(Applies to both Domestic and Non-Domestic Premises)

Works relating to thermal elements can arise in building an extension, a material change of use, a material alteration, changing a buildings energy status or when carrying out other renovation works.

Thermal Elements -

Are defined as a wall, floor or roof, excluding windows and doors / roof lights and roof windows (separate controlled fittings rules apply to these), which separates part of a building that is thermally conditioned part of the building ('the conditioned space') from either:

1. The external environment (including the ground); or
2. In the case of floors and walls, another part of the building, which is:
    a. unconditioned (i.e. unheated space).
    b. A building such as a conservatory, carport or porch.
    c. conditioned to a different temperature

Also for commercial types of buildings only included is when the other part of the building is used for a purpose that is not similar or identical to the purpose for which the conditioned space is used (this requirement does not apply to dwellings).

All elements between the surface bounding the conditioned space and the external environment or other part of the building are considered to be 'Thermal elements'.

Note - this definition encompasses the walls and the floor of a swimming a swimming pool basin where this is part of an existing dwelling.

Major Renovation or Renovation of a Thermal Element.

Renovation of a thermal element through the provision of a new layer means either of the following:

a. Cladding or rendering the external surface of the thermal element; or
b. Dry-lining the internal surface of a thermal element.

The regulations defines two type of renovation to a individual thermal element -

(a) **Major Renovation** – which means the renovation of a building when more than 25% of the surface area of the building envelope under goes renovation.

'Building Envelope' includes walls, floors, roof, windows, doors, roof windows and roof lights.

or

(b) **Renovation** - which amounts to the renovation of more than 50% of the elements surface area.

Where the works constitute either of the above that renovation must be carried out so as to ensure that the ***whole of the element*** complies with paragraph L1 (A) (1) of schedule 1, insofar as that it is technically, functionally and economically feasible.

Note - From 9th January 2013, the installation of thermal insulation to suspended timber floors where the work – (a) consist of installation such insulation only; and (b) the work is not carried out in order to comply with any requirements of these regulation (e.g. as part of upgrade work due to excessive glazing in an extension) is not considered to be controllable under the scope of these regulations.

Replacement of a Thermal Element.

The replacement of an existing layer means either of the following activities:

a. Stripping down the element to expose the basic structural components (brick / blockwork, timber / metal frame, joists, rafters, etc) and then rebuilding to achieve all the necessary performance requirements.

b. Replacing the water proof membrane on a flat roof. *From 15th July 2011 the application of a new layer of felt or the application of a liquid sealant over 25% of the roof area over the existing roof covering does not constitute renovation of a thermal element. Neither are minor works of repair. Note – this does not effect roof works where pitched / flat roof coverings are removed and replaced which are considered replacement thermal elements requiring regulation approval and thermal upgrading* ***works.***

Where a new layer in the thermal element is provided or the works constitute a replacement of an existing layer, but excludes decorative finishes this is defined as 'Renovation'. *The only part of a thermal element that you can replace / provide without requiring approval are decorative finishes.*

Where the whole or any part of an individual element is proposed to be replaced and the replacements – (a) constitutes a major renovation; or (b) (in case of part replacement) amounts to the replacement of more than 50% of the thermal element surface area. Then the whole of the thermal element must be replaced as to ensure complies with paragraph L1 (a) (i) of Schedule 1, insofar as that it is technically, functionally and economically feasible.

Examples of controllable works requiring the submission of a Building Regulation application:

- Renewal of pitched or flat roof coverings – e.g. re-tiling, re-slating of pitched roofs or re-felting of flat roofs.
- Renewal or replacement of ceilings under a roof space or flat roof (with or without the renewal of the supporting structure).
- Renewal of cladding to external walls or dormer cheeks.
- Renewal of a finish or cladding to an external wall area or elevation (render or other cladding or applying a finish or cladding for the first time.
- Renewal of internal wall finishes to an external wall (excluding decoration) or where you are applying a finish for the first time e.g. re-plastering or dry lining walls.
- Renovation or replacement of a solid or suspended floor, involving the replacement of screed or a timber floor deck.

Don't forget that the provision of new roofs and re-building of walls either completely or replacing an outer skin of the wall will also be controllable works.

Note – replacement / renovated curtain walling is considered to be treated the same as replacement windows as it is defined as a controlled fitting.

What energy standards do thermal elements have to satisfy?

Where a thermal element is subject to renovation through und
ertaking any activity listed above, the ***performance of the whole of the thermal element*** should be improved to achieve or better the relevant U-value set out in column (b) of table 3, for Domestic work (Table 5 –for Non domestic jobs), provided the area to be renovated is greater than 50% of the surface of the individual thermal element or constitutes a major renovation where more than 25% of the surface area of the 'building envelope' undergoes renovation.

When a building undergoes a 'major renovation' this may represent an opportunity to consider and take into account the technical, environmental and economic feasibility of installing high– efficiency alternative systems.

Domestic Table

Table 3 **Upgrading retained thermal elements**

Element[1]	(a) Threshold U-value W/m²·K	(b) Improved U-value W/m²·K
Wall – cavity insulation[2]	0.70	0.55
Wall – external or internal insulation[3]	0.70	0.30
Floor[4,5]	0.70	0.25
Pitched roof – insulation at ceiling level	0.35	0.16
Pitched roof – insulation between rafters[6]	0.35	0.18
Flat roof or roof with integral insulation[7]	0.35	0.18

1 'Roof' includes the roof parts of dormer windows and 'wall' includes the wall parts (cheeks) of dormer windows.

2 This applies only in the case of a wall suitable for the installation of cavity insulation. Where this is not the case, it should be treated as 'wall – external or internal insulation'.

3 A lesser provision may be appropriate where meeting such a standard would result in a reduction of more than 5% in the internal floor area of the room bounded by the wall.

4 The U-value of the floor of an extension can be calculated using the exposed perimeter and floor area of the whole enlarged building.

5 A lesser provision may be appropriate where meeting such a standard would create significant problems in relation to adjoining floor levels.

6 A lesser provision may be appropriate where meeting such a standard would create limitations on head room. In such cases, the depth of the insulation plus any required air gap should be at least to the depth of the rafters, and the thermal performance of the chosen insulant should be such as to achieve the best practicable U-value.

7 A lesser provision may be appropriate if there are particular problems associated with the load-bearing capacity of the frame or the upstand height.

Non- Domestic Table

Table 5 **Upgrading retained thermal elements**

Element[1]	U-value W/m².K	
	(a) Threshold	(b) Improved
Wall – cavity insulation	0.70	0.55[2]
Wall – external or internal insulation	0.70	0.30[3]
Floors[4,5]	0.70	0.25
Pitched roof – insulation at ceiling level	0.35	0.16
Pitched roof – insulation at rafter level[6]	0.35	0.18
Flat roof or roof with integral insulation[7]	0.35	0.18

Notes:

1 'Roof' includes the roof parts of dormer windows, and 'wall' includes the wall parts (cheeks) of dormer windows.

2 This applies only in the case of a cavity wall capable of accepting insulation. Where this is not the case it should be treated as for 'wall – external or internal insulation'.

3 A lesser provision may be appropriate where meeting such a standard would result in a reduction of more than 5% in the internal floor area of the room bounded by the wall.

4 The U-value of the floor of an extension can be calculated using the exposed perimeter and floor area of the whole enlarged building.

5 A lesser provision may be appropriate where meeting such a standard would create significant problems in relation to adjoining floor levels.

6 A lesser provision may be appropriate where meeting such a standard would create limitations on head room. In such cases, the depth of the insulation plus any required air gap should be at least to the depth of the rafters, and the thermal performance of the chosen insulant should be such as to achieve the best practicable U-value.

7 A lesser provision may be appropriate if there are particular problems associated with the load-bearing capacity of the frame or the upstand height.

How do we assess area proportions?

In relation to the renovation of individual thermal elements, when assessing the proportion of the surface area that is to be renovated, the area of the thermal element should be assessed as the area of each individual thermal element, ***not the area of all elements of that type in the building.***

The area of each individual thermal element should also be interpreted in the context of whether the element is being renovated from inside or outside, e.g. if removing all the plaster finish from the inside of a solid brick wall, the area of the element is the area of external wall in the room. If removing external render, it is the area of the elevation in which the wall sits.

This means that if all the roofing on the flat roof of the extension is being stripped down, the area of the individual element is the 'roof area' of the extension, not the 'total roof area' of the dwelling.

Similarly, if the rear wall of a single story domestic extension is being re-rendered externally, then the rear wall of the extension should be upgraded to the standards of Table 3 column (b), even if the renovation affected less than 50% of the total area of the building elevation when viewed from the rear.

If plaster is being removed from a bedroom wall, the relevant area is the area of the external wall in the room, not the area of the external elevation which contains the wall section. This is because the marginal cost of dry-lining with insulated plasterboard rather than plain Plasterboard is small.

Replacement of 'Thermal Elements'.

Replacement of 'Thermal Elements': Any existing element that is replaced or rebuilt should achieve the U values for new build

STANDARDS FOR THERMAL ELEMENTS W/m^{2}k

Element (1)	Standards.
Wall	**0.28 W/m2.K(2)**
Pitched roof – insulation at ceiling level	**0.16 W/m2.K**
Pitched roof – insulation at rafter level	**0.18 W/m2.K**
Flat roof or roof with integral insulation	**0.18 W/m2.K**
Floors(3)	**0.22 W/m2.K(4)**
Swimming Pool Basin	**0.25 W/m2.K**

NOTES

1. **Roof includes dormers and wall refers to wall parts (cheeks) of dormer windows.**
2. **Area-weighted values.**
3. **A lesser provision may be appropriate where meeting a standard would result in a reduction of more than 5% in the internal floor area of the room bounded by the wall.**

A less provision may be appropriate where meeting such a standard would create significant problems in relation to adjoining floor levels (the 'U' value of an extension floor can be calculated using exposed perimeter and floor area of the whole enlarged dwelling.

Retained Thermal Elements.

1. Where an existing thermal element is part of building subject to a 'material change of use' or
2. Where an existing thermal element is to become part of the thermal envelope where previously it was not e.g. as part of a loft or garage conversion where the space is now heated.

The thermal elements whose U-values are worse than the threshold value in Table 3 column (a) - Domestic (Table 5 –Non domestic) must be upgraded to achieve the u values given Table 3 / Table 5 column (b) provided it is technically, functionally or economically feasible,

A reasonable test of economic feasibility is to achieve a simple payback of 15 years or less. Where the standard is not technically functionally or economically feasible, then the thermal element should be upgraded to the best standards that is technically and functionally feasible and can achieve a simple payback of no greater than 15 years. Generally this lesser standard should not be worse than 0.7w/m2.k

Examples of where lesser provision than column b might apply are where the thickness of the additional insulation might reduce usable floor area of any room by more than 5% or create difficulties with adjoining floor levels, or where the weight of the additional insulation might not be supported by the existing structural frame.

Feasibility.

Not technically or functionally feasible.

For works to existing buildings there are often practical constraints or technical problems that need to be taken into account, such as an unreasonable reduction in internal floor area where internal insulation is applied; the approved document suggests that the application of internal insulation is unfeasible if the associated reduction in floor area exceeds 5%. Technical problems will be assessed with respect to the impact on other aspects of the regulations. Such things as the need to avoid compromising ventilation when replacing windows and differences in floor levels, the effects of the new construction's loading on the existing will all be important.

Economic feasibility.

Economic feasibility is determined by a simple 15-year payback calculation, i.e. the amount of time taken to recover the initial investment through energy savings.

If the compliant thermal element upgrade is not technically or functionally feasible or would not achieve a simple payback of 15 years or less, the element should be upgraded to the best standards that is technically and functionally feasible and can achieve a simple payback of no greater than 15 years

So technically the level of upgrade could be limited to that which could be paid back over a 15 year period, however the examples quoted in the approved document are believed to meet this requirement.

All these questions of feasibility will be taken into account on a case-by-case basis.

Other Regulations Interfaces.

Remember the requirements of related regulations C, F and J - e.g. condensation control/ ventilation provisions and gas / solid fuel appliance and combustion air.

Examples of cost effective improvements to thermal elements are given in Table A1.

Where the renovation of an individual thermal element constitutes a major renovation; or amounts to the renovation of more than 50% of the element's surface area, an opportunity exists for cost – effective insulation improvements to be undertaken at marginal additional cost.

Table A1 **Cost-effective U-value targets when undertaking renovation works to thermal elements**

Proposed works	Target U-value ($W/m^2.K$)	Typical construction	Comments (reasonableness, practicability and cost- effectiveness)
Pitched roof constructions[16]			
Renewal of roof covering – No living accommodation in the roof void – existing insulation (if any) at ceiling level. No existing insulation, existing insulation less than 50 mm, in poor condition, and/ or likely to be significantly disturbed or removed as part of the planned work	0.16	Provide loft insulation – 250 mm mineral fibre or cellulose fibre as quilt laid between and across ceiling joists or loose fill or equivalent	Assess condensation risk in roof space and make appropriate provision in accordance with the requirements of Part C relating to the control of condensation. Additional provision may be required to provide access to and insulation of services in the roof void
Renewal of roof covering – Existing insulation in good condition and will not be significantly disturbed by proposed works. Existing insulation thickness 50 mm or more but less than 100 mm	0.16	Top up loft insulation to at least 250 mm mineral fibre or cellulose fibre as quilt laid between and across ceiling joists or loose fill or equivalent. This may be boarded out	Assess condensation risk in roof space and make appropriate provision in line with the requirements of Part C relating to the control of condensation. Additional provision may be required to provide insulation and access to services in the roof void Where the loft is already boarded out and the boarding is not to be removed as part of the work, the practicality of insulation works would need to be considered
Renewal of the ceiling to cold loft space. Existing insulation at ceiling level removed as part of the works	0.16	Provide loft insulation – 250 mm mineral fibre or cellulose fibre as quilt laid between and across ceiling joists or loose fill or equivalent. This may be boarded out	Assess condensation risk in roof space and make appropriate provision in accordance with the requirements of Part C relating to the control of condensation. Additional provision may be required to provide insulation and access to services in the roof void Where the loft is already boarded out and the boarding is not to be removed as part of the work, insulation can be installed from the underside but the target U-value may not be achievable
Renewal of roof covering – Living accommodation in roof space (room-in- the-roof type arrangement), with or without dormer windows	0.18	Cold structure – Insulation (thickness dependent on material) placed between and below rafters Warm structure – Insulation placed between and above rafters	Assess condensation risk (particularly interstitial condensation), and make appropriate provision in accordance with the requirements of Part C relating to the control of condensation (Clause 8.4 of BS 5250:2002 and BS EN ISO 13788:2002 Practical considerations with respect to an increase in structural thickness (particularly in terraced dwellings) may necessitate a lower performance target
Dormer window constructions			
Renewal of cladding to side walls	0.30	Insulation (thickness dependent on material) placed between and/or fixed to outside of wall studs. Or fully external to existing structure depending on construction	Assess condensation risk and make appropriate provision in accordance with the requirements of Part C
Renewal of roof covering	–	Follow guidance on improvement to pitched or flat roofs as appropriate	Assess condensation risk and make appropriate provision in accordance with the requirements of Part C

Flat roof constructions			
Renewal of roof covering – Existing insulation, if any, less than 100 mm, mineral fibre (or equivalent resistance) or in poor condition and likely to be significantly disturbed or removed as part of the planned work	0.18	Insulation placed between and over joists as required to achieve the target U-value – Warm structure	Assess condensation risk and make appropriate provision in accordance with the requirements of Part C. Also see BS 6229:2003 for design guidance
Renewal of the ceiling to flat roof area. Existing insulation removed as part of the works	0.18	Insulation placed between and to underside of joists to achieve target U-value	Assess condensation risk and make appropriate provision in accordance with the requirements of Part C. Also see BS 6229:2003 for design guidance. Where ceiling height would be adversely affected, a lower performance target may be appropriate
Solid wall constructions			
Renewal of internal finish to external wall or applying a finish for the first time	0.30	Dry-lining to inner face of wall – insulation between studs fixed to wall to achieve target U-value – thickness dependent on insulation and stud material used Insulated wall board fixed to internal wall surface to achieve the required U-value – thickness dependent on material used	Assess the impact on internal floor area. In general it would be reasonable to accept a reduction of no more than 5% in the area of a room. However, the use of the room and the space requirements for movement and arrangements of fixtures, fittings and furniture should be assessed In situations where acoustic attenuation issues are particularly important (e.g. where insulation is returned at party walls) a less demanding U-value may be more appropriate. In such cases, the U-value target may have to be increased to 0.35 or above depending on the circumstances Assess condensation and other moisture risks and make appropriate provision in accordance with the requirements of Part C. This will usually require the provision of a vapour control and damp protection to components. Guidance on the risks involved is provided in BR 262 and, on the technical options, in Energy Saving Trust publications
Renewal of finish or cladding to external wall area or elevation (render or other cladding) or applying a finish or cladding for the first time	0.30	External insulation system with rendered finish or cladding to give required U-value	Assess technical risk and impact of increased wall thickness on adjoining buildings
Ground floor constructions			
Renovation of a solid or suspended floor involving the replacement of screed or a timber floor deck	See comment	Solid floor – replace screed with an insulated floor deck to maintain existing floor level Suspended timber floor – fit insulation between floor joists prior to replacement of floor deck	The cost-effectiveness of floor insulation is complicated by the impact of the size and shape of the floor (perimeter/area ratio). In many cases existing un-insulated floor U-values are already relatively low when compared with wall and roof U-values. Where the existing floor U-value is greater than 0.70 W/m².K, then the addition of insulation is likely to be cost-effective. Analysis shows that the cost–benefit curve for the thickness of added insulation is very flat, and so a target U-value of 0.25 W/m².K is appropriate subject to other technical constraints (adjoining floor levels, etc.)

[16] Specification of thickness of insulation is based on lambda values (conductivity) of 0.04 W/m.K

STRUCTURAL EFFECTS AS A RESULT OF RE-COVERING ROOFS.

Where the works comprise of re-roofing or recovering of an existing roof structure – you must not forget to consider the requirements of Approved Document A – the works being undertaken could also constitute a 'Material Alteration' in its own right (requiring an application).

Where the work significantly changes the roof applied loading the roofs structural integrity and supporting structure **MUST** be checked to ensure the works do not worsen the compliance of the existing building.

A significant change in roof loading is when the loading upon the roof is increased by more than 15%.

When such checking of the existing roof structure indicates that the construction is unable to sustain any proposed loading increase (e.g. due to over stressing of members or an unacceptable deflection could occur leading to roof ponding), appropriate strengthening works or replacement of the roofing members should be undertaken. 'This is classed as a material alteration' requiring an application.

In carrying out the checks mentioned above an increase of stress in a structural member arising from increased loading does not necessarily indicate that the roof structure is less compliant than original roof provided an adequate factor of safety is maintained.

Where work will significantly decrease the roof dead loading, the roof structure and its anchorage to the supporting structure should be checked to ensure that an adequate factor of safety is maintained against uplift of the roof under imposed wind loading.

If any of the above does occur you should ask for a structural engineers report to verify the roofs suitability and / or the structural strengthening works required on the submission of the Building Regulation application.

TYPICAL LOADINGS OF PITCHED ROOF MATERIALS.

Plain clay tiles - 64kg/m² (0.63 kN/m²) at 100mm gauge.

Plain concrete tiles - 73.8kg/m² (0.72 kN/m²) at 100mm gauge.

Interlocking concrete tiles –

Ludlow Majors - 47kg/m² (0.46kN/m²) at 75mm headlap / 51kg/m² (0.50kN/m²) at 100mm headlap

Bold Roll - 49kg/m² (0.48kN/m²) at 75mm headlap / 53kg/m² (0.52kN/m²) at 100mm headlap

Moderns - 50kg/m² (0.49kN/m²) at 75mm headlap / 54kg/m² (0.53kN/m²) at 100mm headlap

Monarch (artifical slate) - 24 kg/m² (0.23 kN/m²) at 75mm headlap / 26 kg/m² (0.26 kN/m²) at 100mm headlap

Hardrow tiles – random concrete slates 83 kg/m² (0.83 kN/m²).

Blue slates -

Approximate coverage and weight of slating based on 77mm headlap*

Slate size		Cover m^2 per tonne		Weight kg per m^2	
(mm)	(inches)	Westmorland Green	Blue Grey	Westmorland Green	Blue Grey
610	24	18.40	22.00	56.60	44.15
560	22	18.40	22.00	55.34	44.51
510	20	18.40	22.00	53.33	44.49
460	18	18.40	22.00	53.02	44.65
405	16	18.40	22.00	53.81	45.20
355	14	18.40	22.00	54.83	46.31
305	12	18.40	22.00	55.79	47.26

Stone slabs - Weights will vary considerably due to the different thickness / head lap of courses / use of diminishing courses and different weights of stones used – examples of weights are indicated below: These values are indicative and it is very important to confirm them with the supplier

Limestones

- Forest Marble: 118 - 124 kg/sq m (1.1 - 1.25 tonnes per square)
- Fullers Earth - Eyeford Member: 137 kg/sq m (1.28 tonnes per square)
- Cotswold pendle (frost split) slates Stonesfield, Taynton, Trougham: 86 - 95 kg/sq m (0.8 - 0.9 tonnes per square)

Sandstones

- Old Red Sandstone: 70 - 90 kg/sq m (1.29 - 1.66 tonnes per square)
- Carboniferous (Pennine and Pennant) sandstones: 80 - 100 kg/ sq m (1.47 - 1.84 tonnes per square)
- Caithness Flags: 70 - 110 kg/sq m (1.47 - 2.03 tonnes per square)