

# THERMAL INSULATION



## Pitched Roof: Roof Underlay and Insulation Clearance

TECHNICAL UPDATE

### Introduction

With the recent changes in the NZBC clause H1 ( 3rd edition), it has become difficult to install insulation as specified in NZS 4246:2006 Installing Insulation in Residential Buildings. The use of higher R-value insulation with an associated greater nominal thickness has highlighted a design issue in maintaining the 25mm clearance between the roof underlay and insulation at the perimeter of the roof.

The importance of maintaining an air space of 25mm is to allow moisture formed on the underside of the roof cladding to be absorbed by the roofing underlay and then evaporate without restriction. It will also prevent moisture from being wicked into the insulation that would reduce its performance. Excessive moisture in the roof cavity may also cause structural damage.

### Retrofit

When retrofitting insulation into an existing home, three options are available to achieve a 25mm clearance while ensuring thermal performance is not unduly compromised

Option	Thermal Performance	Method
1: Substitute product	<b>Best</b>	A thinner product can be used around the perimeter of the roof space, ensuring insulation is installed to the middle of the top plate
2: Trim	<b>Better</b>	The existing product can be trimmed prior to installing to the centre of the top plate.
3: Pull back	<b>Least Effective</b> Not recommended as uninsulated areas may allow condensation to form and promote mould growth	The insulation can be pulled back to maintain the 25 mm clearance, however the top plate will no longer be insulated and thermal performance will be compromised.

For further details of each option, refer to pgs 3-5

### New Homes

When designing and developing new homes, the higher R-value insulation with greater nominal thicknesses are required to meet NZBC H1, while still maintaining the 25mm clearance between the roof underlay and insulation. **Careful consideration of the roof design is necessary to ensure the insulation can be installed to the centre of the top plate.**

Where this is not possible, the options outlined in the Retrofit section above can be used. However it will be necessary for the designer to ensure NZBC H1 compliance and the associated calculations and installation method are detailed in the plans. Compliance by the *schedule method* is no longer applicable and the *calculation method* must be carried out by the designer to determine the Heat Loss factor for the building. This will result in two different Roof Construction R-values. Refer to the Calculation Method section for further details. ( Pg 6)

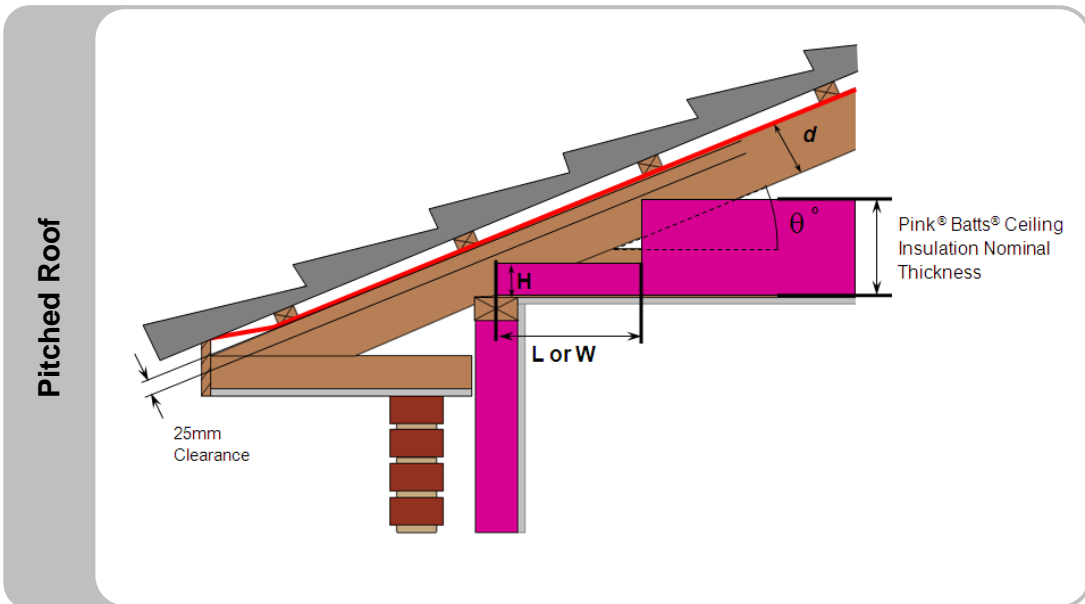


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## Pitched Roof: Roof Underlay and Insulation Clearance

### Pitched Roof

Typical Pitched roof design and terminology



**H** = Maximum height of product where underlay is fixed to rafters

**W**= Option 1: Width to which Substitute Product must be cut

Option 2: Width to which Pink® Batts® Ceiling Insulation is trimmed back

Option 3: Distance Pink® Batts® Ceiling Insulation is pulled back (refer diagram on page 6)

$\theta^\circ$  = Roof Pitch (Common roof pitches from  $15^\circ$  to  $30^\circ$ )

**d**= depth of rafter or truss member

**Note:** The following options are a guide only. The roof construction of each house may vary and the design should be checked on site to ensure the tables are applicable.

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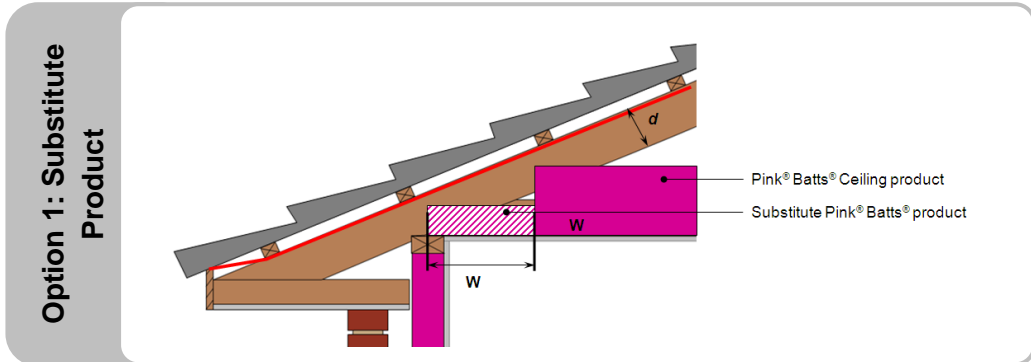
# THERMAL INSULATION



## Pitched Roof: Roof Underlay and Insulation Clearance

### Option 1: Substitute Product

The table below details the Pink® Batts® wall/masonry insulation product that can be used around the perimeter of the roof space as a substitute for the main Pink® Batts® Ceiling insulation.



Pink® Batts® Ceiling Product		R 5.0	R 4.6	R 4.0	R 3.6	R 3.2	R 2.6	R 2.2	R 1.8	
Pink® Batts® Ceiling Product Nominal Thickness (mm)		200	195	190	180	170	140	115	95	
Pitch $\theta^\circ$	d (mm)	Substitute Product	W(mm)							
15	90	R1.0 Masonry	447	428	410	372	335	223	130	55
	140	R2.8 Wall	254	235	216	179	142	30		
	190	R2.8 Wall	61	42	23					
	240	No substitution required, product can be installed to the middle of the top plate and maintain a 25mm clearance								
	290	No substitution required, product can be installed to the middle of the top plate and maintain a 25mm clearance								
20	90	R1.0 Masonry	310	296	283	255	228	145	77	22
	140	R2.8 Wall	164	150	136	109	81			
	190	R2.8 Wall	18	4						
	240	No substitution required, product can be installed to the middle of the top plate and maintain a 25mm clearance								
	290	No substitution required, product can be installed to the middle of the top plate and maintain a 25mm clearance								
25	90	R2.8 Wall	225	214	203	182	160	96	42	
	140	R2.8 Wall	106	96	85	63	42			
	190									
	240	No substitution required, product can be installed to the middle of the top plate and maintain a 25mm clearance								
	290	No substitution required, product can be installed to the middle of the top plate and maintain a 25mm clearance								
30	90	R2.8 Wall	165	156	147	130	113	61	17	
	140	R2.8 Wall	65	56	47	30	13			
	190									
	240	No substitution required, product can be installed to the middle of the top plate and maintain a 25mm clearance								
	290	No substitution required, product can be installed to the middle of the top plate and maintain a 25mm clearance								

*Note: This table is a guide only. The roof construction of each house may vary and the design should be checked on site to ensure the table is applicable.*

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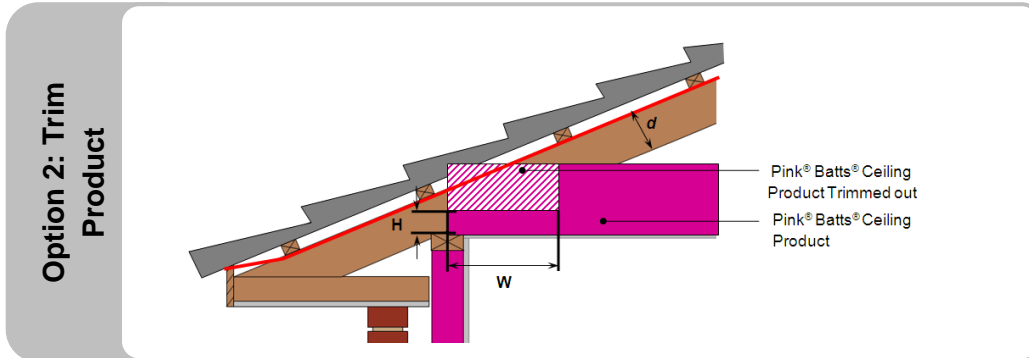


# THERMAL INSULATION

## Pitched Roof: Roof Underlay and Insulation Clearance

### Option 2: Trim Product

The table below details the trimming required of the Pink® Batts® ceiling product located at the perimeter of the roof space.



Pink® Batts® Ceiling Product			R 5.0	R 4.6	R 4.0	R 3.6	R 3.2	R 2.6	R 2.2	R 1.8
Pink® Batts® Ceiling Product Nominal Thickness (mm)			200	195	190	180	170	140	115	95
Pitch $\theta^\circ$	d (mm)	H (mm)	W(mm)							
15	90	80	447	428	410	372	335	223	130	55
	140	132	254	235	216	179	142	30		
	190	184	61	42	23					
	240		No trimming required, product can be installed to the middle of the top plate and maintain a 25mm clearance							
	290		No trimming required, product can be installed to the middle of the top plate and maintain a 25mm clearance							
20	90	87	310	296	283	255	228	145	77	22
	140	140	164	150	136	109	81			
	190	194	18	4						
	240		No trimming required, product can be installed to the middle of the top plate and maintain a 25mm clearance							
	290		No trimming required, product can be installed to the middle of the top plate and maintain a 25mm clearance							
25	90	95	225	214	203	182	160	96	42	
	140	150	106	96	85	63	42			
	190		No trimming required, product can be installed to the middle of the top plate and maintain a 25mm clearance							
	240		No trimming required, product can be installed to the middle of the top plate and maintain a 25mm clearance							
	290		No trimming required, product can be installed to the middle of the top plate and maintain a 25mm clearance							
30	90	105	165	156	147	130	113	61	17	
	140	163	65	56	47	30	13			
	190		No trimming required, product can be installed to the middle of the top plate and maintain a 25mm clearance							
	240		No trimming required, product can be installed to the middle of the top plate and maintain a 25mm clearance							
	290		No trimming required, product can be installed to the middle of the top plate and maintain a 25mm clearance							

*Note: This table is a guide only. The roof construction of each house may vary and the design should be checked on site to ensure the table is applicable.*

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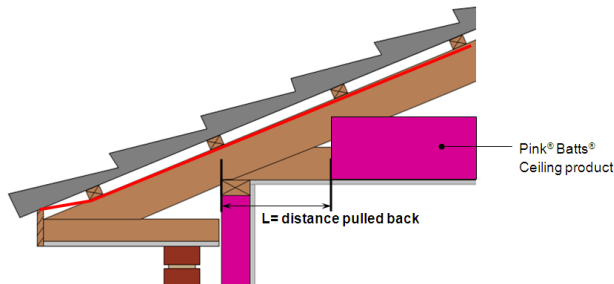


## Pitched Roof: Roof Underlay and Insulation Clearance

**Option 3: Pull Back** - *Not recommended as uninsulated areas may allow condensation to form and promote mould growth*

The table below details the distance the Pink<sup>®</sup> Batts<sup>®</sup> ceiling insulation product is required to be pulled back for the various ceiling constructions.

Option 3: Pull Back



Pink <sup>®</sup> Batts <sup>®</sup> Ceiling Product		R 5.0	R 4.6	R 4.0	R 3.6	R 3.2	R 2.6	R 2.2	R 1.8
Pink <sup>®</sup> Batts <sup>®</sup> Ceiling Product Nominal Thickness (mm)		200	195	190	180	170	140	115	95
Pitch $\theta^\circ$	d (mm)	L (mm)							
15	90	492	473	455	417	380	268	175	100
	140	299	280	261	224	187	75		
	190	106	87	68					
	240	Product can be installed to centre of top plate and maintain a 25mm clearance							
	290	Product can be installed to centre of top plate and maintain a 25mm clearance							
20	90	355	341	328	300	273	190	122	67
	140	209	195	181	154	126			
	190	63	49						
	240	Product can be installed to centre of top plate and maintain a 25mm clearance							
	290	Product can be installed to centre of top plate and maintain a 25mm clearance							
25	90	270	259	248	227	205	141	87	
	140	151	141	130	108	87			
	190	Product can be installed to centre of top plate and maintain a 25mm clearance							
	240	Product can be installed to centre of top plate and maintain a 25mm clearance							
	290	Product can be installed to centre of top plate and maintain a 25mm clearance							
30	90	210	201	192	175	158	106	62	
	140	110	101	92	75	58			
	190	Product can be installed to centre of top plate and maintain a 25mm clearance							
	240	Product can be installed to centre of top plate and maintain a 25mm clearance							
	290	Product can be installed to centre of top plate and maintain a 25mm clearance							

*Note: This table is a guide only. The roof construction of each house may vary and the design should be checked on site to ensure the table is applicable.*

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## Pitched Roof: Roof Underlay and Insulation Clearance

### Calculation method for designers

To maintain roof underlay and insulation clearances in a new home, the *calculation method* can be used to determine compliance. For further information on the *calculation method* please refer to NZS4218:2004 Energy efficiency- Housing and small building envelope

#### Product R-values: R-value of Product installed for each option

**Option 1:** R-value of Substitute product e.g. R-value of R 2.8 product = R2.8

**Option 2:** R-value of original product reduced by the same percentage as the reduction in thickness. i.e. 65% reduction original thickness = 65% reduction in original R-value

**Option3:** No Insulation present i.e. Product R-value =0

$$H_{REF} = \frac{A_{ROOF}}{R_{ROOF}} + \frac{A_{WALL}}{R_{WALL}} + \frac{A_{FLOOR}}{R_{FLOOR}} + \frac{A_{GLAZING}}{R_{GLAZING}}$$

For  $H_{NEW}$  **Construction R-values** must be used, not Product R-values.

$$H_{NEW} = \frac{A_{ROOF\_PERIMETER}}{R_{ROOF\_PERIMETER}} + \frac{A_{ROOF1}}{R_{ROOF1}} + \frac{A_{WALL}}{R_{WALL}} + \frac{A_{FLOOR}}{R_{FLOOR}} + \frac{A_{GLAZING}}{R_{GLAZING}}$$

**Construction R-value is the R-value of system. For a roof includes cladding type, framing spacing and R-value of insulation; or in the case of option 3, a system with no insulation at the perimeter. Refer to BRANZ House Insulation Guide Third Edition for values**

For compliance with NZBC Clause H1:  $H_{NEW} < H_{REF}$

$A_{ROOF}$ ,  $A_{WALL}$ ,  $A_{FLOOR}$  and  $A_{GLAZING}$  = Area of building structure

$R_{ROOF}$ ,  $R_{WALL}$ ,  $R_{FLOOR}$  and  $R_{GLAZING}$  = Minimum construction R-values as specified for each zone and construction in NZBC: Clause H1. Refer to note section for  $H_{REF}$  below

$A_{ROOF\_PERIMETER}$  = Area of Thin product/Trimmed Product/ Gap from pull back product (Perimeter x L or W)

$R_{ROOF\_PERIMETER}$  = Construction R-value of Thin product/Trimmed Product/ Gap from pull back product (Refer to BRANZ House Insulation Guide Third Edition for values)

$A_{ROOF1}$  = Total Roof Area -  $A_{ROOF1}$

$R_{ROOF1}$  = Construction R-value of Pinks® Batts® Ceiling Insulation in the designed construction

Notes: For  $H_{REF}$

- Set wall area as either 70% of total wall area, or actual wall area, whichever is less
- Set glazing area as either 30% of total wall area, or actual window area, whichever is greater
- Total area of glazing (including skylights) must be <50% of the total wall area
- An R-value of 0.26 may be used for traditional leadlight glass if the total area is < 2.6 m<sup>2</sup>
- Non-glazed areas of door openings > 3 m<sup>2</sup> are treated as wall

**Ensure method used is clearly detailed in any plans**



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