



Commercial Roofing

INSULATION PRODUCT SELECTOR



CSR

Bradford™ DesignSmart™ FOR SMARTER SPECIFICATIONS

Bradford DesignSmart™ has been developed to help architects, designers and specifiers select the right insulation products for their building projects.

DesignSmart encompasses a range of tools and resources that will guide you through the requirements of the Building Code of Australia (BCA) and National Construction Code (NCC), help carry out design calculations quickly and easily and allow you to compare different insulation systems to meet and exceed the regulations.

DesignSmart also provides access to a wealth of resources including, data sheets, samples specifications, CAD files, MSDS/SUIS and expertise from our architectural specialists.

The DesignSmart tools include:



DesignSmart design guides contain all you need to know to meet the deemed to satisfy requirements of the BCA Section J for your specific building type.



The DesignSmart online calculator helps carry out complex calculations to allow you to quickly and easily design insulation systems for your project.



The DesignSmart product selectors provide comprehensive design information to assist with developing project specific specifications while meeting Section J requirements for specific applications.



DesignSmart CPD training modules allow you to improve your understanding and expertise to meet Section J regulations within your practice.

For more information call **1300 760 233** or visit bradfordinsulation.com.au

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1.0

Introduction

Designing and selecting the right materials to meet Building Code and end user requirements is critical during the design phase of a project. With the introduction of amendments to the National Construction Code of Australia for 2016, CSR Bradford™ has updated this Commercial Roofing manual to incorporate the latest changes to the Energy Efficiency provisions for Class 2-9 commercial buildings contained within the Building Code of Australia (BCA).

This manual provides guidance on:

- The building code energy efficiency provisions for commercial roofing insulation;
- How to meet and exceed these BCA requirements with CSR Bradford insulation products;
- Roof spacer and purlin system products available to ensure insulation product recovery in accordance with the BCA regulations;
- Decorative and functional insulation blanket facing options to suit a broad range of applications.

In addition to this manual, the CSR Bradford online DesignSmart suite of resources provides access to a broad range of useful resources, check online at www.bradfordinsulation.com.au/designsmart

The Building Code represents the minimum level of insulation for good energy efficiency and performance of the conditioned spaces within the building envelope. Given the relatively low capital cost of insulation, increasing roofing insulation R-Values during the design phase can decrease the air conditioning load, thus reducing project capital equipment costs as well as future running costs.

Furthermore, even in buildings that are not air conditioned (such as warehouses), the use of insulation will help reduce the extremes of internal temperature to improve employee comfort and productivity.

CSR Bradford recommends that a qualified engineer be consulted when specifying insulation work for your project to ensure that the insulation specified will provide optimum energy efficiency and BCA compliance.



green building council australia
MEMBER

Bradford Insulation is a member of the Green Building Council of Australia.

2.0 Roofing design considerations

2.1 The benefits of insulation

- Helps meet or exceed the BCA Energy Efficiency requirements by providing thermal insulation – by meeting these requirements your smart design allows the mechanical ventilation system to work more efficiently and improves occupier comfort and minimises on-going operational cost.
- Provide a more comfortable working environment for occupants by reducing heat flow in and out of the building;
- A better working environment, by reducing rain and other external noise and also by suppressing reflection of internal noise;
- A safer environment, as it reduces the possibility of fire spread in the event of a roof-space fire;
- Helps manage the occurrence of condensation which minimises the risk of damage to roof sheeting and internal ceiling linings caused by condensation;
- Decreases building running costs, by reducing the load required to heat and cool the space and/or the size of the heating/cooling plant;
- Reduced 'metal creep' – creaking noises which occur when there are sudden external temperature changes.

2.2 Designing for BCA Section J and Green Star

The Building Code of Australia (BCA) provides the minimum deemed to satisfy total thermal performance required for roofs. Insulation plays a major role in achieving these minimum values.

In Green Star buildings one of the highest factors that contribute to the achievement of Green Star points is energy improvement. The upgrade of passive insulation within a building can result in significant energy savings.

Regardless of the building achieving a Green Star rating or meeting Deemed-to-Satisfy provisions of the BCA,

there is a strong case to increase specified insulation performance as the energy savings can help offset the increase in capital costs.

2.3 Designing for condensation requirements

Condensation can become a problem when warm, moist air from inside a building comes in contact with a colder metal roof. This can lead to rust damage of the roof sheeting and internal linings, as well as potential adverse health effects from mould and mildew.


Bradford Anticon™ has been developed specifically for the control of condensation and will dramatically reduce the chance of condensation occurring underneath metal roofs.

Although the BCA does not currently consider condensation control, Bradford Anticon will meet the energy efficiency requirements of the Building Code as well as control condensation in most climate zones. That said, additional care should be taken in tropical and alpine climate zones where climate and moisture are more extreme. Even when buildings are not required to meet the BCA, insulation should still be considered to reduce the potential of condensation occurring in a building.

For applications in tropical climates, Anticon is available with antiglare foil, specifically designed to reduce condensation in humid environments. The antiglare foil can also be installed in an upwards direction to allow installation in direct sunlight. For more information on designing for tropical regions please contact your CSR Bradford representative.

2.4 Designing for noise control

The bulk Glasswool insulation component of Bradford Anticon against the roof metal not only reduces airborne noise, it also provides a damping effect to reduce impact noise such as rain. Rain noise predictions estimate that




DESIGNSMART™ ONLINE CALCULATOR


Customised information at your fingertips

DesignSmart places all the information you need for your specific project at your fingertips. The web based tools allow you to review the BCA for each class of building and help you design and specify the insulation products to meet the building's thermal and acoustic requirements

Best of all, **DesignSmart** will email detailed design calculations, relevant product data sheets, MSDS/SUIS and specifications to you to include in your project file, speeding up your design process.



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the addition of Anticon 145 directly under the roof sheet can reduce the rainfall sound power level (LW dB) by over 20% when compared against no insulation. Please refer to Section 6.3 and Table [6.3] for detailed information and always consult an Acoustic Engineer prior to finalising your project specification.

2.5 Designing to control fire risk and BAL

The Bradford Anticon® bulk insulation blanket range is deemed non-combustible, making roof designs safer by not adding to the fuel load in the roof space. Anticon also provides additional ember protection in accordance with BAL construction guidelines.

Where the insulation is exposed and becomes the ceiling lining, CSR Bradford has a range of insulation materials, sarking and facing products that can meet the BCA compliance to ISO 9705 Full-room scale test to Group 1, Early fire hazard Indices, tested to AS/NZS1530.3, as well as FM Global Approved range of Anticon FC roofing blankets. Please ensure that your Fire Engineer reviews all recommendations prior to installation.

2.6 Designing for sustainability

Bradford Glasswool is manufactured from up to 80% recycled glass which is not suitable for recycling in other processes and would otherwise go to landfill.

CSR Bradford has undertaken an audit of our Glasswool and reflective foil laminate insulation manufacturing processes referencing the US EPA List of Ozone Depleting Substances (Class 1 and Class 2). The audit found that no ozone depleting substances are involved in either the manufacture or composition of these products. The conclusion of the audit was that Bradford's Glasswool and Reflective foil laminates have an Ozone Depleting Potential of zero.

CSR Bradford recognises that, as an insulation supplier we have a significant role to play in the passive reduction of energy use in our world.

2.7 Designing for agricultural use

CSR Bradford offers a range of products designed to resist the conditions found in agricultural use. Bradford **Agricon™** is specially designed for areas which require wash-down such as poultry and animal husbandry applications and is available in two colours: off white and forest green.

2.8 Designing for aesthetics

Use of the right facing material on your Bradford Anticon can contribute to the interior aesthetic finish of your building. Our premium foil range as well as

membranes that can be laid separately for a decorative finish, can ensure that you achieve the right finish. Contact CSR Bradford for further information or refer to the tables [4.1 & 4.2] on page 9 and 10 for more information.

2.9 Designing for indoor air quality

Bradford Anticon Glasswool insulation has been tested in accordance with ASTM D5116 and found to have low Volatile Organic Content (VOC). This result is below the detection limit for the test method and indicates that the emissions can be considered insignificant.

2.10 Understanding R-Values and emissivity

As most CSR Bradford roofing insulation products combine a Glasswool base blanket with a facing, a very wide range is available. In order to select the right product combination for your application, CSR Bradford recommend that you determine the blanket thickness required to meet the thermal requirements of the project and then select the facing that provides the best level of performance or aesthetics for your particular application.

AS/NZS4859.1:2002 allows insulation manufacturers to present the performance of insulation either as a material value (R_M) or a total R-Value (R_T) for the application. In order to ensure proper product representation and accurate performance and cost comparison of products, it is important that the distinction between the two classifications is clear.

MATERIAL R-VALUE (R_M)

This is a unit of thermal resistance for a particular material (e.g. an insulation batt) or assembly of materials (such as an insulation panel). The higher the R-Value of the material the better it insulates. This unit is product specific, can be independently verified, and does not account for the impact of installation specific contributions from aspects such as air spaces or the contribution of other materials in the building construction.

Note: R_M is directly proportional to the insulation material thickness

TOTAL R-VALUE (R_T)

This is the overall performance of the roof system, including the base insulation material, contribution of materials used in the construction of the building, air spaces and air film resistances.

Please note that as the emissivity of the facing material can influence the Total R-Value – this manual only represents R_T values for reflective foil faced products. For all other facing materials (for example white) it is important that CSR Bradford is consulted early in the design phase to ensure that the base insulation material is adequately compensated for any reduction in overall performance.

*Density up to 15.9kg/m³

3.0 Compliance to the BCA

The BCA makes provisions for energy efficiency in conditioned spaces, sound insulation and fire protection for buildings. These recognise that well insulated buildings that control heat and cold, along with good acoustic insulation are important elements of good building design.

Please note that the following is a guide and CSR Bradford recommends that you work closely with your building surveyor/private certifier, fire engineering consultant and insurance provider early in the design phase of your building to ensure compliance where appropriate to your specific building type and project requirements.

To provide long term energy savings with a minimal increase in initial installation cost, CSR Bradford recommends an incremental increase in insulation performance above the BCA Section J Deemed-to-Satisfy minimum insulation levels. The Bradford

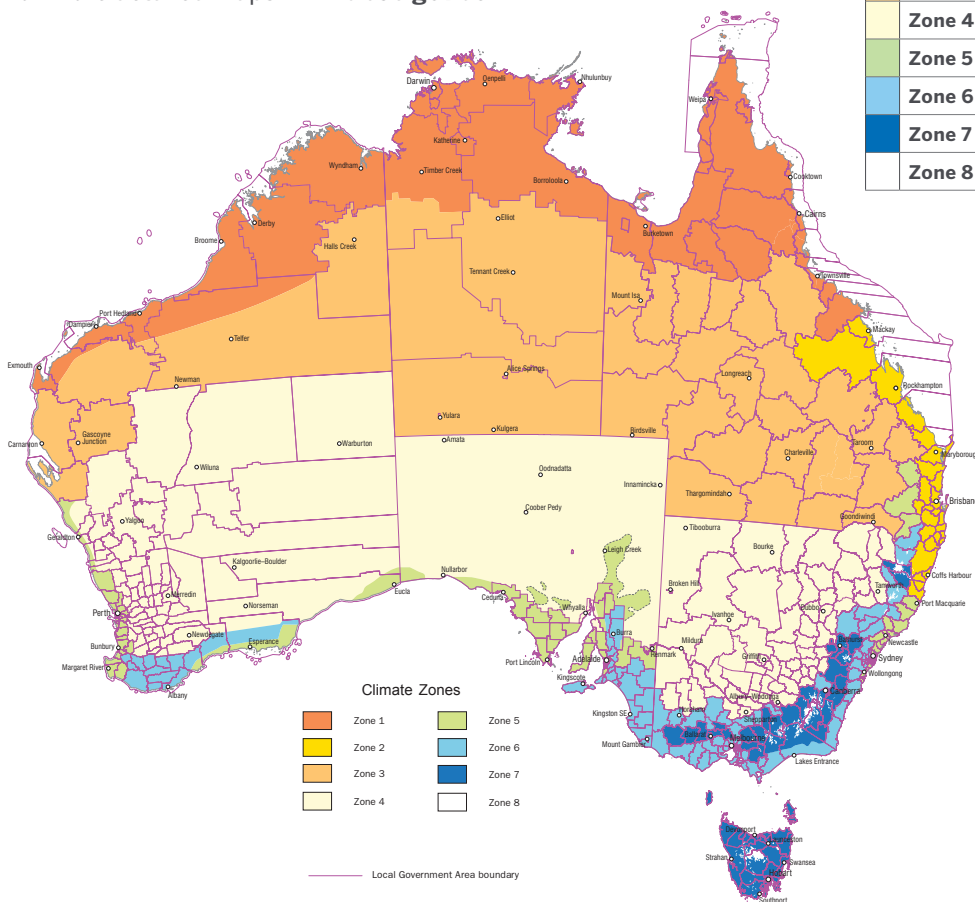
DesignSmart program has been developed specifically to help simplify the process of meeting the Deemed-to-Satisfy provisions of the BCA. Follow these simple steps to specify the right roofing insulation for your project.

Bradford™
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TECHNICAL SERVICES

- A.** Select the climate zone for your project location from the BCA map
- B.** Determine the required thermal performance
- C.** Select the required roof system and note the minimum required insulation product

STEP A: Select the Climate Zone

The BCA specifies the minimum Deemed-to-Satisfy performance for a commercial roof dependent upon the climate zone the building is located in. Locate the correct climate zone for your building from the following map or go to the Australian Building Codes Board website for more detailed maps www.abcb.gov.au.



CLIMATE ZONE

- | | |
|---------------|--|
| Zone 1 | Darwin, Townsville, Cairns |
| Zone 2 | Brisbane, Gold Coast, Sunshine Coast |
| Zone 3 | Alice Springs |
| Zone 4 | Dubbo, Griffith |
| Zone 5 | Sydney East of Parramatta, Adelaide, Perth |
| Zone 6 | Melbourne, Sydney West of Parramatta |
| Zone 7 | Hobart, Canberra |
| Zone 8 | Alpine regions |



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Last amended: May 2009

Developed from a map produced by the Bureau of Meteorology

STEP B: Select the Roof Colour

The requirements for system R-Value contained in BCA Section J vary depending on the colour of the roof. It is critical that the manufacturer's designated solar absorptance value for the building's selected roof colour is used in this step of the process.

IMPORTANT – Loss of ceiling insulation BCA Table J1.3b – note that the BCA also sets out a requirement for adjustment of minimum R-Value to compensate for loss of ceiling insulation due to the presence of recessed light fittings and services. The following roofing insulation tables in this manual do not provide solutions where the loss of ceiling insulation exists – please refer to the BCA for further details and contact CSR Bradford for solutions.

3.1. Minimum total system R-Value required

Using the relevant climate zone selected in step A, determine the solar absorptance and appropriate BCA compliant year for the project design. Using the table below correlate the three (3) variables to determine the minimum Total System R-Value required. Please note that the solar absorptance value range changes between 2011 and 2012 - 2016.

ROOF COLOUR		CLIMATE ZONES							
		1	2	3	4	5	6	7	8
DIRECTION OF HEAT FLOW		INWARDS						OUTWARDS	
BCA 2011	Very light roof (absorptance ≤ 0.4)	R _T 3.2	R _T 3.2	R _T 3.2	R _T 3.2	R _T 3.2	R _T 3.2	R _T 3.7	R _T 4.8
	Light roof (0.4 > absorptance ≤ 0.6)	R _T 3.7	R _T 3.7	R _T 3.7	R _T 3.2	R _T 3.2	R _T 3.2	R _T 3.7	R _T 4.8
	Dark roof (absorptance > 0.6)	R _T 4.2	R _T 4.2	R _T 4.2	R _T 3.2	R _T 3.2	R _T 3.2	R _T 3.7	R _T 4.8
BCA 2012-2016	Very light roof (absorptance ≤ 0.4)	R _T 3.2	R _T 3.2	R _T 3.2	R _T 3.2	R _T 3.2	R _T 3.2	R _T 3.7	R _T 4.8
	Light roof (0.4 > absorptance ≤ 0.6)	R _T 3.7	R _T 3.7	R _T 3.7	R _T 3.7	R _T 3.7	R _T 3.2	R _T 3.7	R _T 4.8
	Dark roof (absorptance > 0.6)	R _T 4.2	R _T 4.2	R _T 4.2	R _T 4.2	R _T 4.2	R _T 3.2	R _T 3.7	R _T 4.8

Table 3.1



STEP C: Determine the minimum insulation required for the roof

From the table below, select the relevant roof system for the project and then correlate this roof system with the required Total R-Value (R_T) generated in Table 3.1 from the preceding step (shown along the top row).

The Bradford Anticon Deemed-to-Satisfy solution is

displayed at the intersection of the roof system (x-axis) and Total R-Value (y-axis).

Note regarding emissivity: These R_T values relate to Anticon products faced with light, medium or heavy duty reflective foils only. Please contact CSR Bradford for assistance in calculating R_T values for Anticon faced with decorative facings or Agricon products.

ROOFS		TARGET TOTAL R-VALUE _T					
DEEMED-TO-SATISFY TOTAL R-VALUE		R _T 3.2	R _T 3.7		R _T 4.2	R _T 4.8	
HEAT FLOW DIRECTION		INWARDS	INWARDS	OUTWARDS	INWARDS	OUTWARDS	
Flat metal roof with no ceiling R0900 – use Spacers where appropriate, refer Section 5							
		Anticon foil faced blanket	100HP	130	145	145	*
		Additional Bradford Gold Ceiling insulation	Nil	Nil	Nil	Nil	*
Flat metal roof with suspended ceiling R1000 – use Spacers where appropriate, refer Section 5							
	air gap ≥ 100mm < 300mm	Anticon foil faced blanket	60	80	130	100	100HP
		Additional Bradford Gold Ceiling insulation	Nil	Nil	Nil	Nil	R1.5
Flat metal roof suspended ceiling plenum return R1100 – use Spacers where appropriate, refer Section 5							
		Anticon foil faced blanket	140	145	145	*	*
		Additional Bradford Gold Ceiling insulation	Nil	Nil	Nil	*	*
Flat 150mm concrete roof with suspended ceiling R1200 – use Hilti or Ramset pins where appropriate							
	air gap ≥ 100mm < 300mm	Anticon foil faced blanket	60	80	130	100	100HP
		Additional Bradford Gold Ceiling insulation	Nil	Nil	Nil	Nil	R1.5
Flat 150mm concrete roof with ceiling plenum return R1300 –use Hilti or Ramset pins where appropriate							
		Anticon foil faced blanket	140	145	140	*	*
		Additional Bradford Gold Ceiling insulation	Nil	Nil	Nil	*	*
Flat metal roof with plasterboard ceiling R0700 – use Spacers where appropriate, refer Section 5							
	minimum air gap 100mm	Anticon foil faced blanket	60	80	130	100	100HP
		Additional Bradford Gold Ceiling insulation	Nil	Nil	Nil	Nil	R1.5
Pitched metal roof with flat ceiling R0200 – use Spacers where appropriate, refer Section 5							
		Anticon foil faced blanket	100	100HP	130	130	100HP
		Additional Bradford Gold Ceiling insulation	Nil	Nil	Nil	Nil	R1.5
Pitched metal roof with cathedral ceiling below rafters (non ventilated) R0400 – use Spacers where appropriate, refer Section 5							
	minimum air gap 100mm	Anticon foil faced blanket	80	100	130	130	100HP
		Additional Bradford Gold Ceiling insulation	Nil	Nil	Nil	Nil	R1.5

Table 3.2: BCA Deemed-to-Satisfy Anticon product solutions

*Contact CSR Bradford for a solution. For detailed system descriptions refer to ICANZ Insulation Handbook, Part 1 Thermal Performance or consult your nearest CSR Bradford representative. In some climates consideration must be given to the positioning of the vapour barrier and the level of insulation as the minimum BCA targets may not be adequate to provide the required condensation control. BCA also sets out a requirement for adjustment of minimum R-Value to compensate for loss of ceiling insulation due to the presence of recessed light fittings and services, please refer to BCA Part J, Table J1.3b Adjustment of minimum R-Value for loss of ceiling insulation, or consult Bradford for further details.

Choosing the right product for your project is essential to ensure the proper performance and appearance. This section provides basic guidance on product selection, but if you are in doubt please contact CSR Bradford for expert advice specific to your project needs.

4.1 How to select the right product for your project

The CSR Bradford range of roofing insulation products can be used for a variety of applications. The following table provides guidance on some of the more popular product applications.

APPLICATION	RECOMMENDED PRODUCT AND FACING
Warehouse: Exposed roof which requires an adequate finish while maximising the potential for reflective insulation benefits	Bradford Anticon with medium or heavy duty foil
Bulky goods retail: Exposed roofs that require a superior aesthetic finish and good light reflectance	Bradford Building Blanket with heavy duty foil or Thermoplast 993 white sarking laid separately
Sporting and halls: Exposed roofs that require a superior aesthetic coloured finish and good light reflectance	Bradford Building Blanket with Thermoplast 993 white sarking laid separately
Farm sheds: Exposed roofs in sheds used for housing poultry and livestock	Bradford Agricon in either off-white or forest green
Car parks: Exposed under-slab roof applications	Bradford Supertel Blanket or Board faced with heavy duty foil or Thermoplast 993 white, or Xtratherm XtroLiner Std/Duo PIR boards
Chilled beam applications: Exposed cooling beams partially visible inside a building	Bradford Supertel faced with Ultraphon (Black)
Exposed roofs: Where aesthetics (visual appearance) is important	Bradford Building Blanket with Thermoplast 993 white sarking or Thermoseal 753 reflective sarking laid separately
Exposed roofs: Where acoustics are important	Bradford Building Blanket with Thermoseal Perforated Foil. (Note: This system is not suitable for condensation control, contact CSR Bradford for alternative solutions)
VENTILATION	
Heat load: Roof spaces where excess heat loads need to be ventilated	Edmonds Hurricane™ or EcoPower® roof ventilators
Noxious gases: Roof spaces where noxious gases need to be ventilated	Edmonds EcoPower® roof ventilator

For project specific applications not listed above, please contact CSR Bradford for design specific advice on product suitability.

Table 4.1



4.2 Available facing materials for roofing blanket

Anticon and Roofing Blanket products are available in a range of facings as shown below. Please note that only facings that are vapour impermeable are suitable for condensation control.




FACING	DESCRIPTION	EMISSION ¹	CONDENSATION CONTROL ²	AESTHETICS ³	ACOUSTICS ⁴ (Assumes same base material)
Foil facings – suitable for all system applications					
Thermoseal™ light duty 729	 An economical reflective foil	✓✓✓	✓✓✓	✓	✓
Thermoseal™ medium duty 730	 A stronger foil with additional tear resistance	✓✓✓	✓✓✓	✓✓	—
Thermoseal™ heavy duty 750	 Premium strength for a premium finish	✓✓✓	✓✓✓	✓✓	—
Acoustituff™	 A tough, lightweight reflective foil facing that provides a combination of acoustic performance and condensation control	✓✓✓	✓✓	✓	✓✓
Antiglare	 Antiglare foil specifically designed to reduce condensation in humid environments, the Antiglare foil can also be installed in an upwards direction to allow installation in direct sunlight.	✓✓	✓✓✓	✓	—
Tuff (Available with Anticon only)	 A polyweave reinforced reflective foil facing with additional tear resistance and reduces resistance to unrolling during installation.	✓✓✓	✓✓	✓✓	—
Acoustic facings – only suitable for R0900 systems (with no ceiling)					
Thermoseal™ Perforated (Note: Only suitable for roof systems with no ceiling. Not suitable as a vapour barrier.)	 Available in Medium Duty (730PERF) and Heavy Duty (750PERF) foil reflective facing for applications where a combination of acoustic and thermal properties are required.	✓✓✓	NA	✓✓	✓✓✓
Ultraphon™ (Note: Not suitable as a vapour barrier.)	 A black, premium woven glass facing suitable for visible applications where superior broadband sound absorption properties are required.	NA	NA	✓✓✓	✓✓✓
Black and white sarkings – suitable for all system applications					
Thermoplast 993 black sarking	 A black, no reflectivity foil sarking – non aesthetic, suitable for hidden applications only	NA	✓✓✓	✓✓	—
Thermoplast 993 white sarking	 A white sarking with medium level of reflectivity. For an aesthetic finish, can be laid separately to Glasswool blanket.	✓	✓✓✓	✓✓✓	—

Table 4.2

- 1 Emissivity is the ability of a material to emit energy by radiation – the table above provides guidance to the degree that the facing material impacts the performance of the total system R-Value (R_{τ}) of the insulation blanket and facing material.
- 2 Condensation control – please note that only facings that are vapour impermeable are suitable for condensation control, which requires all lap joints and penetrations to be lapped and taped at installation.
- 3 Aesthetics refers to the visual appearance of the exposed roof after installation – the table above provides guidance to the visual appearance that can be achieved with the facing material based on typical installation conditions. Other application and installation conditions may affect the visual appearance of the roof.
- 4 Acoustic performance of the facing material assumes same base material.

5.0 Roofing systems

5.1 Code compliance

To ensure compliance with Section J, Energy Efficiency Provisions for class 2-9 buildings, insulation must be allowed sufficient space under the roof sheet to recover to its design thickness, other than where it is compressed between cladding and supporting members. Bulk insulation will only achieve its designed performance (R-Value) when allowed to recover to its nominal thickness and its incumbent on the roof design to allow this to occur.

There are a number of methods that can be used to allow bulk insulation to recover to its designed thickness and deliver the required thermal performance.

Spacer systems: A roof spacer system typically elevates the roof sheet and creates extra space between the top of the purlin and the roof sheet, to allow the insulation to recover.

Purlin systems: A purlin system does not raise the height of the roof, but instead utilises the depth of the purlins to provide a cavity for the insulation to recover to its design thickness.

Panel systems: A panel system consists of using pre-assembled metal roof panels with an insulated core.

5.2 Spacer systems

It is important when spacer systems are used that the height of the spacer is matched to the thickness of insulation blanket being used. Typical roof systems will see the safety mesh installed between purlins to sag to a degree (even when pulled taut as required by Work Cover and OH&S Code of Practice guidelines) and an allowance needs to be made for this.

It should be noted that AS/NZS4859.1 testing makes no allowance for any compression of insulation so it is critical that the combination of spacer and insulation blanket is reviewed to ensure compliance.

5.3 Ashgrid Spacer System

The Bradford Ashgrid Spacer System attaches to the top face of the purlin and elevates the roof sheet to create space for the insulation. Available in a number of different bracket heights to suit the various insulation thicknesses, the Ashgrid Spacer System is also available in a fully tested (low-high-low) cyclonic version. In addition, the Ashgrid spacer system is approved for use with Sayfa 3SIXTY (AP130.10) roof anchors, tested to AS/NZS 5532:2013 Dynamic and 7.5kN Static Load Performance Testing. Refer to the Roof Spacer System Product Selector for detailed specifications.

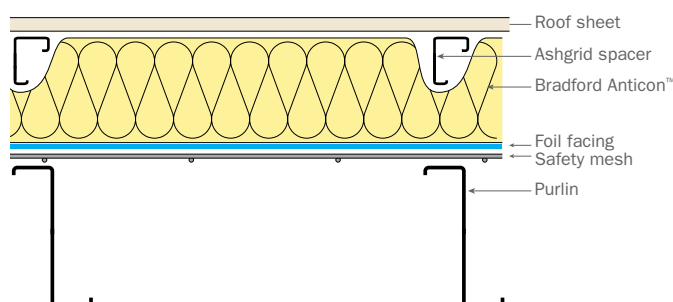


Figure 5.3: Bradford Spacer System configuration

ASHGRID SPACER SELECTOR			
ANTICON PRODUCT	R _{MAT}	BLANKET THICKNESS (mm)	ASHGRID SPACER HEIGHT (mm)
Anticon 60	R1.3	60	40mm batten
Anticon 80	R1.8	80	60
Anticon 100	R2.3	100	80
Anticon 100HP	R2.5	100	80
Anticon 110	R2.5	110	80
Anticon 130	R3.0	130	110
Anticon 140	R3.3	140	120
Anticon 145	R3.6	145	120
Building blanket 175	R4.2	175	150

Table 5.3: Spacer application range for Anticon insulation

Important Note: Ashgrid Spacer Selection is based on installation with safety wire. As Spacer Systems change the roofing structure, please check with your Structural Engineer that the spacer used is compatible with the roof system design prior to construction.



5.4 Purlin systems

Unlike roof spacers, purlin systems utilise the depth of the purlins to provide adequate space for the insulation to recover to its design thickness without elevating the overall roof or fascia height. The lower roof line is also beneficial in keeping the overall volume of the building as designed and not impacting on the capacity of building services required.

In addition, as purlin systems do not require additional roof spacers to elevate the roof sheet above the purlin, this retains the structural integrity and load points of the roof interior. Purlin systems are suitable for most roof pitches and complex roof designs.

5.5 SafeBridge® Purlin system

SafeBridge® is a unique, patented system that combines roof safety with BCA Section J compliance without the use of roof spacers. Through the development of a patented bridging system and keyway, SafeBridge® allows the purlin bridging to be set at a predetermined height during the design phase, to ensure even insulation recovery across the entire roof. By designing in this 'cavity' for the insulation, SafeBridge® retains attachment of the roof sheet to the purlins which ensures that this roof system is as flexible as the architect wants to be.

To further minimise risk exposure, the system uses an innovative 'mesh trolley' to allow extremely fast roll-out of mesh along the length of the purlins, something that is simply not possible with traditional spacer systems.



The key safety benefits are:

- Creates a safer roof environment for workers during construction
- Code compliant with BCA/NCC Section J
- Uses the purlin space without elevating the overall roof or fascia height
- Suitable for cyclonic and non-cyclonic regions

For more information and project specific advice, please contact CSR Bradford early in the design process.

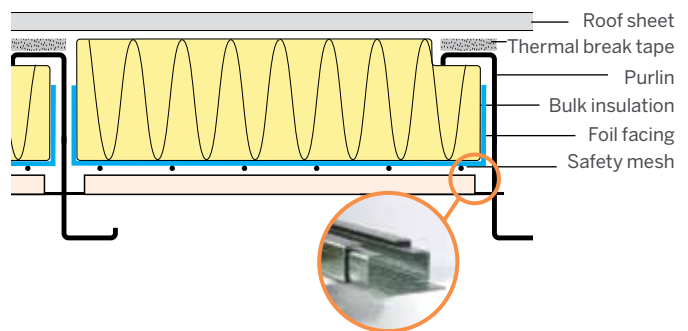
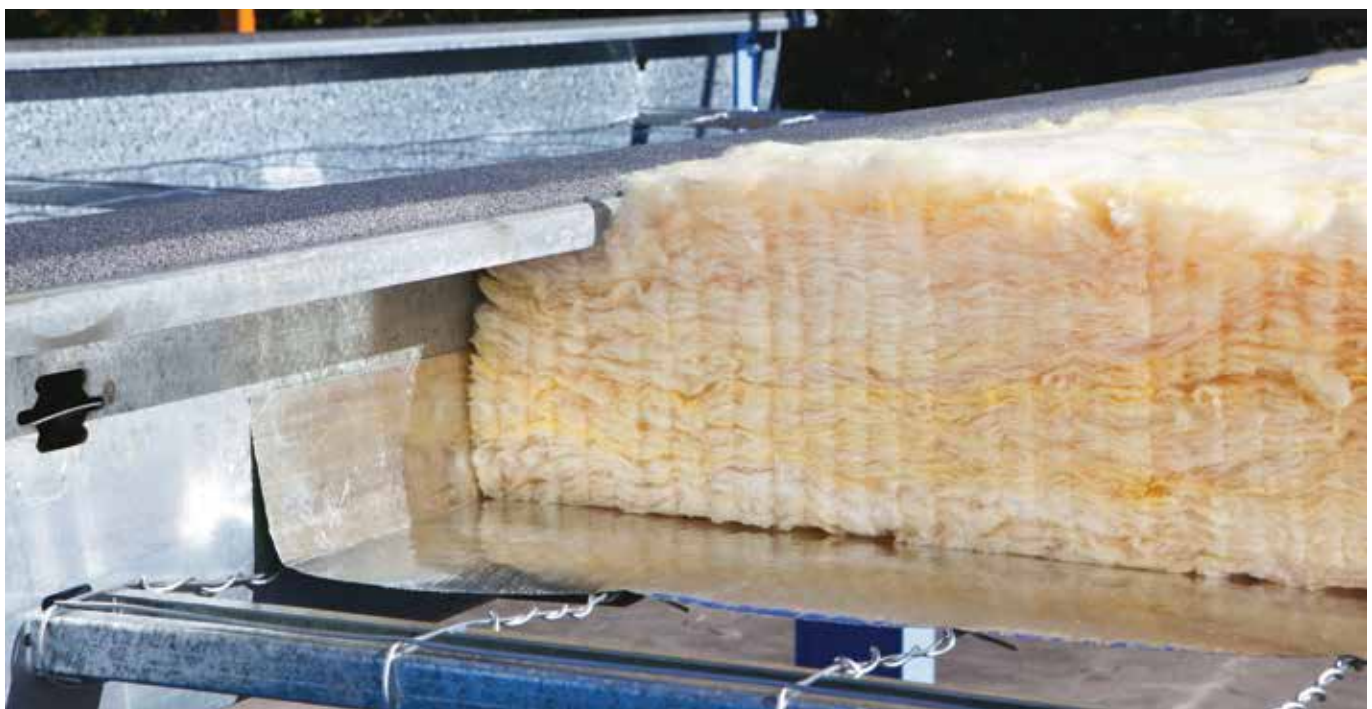


Figure 5.4 SB-1: SafeBridge System Configuration

SAFEBRIDGE® DESIGN SPECIFIC CONSIDERATIONS	
Standard purlin spacing	610mm, 910mm, 1210mm, 1360mm
Bridge bar spacing	Maximum 1500mm

Table 5.4: SafeBridge standard purlin spacing must be chosen at design phase



5.6 Installation under concrete slab roofs – Soffits

When fixing insulation to underside of a suspended concrete slab, insulation is pinned to the slab using plastic anchors such as Hilti X-IE6, Ramset or similar and insulation foil laps and all joins where one section of insulation butts against the next (including overlaps in facing) are taped with approved pressure sensitive products. Unlike rigid foam panels, the compressibility of glasswool allows the insulation to be cut and butted together to form neat joints around structural protrusions and service fixtures.

In determining the finish, note that the density of insulation plays a key role in the 'flatness' of the final finish of the installed surface, particularly after the

application of the anchoring pins. Use of Building blankets or Anticon with a density of around 12 kg/m³ is only recommended where a suspended ceiling is to be installed. For installation without a ceiling, semi-rigid Supertel board with a density of 32 kg/m³ or Xtratherm XtroLiner Std/Duo PIR for a quality flat finish are recommended. Figures below provide a guide to the difference between densities, as well as fixing recommendations for glasswool products faced with light, medium or heavy duty reflective foils (Figures 5.5.1 and 5.5.2). Please consult with your CSR Bradford representative for assistance with choice of densities and/or perforated or decorative facings.

UNDER SLAB OPTIONS



Bradford™ anticon™

Building blanket/Anticon

- Economic solution
- Light performance insulation – 100mm will deliver R2.3
- Non-aesthetic finish – some pillowing

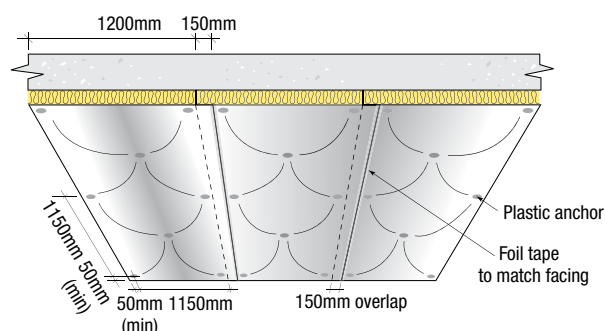


Figure 5.5.1: Underslab fixing – building blanket – some pillowing



Bradford™ supertel™

Supertel

- Standard solution
- Medium performance insulation – 100mm will deliver R3.0
- Non-aesthetic finish – limited pillowing

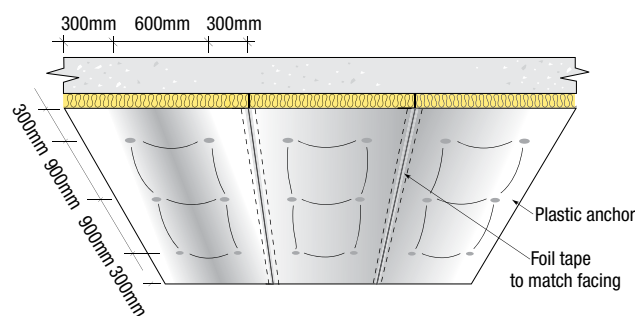


Figure 5.5.2: Underslab fixing – Supertel – limited pillowing



Bradford™ Xtratherm®

Xtratherm XtroLiner Std/Duo PIR

- Quality, flat finish solution
- Thinnest solution where space may be limited
- High performance insulation – 100mm will deliver R4.55
- Limited-aesthetic flat finish – no pillowing
- White or silver options

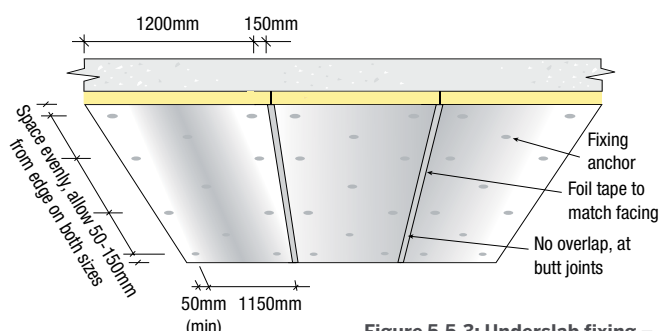


Figure 5.5.3: Underslab fixing – Xtratherm XtroLiner Std/Duo PIR – no pillowing

6.0 Comparing roof systems

6.1 Comparing roof systems

There are currently a number of roof systems in the Australian market that can be broadly classified as spacer systems, purlin systems or panel systems. Designing and selecting the right roof system to meet the energy efficiency provisions in the Building Code of Australia and end user requirements is critical during the design phase of a project.

Some key considerations will determine the type of roof system suitable for a project:

- Climate zone
- Roof type (including pitch and fixing method where applicable)
- Minimum total system R-Value required
- Maximum material R-Value of insulation products
- Ease of installation
- Cost of components and installation
- Worker safety

ROOF SYSTEMS	MAXIMUM TOTAL R-VALUE	BRACKET HEIGHT/ THICKNESS	ROOF TYPE	CLIMATE ZONES	QUICK TO INSTALL	OVERALL INSTALLED COST (incl. materials)	WORKER SAFETY	EASY TO TRAIN
Ashgrid Spacer System (with pre-loaded screws)	Up to R4.8 ¹ (175mm blanket)	60mm, 80mm, 110mm, 120mm, 150mm	Pierced & Concealed fixed	Zones 1 to 8	✓✓	Low to Medium	✓✓	✓✓
SafeBridge purlin system	Up to R4.3 ¹ (145mm blanket)	150mm – 200mm (purlin height)	Pierced & Concealed fixed	Zones 1 to 8	✓✓	Low	✓✓✓	✓
PIR Panel systems	Up to R5.35 ² (100mm) core thickness)	N/A	Pierced fixed	Varies	✓✓	High	✓	✓✓

Table 6.1

Disclaimer: Please note that all the comparisons mentioned herewith have been prepared by CSR Bradford only and is based on CSR Bradford's knowledge of roofing insulation and roof system products (as at 01/05/2015) as well as product information available from product brochures/website. CSR Bradford recognises that Building Codes and Standards are under constant review.



¹ Maximum Total R-Value performance only based upon a non-ventilated flat metal roof with no ceiling, using safety mesh and glasswool insulation with reflective foil facing.

² Maximum Material R-Value based on Polyisocyanurate (PIR) panels, does not include Expanded Polystyrene with Fire Retardant (EPS-FR) panels.

6.2 Comparing roof system costs

To understand the total cost of constructing a roof with each of the key commercial roof systems in the market, including cost of components, equipment, labour-time, and training, a roof system cost comparison survey was conducted by CSR Bradford in June 2014.

Key systems compared:

- Ashgrid spacer system
- SafeBridge purlin system
- PIR Panel systems

Respondents: The respondents were all roofing contractors who specialise in commercial buildings. 16 roofers participated from across Australia including VIC, QLD, SA and NT. All respondents had installed all three types of roof systems and all have many years of experience working on commercial building projects

Survey: Respondents were asked to provide an indicative cost per square meter for each of the key roof systems, based on typical roof installation projects with the following features.

- A commercial warehouse project in climate zone 6
- 7 to 9 metres in height with 5° pitch
- Light coloured roof sheet
- Pierced or concealed fixed
- Non-ventilated flat metal roof with no ceiling
- Purlin spacing 1210mm with safety mesh
- Glasswool insulation with reflective foil facing (where applicable) to achieve (summer) total R-Value R3.2 or PIR panels (thickness) to achieve (summer) R-Value 3.2

Cost inclusions/exclusions: Respondents were asked to base their costs on past projects of similar specifications for each of the roof systems compared. Project specific details such as flashings and gutters were assumed to be excluded unless specified by respondents (in which case they allowed for these details for all 3 system types).

After the survey, selected respondents were also interviewed and asked to provide more detailed feedback on what inclusions/exclusions were allowed, i.e. machine hire, cranes and delivery.

RESULTS

	ASHGRID (\$/m ²)	SAFEBRIDGE (\$/m ²)	PIR PANELS (\$/m ²)
Average	\$60 to \$70	\$55 to \$65	\$115 to \$125
Median	\$70	\$60	\$115

Disclaimer: Average and median figures have been rounded off to the dollar and certain cost points have been amended based on interview responses on what inclusions/exclusions were allowed, i.e. machine hire, cranes and delivery. Please note that building material and installation costs are subject to change.

Cost points vary between respondents, but some common trends are:

Overall, SafeBridge purlin system costs slightly less than Ashgrid spacer system, up to 7% less than Ashgrid.

All respondents have revealed that panel systems have the highest costs compared to other roof systems for the same project - by a considerable amount. Hence, even though panel systems costs are indicative only*, it is possible to conclude that spacer and purlin systems cost significantly less than panel systems. From the results of this survey, panels cost on average around twice as much spacer or purlin systems. Results from this survey as well as anecdotal responses indicate that while the cost of installation varied by state (with NT the most expensive due to higher cost of materials and labour), the relative difference in price between the different roof systems was consistent within each state.



*The range of panel systems available on the market can vary significantly in R-Value, thickness and application, however, it should be noted that although some panels have a lower R-Value per thickness, using a thicker panel of the same or a different core type may in fact be more economical, as improved spans can lead to less supporting materials being required. Different core materials may also have inherently different properties such as fire properties, which can lead to significant variations in cost. For example, PIR is a thermoset, medium density, high strength foam, which will char when exposed to flame, and EPS is a thermoplastic, low density, high strength foam which is self-extinguishing when exposed to flames.

The following tables outline the key technical information on CSR Bradford insulation products.

Further information can be found on the product data sheets available from the CSR Bradford website

www.bradfordinsulation.com.au/designsmart

7.1 Specifications

PRODUCT	BASE BLANKET MATERIAL R-VALUE	THICKNESS (mm)	STANDARD LENGTH (m)	STANDARD WIDTH (mm)	NOMINAL COVERAGE PER ROLL (m ²)	NOMINAL DENSITY (kg/m ³)
Anticon™						
Anticon 60	R1.3	60	15	1200	18	9.8
Anticon 80	R1.8	80	15	1200	18	10.8
Anticon 100	R2.3	100	10	1200	12	11.9
Anticon 100HP	R2.5	100	10	1200	12	14.5
Anticon 110	R2.5	110	10	1200	12	11
Anticon 130	R3.0	130	10	1200	12	12
Anticon 140	R3.3	140	7.5	1200	9	13.5
Anticon 145	R3.6	145	7.5	1200	9	15.9
Building Blanket 175	R4.2	175	7.5	1220	8.72	13.7
Agricon™						
Agricon	R1.5	75	15	1200	18	9

Note: Nominal Pack weight is based on Medium Duty foil facing, for information on pack weights for other facings contact CSR Bradford.

Table 7.1

7.2 Fire performance

Where the insulation is exposed and becomes the ceiling lining, then compliance to AS/NZS1530.3 and group number classifications determined by ISO 9705 Full-scale room test with three walls and a ceiling are required. Bradford insulation products demonstrate the following fire performance and can therefore be used with confidence in classes of buildings 2 to 9.

PRODUCT	FACING	AS/NZS1530.3			
		IGNITABILITY	SPREAD OF FLAME	HEAT EVOLVED	SMOKE DEVELOPED
Building Blanket Supertel and Ultratel	LD	0	0	0	0-1
	MD	0	0	0	0-1
	HD	0	0	0	0-1
	Acoustituff	0	0	0	0-1
	Thermoplast 990 & 993	0	0	0	0-1
	Ultraphon	0	0	0	3

PRODUCT	FACING	AS ISO 9705 (BASED ON FULL-SCALE ROOM TEST)
Building Blankets up to 32kg/m ³ , including Anticon, Multitel and Flexitel for all thicknesses, Supertel up to 100mm	LD	1
	MD	1
	HD	1

Table 7.2

7.3 Acoustic performance

The table below shows the predicted reduction in the estimated overall rainfall sound power level (L_w) that can be achieved with the addition of Anticon directly below the metal roof sheet.

ROOF PROFILE	ESTIMATED PERFORMANCE – RAINFALL SOUND POWER LEVEL PREDICTIONS, L_w dB			
	NO INSULATION (dB)	ANTICON 60 (dB)	ANTICON 100HP (dB)	ANTICON 145 (dB)
Trimdek®	69	63	59	54
Klip-Lok®	67	61	57	52
Trimclad®	73	68	64	58
Custom Orb®	75	70	65	60
Six Rib	70	64	60	55

Table 7.3

Notes and assumptions:

- Calculations are based upon a roof area of 10m² with a roof sheet BMT of 0.48mm
- No ceiling system is present
- The insulation is allowed to recover to its design thickness

- The insulation is sandwiched directly between the underside of the metal roof sheet and the building roof structure
- Data is based upon 'intense' rainfall – additional information is available for other rainfall categories
- The estimates above are intended to be equivalent to ISO140-3:1995

The drive for energy efficient buildings has resulted in higher levels of insulation in the roof space and walls, as well as a goal to achieve reduced air leakage through modern energy conscious building practices. As a result, this has dramatically changed the temperature and moisture balance within buildings, which in turn has changed the location and frequency of where and when condensation is likely to form.

The possible consequences of condensation formation can include:

- Unseen mould formation which can lead to health risks
- Deterioration of visible surfaces due to staining
- Structural decay due to high levels of moisture which can cause timber rot or rust
- Decreased energy efficiency due to high moisture levels in insulation

8.1 Where condensation forms in the building

Condensation occurs when warm moist air hits a surface which is at or below dew point temperature. In an energy efficient airtight building with a conditioned (heated or cooled) internal environment, consideration needs to be given to the climatic location of the building in combination with the heating and cooling parameters of the internal environment.

In cold climates, the warmer interior of the building will form a higher vapour pressure and hold higher levels of water vapour than the colder exterior air. Under these conditions, if the warm interior air is allowed to contact a surface at or below dew point temperature whilst still inside the building structure, condensation will form inside the building.

In hot and high humidity climates, the inverse will occur as the interior air is cooled and the exterior air is warmer and therefore able to hold more water vapour. In these conditions, warm outside air that is allowed to enter the building will form condensation on the cooler surfaces inside the conditioned interior of the building that are at or below dew point temperature.

For designers, the risk is further complicated if condensation is allowed to accumulate rather than applying a methodology of control, where condensation is allowed to form and drain into cavities which are then allowed to vent and dry.

8.2 Cold climate design solution

In cold climates where the risk of condensation is high, a sensible prevention strategy can involve allowing water vapour to be released from the interior of the building so it can safely form in a drainage and drying cavity. This is achieved through the use of a vapour permeable wall wrap or roof sarking such as the Bradford Enviroseal™ ProctorWrap™ range of products.

The high water vapour permeability of the Enviroseal™ ProctorWrap™ range of vapour permeable membranes allows the controlled escape of moisture from within a building structure whilst restricting the ingress of liquid water and dust from the outside environment.

8.3 Hot and high humidity climate design

In hot and high humidity climates, when the interior of the building is cooled, condensation prevention relies upon sealing the building from the ingress of warm external air which carries more water vapour. This is achieved through the use of a continuous vapour barrier product, sealed by lapping and taping at all joins, discontinuities and penetrations.

By using a high vapour barrier wall wrap and roof sarking such as the Bradford Thermoseal range of products, high air and water resistance can also be achieved.

Please note that climate controlled environments and high humidity indoor environments (such as aquatic centres) may influence condensation control – please seek application specific advice from CSR Bradford for these applications.



9.0 Ventilation products

A well designed building ventilation system will contribute to improved productivity and a safer work environment.

In June 2012, the classification of diesel exhaust was upgraded to 'carcinogenic to humans' by the World Health Organisation's International Agency for Research on Cancer (IARC).

Ventilation can improve the air quality and comfort level for building occupants, as well as reduce energy usage, greenhouse gas emissions and assist in the control of condensation.

The Edmonds® commercial ventilation range consists of the naturally (wind) powered Hurricane® and hybrid (wind and electrical) powered EcoPower®, as well as custom bases and ventilator dampers.

9.1 Hurricane®

Edmonds Hurricane ventilators are designed to be powered naturally by wind and rising hot air. As a result, the performance is dependent on favourable weather conditions. The standard Hurricane is available in a wide range of sizes from 100mm to 900mm. They are constructed from corrosion resistant aluminium and feature a double row bearing system. Edmonds standard Hurricane vents are covered by a 15 year warranty. The broad Hurricane range includes ventilators suitable for:

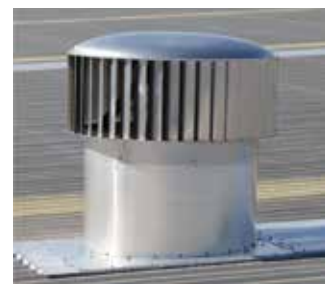
- Normal building ventilation, primarily excess heat;
- Buildings and structures with high levels of moisture or humidity;
- Buildings with hostile or highly corrosive internal environments.
- Available for bushfire zones up to BAL40.



9.2 EcoPower®

Edmonds EcoPower has been designed to overcome the limitations of natural ventilators in situations of little or no wind. EcoPower incorporates a highly efficient electrically commutating (EC) motor built into the ventilator turbine, which does not obstruct the throat of the ventilator and affect flow rates. This patented design allows the EcoPower to operate as a natural ventilator or be switched to powered mode to deliver high levels of ventilation equivalent to that of a powered fan but with substantially lower levels power consumption and noise, as the table below shows. Edmonds EcoPower offers the following unique benefits:

- High efficiency ventilation at all times with low energy consumption;
- Night purge allows for heat built up during the day to be removed in the evening, cooling the building structure and delay the effect of heat build up during the day;
- Light weight Edmonds vertical vane vent technology for higher performance*.



	300mm Axial fan	EcoPower 400	Change	450mm Axial fan	EcoPower 600	Change	630mm Axial fan	EcoPower 900	Change
EXHAUST RATE (m ³ /hr)	2160	2480	14% higher	4280	4360	2% higher	9000	10320	15% higher
POWER (W)	160	59	63% lower	480	99	79% lower	1000	212	79% lower
NOISE @ 3M (dB(A))	55	46	9 dB(A) lower	60	49	11 dB(A) lower	60	45.5	14.5dB(A) lower

*Flow coefficient tests performed under AS4740:2000

Table 9.0

The EcoPower EP900 with temperature sensor has been designed for modern commercial buildings with typically flat roofs, with the ability to operate at variable speed levels depending on the temperature near the ventilator. As the temperature increases the ventilator increases in speed. This allows the ventilator to operate at maximum efficiency with minimal power consumption.

To allow complete control of your buildings ventilation system, manual and electric dampers are available to suit both the Hurricane and EcoPower ventilator ranges.

10

Accessories

CSR Bradford stocks a broad range of accessories to enable roofing contractors to source a wide range of products from a single supplier. For a comprehensive list of products and pricing refer to CSR Bradford price list or contact your local Bradford distributor.






PRODUCT		DESCRIPTION
Safety Mesh		Safety Mesh is designed to cover the entire roof, once purlins are erected to provide fall protection both during and after installation. Safety mesh must comply with AS/NZS 4389:2015 – Safety Mesh should be installed as per the fixing details and any local fixing requirements, it must be pulled taut to comply with Work Cover and OH&S requirements to ensure worker safety. Available in a range of widths, lengths and colours.
Ashgrid Spacer System		Ashgrid Spacer System ensures compliance to BCA section J and is available in a wide range of bracket heights (60/80/110/120/150mm) with corresponding Anticon blanket thickness. Ashgrid modular bars are pre-assembled and pre-loaded with brackets, 12-14 x 38 Ashgrid screws to the brackets and fitted into a rubber retainer, to substantially reduce the installation time, as well as enhancing thermal break for project specific applications; saving both time and money.
SafeBridge		SafeBridge is a unique roof system, available exclusively from Bradford that provides compliance to BCA section J without raising the roof height. Standard purlin spacings are 610mm, 910mm, 1210mm or 1360mm widths. Corresponding widths of Anticon blankets with centre bonded facing and safety mesh are available.
Reinforced Foil Tape		High strength, glass fibre reinforced tape with high tack adhesive backing. Suitable for taping foil overlap and patching to maintain the condensation barrier. Available in widths 48/63/72/96mm.
Foam Tape		Foam Tape provides an uncompressed material R-Value of R0.2 in accordance with AS/NZS4859. Manufactured from durable PE foam with a high tack adhesive backing with protective paper. Foam Tape is available in 30mm wide to suit wall applications and 60mm wide for roofs.

Table 10.0

11

Health and safety

Glasswool insulation is the most common form of insulation used in residential and commercial building envelopes worldwide and it has been used and thoroughly researched for over 80 years. Combined with excellent fire resistance properties and proven performance characteristics it is easy to see why Glasswool is the preferred choice of building designers and builders alike.

Bradford Glasswool products are manufactured using the latest FBS-1 bio-soluble technology. Detailed information on health and safety is contained in the MSDS/SUIS and ICANZ (Insulation Council of Australian and New Zealand) literature available from our website: www.bradfordinsulation.com.au

12 Product warranty

CSR Building Products Limited warrants CSR Bradford™ products to be free of defects in materials and manufacture. CSR Bradford™ bulk insulation and foil faced products should not come into contact with water or be used in external applications or alkaline environments. Contact CSR Bradford™ for further warranty details or refer to our website.



For more information call **1300 850 305** or visit **www.bradfordinsulation.com.au**



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