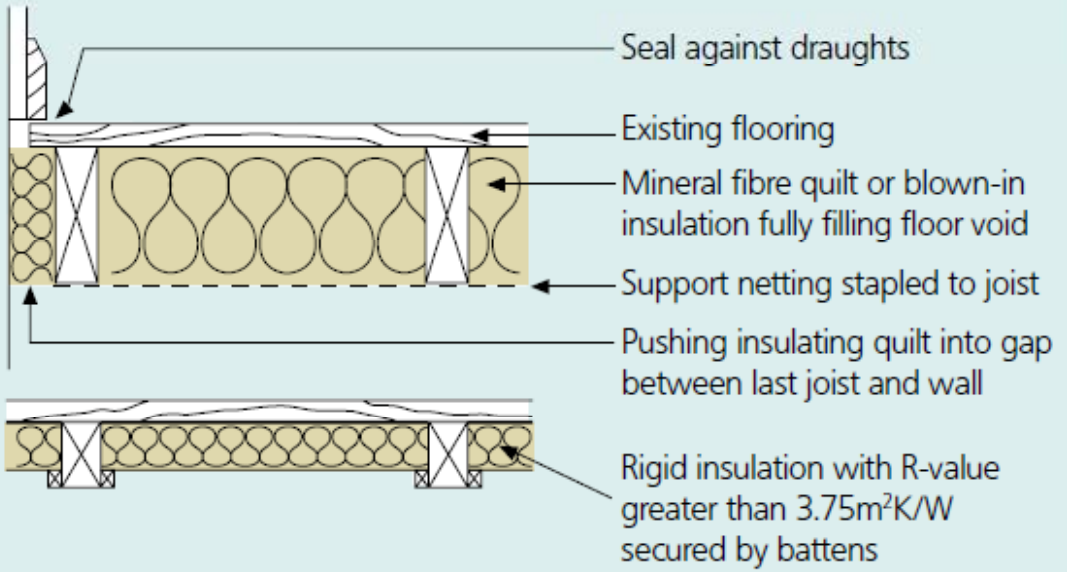
- Specify draught-stripping of floor at skirting.
- Do not specify a vapour-control layer – it can trap spilt water.
- Ensure the under-floor void is well ventilated.

	Typical
Annual saving	£40-50
Installed cost	from £100 for materials
Installed payback	less than 3 years

Source: EST GPG171 – Domestic energy primer – an introduction to energy efficiency in existing homes

Timber floors – from below

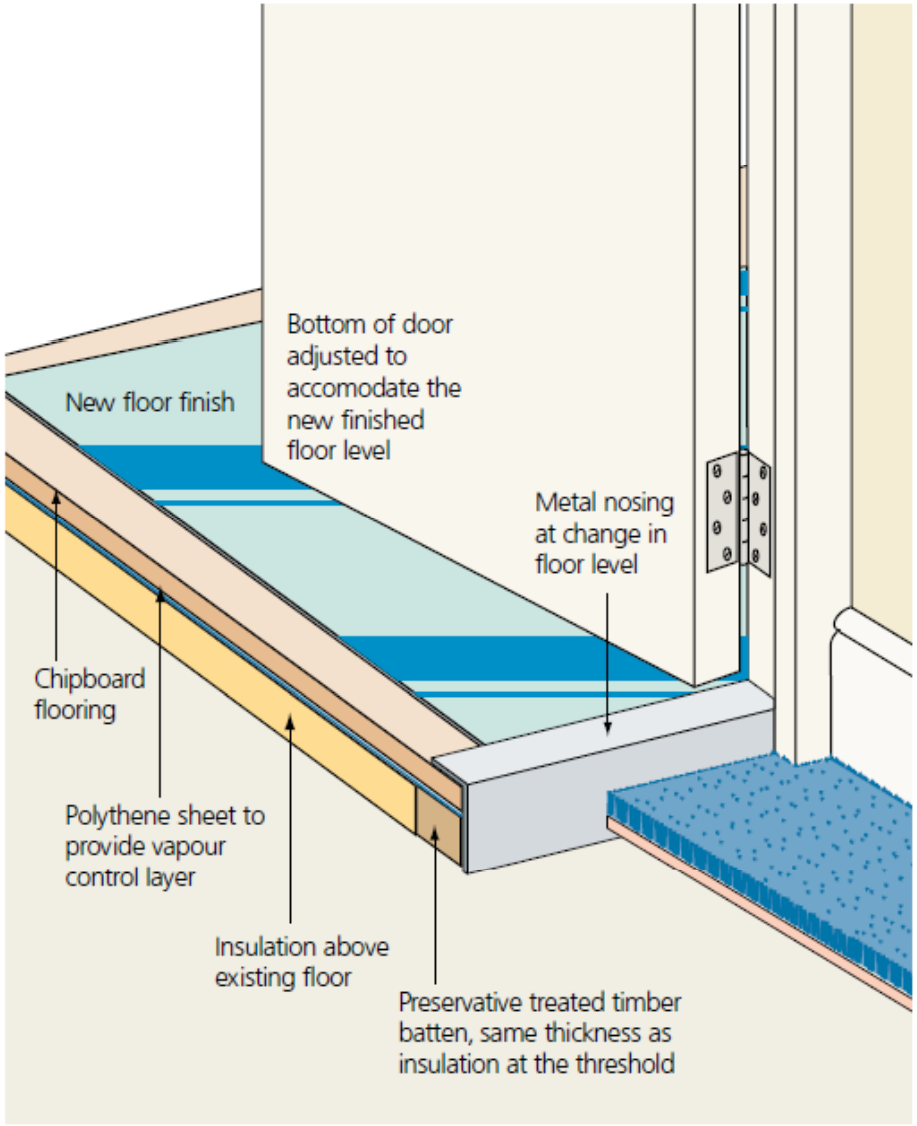




- Floor may need a fire resistance of up to an hour if over the basement.
- Draught-stripping of floor at skirting.
- Do not specify a vapour-control layer – it can trap spilt water.
- Ensure the under-floor void is well ventilated.

Source: EST GPG171 – Domestic energy primer – an introduction to energy efficiency in existing homes

Solid floors



Insulating solid floors:

- ✓ Can help to reduce cold draughts and air leakage.
- ✓ Placing insulation above the concrete slab helps the room to warm up quickly when the heating is switched on.
- ✗ Will raise the floor level.
- ✗ Skirting boards need to be removed and re-fixed and doors will need to be shortened.
- ✗ Can cause problems with unequal heights at staircases and external doors.

Source: EST GPG171 – Domestic energy primer – an introduction to energy efficiency in existing homes

Draught-stripping/cylinder jacket

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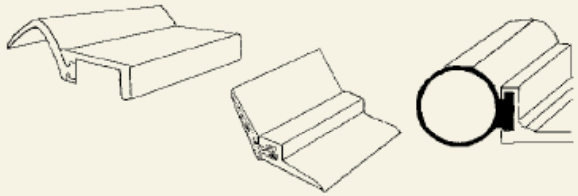
Compression seals

Compression seals are particularly well suited for external doors as the initial 3mm of the draught-stripping allows for seasonal movement of the door.

There is a wide variety of synthetic rubbers which offer good performance (including EPDM and silicone seals), sheathed foam or nylon brush, with rigid PVC-U or aluminium carriers nailed or screwed to the frame of the door. Care may be needed when painting to avoid damage to brushes and some types of rubber.

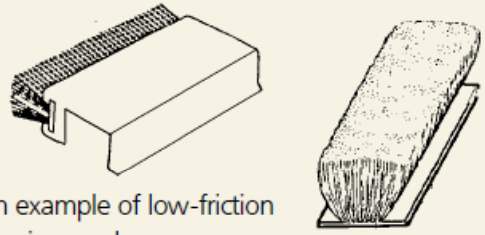


An example of compression seals

Low-friction or wiper seals

Suitable for most doors and window types. Wiper seals are generally made of nylon brush pile; are self-adhesive; and available in a variety of pile heights for different gaps. They are especially good on sliding windows and doors, but need special care when repainting.

Rubber blade wiper seals are good for wooden doors and casement windows. Some types are suitable for sliding applications.

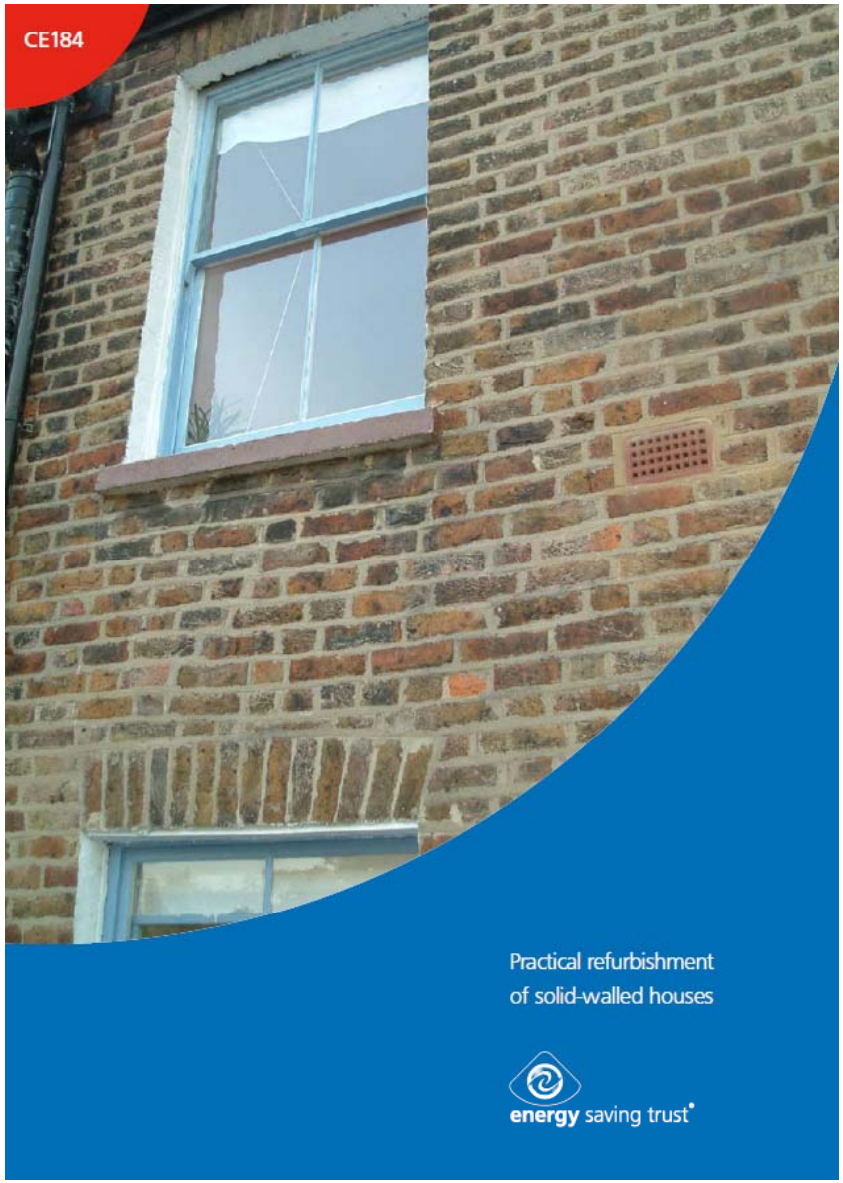


An example of low-friction or wiper seals

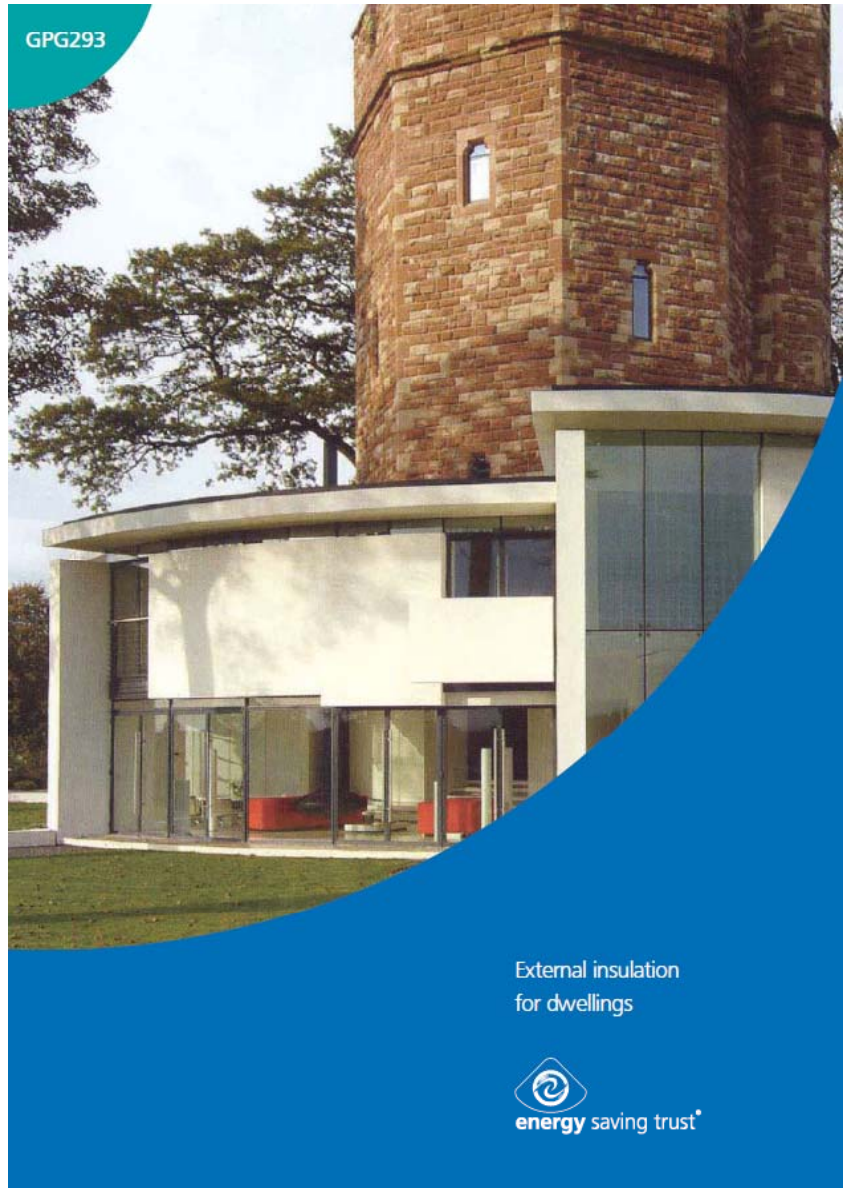
	Typical
Annual saving	around £20
Installed cost	from £75
Installed payback	around 4 years

	Typical
Annual saving	Approx £20
Installed cost	from £10
Installed payback	around 6 months

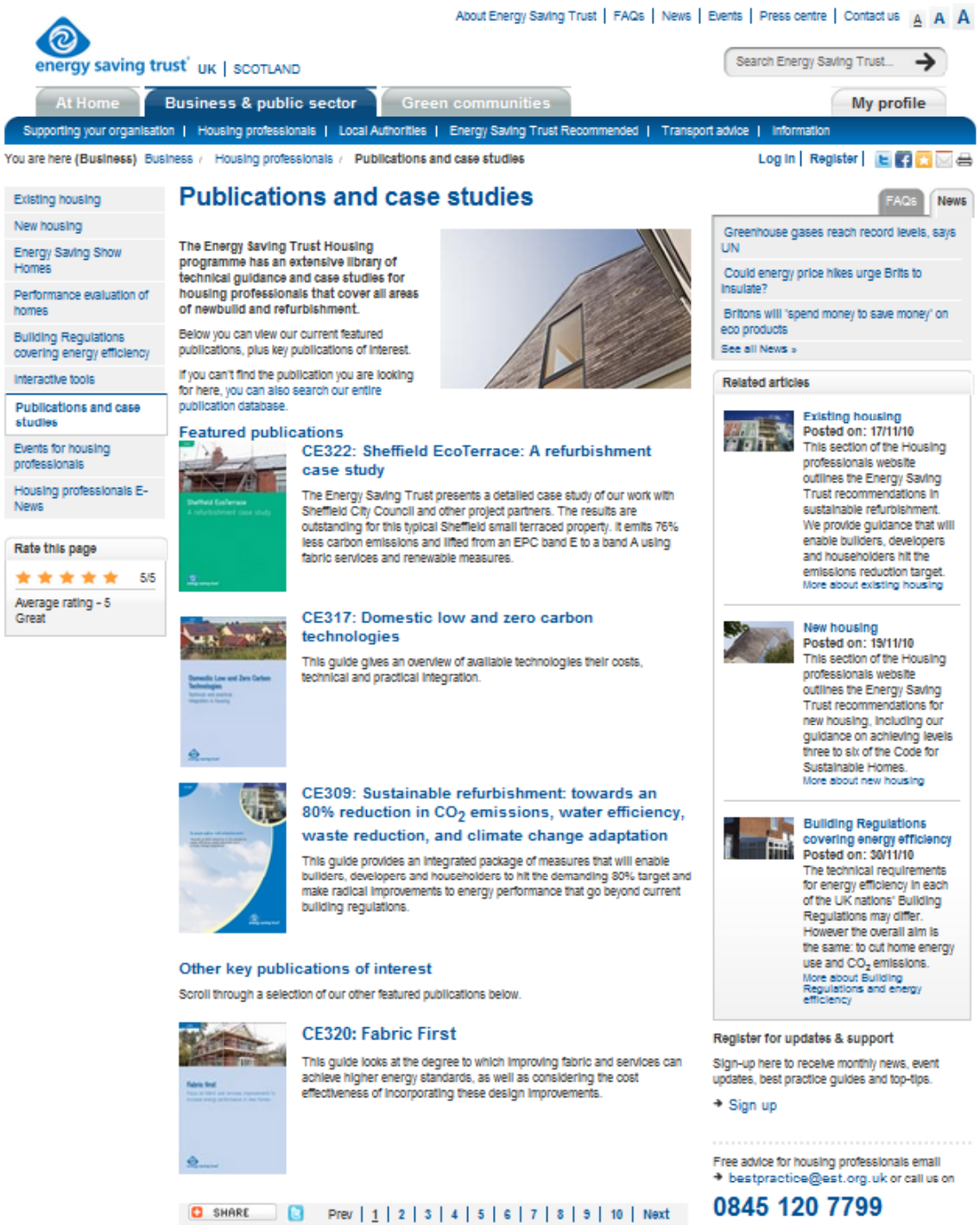
Source: EST GPG171 – Domestic energy primer – an introduction to energy efficiency in existing homes



CE184/GPG293 Practical refurbishment of solid-walled houses



CE118/GPG293 External insulation for dwellings



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www.energysavingtrust.org.uk/business/Business/Housing-professionals

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Any questions?