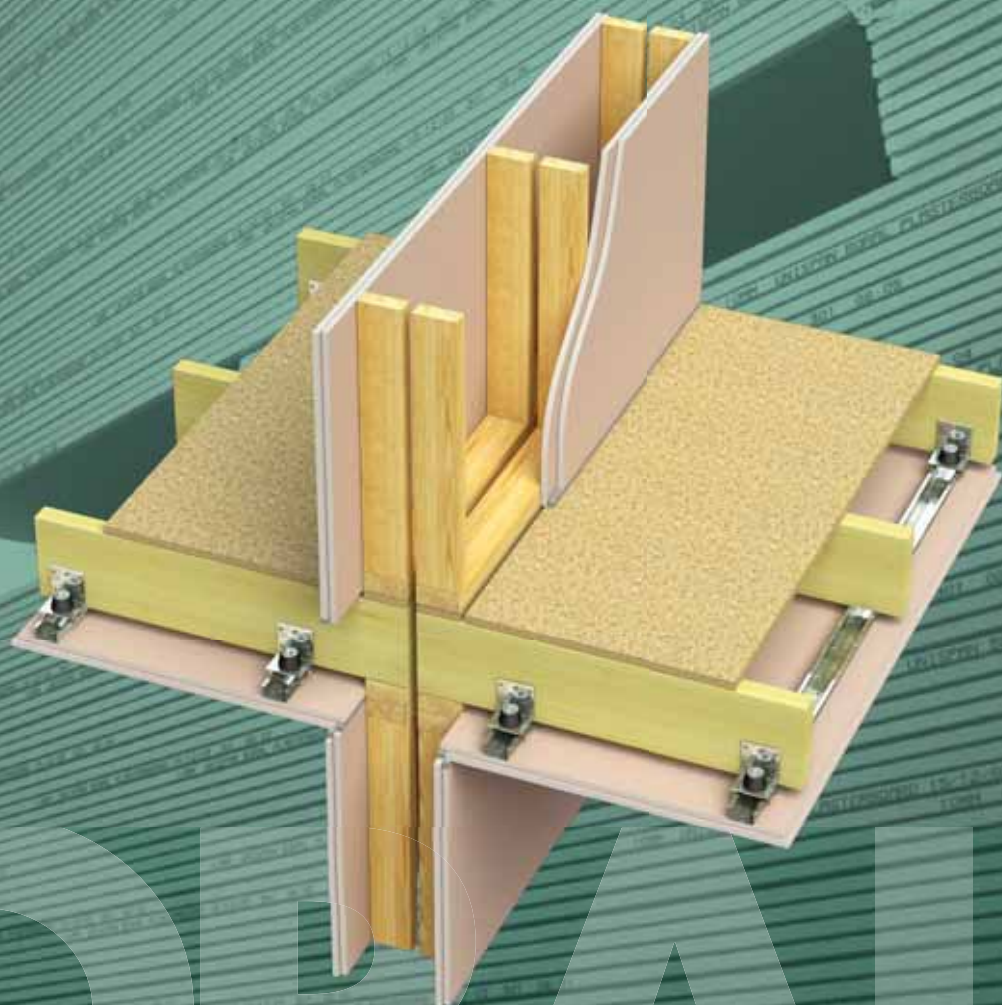


Multiframe™

TIMBER FRAMED CLASS 2 BUILDINGS



Boral's Purpose ...

to create sustainable solutions for a worldwide building and construction industry.

Boral is a leading Australian supplier of building and construction materials, operating also throughout Asia and in the United States.

Boral offers a wide range of building solutions for the residential, commercial and infrastructure sectors, including Bricks, Roof Tiles, Plasterboard, Concrete, Asphalt and many others. Information on the full range of Boral products can be found at www.boral.com.au

Boral Plasterboard specialises in the manufacture, distribution and installation of plasterboard based wall and ceiling systems. In Australia, Boral operates plasterboard manufacturing facilities in New South Wales, Queensland and Victoria. Boral Plasterboard also operates Australia-wide distribution network of about 100 company owned stores and independent resellers.

Striving to create sustainable building solutions for a worldwide building and construction industry, Boral aims to reduce the impact of its operations on the environment and to make a positive difference to the communities in which it operates.

Boral Plasterboard prides itself on its leadership in the area of lightweight building solutions.

Among the successful solutions pioneered by the company over the years are: Partiwall® and IntRwall® separating wall systems, OutRwall® and FireClad® fire rated exterior wall systems, CinemaZone® acoustic walls and ceilings for home cinemas, and many others.

Boral Plasterboard's Product and Systems Development (PSD) team boasts unrivalled expertise in lightweight fire rated and acoustic systems, and routinely works with customers to select and, if required, tailor solutions for specific projects.

Together with the TecASSIST® customer help line, Boral Plasterboard's PSD team is well positioned to provide technical support to projects of any size and complexity.

For expert advice on lightweight Building Systems, contact Boral TecASSIST® 1800 811 222.



Boral Plasterboard plant at Pinkenba, Queensland, uses recycled water in the manufacturing process to reduce the dependence on public water resources.

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Figure 1: Multiframe™ General View

Introduction

Boral Multiframe™ is a complete lightweight construction system for low-rise apartment buildings.

Developed by Boral Plasterboard in consultation with industry stakeholders, Boral Multiframe™ comprises a range of timber framed plasterboard wall and ceiling solutions and associated construction details that satisfy fire rating and acoustic requirements of the Building Code of Australia (BCA) for Class 2 buildings up to 4 storeys:

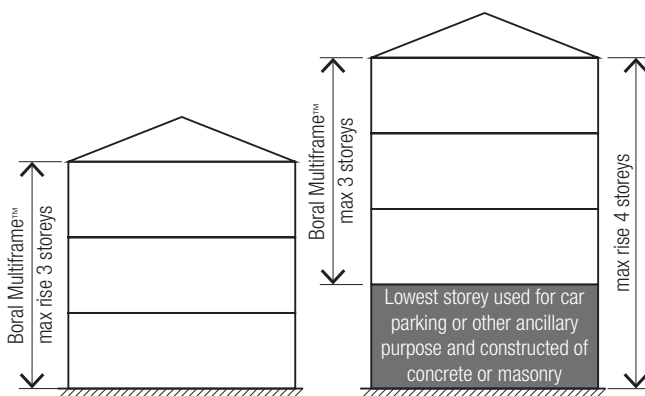


Figure 2: **Boral Multiframe™ Applications in Class 2 buildings**

Note:

Refer Fire Resistance section in this manual for calculations of rise in storeys.

Boral Multiframe™ has been specifically developed for use in Class 2 buildings where sole occupancy units are located above one another. For Class 1 and Class 2 buildings comprising attached sole occupancy units Boral Partiwall® separating wall system may

provide a more cost effective solution than Multiframe™ (see www.boral.com.au/partiwall). Consult the project Building Surveyor for building classification and system suitability.

This manual provides a summary of BCA fire, acoustic and thermal insulation provisions for Class 2 buildings and outlines Boral Multiframe™ systems, general construction details and design considerations.

Fire resistance performance of the Multiframe™ systems have been certified or assessed by CSIRO and Exova Warringtonfire Aus Pty Ltd.

Acoustic ratings provided in the System Reference Tables have been certified by Acoustical Consultants Renzo Tonin and Associates Pty Ltd.

Total R-values of Multiframe™ systems provided in this manual have been assessed by James M Fricker based on AS/NZS 4859.1:2002/Amdt 1 2006. Materials for the Thermal Insulation of Buildings (James M Fricker Report: i274Dw).

A full set of Boral Multiframe™ construction details can be found at www.boral.com.au/multiframe

For additional guidance on design and construction of timber framed multi-residential buildings refer Timber-framed Construction for Multi-residential Buildings Class 2, 3 and 9c published by Forest and Wood Products Australia (www.woodsolutions.com.au).

Boral Multiframe™ key features and benefits are as follows:

Table 1: **Boral Multiframe™ Features and Benefits**

Features	Benefits
Cost effective	<ul style="list-style-type: none"> Lower cost of wall and floor systems as compared to concrete and masonry construction¹
Lightweight	<ul style="list-style-type: none"> No need for heavy lifting equipment Suitable for reactive soils, sloping sites and seismic construction
Comprehensive solution	<ul style="list-style-type: none"> Complete building system A full range of systems to meet BCA requirements Extensive CAD details
Timber framed plasterboard construction	<ul style="list-style-type: none"> Ready availability of materials and skills Flexibility of design and construction Ease of installation of electrical and plumbing services Use of plantation timber reduces impact on the environment GECA certified plasterboard products may contribute to Green Star rating Ease of incorporating thermal and acoustic insulation Pre-fabricated framing may reduce construction time
Expert technical support	<ul style="list-style-type: none"> Boral TecASSIST® free-call service available to Multiframe™ users Back-up at design and construction stages by Boral Engineers Highly trained Sales staff
Regulatory compliance	<ul style="list-style-type: none"> Meets BCA Fire, Acoustic and Thermal Rating requirements (Reports and Opinions are available on request) System application recommendations provided
High acoustic ratings	<ul style="list-style-type: none"> Systems available with acoustic performance above BCA requirements Possible credit points towards Green Star rating components

¹ Independent cost assessment by aQuenta Consulting Quantity Surveyors, dated 2012

Design Considerations

Fire Resistance

BCA Fire Resistance Provisions

BCA Fire Resistance provisions state that a Class 2 building must be constructed to maintain structural stability during fire and must be provided with safeguards to prevent the spread of fire. These requirements can be fulfilled through compliance with the Deemed-to-Satisfy provisions for fire separation and compartmentalisation of buildings.

Fire Resistance Levels

Under the BCA's Deemed-to-Satisfy provisions, certain building elements in a Class 2 building must achieve a Fire Resistance Level (FRL) specified for the required type of fire-resisting construction ranging from Type A (the most fire-resistant) to Type C (the least fire-resistant).

Note:

FRL is defined as the grading periods in minutes, determined by: Structural adequacy / Integrity / Insulation and expressed in that order.

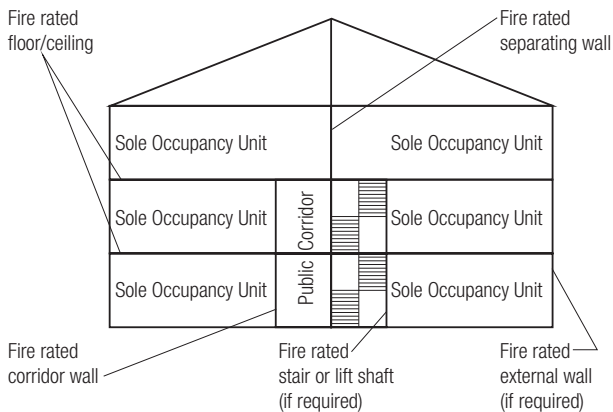


Figure 3: Fire Separation in Class 2 Buildings

Table 2: Types of Fire Resisting Construction for Class 2 Buildings

Rise in Storeys	Type of Construction
4 or more	A
3	A
2	B
1	C

Calculation of Rise in Storeys (BCA C1.2):

From BCA C1.2, the rise in storeys is the sum of the greatest number of storeys at any part of the external wall of the building and any storeys within the roof space.

A storey is not counted if:

- (i) It is situated at the top of the building and contains only heating, ventilating or lift equipment, water tanks, or similar service units or equipment.
- (ii) It is situated partly below the finished ground and the underside of the ceiling is not more than 1m above the average finished level of the ground at the external wall.

Treatment of Mixed Types of Construction and Buildings With Multiple Classifications (BCA C1.3):

In a building of multiple classifications, the type of construction required for the building is the most fire-resisting Type on the basis that the classification applying to the top storey applies to all storeys.

Concession for Class 2 buildings:

A building having a rise in storeys of 2 may be a Type C construction if it has:

- (i) access to at least 2 exits, or
 - (ii) its own direct access to a road or open space.
- Exit is defined as any of the following providing egress to a road or open space:
- (i) an internal or external stairway
 - (ii) a ramp
 - (iii) a fire-isolated passageway
 - (iv) a doorway opening to a roof or open space.

Consult the Project Building Surveyor for calculation of rise in storeys for a specific building.

« Design Considerations

Table 3: **Minimum FRLs of Building Elements in a Class 2 Building Without Sprinklers**

Building Element	Type of Fire Resisting Construction				
	Type A		Type B		Type C
	Loadbearing	Non-Loadbearing	Loadbearing	Non-Loadbearing	
External wall (including any column and other building element incorporated therein) or other external building element, where the distance from any fire-source feature to which it is exposed is:					
Less than 1.5m	90/90/90	-/90/90	90/90/90	-/90/90	90/90/90
1.5m to less than 3m	90/60/60	-/60/60	90/60/30	-/60/30	-/-/-
3m to less than 9m	90/60/30	-/-/-	90/30/30	-/-/-	-/-/-
9m to less than 18m	90/60/30	-/-/-	90/30/-	-/-/-	-/-/-
18m or more	90/60/30	-/-/-	-/-/-	-/-/-	-/-/-
External Column (not incorporated in an external wall) Distance from a fire-source feature:					
Less than 1.5m	90/-/-	-/-/-	90/-/-	-/-/-	90/-/-
1.5m to less than 3m	90/-/-	-/-/-	90/-/-	-/-/-	-/-/-
3m or more	-/-/-	-/-/-	-/-/-	-/-/-	-/-/-
Internal Walls					
Fire-resisting lift shafts	90/90/90	-/90/90	90/90/90	-/-/-	-/-/-
Fire-resisting stair shafts	90/90/90	-/90/90	90/90/90	-/90/90	60/60/60
Bounding public corridors, public lobbies and the like	90/90/90	-/60/60	60/60/60	-/60/60	60/60/60
Between or bounding sole-occupancy units	90/90/90	-/60/60	60/60/60	-/60/60	60/60/60
Ventilating, pipe, garbage and like shafts not used for the discharge of hot products of combustion	90/90/90	-/90/90	-/-/-	-/-/-	-/-/-
Other Loadbearing Internal Walls	90/-/-	NA	60/-/-	NA	-/-/-
Loadbearing Internal Columns	90/-/-	NA	60/-/-	NA	-/-/-
Internal Beams	90/-/-	NA	Ref BCA	NA	Ref BCA
Floors	90/90/90	NA	Ref BCA	NA	NA

- Where fire rated internal wall extends to the underside of a ceiling immediately below the roof, such ceiling must have resistance to incipient spread of fire (RISF) of not less than 60 minutes.
- Where the lowest storey is used solely for car parking or some other ancillary purpose, such storey must be separated from the storey above by construction having an FRL of not less than 90/90/90.

Fire Hazard Properties of Lining Materials

Under the BCA, wall and ceiling lining materials are assigned a group number from Group 1 (best performing) to Group 4 (worst performing) based on their Fire Hazard Properties.

The following table outlines permitted group numbers of wall and ceiling lining materials in Class 2 buildings:

Table 4: **Permitted Groups for Wall and Ceiling Materials**

Class of Building	Fire-Isolated Exits & Fire Control Rooms	Public Corridors		Sole Occupancy Units		Other Areas
	Wall/Ceiling	Wall	Ceiling	Wall	Ceiling	Wall/Ceiling
Unsprinklered	1	1, 2	1, 2	1, 2, 3	1, 2, 3	1, 2, 3
Sprinklered	1	1, 2, 3	1, 2, 3	1, 2, 3	1, 2, 3	1, 2, 3

Smoke-proof Walls

Public corridors in Class 2 buildings must be divided at intervals of not more than 40m with smoke-proof walls complying with Specification C2.5 of BCA.

Structural Tests for Lightweight Construction

Fire-resisting walls of lightweight construction must satisfy the structural test criteria outlined in Specification C1.8 of BCA.

Non-Combustible Materials

Under Clause C1.12 of BCA, plasterboard is deemed to be a non-combustible material. Where Class 2 building is constructed using timber framing, insulation in the cavity of a fire-resisting wall must be non-combustible.

« Design Considerations

Table 5: **Minimum FRLs of Building Elements in a Class 2 Building With Sprinklers**

Building Element	Type of Fire Resisting Construction				
	Type A		Type B		Type C
	Loadbearing	Non-Loadbearing	Loadbearing	Non-Loadbearing	
External wall (including any column and other building element incorporated therein) or other external building element Distance from a fire-source feature:					
Less than 1.5m	90/90/90	-/90/90	90/90/90	-/90/90	90/90/90
1.5m to less than 3m	90/60/60	-/60/60	90/60/30	-/60/30	-/-/
3m to less than 9m	90/60/30	-/-/	90/30/30	-/-/	-/-/
9m to less than 18m	90/60/30	-/-/	90/30/-	-/-/	-/-/
18m or more	90/60/30	-/-/	-/-/	-/-/	-/-/
External Column (not incorporated in an external wall) Distance from a fire-source feature:					
Less than 1.5m	90/-/	-/-/	90/-/	-/-/	90/-/
1.5m to less than 3m	90/-/	-/-/	90/-/	-/-/	-/-/
3m or more	-/-/	-/-/	-/-/	-/-/	-/-/
Internal Walls					
Fire-resisting lift shafts	60/60/60	-/-/	60/60/60	-/-/	-/-/
Fire-resisting stair shafts	60/60/60	-/-/	60/60/60	-/-/	60/60/60
Bounding public corridors, public lobbies and the like	60/60/60	-/-/	60/60/60	-/-/	60/60/60
Between or bounding sole-occupancy units	60/60/60	-/-/	60/60/60	-/-/	60/60/60
Ventilating, pipe, garbage and like shafts not used for the discharge of hot products of combustion	60/60/60	-/-/	-/-/	-/-/	-/-/
Other Loadbearing Internal Walls	60/-/	NA	60/-/	NA	-/-/
Loadbearing Internal Columns	90/-/	NA	60/-/	NA	-/-/
Internal Beams	90/-/	NA	Ref BCA	NA	Ref BCA
Floors	60/60/60	NA	Ref BCA	NA	Ref BCA

- Where fire rated internal wall extends to the underside of a ceiling immediately below the roof, such ceiling must have resistance to incipient spread of fire (RISF) of not less than 60 minutes.
- Where the lowest storey is used solely for car parking or some other ancillary purpose, such storey must be separated from the storey above by construction having an FRL of not less than 90/90/90.

« Design Considerations

Boral Multiframe™ Fire Rated Systems

Boral Multiframe™ comprises a range of fire rated solutions satisfying BCA's Deemed-to-Satisfy FRL requirements for various Types of fire-resisting construction. All Boral Multiframe™ fire rated systems are supported by a report from a Registered Testing Authority. A copy of the Report can be obtained from Boral TecASSIST® 1800 811 222.

For FRLs of Boral Multiframe™ wall and floor/ceiling systems refer System Reference Tables in this publication.

Boral Multiframe™ systems utilise Boral Firestop® and Boral Wet Area Firestop™ plasterboard to achieve required FRLs. Material substitution in Boral Multiframe™ systems may lead to a reduction in FRL and may void reports in support of BCA compliance.

Penetrations In Fire Rated Systems

As the fire resistance of Boral Multiframe™ systems is provided by the plasterboard internal linings, penetrations through the internal linings should be minimised. Where services and the like penetrate fire rated internal linings, the penetrations must be treated as per the details provided on Boral Multiframe™ website www.boral.com.au/multiframe

Other proprietary penetration systems (ie fire doors, fire collars, fire rated GPOs, downlight covers, etc) may also be applicable and should be installed to manufacturer's details.

Charfactors

A Charfactor links the load bearing capacity of a timber framed partition under the standard fire test, and at the time of structural failure, to permissible heights and loads for equivalently lined timber framed walls.

Charfactors for Boral Multiframe™ wall systems are indicated in the FRL column in the System Reference Tables.

Maximum heights and loads for timber studs in systems with various Charfactors can be found in Charfactor Tables at www.boral.com.au/multiframe

When determining the stud sizes for Boral Multiframe™ fire rated wall systems, in addition to the load bearing capacities under normal operating conditions, stud capacities under fire conditions must be checked by referring to the appropriate Charfactor tables.

Insulation Materials

Insulation materials specified in Boral Multiframe™ required to have an FRL is to be non-combustible. Refer insulation manufacturer for information.

Ceilings Under Roof

The minimum lining required in ceilings under roof for sound isolation purposes is 1x13mm Firestop® + 1x16mm Firestop® (FRL 60/60/60, RISF 60min). This lining satisfies BCA fire resistance requirements where a fire rated internal wall extends to the underside of a ceiling under roof.

Fire Hazard Properties

The following Boral plasterboard linings are classified as Group 1 materials under the Fire Hazard Properties provisions of the BCA:

Table 6: Fire Hazard Properties of Boral Plasterboard

Product	BCA Classification	Basis
Regular	Group 1	BRANZ FH3235/FH2188
Unispan®	Group 1	BRANZ FH3470
Soundstop®	Group 1	BRANZ FH3471
ENVIRO Soundstop®	Group 1	BRANZ FH3471
Wet Area Board™	Group 1	BRANZ FH3236/FH2189
Firestop®	Group 1	BRANZ FH3237/FH2190
Shaftliner™	Group 1	BRANZ FH3473
Wet Area Firestop™	Group 1	BRANZ FH3472

- Group 1 wall and ceiling lining materials are permitted to be used in all areas of Class 2 buildings.

Gas Appliances

Care is needed in the detailing of plasterboard walls around domestic gas cooking appliances and commercial catering equipment. Designers should check with the instructions and clearance requirements set out in AS/NZS 5601.1:2010/Amdt 1:2011 'Gas Installations - General Installations'.

Gas Reticulation in Fire Rated Walls

Oxygen or combustible fluid reticulation systems should not be located within fire rated wall and ceiling systems unless these are designed, fire tested and constructed to suit this application.

Linings in Smoke-Proof Walls

Where smoke-proof walls must be provided, such walls should be lined with minimum 13mm thick Regular plasterboard and constructed as per the BCA requirements.

« Design Considerations

Acoustics

BCA Acoustic Requirements

The objective of the Sound Transmission and Insulation provisions of the BCA in relation to Class 2 buildings is to safeguard occupants from illness or loss of amenity as a result of undue sound being transmitted between adjoining sole-occupancy units and from common spaces to sole-occupancy units.

Sound insulation ratings of walls and floors are stipulated for the various applications that divide sole-occupancy units, including sound insulation rating of services that are located in a wall or floor cavity that serves or passes through more than one sole-occupancy unit:

Table 7: Summary of BCA Acoustic Requirements for Floors, Walls and Services in Class 2 Buildings

Application	BCA Deemed-To-Satisfy Provision (Laboratory performance)				BCA Verification Method (In-situ performance)		
	R_w (not less than)	$R_w + C_{tr}$ (not less than)	Impact sound insulation (discontinuous const, walls only)	$L_{n,w} + C_i$ (not more than - floor only)	$D_{nT,w}$ (not less than)	$D_{nT,w} + C_{tr}$ (not less than)	$L_{n,w} + C_i$ (not more than - floor only)
Floors separating sole-occupancy units	-	50	-	62	-	45	62
Floors separating a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification	-	50	-	62	-	45	62
Walls separating sole-occupancy units ie habitable rooms adjoining, or, non-habitable rooms adjoining	-	50	No	-	-	45	-
Walls separating a sole-occupancy unit from a stairway, public corridor, public lobby or the like	50	-	No	-	45	-	-
Walls separating a sole-occupancy unit from a plant room or lift shaft	50	-	Yes	-	45	-	-
Walls separating a bathroom, sanitary compartment, laundry or kitchen in one sole-occupancy from a habitable room (other than a kitchen) in an adjoining unit	-	50	Yes	-	-	45	-
Duct, soil, waste or water supply pipe, including a duct or pipe that is located in a wall or floor cavity, that serves or passes through more than one sole-occupancy unit if the adjacent room is a habitable room (other than a kitchen)	-	40	-	-	-	-	-
Duct, soil, waste or water supply pipe, including a duct or pipe that is located in a wall or floor cavity, that serves or passes through more than one sole-occupancy unit if the adjacent room is a kitchen or non-habitable room	-	25	-	-	-	-	-

- Refer BCA for explanation of various sound insulation ratings
- For the purpose of the BCA, discontinuous construction is a wall having a minimum 20mm cavity between 2 separate leaves. In the case of stud construction, there must be no mechanical linkage between leaves, except at the periphery. Staggered studs are not considered discontinuous construction.
- Specification F5.2 of the BCA states that a water supply pipe must only be installed in the cavity of discontinuous construction. In the case of a water supply pipe that serves only one sole-occupancy unit, the pipe must not be fixed to the wall leaf on the side adjoining any other sole-occupancy unit and have a clearance not less than 10mm to the other wall leaf.
- The designer has a choice of using BCA Deemed-to-Satisfy Provisions or the Verification Method. Boral Multiframe systems outlined in the System Selector Tables meet or exceed the above Deemed-to-Satisfy Provisions.
- Other acoustic provisions apply to Class 2 buildings however they are outside the scope of this publication. Refer to the BCA for further information.

The solutions provided in this manual meet the minimum acoustic provisions of the BCA. Acoustic ratings in excess of BCA requirements are also provided for projects that need a higher acoustic standard.

« Design Considerations

Achieving Best Acoustic Performance

In-situ acoustic performance of building systems is invariably lower than the acoustic rating achieved under controlled laboratory conditions. The variance between in-situ and laboratory performance may be due to such factors as flanking sound (see below), incorrect installation details or non-ideal measurement conditions (for instance, small room sizes may affect accurate measurements in particular frequencies).

The BCA Verification Method recognises the difference between laboratory and site conditions by providing a 5dB concession for a field performance. Attention to detail in the design and construction and proper caulking/sealing of perimeter gaps and penetrations should produce an in-situ performance within 5dB of the laboratory tested or estimated values.

The following guidelines will assist designers and builders of multi-residential buildings to achieve the best possible acoustic performance of Boral Multiframe systems on site and to improve acoustic amenity of building occupants:

Structural Flanking

Flanking is sound transmission through adjacent parts of the building (structural flanking) or through untreated penetrations.

One of the main flanking routes occurs around the wall and floor structure as shown in Figure 4. These routes particularly apply to walls and floors between sole occupancy units but may also apply to external and internal walls within the sole-occupancy unit.

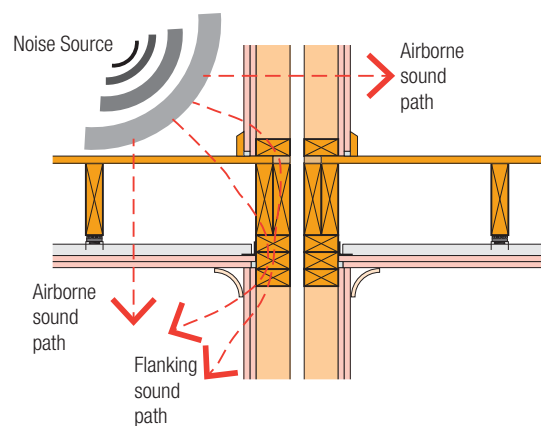


Figure 4: **Flanking and Airborne Noise Pathways Through Floor/Wall Junction**

A recommended solution to minimise structural flanking at wall floor intersections is to fix plasterboard linings to timber studs via furring channels on resilient mounts.

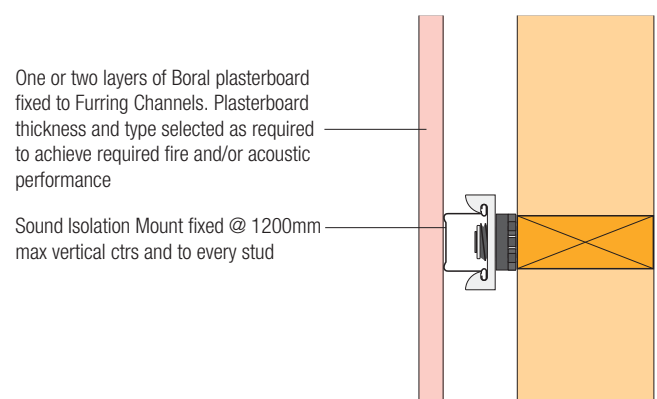


Figure 5: **Plasterboard Lining on Resilient Mounted Furring Channel**

Note:

Resilient mounted furring channel may be required to both sides of wall system. Refer to Boral TecASSIST® for advice on appropriate detailing for flanking sound control.

« Design Considerations

Floors

The floor systems in this publication are provided with three types of floor coverings; bare timber floor with and without acoustic underlay, carpet and underlay, and ceramic floor tiles. These floor coverings, in combination with the specified acoustic underlays/ mounts and fire rated ceilings underneath, contribute to the overall acoustic performance of the system in order to achieve the minimum acoustic provisions of the BCA.

With this in mind, consideration should be given to the possibility of occupants changing floor coverings from one type to another that may affect the acoustic performance of the total system. For instance, replacing carpet with timber or another type of floor covering (eg tiles, linoleum), may result in a reduction in acoustic performance that no longer meets the minimum acoustic provisions of the BCA.

If required, contact Boral Plasterboard for advice on a suitable floor system where the contribution of floor coverings is not an integral part of meeting the acoustic provisions of the BCA.

Stated performance of Multiframe™ floor/ceiling systems with acoustic ceiling mounts is based on furring channels spaced at 600mm and supported by Boral Acoustic Ceiling Mounts or Embleton Isolation Hangers at the following spacing:

Table 8: **Maximum Spacing of Boral Acoustic Ceiling Mount and Embleton Ceiling Isolation Hangers**

Plasterboard Ceiling Configuration	Joist Spacing	
	450mm	600mm
2 x 13mm Boral Firestop® or 13mm Boral Firestop® + 16mm Boral Firestop® or 2 x 16mm Boral Firestop®	1350 ^B	1200 ^B
	900 ^B , 1350 ^W	1200 ^B
	900 ^B , 1350 ^W	1200 ^W

- B = Blue rubber element - maximum load 17kg per mount with 5mm static deflection
- W = White rubber element - maximum load 25kg per mount with 5mm static deflection
- Refer to Rondo for maximum spans of furring channels as it may affect spacing of mounts.

Appliances

Noise producing appliances such as dishwashers, clothes dryers, washing machines and pumps should not be affixed to separating walls or should be isolated from the structure with resilient mountings and flexible service leads and connections.

Recessed Light Fittings, Electrical Outlets and Service Pipe Penetrations

Penetrations in fire rated party walls and ceilings such as recessed light fittings, electrical outlets and supply and return air grilles must themselves be fire rated. The associated detailing of these penetrations for fire rating purposes will also provide an adequate acoustic seal ensuring that the acoustic integrity of the system is maintained.

Duct, Soil, Waste or Water Supply Pipes

The minimum BCA Deemed-To-Satisfy provisions for acoustic isolation of ducts, soil and waste or water supply pipes are either $R_w + C_{tr} = 25\text{dB}$ or $R_w + C_{tr} = 40\text{dB}$ depending on the application (refer Table 7).

While $R_w + C_{tr} = 25\text{dB}$ can be achieved by the plasterboard linings alone without any treatment of the pipe or insulation in the wall or ceiling cavity, achieving $R_w + C_{tr} = 40\text{dB}$ generally requires cavity insulation and soil or waste pipes to be lagged and clad.

As demonstrated in the tables below, fire rated linings of Boral Multiframe systems incorporating lagged or unlagged pipes meet or exceed the minimum BCA requirement of $R_w + C_{tr} 25$ and $R_w + C_{tr} 40$ respectively:

Table 9: **$R_w + C_{tr}$ Acoustic Ratings of Boral Multiframe™ Plasterboard Linings**

Plasterboard Lining Configuration	Unlagged Pipes	Lagged/Clad Pipes
1 x 16mm Firestop®	30	40
1 x 16mm Firestop® + 1 x 10mm Regular	32	42
2 x 13mm Firestop®	33	42
1 x 13mm Firestop® + 1 x 16mm Firestop®	34	42
2 x 16mm Firestop®	34	43

- For lagged and clad pipes, any insulation that is listed as part of the system assembly is acceptable.
- Acoustic ratings based on pipe lagged and clad with Soundlag 4525C from Pyrotek Noise Control.
- Penetrations in plasterboard linings may reduce their acoustic performance. Refer to Fire Resistance for additional information.

« Design Considerations

Sound Isolation Within Roof Space

In accordance with the BCA, where a wall required to have sound insulation has a roof above, the wall must continue to:

- (a) the underside of the roof; or
- (b) a ceiling that provides the sound insulation required for the wall.

Where option (b) is adopted, the ceiling must be designed to ensure that the acoustic rating of over partition flanking path matches the performance of the wall:

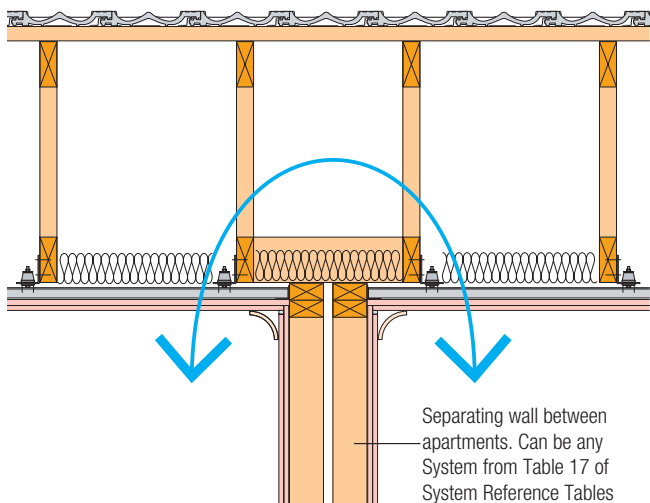


Figure 6: Sound Isolation in Roof Space

The following ceiling treatment is required to achieve over partition acoustic rating of $R_w + C_{tr} = 50\text{dB}$:

- The minimum ceiling lining is 1 x 13mm Firestop® + 1 x 16mm Firestop® (FRL 60/60/60, RISF 60min).
- Insulation must be laid over the entire ceiling either side of the wall and must be either minimum 90mm thick glass wool 14 kg/m³ or minimum 130mm thick glass wool, 11kg/m³ (R2.5 ceiling batt).
- The plasterboard ceiling must not be continuous over the separating wall.
- In the case where ceiling members/roof trusses run perpendicular over the party wall, the ceiling on both sides must be fixed via steel furring channel on Boral Acoustic Ceiling Mounts or Embelton Ceiling Isolation Hangers to minimise the effects of flanking sound.
- Ceiling penetrations such as A/C ducts and recessed light fittings are required to be fire rated. The associated detailing will provide adequate acoustic seal ensuring that the acoustic integrity of the systems maintained.

Additional treatments will be required for party walls with specified acoustic performance above $R_w + C_{tr} = 50\text{dB}$.

Contact Boral TecASSIST® 1800 811 222 for further advice.

« Design Considerations

Structural

Timber Framing

Timber framing, for Boral Multiframe™ systems, is to be designed by a suitably qualified Structural Engineer to satisfy the BCA requirements and the relevant Australian Standards.

When determining the stud sizes for Boral Multiframe™ fire rated wall systems, in addition to the load bearing capacities under normal operating conditions, stud capacities under fire conditions must be checked by referring to the appropriate Charfactor tables (see Fire Resistance – Charfactors).

Stud spacing in Multiframe™ fire rated wall systems shall not exceed 600mm centres.

Design Loads

Boral Multiframe™ fire rated and acoustic systems are heavier than regular internal partitions and ceilings due to the use of specialised plasterboard linings and other components (ie insulation and furring channels). This increase in weight, together with the weight of the timber framing, must be taken into account when determining dead loads on Boral Multiframe™ systems and supporting structure.

The weights of plasterboard linings for various Boral Multiframe™ systems are provided in the System Reference Tables. For the reference, the weights of various Boral plasterboard products are provided below:

Table 10: **Boral Plasterboard Weights**

Plasterboard	Weight (kg/m ²)
10mm Regular	6.8
13mm Regular	8.6
13mm Firestop®, 13mm Wet Area Firestop™	10.5
16mm Firestop®, 16mm Wet Area Firestop™	13.0
13mm Impactstop®	11.0

Testing

Boral Plasterboard fire rated wall systems have been tested at Boral Plasterboard's NATA accredited laboratory and satisfy the requirements of BCA Specification C1.8 'Structural tests for lightweight construction'.

Control Joints

Control joints in plasterboard linings minimise the potential for development of unsightly cracks which may also affect the fire and/or acoustic performance of the system.

In addition to construction joints that may be required in the building structure, Australian Standard AS 2589:2007 Gypsum Linings – Application and Finishing' requires control joints in plasterboard wall and ceiling linings as follows:

- at 12m maximum intervals
- at any change in substrate material (ie timber to steel or masonry).

Details of control joints in fire rated plasterboard walls and ceilings are provided at www.boral.com.au/multiframe

« Design Considerations

Thermal Insulation

Under the Deemed-to-Satisfy provisions of the Energy Efficiency requirements of the BCA, walls, roofs and ceilings forming part of a building envelope of a Class 2 building must achieve the following minimum total *R*-values for various Climate Zones:

Table 11: **Minimum *R* Values for Class 2 Buildings**

Climate Zone	Example City	Roofs and Ceilings			Internal Floors	External Walls
		Red, Green, Dark Grey	Light Grey, Yellow	Light Cream, Off White		
1	Darwin	4.2	3.7	3.2	2.0	3.3
2	Brisbane	4.2	3.7	3.2	2.0	3.3
3	Alice Springs	4.2	3.7	3.2	2.0	3.3
4	Broken Hill, Mildura	3.2	3.2	3.2	2.0	2.8
5	Sydney East, Adelaide, Perth	3.2	3.2	3.2	2.0	2.8
6	Melbourne, Sydney West, Ballarat	3.2	3.2	3.2	2.0	2.8
7	Canberra, Hobart	3.7	3.7	3.7	2.0	2.8
8	Mount Buller	4.8	4.8	4.8	3.5	3.8

Refer to the BCA for:

- Full set of Deemed-to-Satisfy Energy Efficiency provisions
- Outline of Climate Zones
- Definition of a building envelope for the purposes of thermal design
- Thermal construction compliance and installation requirements
- Adjustments of minimum *R*-values for roofs and ceilings to account for loss of ceiling insulation due to exhaust fans, flues, recessed downlights, etc
- Reduction of minimum *R*-value requirements for external walls to account for their thermal mass, orientation, shading and composition.

R-values:

- *R*-values of Multiframe™ wall and floor systems are provided in the System Reference Tables
- *R*-values of Multiframe™ roof systems are provided at www.boral.com.au/multiframe
- *R*-values for roof and ceilings are obtained based on downward heat flow (summer) only
- For *R*-values corresponding to upward heat flow (winter), refer to BCA or contact Boral TecASSIST® 1800 811 222
- *R*-values for internal floors are applicable for scenarios where the floors separate conditioned and unconditioned space.

Condensation

Artificial cooling and heating of buildings in some climates can cause condensation to form inside the layers of the building envelope. Such condensation can cause significant structural and cosmetic damage to the envelope before it is detected. Associated mould growth may also create health risks to the occupants.

As a general rule, a fully sealed vapour barrier installed on the more humid, or generally warmer, side of insulation will reduce the risk of condensation.

Placing some of the required roof insulation at the roof level (as opposed to ceiling level) may significantly moderate the roof space temperature extremes and condensation risk.

A suitably qualified Mechanical Engineer should be consulted for condensation prevention measures for a specific project.

For further guidance on condensation control refer Condensation in Buildings handbook by the Australian Building Codes Board (ABCB) www.abcb.gov.au

« Design Considerations

Wet Areas

Wet Areas (as defined in the BCA) must be waterproofed as per the Wet Area details contained in the Boral Plasterboard Installation Manual.

Where a Wet Area wall is required to be fire rated, plumbing penetrations and perimeter gaps must be sealed with an approved fire rated sealant.

Boral Multiframe™ wall systems extending into Wet Areas must incorporate approved water resistant linings. The following Boral Wet Area linings can be used in Boral Multiframe™ systems without affecting their fire or acoustic performance:

Table 12: **Equivalent Wet Area Linings**

Specified Internal Lining	Wet Area Lining
13mm Firestop®	13mm Wet Area Firestop™
16mm Firestop®	16mm Wet Area Firestop™
10mm Regular	10mm Wet Area Board™ or 6mm Villaboard®

- Where wall systems have specified multiple layers of internal linings in the wet areas, all layers must be replaced with an equivalent Wet Area lining.

Details of fire rated wet area penetrations and shower bases and bath tubs recessed into fire rated walls are provided at www.boral.com.au/multiframe



Impact Resistance

Where an increased impact resistance of internal wall linings is desirable, Boral Impactstop® plasterboard provides a cost-effective solution.

Impactstop® plasterboard has a fibre glass mat embedded within its core and is particularly effective in high traffic areas subject to soft body impact.

In areas subject to hard body or glancing impact Boral recommends the use of Fiberock® Aqua-Tough - a high performance paperless gypsum board with cellulose fibre reinforcement.

Impactstop® plasterboard can be substituted for Regular and Firestop® plasterboard of the same thickness without detrimentally affecting acoustic or fire performance of the system. For acoustic and fire rated performance of Fiberock® Aqua-Tough contact Boral TecASSIST® 1800 811 222.

Green Star Rating

The use of Boral Multiframe™ systems may contribute credit points in the following categories when assessed under the Green Star Multi Unit Residential v1 rating tool:

Waste Management (Ref No Man-7)

Up to two credit points can be awarded for minimisation of construction waste going to disposal.

For information on Boral plasterboard waste collection services available in your area contact the local Boral Plasterboard office.

Internal Noise Levels (Ref No IEQ-7)

The use of Boral Multiframe™ wall and ceiling systems with acoustic ratings $R_w + C_{tr} \geq 55\text{dB}$, and ceiling systems with impact sound ratings $L_{n,w} + C_1 \leq 55\text{dB}$ may contribute one credit point.

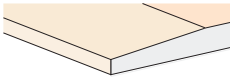

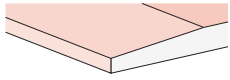

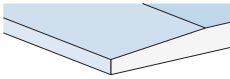










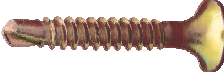



Volatile Organic Compounds (Ref No IEQ-8)

One credit point can be awarded where at least 95% of all adhesives and sealants meet the defined VOC content limits. Boral Multiframe™ plasterboard products, compounds, and adhesives have been independently tested to confirm compliance with Green Star VOC limits.

Materials

The following Boral Plasterboard and Boral Timber materials are recommended for the installation of Boral Multiframe™ fire rated and acoustic systems:

Table 13: **Boral Multiframe™ Materials**

Product Image	Item Description	Product Image	Item Description
	10mm Regular plasterboard		18mm Boral Parquetry
	13mm Firestop® plasterboard 16mm Firestop® plasterboard		10mm Boral Overlay Solid Strip Flooring 13mm Boral Overlay Solid Strip Flooring
	13mm Wet Area Firestop™ plasterboard 16mm Wet Area Firestop™ plasterboard		Boral RV-4 acoustic underlay
	Boral Acoustic Ceiling Mount - Direct Fix		Firesound® mastic, 600ml sausage
	Embelton Ceiling Isolation Hanger LB Bracket (Blue rubber element)		Type 'S' Steel Screws
	Embelton Ceiling Isolation Hanger HB Bracket (White rubber element)		Type 'W' Timber Screws
	Furring Channel Clip		Type 'L' Laminating Screws Type 'L' Laminating Screws
	28mm Furring Channel		Type 'D' Drill Point Wafer Head Screws Type 'D' Drill Point Wafer Head Screws
	15mm Boral Silkwood Engineered Hardwood Flooring 18mm Boral Silkwood Engineered Hardwood Flooring		Tyvek® Homewrap®
			Insulation

- Multiframe™ performance values stated in this document are based on the use of materials and components listed above. Material substitution may affect the performance of Multiframe™ systems. Please contact TecASSIST™ 1800 811 222 for advice.
- Call your nearest Boral Plasterboard store for information on the range of insulation listed in the Multiframe™ Systems tables.

Handling and Storage

To reduce the risk of damage, plasterboard should be delivered to site just prior to installation.

During handling sheets should be carried in an 'upright' position with particular care taken to protect the edges.

Plasterboard should be stored in flat stacks off the ground/floor in a dry, covered area. If storing outdoors, sheets should be fully protected from the weather. Plasterboard stacking supports should be spaced at no more than 600mm centres.

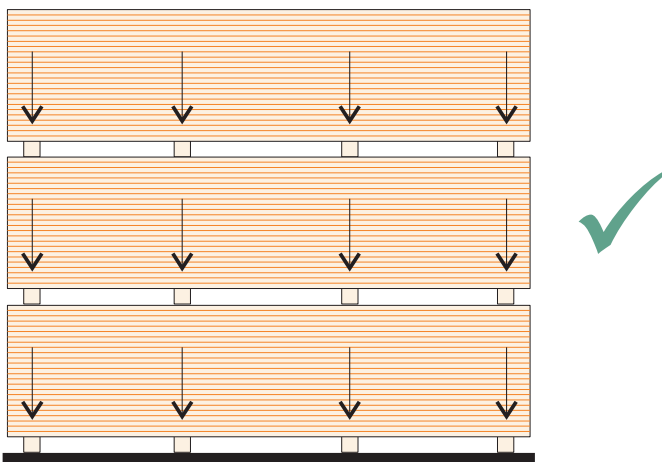


Figure 7: **Correct placement of billets**

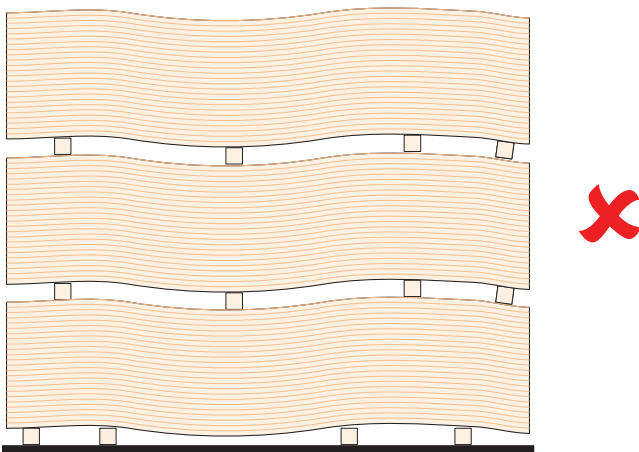


Figure 8: **Incorrect placement of billets**

System Selection Guidelines

Boral Multiframe™ systems have been carefully selected to provide cost effective fire rated and acoustic solutions complying with BCA requirements for Class 2 buildings.

The System Applications Tables and System Reference Tables on the following pages have been provided in order to assist the specifiers and builders in selecting appropriate Multiframe™ systems for their projects. The System Reference Tables have been verified by Exova Warringtonfire Aus Pty Ltd (fire resistance) and Renzo Tonin and Associates Acoustic Consultants (acoustic ratings).

The System Application Tables outline the Multiframe™ systems suitable for various applications within a Class 2 building, taking into account BCA fire resistance and acoustic requirements as summarised in this manual. These tables have been provided for the purposes of preliminary system selection on the basis of the building's Type of Fire Resisting Construction (see Fire Resistance – Fire Resistance Levels), sprinkler availability and system application.

The system selection for a particular project must be verified by the project Building Surveyor with the reference to the BCA, other relevant regulations and the System Reference Tables provided in this manual.

The typical system selection process is outlined below:

Function	Conceptual Design	Performance Requirements	System Selection	Structural Check
Architect	Develop Conceptual Design		Select Boral Multiframe™ fire rated and acoustic systems	
Building Surveyor		Determine BCA fire resistance and acoustic requirements		
Structural Engineer				Check sizes of fire rated wall studs using Charfactor tables

Figure 9: Typical System Selection Process

With regard to selected Multiframe™ wall systems, the stud sizes and spacing indicated in the System Reference Tables must be checked by the Project Structural Engineer based on design loads and the wall Charfactor (see Fire Resistance – Charfactors).

Please note that the changes in the stud sizes and spacing may affect the acoustic performance of the system. Should any such changes be required, please contact Boral TecASSIST® 1800 811 222 for advice.

For explanation of system referencing convention refer Selector+ www.boral.com.au/selector+

System Application Tables

Table 14: Applications of Fire Rated Internal Wall Systems

Sprinklers Availability	Building Element	Type of Fire Resisting Construction					
		Type A		Type B		Type C	
		Loadbearing	Non-Loadbearing	Loadbearing	Non-Loadbearing	Loadbearing	Non-Loadbearing
Without Sprinklers	Walls separating a sole-occupancy unit from a stairway, public corridor, public lobby or the like	TT2626F TF2626F	TT1616F TF1616F	TT1616F TF1616F	TT1616F TF1616F	TT1616F TF1616F	TT1616F TF1616F
	Between sole-occupancy units	TT2626F	TT1616F	TT1616F	TT1616F	TT1616F	TT1616F
	Other Loadbearing Internal Walls	T2626F	NA	T1616F	NA	NA	NA
With Sprinklers	Walls separating a sole-occupancy unit from a stairway, public corridor, public lobby or the like	TT1616F TF1616F	TT1616F TF1616F	TT1616F TF1616F	TT1616F TF1616F	TT1616F TF1616F	TT1616F TF1616F
	Between sole-occupancy units	TT1616F	TT1616F	TT1616F	TT1616F	TT1616F	TT1616F
	Other Loadbearing Internal Walls	T1616F	NA	T1616F	NA	NA	NA

- Common and fire walls require FRL 90/90/90 (-/90/90) for all types of construction (A, B and C).
- In Type A and B construction, fire isolated stairs and lifts require FRL 90/90/90 (-/90/90).
- In Type C construction, other load bearing internal walls may require FRL 60/60/60 if they support a fire rated floor.
- BCA Specification C1.1 Clause 2.2 relating to fire protection for a support of another part may require additional building elements to be fire rated if they provide support to a fire rated building element.
- Where both twin stud (TT) and furring channel (TF) wall types are indicated, either option will satisfy BCA acoustic requirements, however, twin stud walls will provide higher isolation from acoustic impact sound.
- Where acoustic ratings in excess of BCA requirements are desirable, systems TT16F1016F10 or TT1616F10 can be used instead of TT1616F (see Systems Reference Tables).

Table 15: Applications of Floor/Ceiling Systems

Application	Sprinklers Availability	Floor Covering	Type of Fire Resisting Construction		
			Type A	Type B	Type C ¹
Floors separating sole-occupancy units and Floors	Without Sprinklers	Hardwood	HCF32F HCFA32F	HCF26F HCFA26F	HCF26F HCFA26F
		Carpet	CCF32F	CCF26F	CCF26F
		Tiles	TCF32F	TCF26F	TCF26F
	With Sprinklers	Hardwood	HCFA29F HCFA29F	HCFA26F HCFA26F	HCFA26F HCFA26F
		Carpet	CCF29F	CCF26F	CCF26F
		Tiles	TCFA29F	TCFA26F	TCFA26F

- ¹ Only applies when building meets deem-to-satisfy provisions of BCA C1.5.
- BCA Specification C1.1 Clause 2.2 relating to fire protection for a support of another part may require additional building elements to be fire rated if they provide support to a fire rated building element.
 - Hardwood flooring must be 15mm or 18mm Boral Silkwood Engineered Flooring, 18mm thick Parquetry, 10mm or 13mm thick overlay solid strip flooring (8.5kg/m²).
 - While both hardwood floor system types HCF (with acoustic floor underlay) and HCFA (with acoustic ceiling clips) satisfy BCA acoustic impact isolation requirements, systems type HCF provide higher acoustic impact isolation.

« System Application Tables

Table 16: **Applications of Fire Rated External Wall Systems With Lightweight External Cladding**

Sprinklers Availability	Distance from a fire-source feature	Type of Fire Resisting Construction					
		Type A		Type B		Type C	
		Loadbearing	Non Loadbearing	Loadbearing	Non Loadbearing	Loadbearing	Non Loadbearing
Without Sprinklers	Less than 1.5m	OW26WF26F	OW26WF26F	OW26WF26F	OW26WF26F	OW32WF10	OW32WF10
	1.5m to less than 3m	OW26WF26F	OW16WF16F	OW26WF26F	OW16WF16F	OW10	OW10
	3m to less than 9m	OW26WF26F	OW10	OW26WF26F	OW10	OW10	OW10
	9m to less than 18m	OW26WF26F	OW10	OW26WF26F	OW10	OW10	OW10
	18m or more	OW26WF26F	OW10	OW13WF13F ¹	OW10	OW10	OW10
With Sprinklers	Less than 1.5m	OW32WF16F	OW26WF26F	OW32WF16F	OW26WF26F	OW32WF10	OW32WF10
	1.5m to less than 3m	OW32WF16F	OW16WF16F	OW32WF16F	OW16WF16F	OW10	OW10
	3m to less than 9m	OW32WF16F	OW10	OW32WF16F	OW10	OW10	OW10
	9m to less than 18m	OW32WF16F	OW10	OW32WF16F	OW10	OW10	OW10
	18m or more	OW32WF16F	OW10	OW13WF13F ¹	OW10	OW10	OW10

¹ Fire rated wall system to satisfy BCA Specification C1.1 Clause 2.2. Refer Building Surveyor / Architect for advice as appropriate.

- In Type A construction, BCA Clause C2.6 relating to vertical separation of openings in external walls may require additional external walls to achieve FRL of 60/60/60.

- BCA Specification C1.1 Clause 2.2 relating to fire protection for a support of another part may require additional building elements to be fire rated if they provide support to a fire rated building element.

Table 17: **Applications of External Wall Systems With Brick Veneer**

Sprinklers Availability	Distance from a fire-source feature	Type of Fire Resisting Construction					
		Type A		Type B		Type C	
		Loadbearing	Non Loadbearing	Loadbearing	Non Loadbearing	Loadbearing	Non Loadbearing
Without Sprinklers	Less than 1.5m	TBV(90)26F	TBV(90)26F	TBV(90)26F	TBV(90)26F	TBV(90)10	TBV(90)10
	1.5m to less than 3m	TBV(90)26F	TBV(60)16F	TBV(90)26F	TBV(60)16F	TBV(0)10	TBV(0)10
	3m to less than 9m	TBV(90)26F	TBV(0)10	TBV(90)26F	TBV(0)10	TBV(0)10	TBV(0)10
	9m to less than 18m	TBV(90)26F	TBV(0)10	TBV(90)26F	TBV(0)10	TBV(0)10	TBV(0)10
	18m or more	TBV(90)26F	TBV(0)10	TBV(30)13F ¹	TBV(0)10	TBV(0)10	TBV(0)10
With Sprinklers	Less than 1.5m	TBV(90)16F	TBV(90)26F	TBV(90)16F	TBV(90)26F	TBV(90)10	TBV(90)10
	1.5m to less than 3m	TBV(90)16F	TBV(60)16F	TBV(90)16F	TBV(60)16F	TBV(0)10	TBV(0)10
	3m to less than 9m	TBV(90)16F	TBV(0)10	TBV(90)16F	TBV(0)10	TBV(0)10	TBV(0)10
	9m to less than 18m	TBV(90)16F	TBV(0)10	TBV(90)16F	TBV(0)10	TBV(0)10	TBV(0)10
	18m or more	TBV(90)16F	TBV(0)10	TBV(30)13F ¹	TBV(0)10	TBV(0)10	TBV(0)10





¹ Fire rated wall system to satisfy BCA Specification C1.1 Clause 2.2. Refer Building Surveyor / Architect for advice as appropriate.

- In Type A construction, BCA Clause C2.6 relating to vertical separation of openings in external walls may require additional external walls to achieve FRL of 60/60/60.

- BCA Specification C1.1 Clause 2.2 relating to fire protection for a support of another part may require additional building elements to be fire rated if they provide support to a fire rated building element.

System Reference Tables





Table 18: Separating Walls Between Apartments

Assembly	System Reference	Nom Width (mm)	Stud Size (mm)	Pbd Weight (kg/m ²)	Fire FRL Basis	Acoustic Ratings			Total R Value (m ² K/W)
						R _w	R _w +C _v	Insulation	
	TT1616F - 1x16mm Firestop® plasterboard - timber stud - 20mm gap - timber stud - 1x16mm Firestop® plasterboard	192	70	26.0	60/60/60 Cf NA FCO-0626	58	50	70mm glass wool, min 11kg/m ³ in each stud cavity	4.0
		232	90			59	50	70mm glass wool, min 11kg/m ³ in each stud cavity	4.2
	TT1616F10 - 1x10mm Regular plasterboard - 1x16mm Firestop® plasterboard - timber stud - 20mm gap - timber stud - 1x16mm Firestop® plasterboard	202	70	32.8	60/60/60 Cf NA FCO-0626	59	50	50mm glass wool, min 11kg/m ³ in one stud cavity only	1.9
		242	90			59	51	50mm glass wool, min 11kg/m ³ in one stud cavity only	1.8
		242	90			63	55	50mm glass wool, min 14kg/m ³ in each stud cavity	3.5
	TT16F1016F10 - 1x10mm Regular plasterboard - 1x16mm Firestop® plasterboard - timber stud - 20mm gap - timber stud - 1x16mm Firestop® plasterboard - 1x10mm Regular plasterboard	212	70	39.6	60/60/60 Cf NA FCO-0626	61	52	50mm glass wool, min 11kg/m ³ in one stud cavity only	1.9
		252	90			62	54	50mm glass wool, min 11kg/m ³ in one stud cavity only	1.9
		252	90			64	55	90mm glass wool, min 11kg/m ³ in one stud cavity only	2.9
	TT2626F - 2x13mm Firestop® plasterboard - timber stud - 20mm gap - timber stud - 2x13mm Firestop® plasterboard	212	70	42.0	90/90/90 Cf 21 FCO-2564	64	55	50mm glass wool, min 11kg/m ³ in one stud cavity only	1.9
		252	90			65	56	50mm glass wool, min 11kg/m ³ in one stud cavity only	1.9

- Acoustic ratings based on studs @ 450mm centres.
 - All Separating Walls Between Apartments meet BCA definition of 'discontinuous construction'.

« System Reference Tables



Table 19: Separating Walls Between Apartments and Public Corridors

Assembly	System Reference	Nom Width (mm)	Stud Size (mm)	Pbd Weight (kg/m ²)	Fire FRL Basis	Acoustic Ratings			Total R Value (m ² K/W)
						R _w	R _w +C _{tr}	Insulation	
	TT1616F - 1x16mm Firestop® plasterboard - timber stud - 20mm gap - timber stud - 1x16mm Firestop® plasterboard	192	70	26.0	60/60/60 Cf NA FCO-0626	54	46	50mm glass wool, min 11kg/m ³ in one stud cavity only	1.8
		232	90			55	48	50mm glass wool, min 11kg/m ³ in one stud cavity only	1.8
	TF1616F - 16mm Firestop® plasterboard - timber stud - 28mm steel furring channel on furring channel clips - 1x16mm Firestop® plasterboard	130	70	26.0	60/60/60 FCO-0619	50	42	90mm glass wool, min 14kg/m ³	2.9
		150	90			50	42	70mm glass wool, min 14kg/m ³	2.4
	TT2626F - 2x13mm Firestop® plasterboard - timber stud - 20mm gap - timber stud - 2x13mm Firestop® plasterboard	212	70	42.0	90/90/90 Cf 21 FCO-2564	50	42	Nil	0.7
		252	90			52	43	Nil	0.7
	TF2626F - 2x13mm Firestop® plasterboard - timber stud - 28mm steel furring channel on furring channel clips - 2x13mm Firestop® plasterboard	150	70	42	90/90/90 FCO-2564	47	40	Nil	0.7
		150	70			54	48	50mm glass wool, min 11kg/m ³	1.9
		170	90			55	49	50mm glass wool, min 11kg/m ³	1.9

- Acoustic ratings based on studs @ 450mm centres.

« System Reference Tables




Table 20: Load Bearing Internal Walls

Assembly	System Reference	Nom Width (mm)	Stud Size (mm)	Pbd Weight (kg/m ²)	Fire	Acoustic Ratings			Total R Value (m ² K/W)
					FRL Basis	R _w	R _w +C _{tr}	Insulation	
	T1616F	122	90	26.0	60/60/60 Cf 11 WFRA C91202 FCO-0619 FCO-0626	39	31	Nil	0.6
	- 1x16mm Firestop® plasterboard - timber stud - 1x16mm Firestop® plasterboard]								
	T2626F	142	90	42.0	90/90/90 Cf 11 FCO-2564 91/103	45	37	Nil	0.7
	- 2x13mm Firestop® plasterboard - timber stud - 2x13mm Firestop® plasterboard								

- Acoustic ratings are based on studs @ 450mm centres.

« System Reference Tables

Table 21: External Walls - Lightweight Cladding (Boral OutRwall®)

Assembly	System Reference	Nom Width (mm)	Stud Size (mm)	Pbd Weight (kg/m ²)	Fire	Acoustic Ratings*			Total R Value (m ² K/W)
					FRL Basis	R _w	R _w +C _{tr}	Insulation	
	OW10 - cladding, battens and Tyvek® HomeWrap® membrane - timber stud - 1x10mm Regular plasterboard	10 + frame + cladding system	As req	6.8	-/-/-	28	25	90mm glass wool, min 16kg/m ³ (R2.5 glass wool wall batts or equiv)	2.9
	OW13WF13F - cladding, battens and Tyvek® HomeWrap® membrane - 1x13mm Wet Area Firestop™ plasterboard - timber stud - 1x13mm Firestop® plasterboard	26 + frame + cladding system	As req	21.0	30/30/30 FCO-2393 WFRA 460081 WFRA C91550	40	31	90mm glass wool, min 16kg/m ³ (R2.5 glass wool wall batts or equiv)	3.2
	OW16WF16F - cladding, battens and Tyvek® HomeWrap® membrane - 1x16mm Wet Area Firestop™ plasterboard - timber stud - 1x16mm Firestop® plasterboard	32 + frame + cladding system	As req	26.0	60/60/60 FCO-0619 FCO-0626	41	37	90mm glass wool, min 16kg/m ³ (R2.5 glass wool wall batts or equiv)	3.2




- Acoustic ratings indicated for Multiframe™ external wall systems are based on cavity insulation required to achieve total wall thermal resistance value of at least R2.8m² K/W. For insulation requirements and acoustic ratings corresponding to higher total R-values contact Boral TecASSIST® 1800 811 222.

- Acoustic ratings based on 90mm timber studs @ 450mm centres.

- Acoustic ratings exclude cladding.

« System Reference Tables

Table 21 (cont): External Walls - Lightweight Cladding (Boral OutRwall®)

Assembly	System Reference	Nom Width (mm)	Stud Size (mm)	Pbd Weight (kg/m ²)	Fire FRL Basis	Acoustic Ratings*			Total R Value (m ² K/W)
						R _w	R _w +C _v	Insulation	
	OW26WF26F - cladding, battens and Tyvek® HomeWrap® membrane - 2x13mm Wet Area Firestop™ plasterboard - timber stud - 2x13mm Firestop® plasterboard	52 + frame + cladding system	As req	42.0	90/90/90 cf11 FCO-2564 C91/103	48	42	90mm glass wool, min 16kg/m ³ (R2.5 glass wool wall batts or equiv)	3.3
	OW32WF16F - cladding, battens and Tyvek® HomeWrap® membrane - 2x16mm Wet Area Firestop™ plasterboard - timber stud - 1x16mm Firestop® plasterboard	48 + frame + cladding system	As req	39.0	90/90/90 from outside 60/60/60 from inside C91580	45	40	90mm glass wool, min 16kg/m ³ (R2.5 glass wool wall batts or equiv)	3.3
	OW32WF10 - cladding, battens and Tyvek® HomeWrap® membrane - 2x16mm Wet Area Firestop™ plasterboard - timber stud - 1x10mm Regular plasterboard	42 + frame + cladding system	As req	32.8	90/90/90 from outside only WFRA C92580	45	37	90mm glass wool, min 16kg/m ³ (R2.5 glass wool wall batts or equiv)	3.3




- Acoustic ratings indicated for Multiframe™ external wall systems are based on cavity insulation required to achieve total wall thermal resistance value of at least R2.8m²K/W. For insulation requirements and acoustic ratings corresponding to higher total R-values contact Boral TecASSIST® 1800 811 222.

- Acoustic ratings based on 90mm timber studs @ 450mm centres.

- Acoustic ratings exclude cladding.

« System Reference Tables

Table 22: External Walls - Brick Veneer

Assembly	System Reference	Nom Width (mm)	Stud Size (mm)	Pbd Weight (kg/m ²)	Fire	Acoustic Ratings			Total R Value (m ² K/W)
					FRL Basis	R _w	R _w +C _r	Insulation	
	TBV(0)10 - Non fire rated brick veneer - cavity - timber stud - 1x10mm Regular plasterboard	10 + frame + cavity + veneer	As req	6.8	-/-	59	52	90mm glass wool, min 16kg/m ³ (R2.5 glass wool wall batts or equiv)	3.3
	TBV(30)13F - FRL 30/30/30 brick veneer - cavity - timber stud - 1x13mm Firestop® plasterboard	13 + frame + cavity + veneer	As req	10.5	30/30/30	59	53	90mm glass wool, min 16kg/m ³ (R2.5 glass wool wall batts or equiv)	3.3
	TBV(60)16F - FRL 60/60/60 brick veneer - cavity - timber stud - 1x16mm Firestop® plasterboard	16 + frame + cavity + veneer	As req	13.0	60/60/60 FCO-0626	59	53	90mm glass wool, min 16kg/m ³ (R2.5 glass wool wall batts or equiv)	3.3

- Acoustic ratings indicated for Multiframe™ external wall systems are based on cavity insulation required to achieve total wall thermal resistance value of at least R2.8m²K/W. For insulation requirements and acoustic ratings corresponding to higher total R-values contact Boral TecASSIST® 1800 811 222.




- Acoustic ratings based on 90mm timber studs @ 450mm centres.

- Acoustic ratings exclude cladding.

- Fire rated brick veneer as per the manufacturer's specification.

« System Reference Tables

Table 22 (cont): External Walls - Brick Veneer

Assembly	System Reference	Nom Width (mm)	Stud Size (mm)	Pbd Weight (kg/m ²)	Fire	Acoustic Ratings			Total R Value (m ² K/W)
					FRL Basis	R _w	R _w +C _t	Insulation	
	TBV(90)26F - FRL 90/90/90 brick veneer - cavity - timber stud - 2x13mm Firestop® plasterboard	26 + frame + cavity + veneer	As req	21.0	90/90/90 FCO-0966	60	55	90mm glass wool, min 16kg/m ³ (R2.5 glass wool wall batts or equiv)	3.3
		TBV(90)16F - FRL 90/90/90 brick veneer - cavity - timber stud - 1x16mm Firestop® plasterboard	16 + frame + cavity + veneer	As req	13.0	90/90/90 from outside 60/60/60 from inside	59	53	90mm glass wool, min 16kg/m ³ (R2.5 glass wool wall batts or equiv)
		TBV(90)10 - FRL 90/90/90 brick veneer - cavity - timber stud - 1x10mm Regular plasterboard	10 + frame + cavity + veneer	As req	6.8	90/90/90 from outside only	59	52	90mm glass wool, min 16kg/m ³ (R2.5 glass wool wall batts or equiv)

- Acoustic ratings indicated for Multiframe™ external wall systems are based on cavity insulation required to achieve total wall thermal resistance value of at least R2.8m²K/W. For insulation requirements and acoustic ratings corresponding to higher total R-values contact Boral TecASSIST® 1800 811 222.

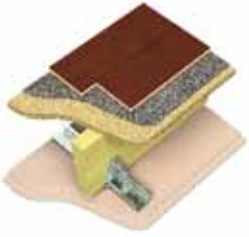
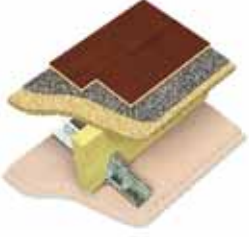
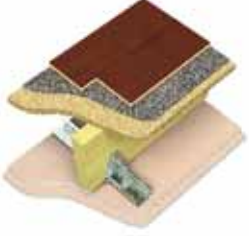
- Acoustic ratings based on 90mm timber studs @ 450mm centres.

- Acoustic ratings exclude cladding.

- Fire rated brick veneer as per the manufacturer's specification.

« System Reference Tables


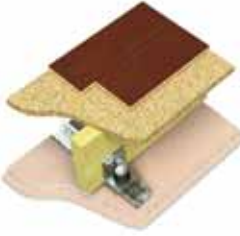
Table 23: Floor/Ceiling Systems - Hardwood Timber Floors

Assembly	System Reference	Pbd Weight (kg/m ²)	Fire FRL Basis	Acoustic Ratings				Total R Value (m ² K/W)
				R _w	R _w +C _{tr}	L _{n,w} + C _i	Insulation	
	HCF26F <ul style="list-style-type: none"> - Boral 15mm or 18mm thick Silkwood Engineered Flooring, 18mm thick Parquetry, 10mm or 13mm thick Overlay Solid Strip Flooring (8.5kg/m²) - Boral Rv-4 Impact Sound Acoustic Underlay (1.7kg/m²) - Minimum 19mm particleboard flooring (12.8kg/m²) - 190mm to 240mm deep joists - 28mm furring channel @ 600mm ctrs housed in a direct fixing clip arrangement - 2x13mm Firestop® plasterboard 	21.0	60/60/60 from below RISF 30min FCO-1658	58	50	52	Min 115mm glass wool, min 11kg/m ³ (R2.5 glass wool ceiling batts or equivalent)	4.2
	HCF29F <ul style="list-style-type: none"> - Boral 15mm or 18mm thick Silkwood Engineered Flooring, 18mm thick Parquetry, 10mm or 13mm thick Overlay Solid Strip Flooring (8.5kg/m²) - Boral Rv-4 Impact Sound Acoustic Underlay (1.7kg/m²) - Minimum 19mm particleboard flooring (12.8kg/m²) - 190mm to 240mm deep joists - 28mm furring channel @ 600mm ctrs housed in a direct fixing clip arrangement - 1x13mm Firestop® plasterboard - 1x16mm Firestop® plasterboard 	23.5	60/60/60 from below RISF 60min FCO-1658	60	52	52	Min 115mm glass wool, min 11kg/m ³ (R2.5 glass wool ceiling batts or equivalent)	4.2
	HCF32F <ul style="list-style-type: none"> - Boral 15mm or 18mm thick Silkwood Engineered Flooring, 18mm thick Parquetry, 10mm or 13mm thick Overlay Solid Strip Flooring (8.5kg/m²) - Boral Rv-4 Impact Sound Acoustic Underlay (1.7kg/m²) - Minimum 19mm particleboard flooring (12.8kg/m²) - 190mm to 240mm deep joists - 28mm furring channel @ 600mm ctrs housed in a direct fixing clip arrangement - 2x16mm Firestop® plasterboard 	26.0	90/90/90 from below RISF 60min FCO-1658 FCO-0629	61	52	52	Min 115mm glass wool, min 11kg/m ³ (R2.5 glass wool ceiling batts or equivalent)	4.3

- R-value indicated in the Multiframe™ floor systems are based on 10mm solid strip flooring. For R-values corresponding to other flooring materials contact Boral TecASSIST® 1800 811 222

« System Reference Tables

Table 23 (cont): Floor/Ceiling Systems - Hardwood Timber Floors




Assembly	System Reference	Pbd Weight (kg/m ²)	Fire FRL Basis	Acoustic Ratings				Total R Value (m ² K/W)
				R _w	R _w +C _{tr}	L _{n,w} + C _l	Insulation	
	HCFA26F - Boral 15mm or 18mm thick Silkwood Engineered Flooring, 18mm thick Parquetry, 10mm or 13mm thick Overlay Solid Strip Flooring (8.5kg/m ²) - Minimum 19mm particleboard flooring (12.8kg/m ²) - 190mm to 240mm deep joists - Boral Acoustic Ceiling Mounts or Embelton Ceiling Isolation Hangers - 28mm furring channel @ 600mm ctrs - 2x13mm Firestop® plasterboard	21.0	60/60/60 from below RISF 30min FCO-1658	58	52	57	Min 115mm glass wool, min 11kg/m ³ (R2.5 glass wool ceiling batts or equivalent)	4.2
	HCFA29F - Boral 15mm or 18mm thick Silkwood Engineered Flooring, 18mm thick Parquetry, 10mm or 13mm thick Overlay Solid Strip Flooring (8.5kg/m ²) - Minimum 19mm particleboard flooring (12.8kg/m ²) - 190mm to 240mm deep joists - Boral Acoustic Ceiling Mounts or Embelton Ceiling Isolation Hangers - 28mm furring channel @ 600mm ctrs - 1x13mm Firestop® plasterboard - 1x16mm Firestop® plasterboard	23.5	60/60/60 from below RISF 60min FCO-1658	60	54	57	Min 115mm glass wool, min 11kg/m ³ (R2.5 glass wool ceiling batts or equivalent)	4.2
	HCFA32F - Boral 15mm or 18mm thick Silkwood Engineered Flooring, 18mm thick Parquetry, 10mm or 13mm thick Overlay Solid Strip Flooring (8.5kg/m ²) - Minimum 19mm particleboard flooring (12.8kg/m ²) - 190mm to 240mm deep joists - Boral Acoustic Ceiling Mounts or Embelton Ceiling Isolation Hangers - 28mm furring channel @ 600mm ctrs - 2x16mm Firestop® plasterboard	26.0	90/90/90 from below RISF 60min FCO-1658 FCO-0629	60	55	57	Min 115mm glass wool, min 11kg/m ³ (R2.5 glass wool ceiling batts or equivalent)	4.2

- Refer Table 8 for maximum spacing of Boral Acoustic Ceiling Mounts and Embelton Ceiling Hangers.

- R-value indicated in the Multiframe™ floor systems are based on 10mm solid strip flooring. For R-values corresponding to other flooring materials contact Boral TecASSIST® 1800 811 222

« System Reference Tables

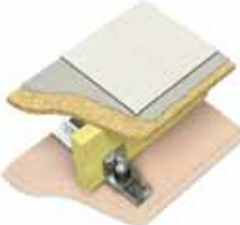
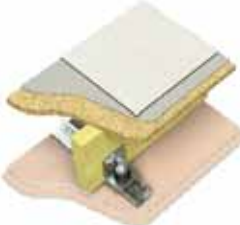

Table 24: Floor/Ceiling Systems - Carpeted Floors

Assembly	System Reference	Pbd Weight (kg/m ²)	Fire FRL Basis	Acoustic Ratings				Total R Value (m ² K/W)
				R _w	R _w +C _{tr}	L _{n,w} + C _i	Insulation	
	CCF26F - Carpet + Underlay - Minimum 19mm particleboard flooring (12.8kg/m ²) - 190mm to 240mm deep joists - 28mm furring channel @ 600mm ctrs housed in a direct fixing clip arrangement - 2x13mm Firestop® plasterboard	21.0	60/60/60 from below RISF 30min FCO-1658	56	50	38	Min 215mm glass wool, min 11kg/m ³ (R5 glass wool ceiling batts or equivalent)	4.4
	CCF29F - Carpet + Underlay - Minimum 19mm particleboard flooring (12.8kg/m ²) - 190mm to 240mm deep joists - 28mm furring channel @ 600mm ctrs housed in a direct fixing clip arrangement - 1x13mm Firestop® plasterboard - 1x16mm Firestop® plasterboard	23.5	60/60/60 from below RISF 60min FCO-1658	56	50	38	Min 160mm glass wool, min 11kg/m ³ (R3.5 glass wool batts or equivalent)	5.5
	CCF32F - Carpet + Underlay - Minimum 19mm particleboard flooring (12.8kg/m ²) - 190mm to 240mm deep joists - 28mm furring channel @ 600mm ctrs housed in a direct fixing clip arrangement - 2x16mm Firestop® plasterboard	26.0	90/90/90 from below RISF 60min FCO-1658 FCO-0629	57	50	38	Min 160mm glass wool, min 11kg/m ³ (R3.5 glass wool batts or equivalent)	5.5

- R-value indicated in the Multiframe™ floor systems are based on 10mm solid strip flooring. For R-values corresponding to other flooring materials contact Boral TecASSIST® 1800 811 222

« System Reference Tables

Table 25: Floor/Ceiling Systems - Tiled Floors

Assembly	System Reference	Pbd Weight (kg/m ²)	Fire FRL Basis	Acoustic Ratings				Total R Value (m ² K/W)
				R _w	R _w +C _{tr}	L _{n,w} + C _l	Insulation	
	TCFA26F - 6mm thick ceramic floor tiles laid on nom 6mm thick cement sheet (total mass nom 15kg/m ²) - Minimum 19mm particleboard flooring (12.8kg/m ²) - 190mm to 240mm deep joists - Boral Acoustic Ceiling Mounts or Embelton Ceiling Isolation Hangers - 28mm furring channel @ 600mm ctrs - 2x13mm Firestop® plasterboard	21.0	60/60/60 from below RISF 30min FCO-1658	58	50	58	115mm glass wool, min 11kg/m ³ (R2.5 glass wool batts or equivalent)	4.3
	TCFA29F - 6mm thick ceramic floor tiles laid on nom 6mm thick cement sheet (total mass nom 15kg/m ²) - Minimum 19mm particleboard flooring (12.8kg/m ²) - 190mm to 240mm deep joists - Boral Acoustic Ceiling Mounts or Embelton Ceiling Isolation Hangers - 28mm furring channel @ 600mm ctrs - 1x13mm Firestop® plasterboard - 1x16mm Firestop® plasterboard	23.5	60/60/60 from below RISF 60min FCO-1658	60	52	58	115mm glass wool, min 11kg/m ³ (R2.5 glass wool batts or equivalent)	4.3
	TCFA32F - 6mm thick ceramic floor tiles laid on nom 6mm thick cement sheet (total mass nom 15kg/m ²) - Minimum 19mm particleboard flooring (12.8kg/m ²) - 190mm to 240mm deep joists - Boral Acoustic Ceiling Mounts or Embelton Ceiling Isolation Hangers - 28mm furring channel @ 600mm ctrs - 2x16mm Firestop® plasterboard	26.0	90/90/90 from below RISF 60min FCO-1658 FCO-0629	61	53	58	115mm glass wool, min 11kg/m ³ (R2.5 glass wool batts or equivalent)	4.3

- Refer Table 8 for maximum spacing of Boral Acoustic Ceiling Mounts and Embelton Ceiling Hangers.

- R-value indicated in the Multiframe™ floor systems are based on 10mm solid strip flooring. For R-values corresponding to other flooring materials contact Boral TecASSIST® 1800 811 222

Installation

Plasterboard Fixing

Plasterboard linings in fire rated systems must be mechanically fixed to the framing. Adhesive fixing must not be used as it will downgrade the fire rated performance of the system.

The following fasteners should be used for fixing of Boral Multiframe™ linings:

Typical plasterboard fixing details for fire rated timber walls and ceilings are provided on the following pages. For a full set of Multiframe™ installation details refer www.boral.com.au/multiframe

Table 26: **Fasteners for Fixing of Fire Rated Plasterboard Linings**

Plasterboard Thickness (mm)	Timber Frame - Type W Screws	Furring Channels - Type S Screws, Type D Screws
1 x 10	6-9 x 25W wall 6-9 x 32W ceiling	6-8 x 25S, D ¹
1 x 13	6-9 x 32W	6-18 x 25S, D ¹
1 x 16	6-9 x 40W	6-18 x 30S, D
1 x 25	-	6-18 x 40S, D
2 x 10	6-9 x 40W	6-18 x 30S, D
2 x 13	6-9 x 50W	6-18 x 40S, D
13 + 16	6-9 x 50W	6-18 x 40S, D
2 x 16	6-9 x 60W	6-18 x 45S, D
3 x 13	8-8 x 60W	7-16 x 50S
3 x 16	8-8 x 75W	7-16 x 60S

- All screws to be to Australian Standard AS3566.2 2002 corrosion class 1.
- "W" is a single start, needle point, bugle head type W gypsum screw for fixing to hardwood and softwood framing. In some instances double start thread screws are permissible (refer Boral Plasterboard).
- "S" is a double start, needle point, bugle head type S gypsum screw for fixing to steel gauges of up to 0.80mm BMT.
- "D" is a double start, drill point, bugle head type D gypsum screw for fixing to steel gauges 0.80 to 2.00mm BMT.
- Screw designation given as (minimum screw gauge) - (threads per inch +1) x (minimum screw length).
- 1 For ease of construction with framing steel gauges of less than 0.8mm BMT use 30mm minimum screw length.
- Correct screw length is critical when fastening to resilient furring channel to avoid acoustic bridging.
- Tables to be read in conjunction with plasterboard installation details.

« Installation

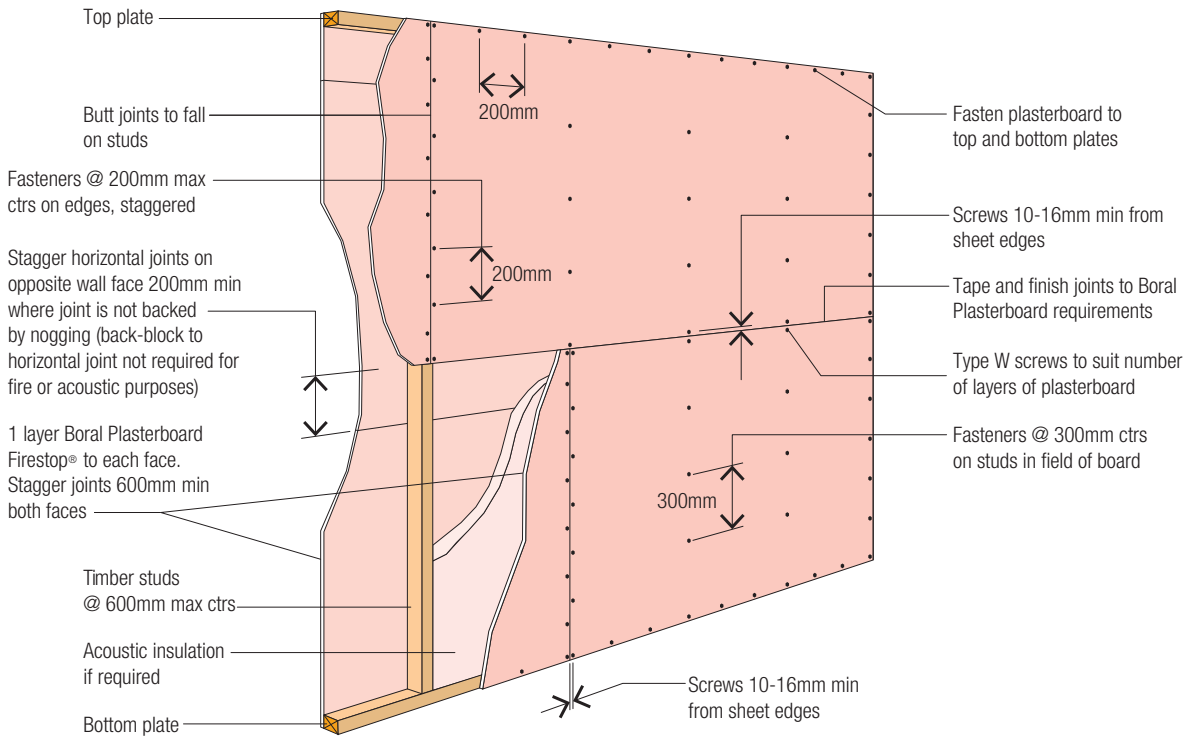


Figure 10: Fire Rated Timber Framed Wall - Horizontal Plasterboard Fixing (Single Layer)

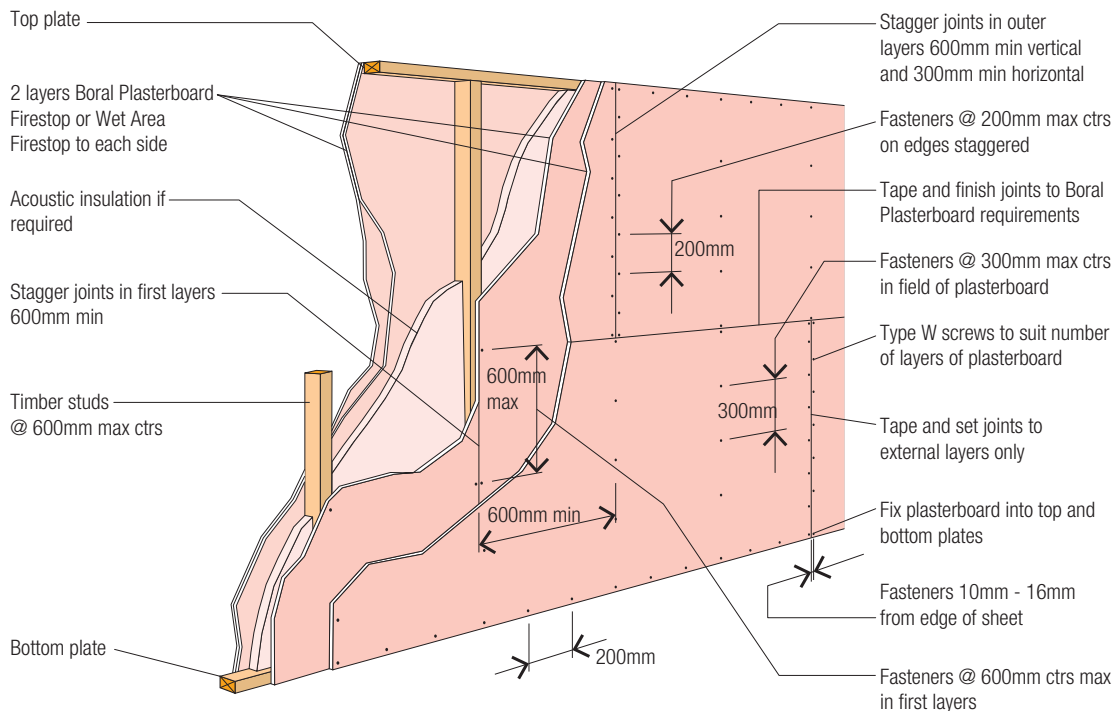


Figure 11: Fire Rated Timber Framed Wall - Mixed Orientation (Multiple Layers)

« Installation

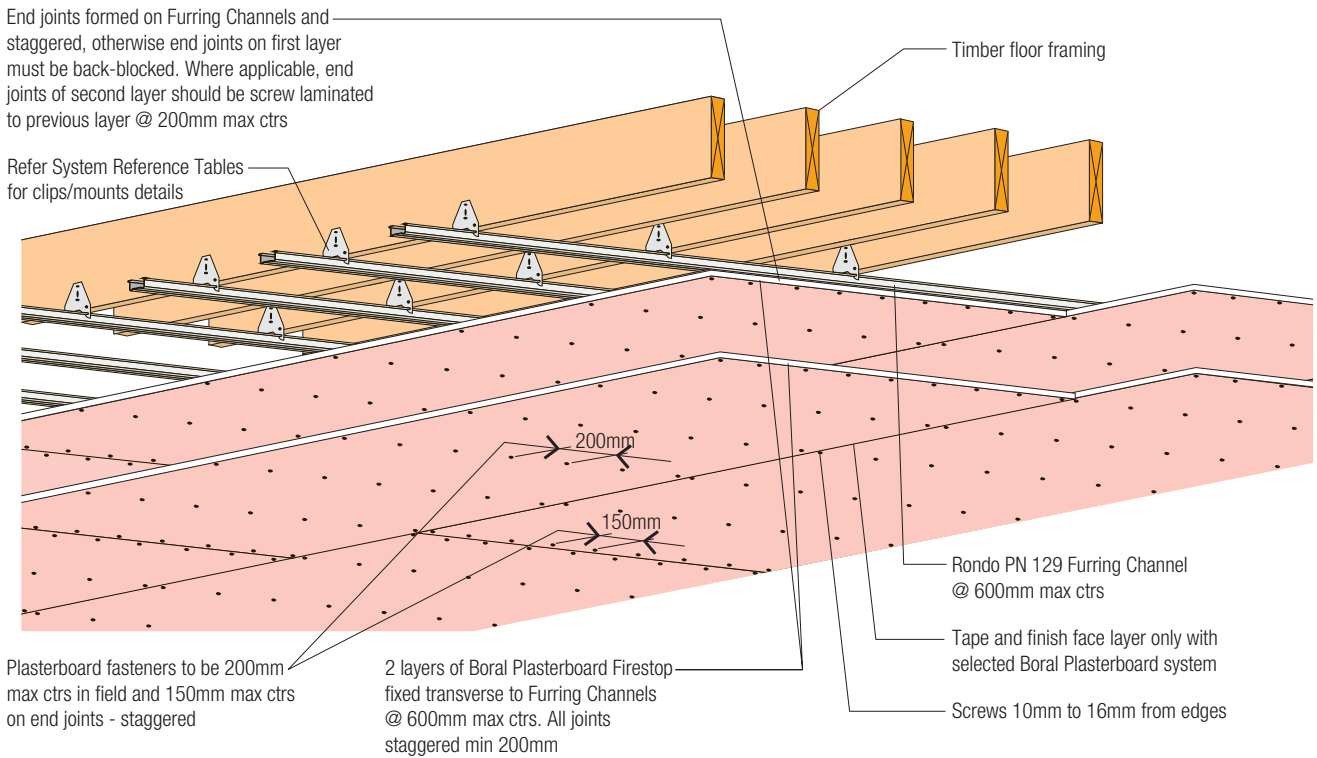


Figure 12: **Fire Rated Timber Framed Ceiling – Plasterboard Fixing on Furring Channels**

Sustainability

Boral Plasterboard aims to minimise the environmental impact of its operations and to make a positive difference to the environment and communities in which it operates. Plasterboard is manufactured from abundant natural gypsum resources and 100% recycled paper liner.

Lightweight plasterboard construction offers the benefits of low embodied energy, ease of thermal and acoustic upgrading and ease of modifications and repair.

Plasterboard waste can be recycled back into new plasterboard or used as a soil conditioner. Please contact Boral Plasterboard regarding waste collection services available in your region.

Health and Safety

For information regarding the safe use of Boral Plasterboard products and accessories please refer to instructions on the product packaging or contact your local Boral Plasterboard Sales Office or TecASSIST® for a current copy of the Material Safety Data Sheet.

Technical Enquiries 1800 811 222

TecASSIST® provides technical advice to builders, architects, contractors, engineers, regulators and home owners throughout Australia.

Our friendly team can offer both practical and design input at all levels of the plasterboard industry. Get your next project off on the right track by contacting TecASSIST® weekdays 8.30am - 4.30pm AEST on 1800 811 222 or www.boral.com.au/tecassist.

Sales Enquiries

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Northern Territory	Coonawarra Road, Winnellie 0820	F: (08) 8984 3778
Queensland	22 Kirra Street, Pinkenba 4008	F: (07) 3115 7321
South Australia	39 Burleigh Avenue, Woodville North 5012	F: (08) 7002 6381
Tasmania	93 Albert Road, Moonah 7009	F: (03) 6278 9865
Victoria	251 Salmon Street, Port Melbourne 3207	F: (03) 9214 2192
Western Australia	41 Rudderham Drive, North Fremantle 6159	F: (08) 6226 9833
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This Technical Information Guide is intended to provide general information on the features of Multiframe™ and should not be used as a substitute for professional advice. There are many variables that can influence construction projects which affect whether a particular construction technique is appropriate. Before proceeding with any project we recommend you obtain professional advice to ascertain the appropriate construction techniques to suit the particular circumstances of your project having regard to the contents of this Technical Information Guide. We recommend you use qualified tradespersons to install this system.

www.boral.com.au/multiframe

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The technical information contained in this manual was correct at the time of printing.

Building systems and details are, however, subject to change.

To ensure the information you are using is current, Boral recommends you review the latest building information available on the Boral website.

For further information contact TecASSIST® or your nearest Boral Plasterboard Sales Office.

