5

Insulation & skylights

You often consider insulating a building to reduce:

- heating from the sun in summer;
- loss of heat from inside in winter;
- condensation on the inside of the roofing and walling; and
- noise from rain, thermal expansion and contraction, and other sources.

Usually, when one of these four is treated, there is also a beneficial effect on the others.

You need to compare the initial cost of installing insulation with the savings in costs of heating and cooling. There are also gains for the environment when you save energy.

HB63-1994 Home Insulation in Australia - Recommended insulation level for all States thoroughly treats the subject, including comprehensive tables of recommended thermal resistance (R values) for over 1000 towns throughout Australia.

5.1 Heat control

In summer buildings get hot from the sun and we want to cool the inside; in winter we often heat the inside and want to avoid losing that heat.

Factors in controlling heat include:

- the orientation of the building relative to the sun;
- external shading from trees or other buildings;
- design of the building, especially ventilation and sealing at doors and windows;
- the colours and surface gloss of the cladding.

The first three factors are outside the scope of this book. Heat is absorbed into a sheet on one side, and some of that absorbed heat is re-radiated from the other side (Figure 5.1.1).

- Light-coloured or shiny surfaces don't absorb much heat, and they radiate little.
- Dark-coloured or dull surfaces absorb a lot of heat, and they radiate a lot. This doesn't stop you using darker claddings because you can use reflective foil laminate under the cladding.

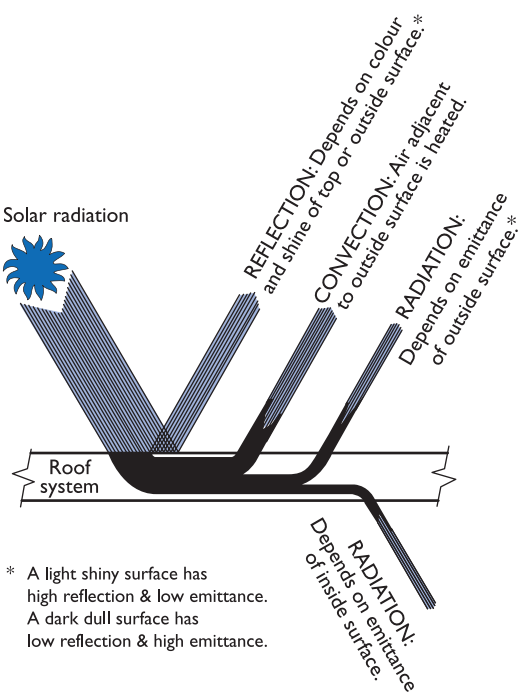


Figure 5.1.1
Heat transmitted into a building

COLORBOND® steel with THERMATECH® technology

The next generation COLORBOND® steel incorporates THERMATECH® technology, which provides a new level of thermal protection by absorbing less heat. Average reduction in solar absorption across all standard colours is 5%.

Now 14 of the 20 standard COLORBOND® steel colours are 'medium to light' under the BASIX colour classification, which means reflective foil at the roof may not be required. It also means a drop of roof insulation R rating may be applicable.

New COLORBOND COOLMAX® is specifically designed to reduce solar absorbtion. Refer to your local branch for colour availability for these products.

Table 5.1.1
Approximate thermal transmission (for comparisons only)

	Roofing only		Roofing with reflective foil laminate		Roofing with 50 mm insulation blanket & reflective foil laminate	
	Heat radiated from underside	Heat radiated + convected	Heat radiated from underside	Heat radiated + convected	Heat radiated from underside	Heat radiated + convected
	W/m²	W/m²	W/m²	W/m²	W/m²	W/m²
ZINCALUME®	25	40	2.0	9.0	2.0	7.0
COLORBOND®						
Coolmax® (Whitehaven®)	22.5	26.6	0.9	3.8	0.6	2.7
Classic Cream®, Surfmist®	37.1	43.8	1.5	6.1	1.1	4.3
Sandbank®	59.7	70.3	2.4	9.6	1.7	6.9
Wilderness®	91.2	106.9	3.6	14.4	2.5	10.3
Woodland Grey®	101.4	118.7	4.0	15.9	2.8	11.3
Deep Ocean®	108.2	126.6	4.3	16.9	3.0	12.0

Assumptions
- solar radiation = 850 W/m² (' average' Australian summer)
- ambient temperature = 30° C
- wind velocity over roof = 3 m/s
- still air under the roof system
- inside temperature = 30° C

Comparison of thermal performance

Table 5.1.1 shows thermal performances of different insulation systems by showing the heat that may be expected through roofs of new materials.

Heat control methods

In roofs, a simple, inexpensive and very effective method is to drape a membrane of reflective foil laminate over the supports before laying the cladding. The laminate can also provide a vapour barrier to minimise condensation. If the membrane is allowed to drape 50 to 75mm between the supports the air space between the membrane and the roof cladding will further improve heat insulation (Figure 5.1.2).

Additional heat insulation is often achieved by using bulk insulation blankets or batts (Figure 5.1.3).

The same principles apply to walls, though the foil is not draped.

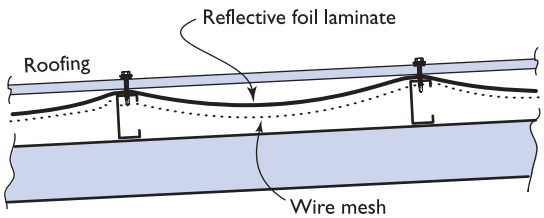


Figure 5.1.2
Reflective foil laminate is simple, cheap and very effective

5.2 Condensation

When the air in a building in contact with metal cladding is warmer than the cladding, water vapour (moisture) in the air can condense on the inside of the cladding.

Water vapour passes fairly freely through most building linings into the ceiling and wall spaces where it may directly contact the cladding.

Condensation can lead to deterioration of building components and staining of ceiling and walls. If insulation blankets or batts are wet, or even slightly dampened by condensation, its efficiency is reduced markedly.

The amount of condensation depends upon the amount of water vapour in the air and this varies with climatic conditions. Activities within a building can add substantially to the amount of water vapour, and typical domestic situations include bathing, showering, cooking, washing and drying clothes and dishes, and breathing. It is essential to vent substantial amounts of water vapour to outside the building.

To minimise the risk of condensation on the underside of roofing, a vapour barrier is often used to prevent contact of warm moist air with the roofing – reflective foil laminate is commonly used.

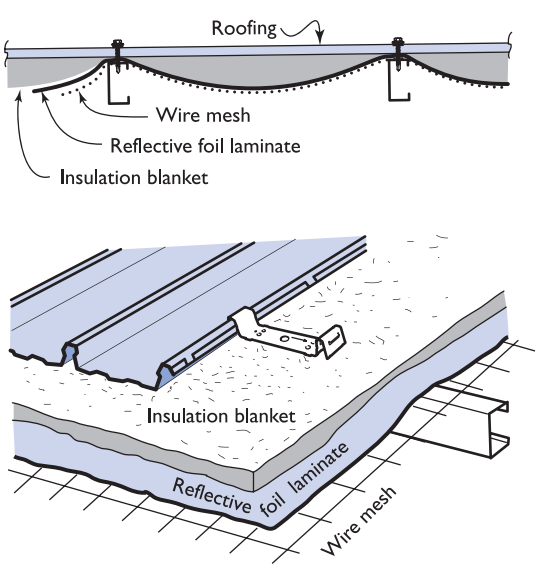


Figure 5.1.3
Typical roof insulation with foil and blanket

To minimise the risk of condensation on the underside of the laminate, the laminate must be draped between roof supports so that the cold cladding is not in contact with the laminate (except at the supports).

5.3 Noise reduction

Rain noise

To reduce rain noise on metal roofing, an insulation blanket can be placed over the foil laminate described above, before laying the roofing. It is important that the laminate is pulled tight enough to hold the blanket hard against the underside of the roofing so as to dampen the rain-induced vibration at the point of impact. If the blanket is not hard against the roofing the noise reduction will not be as good.

For purlin spacings over 1200mm: first lay wire mesh over the purlins, tighten and fix it, before laying the membrane.

Thermally-induced noise

Roofing expands and contracts due to temperature changes in the cladding, and particularly rapid changes can be caused by passing clouds or a strong breeze. For example: if a passing cloud suddenly shades the roof from the sun, the cladding temperature could drop about 3°C after 30 seconds in shade and about 10°C after 2 minutes in shade.

Thermally-induced noise is caused by slipping at fasteners where the roof expands relative to its supports. The slipping is controlled by the friction between the roof and its supports. When the static friction is overcome impulsively, sounds are produced — sometimes as loud as a pistol-shot — the higher the friction, the louder the sound. No damage to the cladding or fasteners will occur.

The noise can be reduced by:

- placing a material with low coefficient of friction between the roofing and its supports (for example PVC tape or strips of foil laminate);
- choosing steel supports rather than timber (lower coefficient of friction);
- choosing light coloured roofing;
- venting the roof space;
- including an expansion joint (Section 10.5);
- being careful about design details in valleys (where heat tends to be retained); and/or
- insulating the roof space to reduce the thermal differential. In tropical areas it may be better to insulate the ceiling rather than the roofing (which can also reduce noise) by having the silver foil facing upwards towards the roofing, instead of downwards towards the ceiling.;
- insulation previously recommended to overcome rain noise will also reduce the thermally induced clicking noise.

5.4 Insulation materials

Typical insulation materials are reflective foil laminates, insulation blankets or batts made from fibreglass, and boards made from polystyrene. Remember that the colour of cladding also has a marked effect (Section 5.1).

Foil laminates

Foil laminates reflect heat and can double-up as a vapour barrier to control condensation. Where they are used as a vapour barrier the joints between successive strips are overlapped about 100mm, and sealed with a tape impervious to moisture.

Blankets and batts

Blankets and batts minimise heat convection and are available with the laminate bonded to the fibreglass. They are also effective in reducing noise.

Insulation blankets must be protected from moisture, particularly around the edges of the roof and even more particularly at the bottom end of the cladding where rainwater run-off can be blown back under a low-pitched roof. If the blanket overhangs the bottom support, it may even come into contact with water in the gutter, where the insulation will absorb moisture and remain damp for extended periods, thus leading to deterioration of the coating on the underside of the roofing and reducing the effectiveness of the insulation.

Insulation blankets up to a nominal thickness of up to 100mm for pierce-fixed cladding and KLIP-LOK 700HS; and up to 50mm for KLIP-LOK 406 and all other concealed-fixed profiles will compress sufficiently over the roof supports to allow normal procedures to be used for fixing.
For KLIP-LOK CLASSIC 700, in thicknesses between 75-100mm, seek advice from our technical support line. However, you may need to increase the length of fasteners slightly to allow for the thickness of the compressed blanket between the cladding and support.

Polystyrene boards

Expanded and extruded polystyrene is also used for the same purposes as blankets and batts. The boards are more rigid and relatively less compressible which demand different fixing to that mentioned above. Seek advice from manufacturers of polystyrene insulation.

5.5 Insulation thickness (glass wool)

Insulation blankets and batts can cause cladding to bow out between the fasteners. To minimise this problem, the maximum thickness of blankets and batts should be 100mm for pierce-fixed cladding and KLIP-LOK 700HS and 50mm for KLIP-LOK 406 and all LONGLINE 305. (Maximum density 12kg/m^3.) For KLIP-LOK CLASSIC 700, in thicknesses between 75-100mm, seek advice from our technical support line. For more dense glass wool and rock wool, and thicker insulation, spacers are recommended.

5.6 Skylighting

One of the simplest methods of getting natural light through a steel roof is the inclusion of translucent sheets which match the steel profiles.

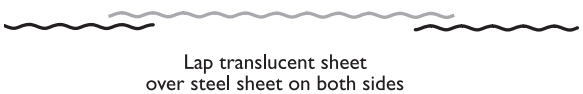
It is preferable to use profiled translucent cladding in single widths so that they can overlap, and be supported by, the steel cladding on both sides. It is also preferable to position the lengths of translucent cladding at the top of a roof run so the high end can lap under the capping or flashing and the low end can overlap a steel sheet. This is because the translucent cladding will readily overlap a steel sheet but the reverse is difficult.

Building regulations require a safety mesh to be fitted under translucent cladding.

Because of its greater thermal expansion, translucent cladding should be fixed using oversized holes and sealing washers recommended by the translucent cladding manufacturer. When used with concealed fixed claddings, ensure the fasteners do not penetrate the steel cladding. There are translucent products available that easily accommodate this and some translucent products have a clip-fixing system to allow thermal movement. Don't exceed the maximum support spacing specified by the translucent cladding manufacturer.

Skylighting increases the transmission of solar heat. Generally speaking, heat transmission is proportional to light transmission, so the more sunlight that enters a building the hotter it will be. Clear, uncoloured fibreglass has good light transmission of about 65% but this means on a typical summer day, with peak solar radiation of 850 W/m^2, transmission through a clear fibreglass skylight would be about 550 W/m^2.

Translucent fibreglass cladding is available to match CUSTOM ORB, INTEGRITY 820, KLIP-LOK 406, KLIP-LOK CLASSIC 700, KLIP-LOK 700HS, LONGLINE 305, SPANDEK and TRIMDEK. Polycarbonate cladding is also available for CUSTOM ORB and TRIMDEK.



Lap translucent sheet
over steel sheet on both sides

Figure 5.6.1
Placement of translucent sheets - pierce fixed decks

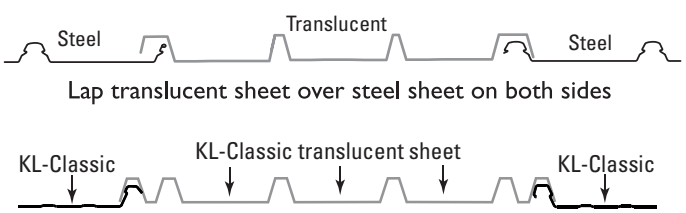


Figure 5.6.2
Placement of translucent sheets - concealed fixed decks

Date of Issue February, 2012

This Guide is the 2012-13 edition of the LYSAGHT Roofing & Walling Manual, issued on February, 2012. BlueScope Steel and BlueScope Lysaght may make changes to this Guide in its sole discretion. You should check you are using the most up-to-date version of the Guide before you start construction.

Conditions of Use

If you use this Guide, you acknowledge and agree that your use is subject to the terms and conditions in this Guide. BlueScope Steel, its agents, officers, employees, sub-contractors or consultants make no representations, either expressed or implied, as to the suitability of the information and data in this Guide for your particular purposes. It's your responsibility to ensure the design you use is appropriate for your needs, the products you have purchased, your site and structural limitations and your building and construction capabilities.

Use of Genuine Materials

Structures in this Guide should only be built or constructed using those genuine LYSAGHT® or recommended third party products. Except as otherwise provide in these terms, any warranties only apply to you (if at all) if you use the recommended genuine LYSAGHT® or third party products and method of construction.

Check Delivery

It is important that you check all materials delivered to site against your invoice before you use them in your building or construction to ensure all components have arrived, are of the appropriate quality and are ready for installation.

Limitation of Liability

By using this Guide, you accept the risks and responsibility for all losses, damages, costs and other consequences resulting directly or indirectly from using this Guide. To the maximum extent permitted by law, BlueScope Lysaght's liability (whether arising under statute, contract, tort (including negligence), equity or otherwise) to any persons whatsoever in respect of anything done or not done, arising directly or indirectly, by any such person in reliance, whether in whole or in part, on this Guide, is limited, at BlueScope Lysaght's option, to:

(a) in the case of goods, the repair of the goods, the replacement of the goods or paying for the cost of repair or replacement of the goods; or

(b) in the case of services, the resupply of services or paying for the cost of resupplying the services.

This publication is intended to be an aid for professional engineers in design matters, and builders or roofing contractors in relation to construction and is not a substitute for professional judgement.

Product Descriptions

All descriptions, specifications, illustrations, drawings, data, dimensions and weights contained in catalogues, price lists, or other advertising matter of BlueScope Lysaght or elsewhere are approximations only. They are intended by BlueScope Lysaght to be a general description for information and identification purposes and do not create a sale by description. BlueScope Lysaght reserves the right at any time to:

(a) manufacture and procure Goods with such minor modifications from its drawings and specifications as it sees fit; and

(b) alter specifications shown in its promotional literature to reflect changes made after the date of such publication

GENERAL NOTES TO READ BEFORE YOU USE THIS GUIDE

This Guide has been prepared for a range of roofing and walling applications including water drainage systems, using products manufactured or supplied by BlueScope Lysaght.

The information in this booklet is suitable for use only in areas where a tropical cyclone is unlikely to occur as defined in AS/NZS 1170. 2:2002 Part 2: Structural Actions - Wind Actions (or if used outside Australia, to the equivalent standard).

Information on cyclonic performance may be found in our Cyclonic Area Design Manual which is available on-line at www.lysaght.com.

All erection and connection details to be made in accordance with the relevant standard connection details drawing contained in this Guide.

We recommend you get professional advice to ensure your particular needs are adequately met.

a) Before you commence construction:

b) you should check with your local government authority to see if any form of prior permission or approval is required;

c) if you want to build or construct any attached structure, you should seek advice from a suitably qualified engineer to verify the capacity of your existing structure to withstand any additional load arising from the attached structure. You should also check with your local government authority to determine any specific requirements for the attachment to existing structures;

d) you should check with your local workplace health and safety authority to see what safety measures you need to put in place prior to and during construction. It is the responsibility of the installer/erector to ensure all local safe work practices are adhered to and the safety of the whole site is maintained at all times.

To ensure maximum lifespan of your building, consult your nearest BlueScope Lysaght branch for information regarding maintenance, handling, storage and any other technical assistance you may require.

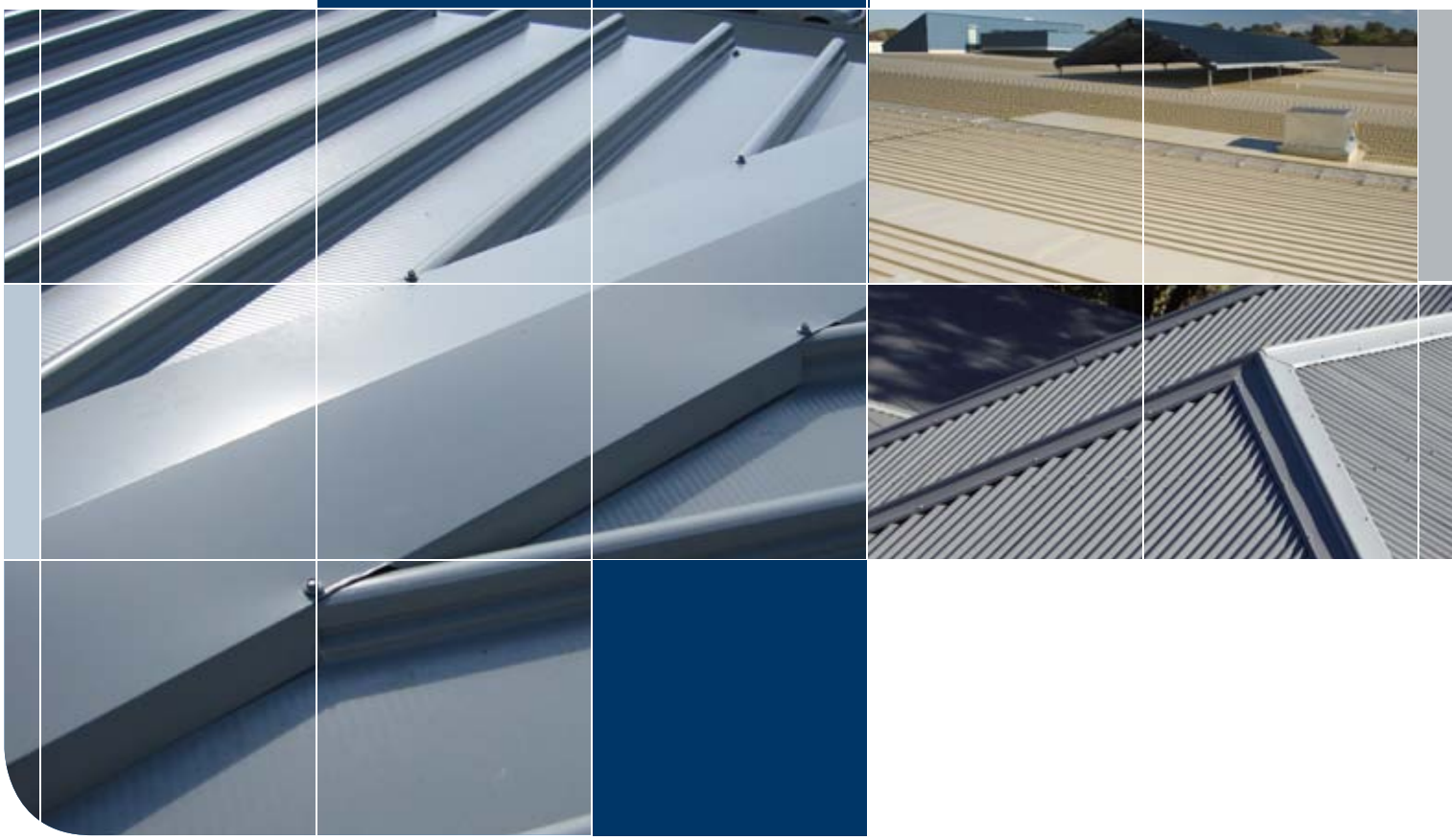
Terms and conditions of sale are available at local BlueScope Lysaght sales offices.

Published by BlueScope Lysaght Limited
© BlueScope Lysaght Limited 2012

Lysaght Roofing and Walling Manual

Previously published as:

Lysaght Roofing & Walling Users Guide
Steel Roofing and Walling: Installation Manual, and
Using Lysaght Roofing and Walling



Product Descriptions
All descriptions, specifications, illustrations, drawings, data, dimensions and weights contained this catalogue, all technical literature and websites containing information from BlueScope Lysaght are approximations only.
They are intended by BlueScope Lysaght to be a general description for information and identification purposes and do not create a sale by description. BlueScope Lysaght reserves the right at any time to:

(a) supply Goods with such minor modifications from its drawings and specifications as it sees fit; and
(b) alter specifications shown in its promotional literature to reflect changes made after the date of such publication.

Disclaimer, warranties and limitation of liability

This publication is intended to be an aid for all trades and professionals involved with specifying and installing Lysaght products and not to be a substitute for professional judgement.

Terms and conditions of sale available at local BlueScope Lysaght sales offices.

Except to the extent to which liability may not lawfully be excluded or limited, BlueScope Steel Limited will not be under or incur any liability to you for any direct or indirect loss or damage (including, without limitation, consequential loss or damage such as loss of profit or anticipated profit, loss of use, damage to goodwill and loss due to delay) however caused (including, without limitation, breach of contract, negligence and/or breach of statute), which you may suffer or incur in connection with this publication.

© Copyright BlueScope Steel Limited March 2, 2012

BLUESCOPE LYSAGHT

Technical enquires: steeldirect@bluescopesteel.com or call 1800 641 417

www.lysaght.com

Please check the latest information which is always available at www.lysaght.com

LYSAGHT is a registered trademark of BlueScope Steel Limited, ABN 16 000 011 058. The LYSAGHT® range of products is exclusively made by BlueScope Steel Limited trading as BlueScope Lysaght. Printed by PM 1.5K 3/12

9 320075 072810