SOUNDCONTROL

External Noise Systems

GYP572 SEPTEMBER 2008

CSR

Contents

Sound Control Systems

Introduction

CSR External Sound Control Systems are designed to keep unwanted noise out of the home, to bring a level of peace and quiet to the occupants.

For various external sound environments, the home can be designed so the interior noise is reduced to a selected level. The systems have been designed to give a choice of two performance levels. These provide substantial step improvements over standard construction for each construction method.

The system elements are based on the building's 'external envelope', the walls, roof, windows and doors that are used to block noise. The systems rely on products from CSR, including Monier™ and Wunderlich™ roof tiles, PGH bricks, Bradford insulation, Hebel panels, Cemintel™ fibre cement and Gyprock™ plasterboard, as well as other proprietary products with proven performance.

About This Guide

The purpose of this guide is to provide solutions for the design of new residential buildings subject to certain types of external noise. The noise environments are based on actual measurements of sound in typical residential locations. For the specified systems, the resulting interior noise levels are those that would be expected when tested in locations with the exact noise environment. Nevertheless, similar noise levels should result in houses with minor variations to the stated noise environment.

Acoustic design is a complex science, and there will be instances where a specialist acoustic consultant is required. These include construction that is not exactly as detailed in the systems and where local authorities have specific requirements for the conditions in an area.

This guide is intended for system selection only. For construction and installation details, refer to the appropriate product guide and code of practice manuals. A complete list of CSR installation manuals can be found at www.csr.com.au

External Noise

External, or environmental, noise in urban areas is pollution that can intrude into homes. It has many sources and can have a number of undesirable impacts.

Common external noise sources include:

- Road, air and rail transport,
- Industrial operations,
- Entertainment venues,
- Sporting activity,
- Pool and garden equipment,
- Neighbourhood noise such as television, parties, barking dogs and lawn mowers.

There is increasing awareness of environmental noise and there are some government schemes to approach it, including freeway sound barriers and airport noise insulation projects. There are, however, no provisions in the current building code to protect occupants from this type of noise.

There are a number of reasons that high levels of environmental noise are becoming critical. These include increasing population and population density, increasing volumes of road, rail and air traffic and for extended periods, and increased intrusion into commercial and industrially zoned areas.

The effects of excessive noise levels in homes have been widely researched. They include annoyance, anger and frustration, and they have been linked to health problems such as loss of sleep and sleep quality, heart disease, hypertension and psychiatric disorders. For these reasons, designers should carefully consider the products and systems used in houses with regards to their acoustic performance.

The noise sources considered in this manual are local road traffic, highway/motorway road traffic, air traffic, rail traffic, industrial activity, and neighbourhood noise.

ROAD TRAFFIC

Road traffic noise has been rated as one of the most common and intrusive environmental problems. Many residents are exposed to outdoor noise levels of up to 65dB(A), a level that can affect behaviour, sleep and health.

The main reasons why road traffic noise has become a major environmental problem are: poor land use planning and integration with transport; traffic build up during road construction; and the cost and complexity of potential solutions. In general, car ownership and levels of road traffic are increasing.

Other factors that affect the level of road traffic noise include proximity to the road, the road surfacing and condition, vehicle noise emission standards, driver behaviour such as use of truck engine braking, and preventative measures such as barriers and building elements.

AIR TRAFFIC

Although new aircraft are being built with lower noise emissions, increasing numbers of flights, extended hours of operation and changes to flight paths mean that air traffic noise will continue to be an issue.

In metropolitan areas there has been major community impact from the building of new runways and the increase in general noise levels. There is also considerable impact in rural and tourist areas due to low background noise.

For example, in Sydney, the addition of a third runway led to changes in the noise levels. Some areas were exposed to higher noise than predicted and some areas were affected although predicted to have no aircraft noise.

RAIL TRAFFIC

Rail traffic noise can be at very high levels, although it affects fewer people than road or air traffic noise. Factors that relate to the level of noise include the type of engine and rolling stock, the speed of the train and track type and condition. Electric passenger trains are generally quieter than diesel and freight trains.

Some residents adjacent to railway lines have been subject to noise levels up to 85dB(A) from freight trains. New trains are becoming quieter, but again the use of

faster, more frequent and longer trains in urban areas means that rail noise will continue to be a problem.

INDUSTRIAL ACTIVITY

Planning of land use by zoning and the use of buffer zones to separate noisy industry should result in few residents being subject to industrial noise. However, there are many instances where changes of land use have resulted in inappropriate industry existing in urban areas.

Noise from mining, manufacturing and power supply industries that operate 24 hours a day can be significant, and some areas are affected by military operations.

NEIGHBOURHOOD NOISE

Neighbourhood noise results from the high density living of a growing population. Typical noise sources include barking dogs, alarms, parties, lawn mowers, building work, air-conditioning and pool motors.

After road traffic noise, dog barking has been found to be the most annoying because of its unpredictability, repetition and occurrence at night. In addition, neighbourhood noise is a major cause of complaints received by local councils, perhaps indicating greater annoyance ratings from this source of noise.

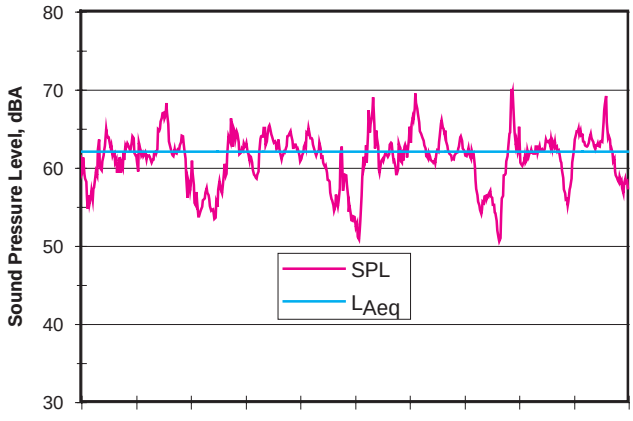
NOISE SOURCES

Noise levels from various sources have been divided into four bands measured as L_{Aeq}. This measure is for noise that fluctuates over time, and is equivalent to a continuous sound with the same acoustic energy as the time-varying sound.

The four bands can be generally described as quiet suburban, 50 – 55dB(A), medium suburban, 55 – 60dB(A), noisy suburban, 60 – 65dB(A), and inner city, 65 – 70dB(A). The System Selection Table describes typical situations that fall into these bands, including the type of noise source and the distance from the source to the house.

The noise levels present at a house exterior from the different noise types are influenced by a large number of factors. These include the terrain, shielding by buildings and fences, time of day, even wind direction. If source noise levels are higher than the typical situations detailed, the resulting interior noise levels will also be higher. Other noise sources, such as industrial and neighbourhood noise, can be estimated in accordance with the general band descriptions, and systems selected as for road and rail traffic sources.

Noise Recorded Near a Busy Road



Interior Noise Levels

The noise levels within a home that result from external noise are measured as L_{Aeq} in the same way as the noise source. The term is a measure of the loudness of a sound, with units dB(A). The A weighting indicates that the value has been filtered to focus on the frequencies to which the ear is sensitive. The noise levels experienced in a home are affected to some extent by the interior furnishings. For the results given, it is assumed that carpets, curtains and furniture are in place.

The systems in Table 1 have been designed to give a resulting interior noise level of L_{Aeq} 35dB(A) for road, train, industrial and neighbourhood noise. The level was selected from Australian Standard AS/NZS2107 Acoustics – Recommended Design Sound Levels And Reverberation Times For Building Interiors. It is the upper limit for sleeping areas in houses near minor roads and within the range recommended for houses near major roads

For aircraft noise A level L_{Aeq} 40dB(A) has been used. The higher level for aircraft noise is given because of the relatively brief duration of the noise, in accordance with the recommendations of AS2021 Acoustics - Aircraft Noise Intrusion - Building Siting And Construction.

The noise level 35dB(A) is very quiet. Occupants could expect to hold a conversation without raising their voices, listen to TV at low volume, and sleep unaffected. Windows and doors must be closed to achieve the stated result

It is possible to choose a lower level of internal noise, however, the designer should consider the ability of a system to reach the level, the higher cost to achieve lower noise levels, and the sensitivity of the occupants to noise.

INTERIOR NOISE LEVEL REDUCTION THROUGH CSR SOUNDCONTROL SYSTEMS

The Building Envelope

The elements that make up the barrier to external noise include the external walls, windows and doors, and the roof/ceiling system. The system solutions consist of a particular combination of products and construction systems as stated in the system table. Variations to the products specified, the relative proportions of products, and the inclusion of elements such as gables, vents, skylights etc, may result in a lower performance.

The range of external wall systems considered is: PGH™ brick veneer, Cemintel Residential ExpressWall™ and Hebel PowerPanel™ veneer. The roof/ceiling systems are made up of Monier™ or Wunderlich™ roof tiles on a pitched roof. The wall and ceiling linings are Gyprock™ plasterboard and the insulation and sarking products are from Bradford.

Included for each system are values for thermal and acoustic performance ratings. These values are given for walls and roofs separately, and exclude any doors, windows and penetrations. For sound, the terms are R_W, weighted sound reduction index, and $R_W + C_{tr}$, which includes a modification to account for low frequencies.

The thermal R-values have been calculated in accordance with ICANZ Insulation Handbook 2008 and component manufacturers' material values. For walls, the summer condition is given. For ceilings, both the summer (heat flow down) and winter (heat flow up) are given, and assume non-ventilated spaces. Air spaces in wall cavities are assumed to be non-ventilated, and roof spaces are assumed to be ventilated unless sarking is installed. Note that thermal performance higher than that given may be required in some climate zones. This may be achieved by using higher rated Bradford insulation products, without reducing acoustic performance.

The Products

CEMINTEL FACADE

The Cemintel Residential ExpressWall™ system utilises 8mm fibre cement sheet with regular expressed joints. The joints are sealed with steel backing strips and foam tapes, and backed by a well-sealed sarking as an air barrier. The 11.7kg/m^2 sheets and the top hat supports combine with standard domestic framing to act as an effective lightweight acoustic wall system.

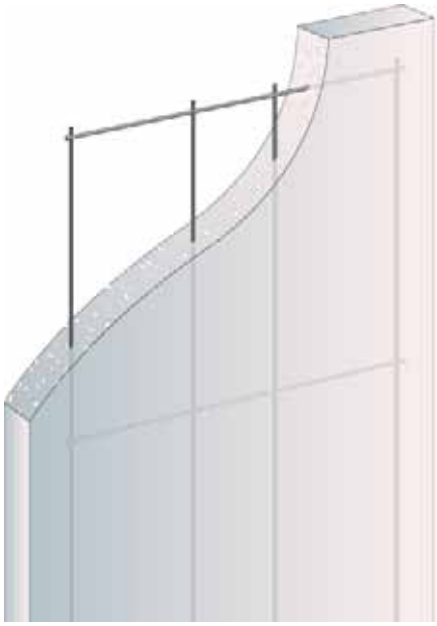
The Cemintel RendaLine™ cladding system may be used as an alternative to ExpressWall™ where a flush jointed finish is preferred. RendaLine™ incorporates 8mm fibre cement sheets on a system of vertical battens. It can be coated with the Mitex™ Texture Coating System for a render-look finish.

Cemintel Texture Base Sheet is 7.5mm cladding which is fixed direct to framing and is finished with Mitex™ Texture Coating Systems. The Texture Base Sheet system may be used in lieu of Residential ExpressWall™ in systems CE1 and CE2 with an approximate increase of internal sound level 2dB(A).

Cemintel Residential ExpressWall™

HEBEL POWERPANEL

Hebel PowerPanel™ is a 75mm thick panel made from steel reinforced autoclaved aerated concrete. It is has good acoustic insulation properties and is lightweight, versatile and has excellent thermal and fire resistance properties.



Hebel PowerPanel™

Hebel PowerPanel™ Wall System

PGH BRICKS

PGH™ Sandstock bricks are dense, quality-controlled products with outstanding acoustic properties. The Sandstock Collection includes, Premium, Convict, Timeless and Roman. Samples from the Convict Collection are shown.

Cadman

Seaforth

Chisholm

Endeavour

Greenway

For a rendered finish, use PGH™ Ultra, a high-density clay block. Also used in multi-residential inter-tenancy walls because of its excellent acoustic performance. Ultra can be rendered or texture coated for a versatile external finish.

BRADFORD SOUNDSCREEN

Made from acoustically optimised rockwool, SoundScreen™ is highly effective for reducing sound. It also provides outstanding thermal insulation, and can result in rooms that are seven degrees cooler in summer and ten degrees warmer in winter.

Products used: SoundScreen™ R1.6, R2.0, R2.5 and R3.0.

Bradford SoundScreen™

BRADFORD ENVIROSEAL

EnviroSeal™ Roof Metal/Wall (light duty) and EnviroSeal™ Roof Tile Plus (medium duty) are foil products designed to ensure maximum performance of walls and roofs. These foils provide acoustic deflection and insulation, to protect the inside environment from the outside climate, and have the added benefits of condensation control, dust exclusion, fire safety and weatherproofing.

Bradford EnviroSeal™

GYPROCK SOUNDCHEK

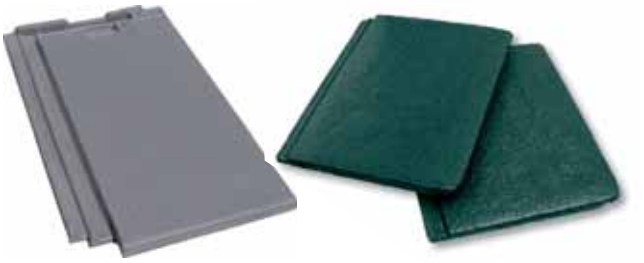
Gyprock Soundchek™ is 10mm high-density, sound resistant plasterboard. It was developed for use in sound rated wall and ceiling systems, and can be used in conjunction with resilient mounts and insulation batts.

Gyprock Soundchek™

MONIER AND WUNDERLICH ROOF TILES

The ultimate Terracotta tile for modern and classic architecture. The Wunderlich™ Nullarbor sits flat in a cross bond pattern with overlap and tolerance to minimize air gaps. It is dense, weighing 46.8kg/m^2, for isolating exterior sound.

The Monier™ Horizon is a low profile concrete tile with generous overlap for effective acoustic control. It is extremely dense at 55kg/m^2, and is suitable for reducing rain noise.



Wunderlich™ Nullarbor Monier™ Horizon

Monier™ Horizon Roof Tiles

TREND WINDOWS

The windows used are awning style with a slim frame construction and round sash profile. They incorporate Pilkington Smart Glass®, with a single 6.38mm laminate or double glazing of 6.76mm laminate glass that can also be coloured or textured.

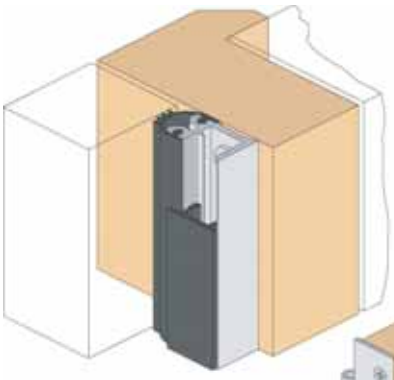
HUME DOORS

The solid timber entrance doors are from the Hume range. Hume Ultimo™ doors are 40mm thick and have timber styles and rails, a core of medium density fibreboard, and a mass or 22.1kg/m^2. The Hume Lincoln™ range are laminated engineered doors of joinery construction, with HMR medium density fibreboard fielded, and a mass 17.9 kg/m^2.

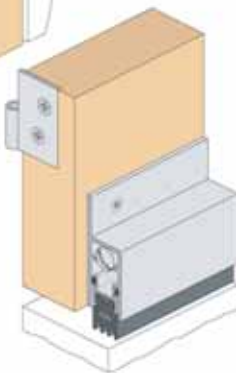
Hume Ultimo™ Door

RAVEN DOOR SEALS

Medium and heavy duty Raven® door seals are specified for the top, sides and base of all exterior doors. The seals have been acoustically tested to AS1191 and AS1276.1 in a wall with R_W56 and achieve up to R_W32.



Raven® RP10 side seal



Raven® RP99 bottom seal

System Selection

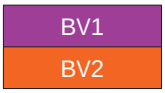
The System Selection Table may be used to choose a recommended system to suit the type of noise problem and the level of noise received. The recommended systems have been designed to achieve at least the minimum interior sound levels deemed suitable for residential buildings.

To use the table, identify the most significant type of noise from the first column. Then select an appropriate typical noise level from the four ranges given. Descriptions of common applications and distances from noise sources are included to assist with the selection. A suitable system can then be chosen.

The system names represent two sound performance levels in each of the three building envelope construction types:

Cemintel Residential ExpressWall™
fibre cement facade

Hebel PowerPanel™
AAC panel facade



Brick veneer with PGH™ Sandstock
or Ultra bricks with render.

TABLE 1: SYSTEM SELECTION

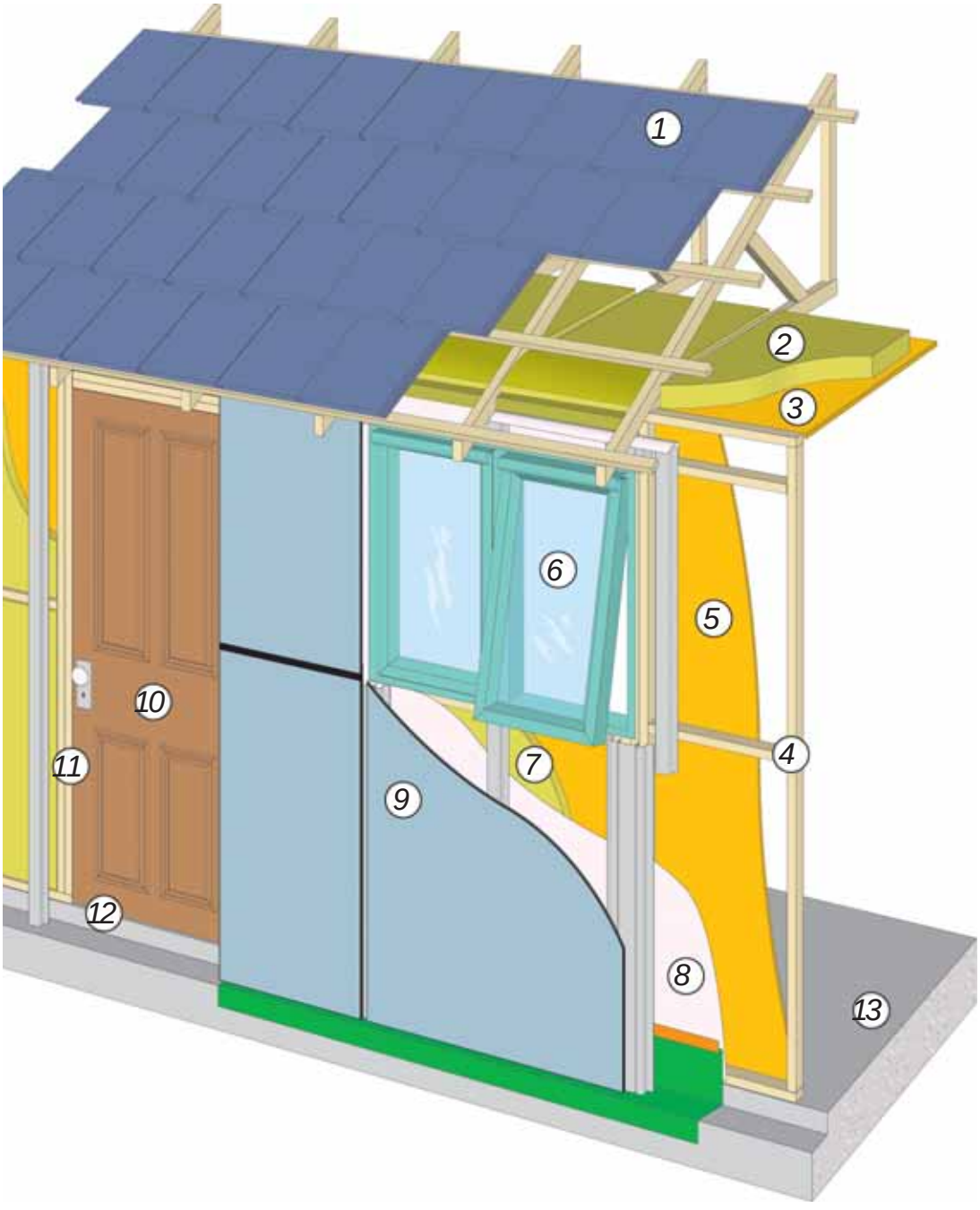
Type of Noise		Typical Exterior Noise Level for Interior Noise Level L_{Aeq} 35 [dB(A)]			
		50 – 55 Quiet Suburban	**55 – 60 Medium Suburban**	**60 – 65 Noisy Suburban**	**65 – 70 Inner City**
STREET TRAFFIC		Distance to main road 120m Distance to minor road 40m	Distance to main road 60m Distance to minor road 20m	Distance to main road 30m Distance to minor road 6m	Distance to main road 10m Distance to minor road 2m
		CE1	CE1	CE2	
		HB1	HB1	HB2	HB2
		BV1	BV1	BV2	BV2
NEIGHBOURHOOD NOISE		Generally quiet with low background noise	Lawn mowers, moderate party noise	Affected by dogs barking, loud parties	Close to music venues, loud parties
		CE1	CE1	CE2	
		HB1	HB1	HB2	HB2
		BV1	BV1	BV2	BV2
INDUSTRIAL NOISE		Low level factory noise	Medium level factory noise	Zoned industrial	NA
		CE1	CE1	CE2	
		HB1	HB1	HB2	
		BV1	BV1	BV2	
MOTORWAY		Distance to motorway 100m	Distance to motorway 60m	Distance to motorway 40m	Distance to motorway 15m
		CE1			
		HB1	HB1	HB2	HB2
		BV1	BV1	BV2	
RAIL TRAFFIC		Distance to line 550m	Distance to line 300m	Distance to line 150m	Distance to line 55m
		CE1	CE1	CE2	
		HB1	HB1	HB2	HB2
		BV1	BV1	BV2	BV2

Type of Noise		Typical Exterior Noise Level for Interior Noise Level L_{Aeq} 40 [dB(A)]			
		60 - 65	**65 - 70**	**70 - 75**	**75 - 80**
AIRCRAFT		Distance to international airport 25km Distance to domestic airport 15km	Distance to international airport 22km Distance to domestic airport 12km	Distance to nternational airport 20km Distance to domestic airport 8km	Distance to international airport 11km Distance to domestic airport 4km
		CE1			
		HB1	HB1	HB2	HB2
		BV1	BV1	BV2	BV2

System Details

CSR SOUND**CONTROL SYSTEM**

CE1



System Components	
1	Monier™ Horizon Roof Tiles
2	Bradford SoundScreen™ R2.5
3	1 x 10mm Gyprock Soundchek™ plasterboard direct fixed to frame
4	90mm Timber or Steel framing
5	1 x 10mm Gyprock Soundchek™ plasterboard direct fixed to frame
6	Trend® Awning Windows with 6.38mm laminated glass (Glazing max. 20% of wall area)
7	Bradford SoundScreen™ R1.6
8	DuPont Tyvek HomeWrap™
9	Cemintel Residential ExpressWall™ system
10	Hume Lincoln™ solid core door (doors up to 5% of wall area)
11	Raven® RP10 Door Perimeter Seals
12	Raven® RP99 Door Bottom Seal
13	Concrete Slab Floor

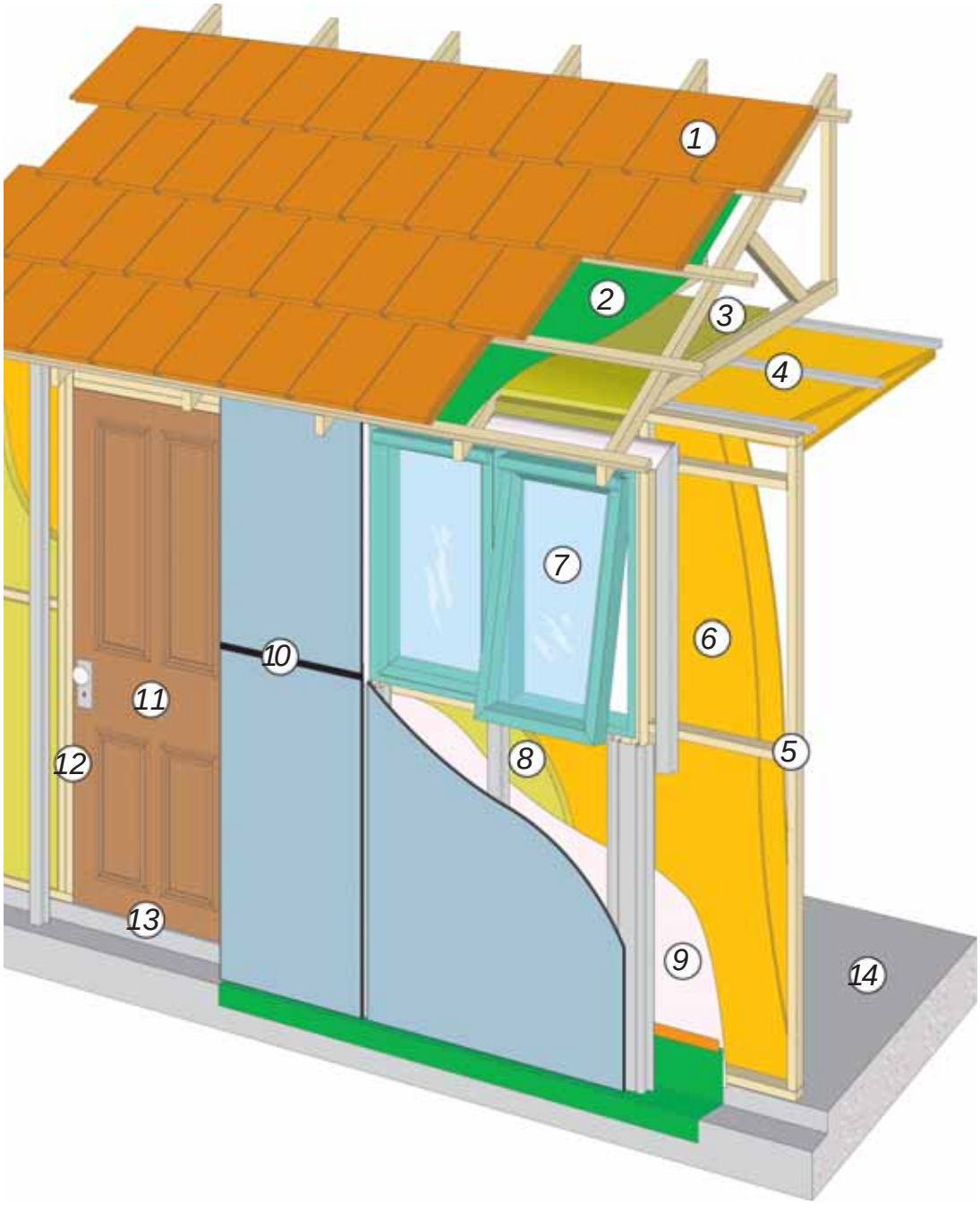
Acoustic Rating R_W/R_W+C_{tr}	
Wall	Roof/Ceiling
44/33	45/39

Total Thermal Rating R m²K/W		
Wall	Roof	
	Heat Flow Down	Heat Flow Up
2.0	3.1	2.9

Note: Acoustic and thermal ratings exclude doors, glazing and other penetrations

CSR SOUND**CONTROL SYSTEM**

CE2



System Components	
1	Wunderlich™ Nullarbor Roof Tiles
2	Bradford EnviroSeal™ Roof Tile Plus
3	Bradford SoundScreen™ R3.0
4	2 x 10mm Gyprock Soundchek™ plasterboard fixed to resilient mount and furring channel system
5	90mm Timber or Steel framing
6	2 x 10mm Gyprock Soundchek™ plasterboard direct fixed to frame
7	Trend® Awning Windows with 6.76mm double glazed laminated glass (Glazing max. 20% of wall area)
8	Bradford SoundScreen™ R2.0
9	DuPont Tyvek HomeWrap™
10	Cemintel Residential ExpressWall™ system
11	Hume Ultimo™ solid core door (doors up to 5% of wall area)
12	Raven® RP47 Door Perimeter Seals
13	Raven® RP38 Door Bottom Seal
14	Concrete Slab Floor

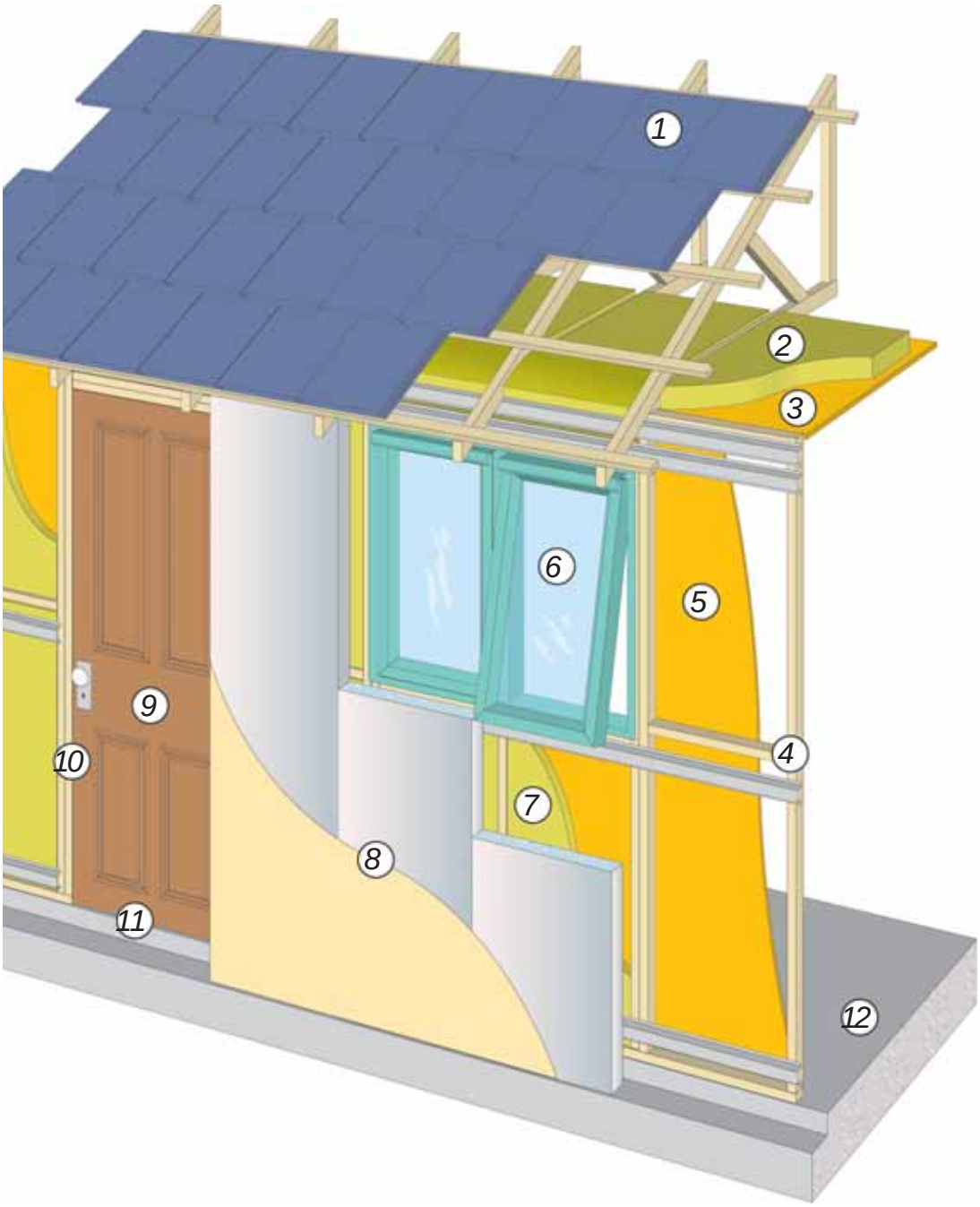
Acoustic Rating R_w/R_w+C_{tr}	
Wall	Roof/Ceiling
47/37	52/46

Total Thermal Rating R m^2K/W		
Wall	Roof	
2.4	Heat Flow Down	Heat Flow Up
	4.5	4.2

Note: Acoustic and thermal ratings exclude doors, glazing and other penetrations

CSR SOUND**CONTROL SYSTEM**

HB1



System Components	
1	Monier™ Horizon Roof Tiles
2	Bradford SoundScreen™ R2.5
3	1 x 10mm Gyprock Soundchek™ plasterboard direct fixed to frame
4	90mm Timber or Steel framing
5	1 x 10mm Gyprock Soundchek™ plasterboard direct fixed to frame
6	Trend® Awning Windows with 6.38mm laminated glass (Glazing max. 20% of wall area)
7	Bradford SoundScreen™ R1.6
8	Hebel PowerPanel™ Wall System
9	Hume Lincoln™ solid core door (doors up to 5% of wall area)
10	Raven® RP10 Door Perimeter Seals
11	Raven® RP99 Door Bottom Seal
12	Concrete Slab Floor

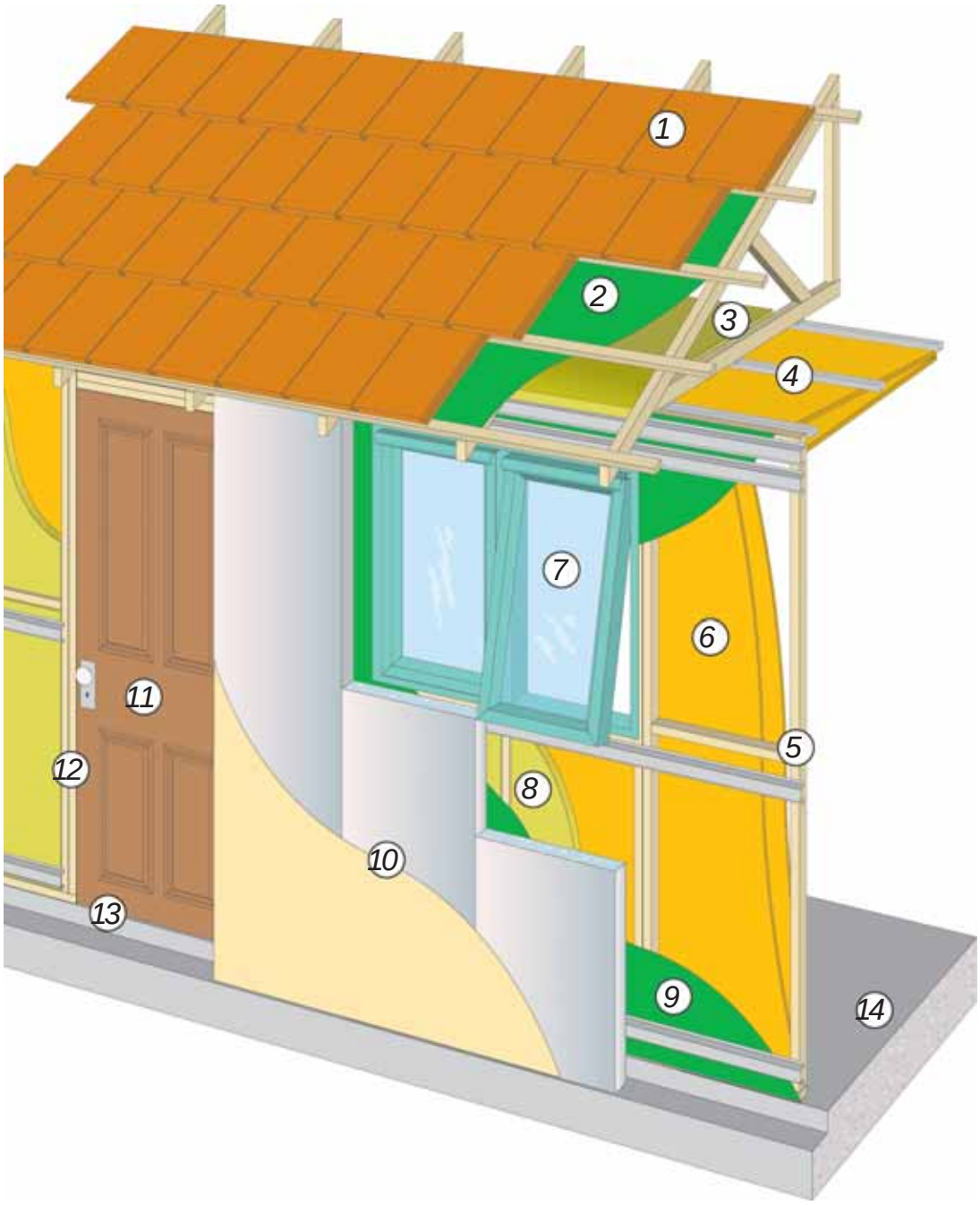
Acoustic Rating R_w/R_w+C_{tr}	
Wall	Roof/Ceiling
60/50	45/39

Total Thermal Rating R m²K/W		
Wall	Roof	
	Heat Flow Down	Heat Flow Up
2.4	3.1	2.9

Note: Acoustic and thermal ratings exclude doors, glazing and other penetrations

CSR SOUNDCONTROL SYSTEM

HB2



System Components	
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5	90mm Timber or Steel framing
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7	Trend® Awning Windows with 6.76mm double glazed laminated glass (Glazing max. 20% of wall area)
8	Bradford SoundScreen™ R2.0
9	Bradford EnviroSeal™ Roof Metal/Wall
10	Hebel PowerPanel™ Wall System
11	Hume Ultimo™ solid core door (doors up to 5% of wall area)
12	Raven® RP47 Door Perimeter Seals
13	Raven® RP38 Door Bottom Seal
14	Concrete Slab Floor

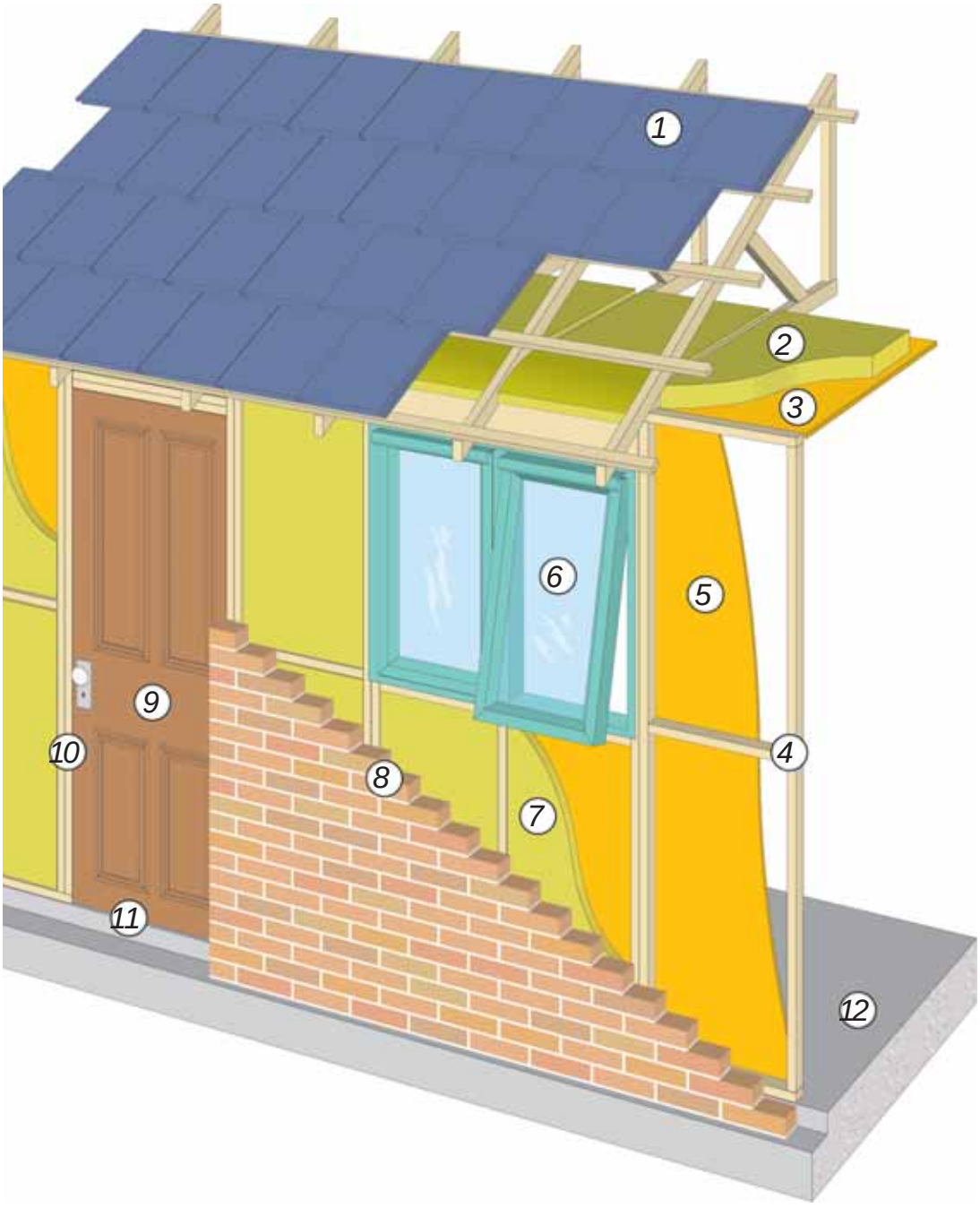
Acoustic Rating R_w/R_w+C_{tr}	
Wall	Roof/Ceiling
63/54	52/46

Total Thermal Rating R m^2K/W		
Wall	Roof	
	Heat Flow Down	Heat Flow Up
3.2	4.5	4.2

Note: Acoustic and thermal ratings exclude doors, glazing and other penetrations

CSR SOUND**CONTROL SYSTEM**

BV1



System Components	
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7	Bradford SoundScreen™ R1.6
8	PGH™ Sandstock bricks
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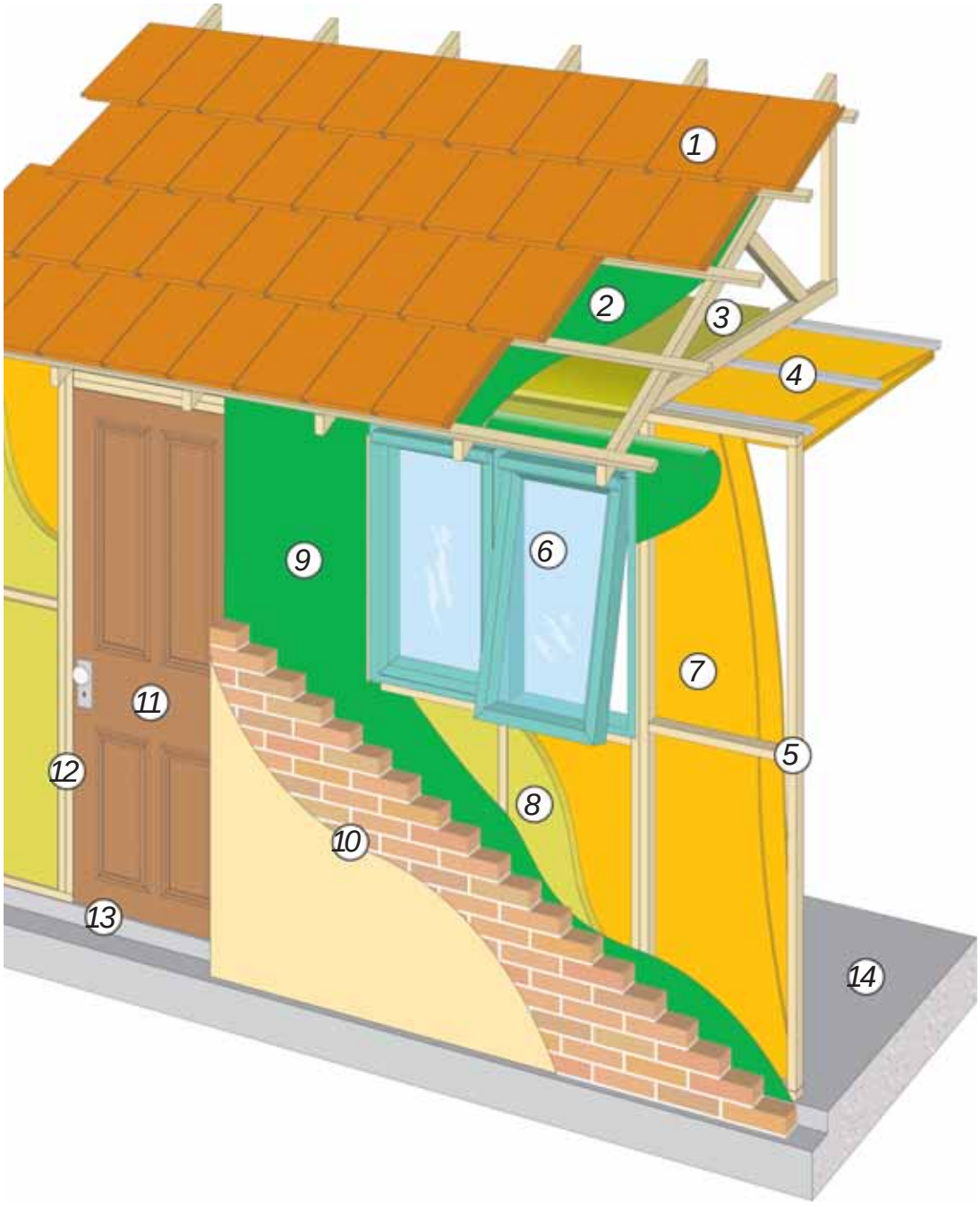
Acoustic Rating R_w/R_w+C_{tr}	
Wall	Roof/Ceiling
60/54	45/39

Total Thermal Rating R m²K/W		
Wall	Roof	
	Heat Flow Down	Heat Flow Up
2.1	3.1	2.9

Note: Acoustic and thermal ratings exclude doors, glazing and other penetrations

CSR SOUND**CONTROL SYSTEM**

BV2



System Components	
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2	Bradford EnviroSeal™Roof Tile Plus
3	Bradford SoundScreen™ R3.0
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7	2 x 10mm Gyprock Soundchek™ plasterboard direct fixed to frame
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10	PGH™ Ultra brick with Ultra Plus Render
11	Hume Ultimo™ solid core door (doors up to 5% of wall area)
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14	Concrete Slab Floor

Acoustic Rating R_w/R_w+C_{tr}	
Wall	Roof/Ceiling
62/55	52/46

Total Thermal Rating R m²K/W		
Wall	Roof	
	Heat Flow Down	Heat Flow Up
3.0	4.5	4.2

Note: Acoustic and thermal ratings exclude doors, glazing and other penetrations

Construction Details

The details in this section show typical construction and the principles for good acoustic sealing practice. There is a large variety of construction details, and the designer should consider the effectiveness of acoustic sealing in each case.

It should be noted that site performance, when compared to acoustic laboratory performance, will be affected by poor building practices and the use of inferior products. For these reasons, a building element constructed in the field might have a lower sound rating than when tested in a laboratory.

Maximum acoustic performance can be achieved by avoiding penetrations in walls, ceilings and roofs, and by caulking any gaps. Power points and light switches should be located away from external walls or acoustically treated products should be used.

When specifying any product that penetrates the building envelope, contact the manufacturer for information on its affect on sound transmission. Where possible, choose products that have been tested and are recommended for the application.

Further information on construction detailing and installation can be found in the CSR product guides. Contact the relevant CSR building division for copies of installation guides.

FIG 1: WINDOW FLASHING DETAILS

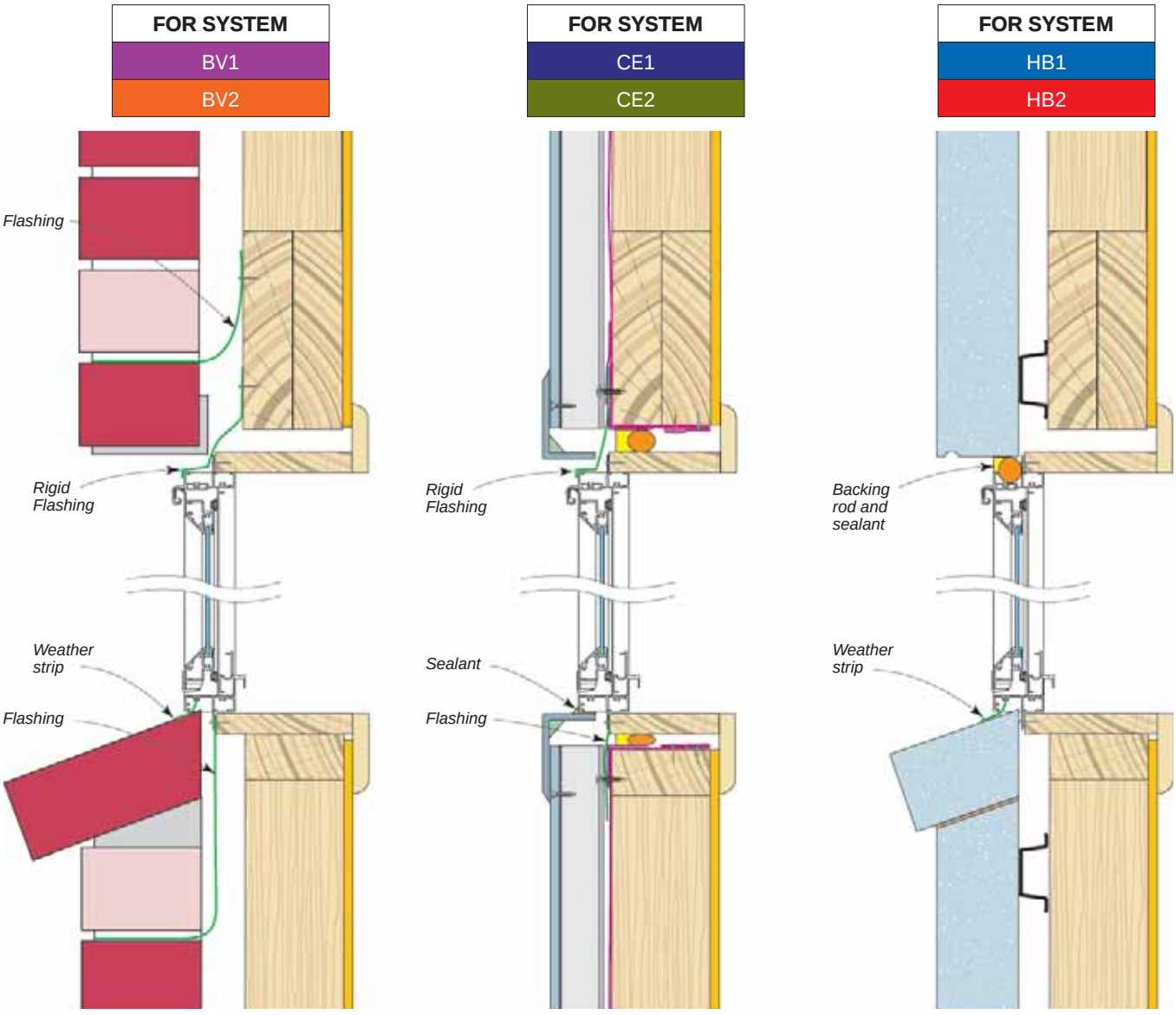


FIG 2: SYSTEM CE2 INSULATION AND SARKING DETAIL AT EAVES

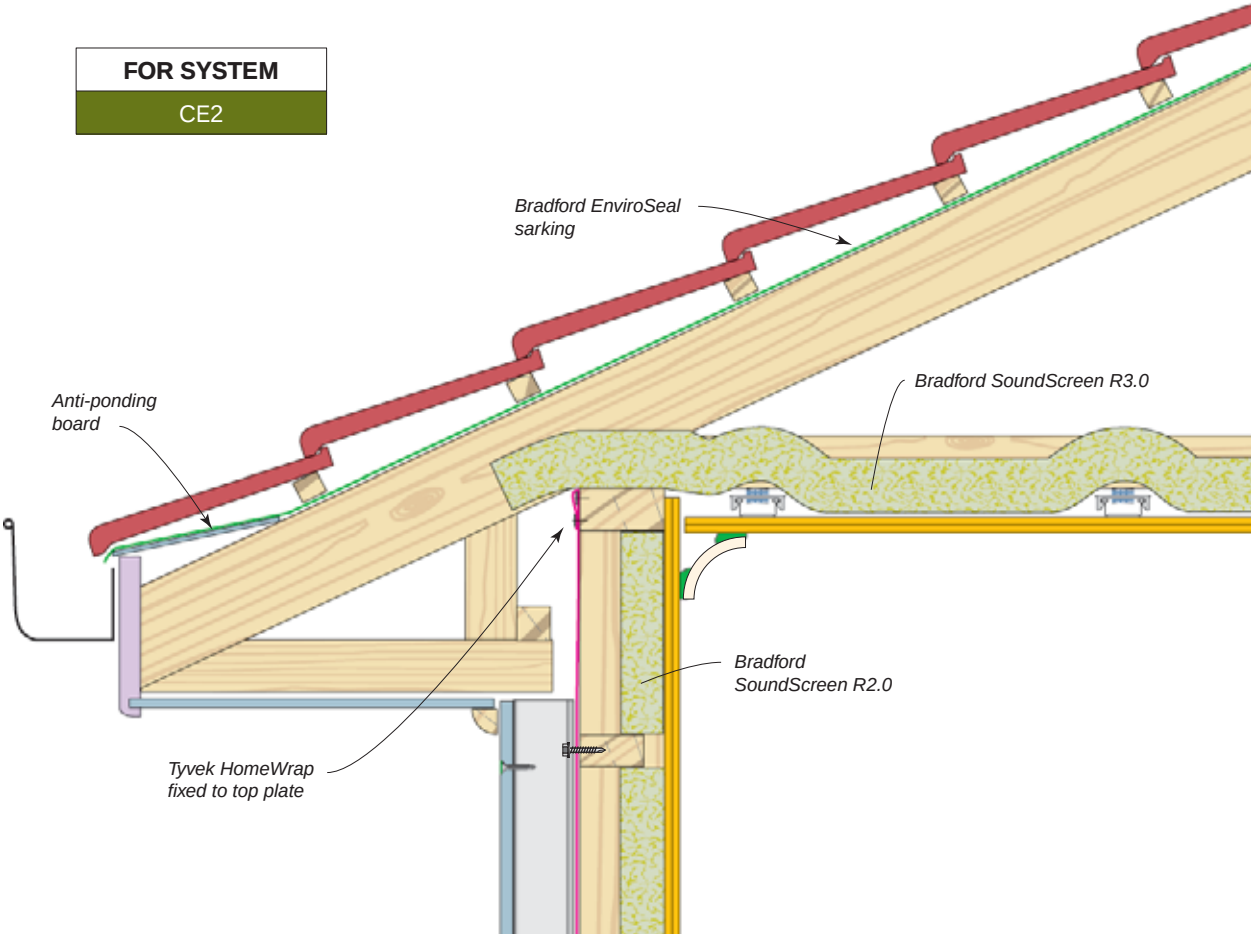


FIG 3: SYSTEM HB2 AND BV2 INSULATION AND SARKING DETAIL AT EAVES

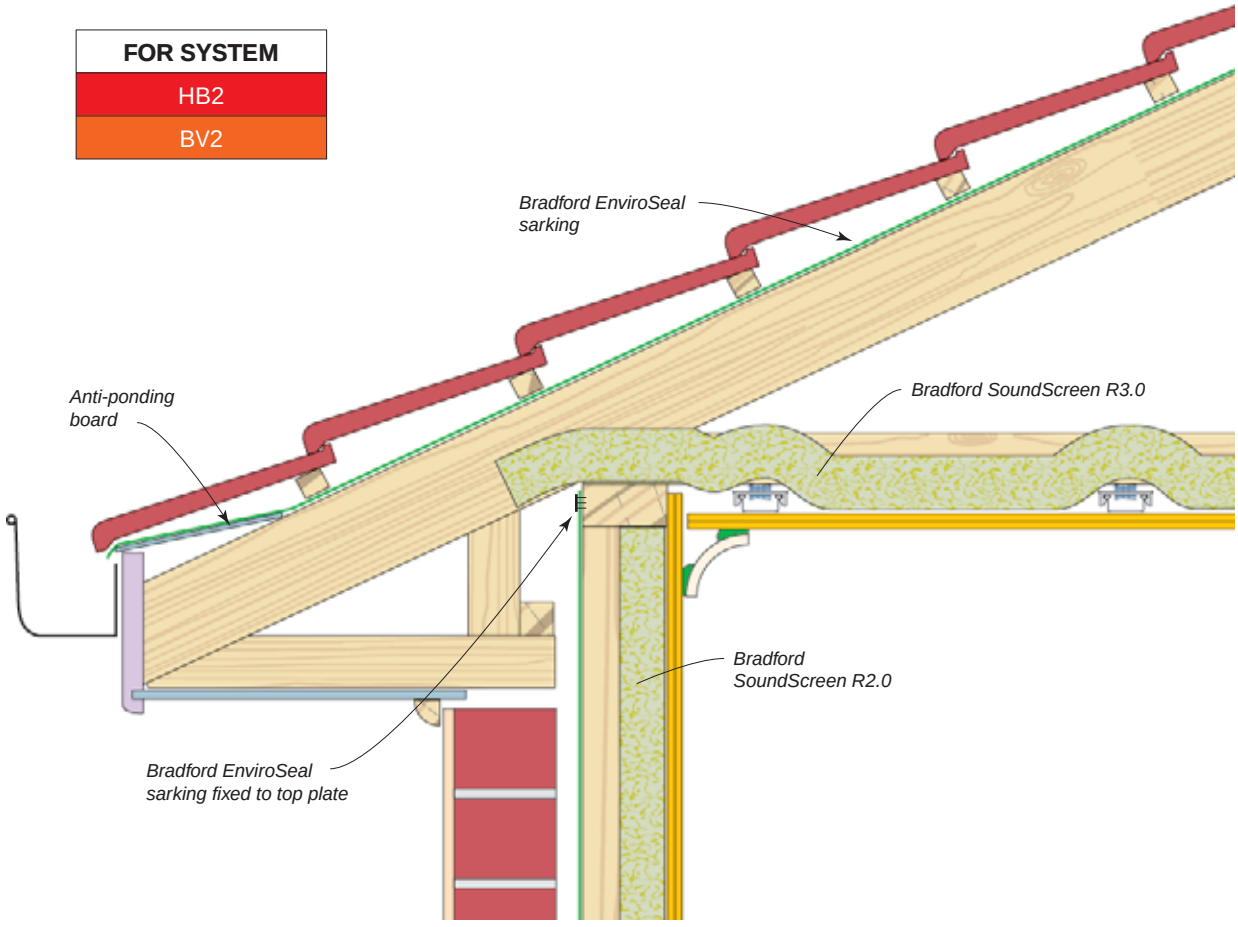
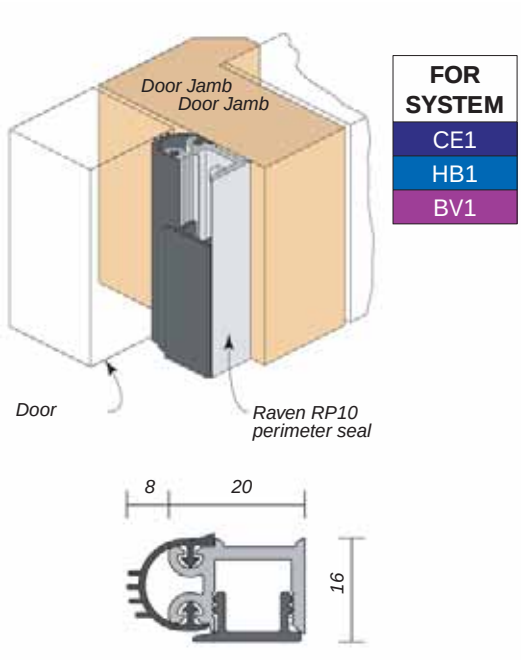
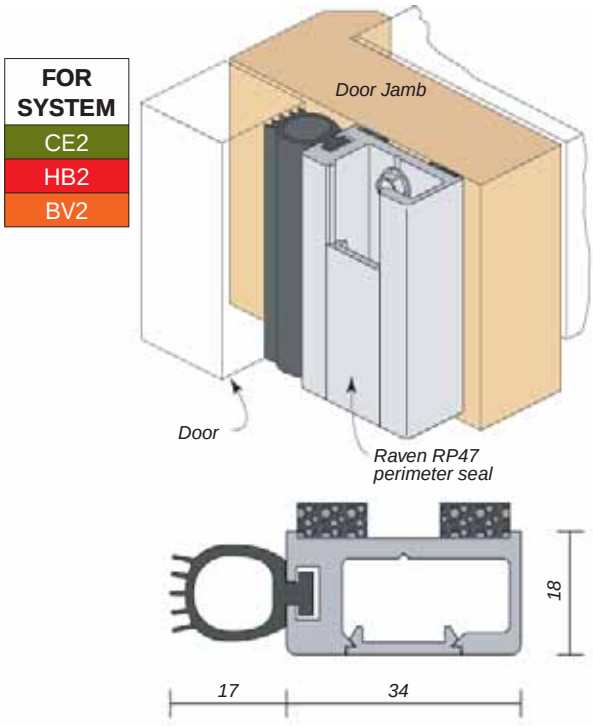


FIG 4: RAVEN RP10 DOOR PERIMETER SEAL



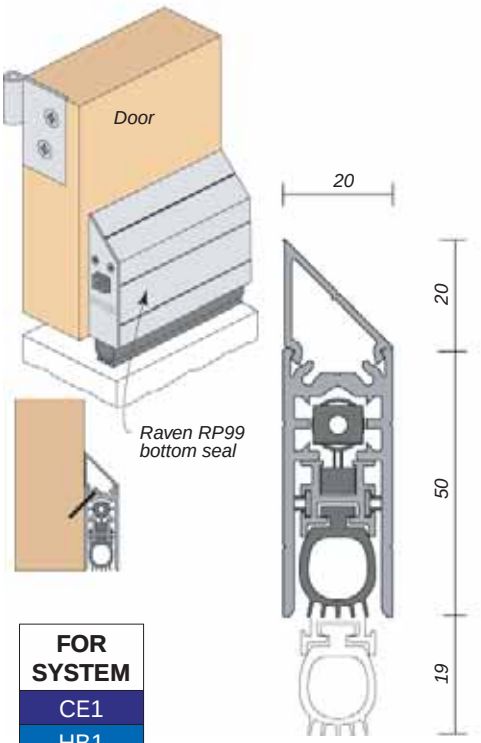
FOR SYSTEM
CE1
HB1
BV1

FIG 6: RAVEN RP47 DOOR PERIMETER SEAL



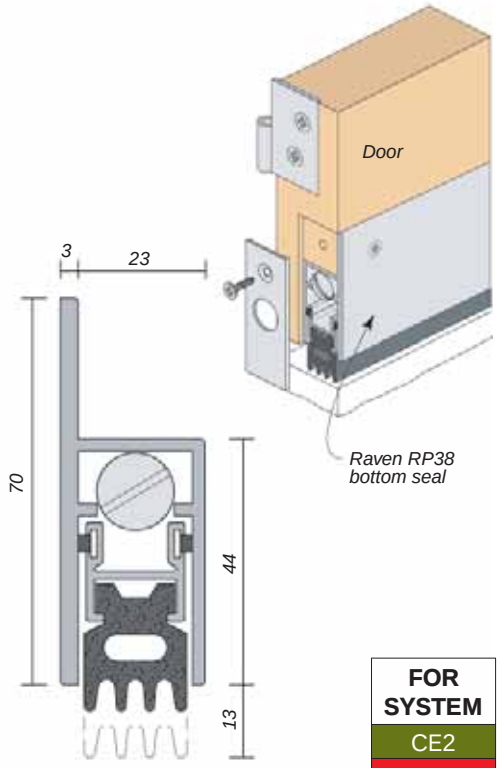
FOR SYSTEM
CE2
HB2
BV2

FIG 5: RAVEN RP99
DOOR BOTTOM SEAL



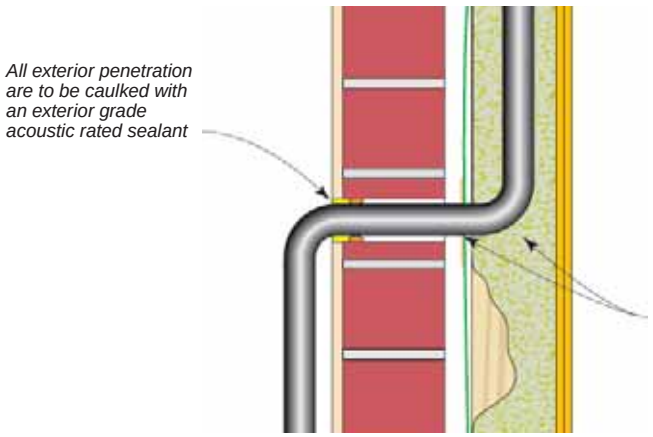
FOR SYSTEM
CE1
HB1
BV1

FIG 7: RAVEN RP38
DOOR BOTTOM SEAL



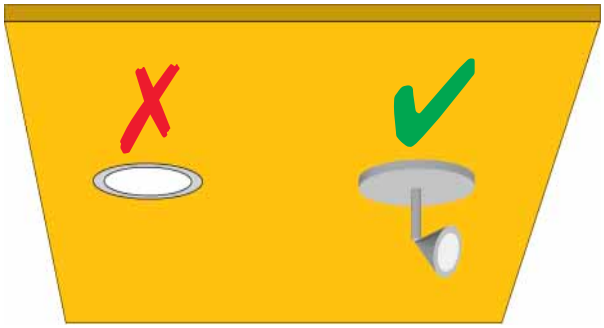
FOR SYSTEM
CE2
HB2
BV2

FIG 8: PENETRATION CAULKING DETAIL



FOR SYSTEM	
CE1	CE2
HB1	HB2
BV1	BV2

FIG 9. CEILING LIGHT RECOMMENDATIONS



Use surface mounted ceiling lights where possible.

FIG 10. SOUND RATED REGAL HALOGEN DOWNLIGHT

Suitable where recessed lights are specified.

FOR SYSTEM	
CE1	CE2
HB1	HB2
BV1	BV2

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