DESIGN GUIDE
FIRE, ACOUSTICS AND THERMAL
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INTRODUCTION

This section provides important background information necessary for the selection and usage of CSR Gyprock fire, acoustic and thermal systems and associated products.

All performance information provided in this manual relies on the system linings, components and accessories being strictly as specified. Information on the performance of third party materials should be sought from the relevant supplier.

REFERENCED MATERIAL

The following Standards and handbooks are referenced in this guide.

Manufacturing Standards:
- AS/NZS 2588 – Gypsum plasterboard.
- AS/NZS 2908.2 – Cellulose-cement products – Flat sheet.

Other referenced Standards and handbooks:
- AS/NZS 1170 series – Structural design actions.
- AS 1530.4 – Fire resistance tests for elements of construction.
- AS 1684 (series) – Residential timber framed construction.
- AS 1720.1 – Timber structures.
- AS/NZS 2358 – Adhesives for fixing ceramic tiles.
- AS/NZS 2589 – Gypsum linings – Application and finishing.
- AS/NZS 2785 – Suspended ceilings - design and installation.
- AS/NZS 3000 – Electrical installations.
- AS 3600 – Concrete Structures.
- AS/NZS 3700 – Masonry structures.
- AS 3740 – Waterproofing of domestic wet areas.
- AS 3959 – Construction of buildings in bushfire-prone areas.
- AS 4055 – Wind loads for housing.
- AS/NZS 4200.1 – Pliable building membranes and underlays – Materials.
- AS 4200.2 – Pliable building membranes and underlays – Installation requirements.
- AS/NZS 4600 – Cold formed steel structures.
- AS/NZS 4858 – Wet area membranes.
- AS/NZS 4859.1 – Material for the thermal insulation of buildings – General criteria and technical provisions.
- AS/NZS 5601.1 – Gas installations – General installations.
- AS 5637.1 – Determination of fire hazard properties.
- AS/ISO 13007 – Ceramic tiles – grouts and adhesives.
- Building Code of Australia (BCA).
- SAHB39 - Installation code for metal roofing and wall cladding.

RELATED GYPROCK PUBLICATIONS
- GYP511 Gyprock Impact Damage Resistant Wall Systems.
- GYP512 Gyprock Cinema Wall Systems.
- GYP514 Gyprock Boundary Wall Installation Guide.
- GYP546 Gyprock Shaft Wall Systems.
- GYP949 Gyprock StrataWall Systems.

RELATED CEMINTEL PUBLICATIONS
- Cemintel Wet Area Systems.
- Cemintel External Cladding & Eave’s Lining.
- Cemintel Texture Base Sheet.
- Cemintel Weatherboard, Endeavour, Headland, Balmoral, Scarborough & Plank.
- Cemintel Commercial ExpressWall
- Cemintel Barestone.
- Cemintel Ceiling Systems.
GYPROCK RANGE & SELECTION

GYPROCK PLASTERBOARD MANUFACTURING

Plasterboard is an internal wall and ceiling lining board, used in residential and commercial lightweight framed construction.

The Gyprock range of plasterboard closely follows the plasterboard market split between Residential and Commercial applications. Each sector has two classifications:

- **Select Range** – Gyprock plasterboards products recommended for use in the majority of non-specialist wall and ceiling applications.
- **Specialty Options** – Gyprock plasterboards products for use in wall and ceiling systems where higher levels of performance are specified.

Plasterboard, or drywall as it is called in some parts of the world, is a machine made sheet comprised of a gypsum core wrapped in a heavy-duty liner paper.

The core is made by first mixing gypsum, a non-toxic sedimentary rock, with a foaming agent to create a wet plaster mix. This plaster is applied onto a sheet of thick paper and the side edges of the paper are wrapped around the plaster. Another sheet of linerboard paper is applied over the top to create a plaster ‘sandwich’ which is cut to length and oven dried, ready for use. The final plasterboard sheet has two long edges that are paper-wrapped and two cut edges.

Gyprock manufactures in Australia to AS2588 – Gypsum plasterboard, and is formally accredited to the standard for Gyprock Plus, Supaceil and Standard Plasterboard 13mm.

In addition to standard plasterboard, Gyprock has developed technologies that deliver significant performance benefits to meet our customers’ specific needs.

Gyprock Optimised Core technology delivers an advanced performance-to-weight ratio, providing greater breaking strength in a substantially lighter board. Optimised Core technology is currently available in Gyprock Plus and Supaceil.

While the majority of the plasterboard range is accredited by Good Environment Choice Australia, Gyprock also produces a handful of plasterboard products featuring higher levels of recycled content. This includes the Gyprock EC08 boards and Superchek, making these products a superior choice for Green Building projects.

**Good Environmental Choice Australia (GECA)**

In 2008, Gyprock was the first Australian manufacturer to deliver a plasterboard product certified by GECA. With continual development in the green building space, Gyprock now presents a range of fifteen accredited plasterboard products, and in 2014, was awarded GECA certification covering the majority of compounds in the range.
## Gyprock Plasterboard Selection

Gyprock plasterboard products are available in a large range of sheet lengths. Lengths vary by state, and a full list is available at www.gyprock.com.au. Standard width is 1200mm. Some products are also available in 900, 1350 and 1400mm widths (lead times may apply). Shaft Liner Panel is supplied in 600mm width only. Colour shading behind each product name approximates the colour of the product face liner sheet.

### Table B1: Gyprock Plasterboard Features, Applications & Specifications

<table>
<thead>
<tr>
<th>Gyprock® Plasterboards</th>
<th>Applications – Walls &amp; Ceilings</th>
<th>Thickness (mm)</th>
<th>Mass kg/m²</th>
<th>Fine Grade</th>
<th>Moisture Resistant</th>
<th>Impact Resistant</th>
<th>Sound Resistant</th>
<th>Sound Absorbent</th>
<th>Mold Resistant</th>
<th>Low VOC</th>
<th>Green Accredited</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RESIDENTIAL – SELECT RANGE</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Plus™</td>
<td>A 10mm thick sheet primarily designed for residential walls. Long edges are recessed to assist in producing a smooth, even and continuous surface once jointed.</td>
<td>10</td>
<td>5.7</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Supaceil™</td>
<td>A 10mm thick sheet designed to span up to 600mm in ceiling applications. Can also be used for wall applications. Long edges are recessed to assist in producing a smooth, even and continuous surface once jointed.</td>
<td>10</td>
<td>6.1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Aquachek™</td>
<td>Both the core and linerboard facing are treated in manufacture to withstand the effects of moisture and high humidity. Recessed long edges allow flush jointing to other Recessed Edge plasterboard types.</td>
<td>10</td>
<td>7.9</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td><strong>RESIDENTIAL – SPECIALTY OPTIONS</strong></td>
<td></td>
<td></td>
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<tr>
<td>Superchek™</td>
<td>Manufactured with a very dense core and heavy duty facing producing high impact and sound resistance. Will span 600mm in ceiling applications. Double the force to impose a discernible surface indentation compared to standard plasterboard. Walls lined with Superchek provide a clearly noticeable reduction in perceived loudness compared to standard plasterboard. Long edges are recessed for flush jointing.</td>
<td>10</td>
<td>10.4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td><strong>COMMERCIAL – SELECT RANGE</strong></td>
<td></td>
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</tr>
<tr>
<td>Standard Plasterboard</td>
<td>RE – Recessed Edge Long edges are recessed to assist in producing a smooth, even and continuous surface once jointed.</td>
<td>13</td>
<td>8.5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RE/SE – 1 Recessed Edge, 1 Square Edge Typically used on walls with a single horizontal joint. One long edge is recessed to assist in producing a smooth, even and continuous surface once jointed. One long edge is square to enable easy fixing of skirting and cornice at the top and bottom of walls.</td>
<td>13</td>
<td>8.5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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</tr>
<tr>
<td></td>
<td>SE – 2 Square Edges Long edges are square, and can be butted together without jointing, or covered with aluminium, timber or vinyl mouldings.</td>
<td>13</td>
<td>8.5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Aquachek™</td>
<td>Both the core and linerboard facing are treated in manufacture to withstand the effects of moisture and high humidity. Recessed long edges allow flush jointing to other Recessed Edge plasterboard types.</td>
<td>13</td>
<td>9.8</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>GYPROCK® PLASTERBOARDS</td>
<td>FEATURES</td>
<td>THICKNESS (mm)</td>
<td>MASS kg/m²</td>
<td>FIRE RATING</td>
<td>MOISTURE RESISTANT</td>
<td>ENHANCED FIRE RESISTANCE</td>
<td>ENHANCED SOUND RESISTANCE</td>
<td>EXHAUSTED BCA BOND</td>
<td>MOULD RESISTANT</td>
<td>LOW VOC</td>
<td>QCA ACCREDITED</td>
</tr>
<tr>
<td>------------------------</td>
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</tr>
</tbody>
</table>
| Soundchek™             | • Designed to provide enhanced acoustic resistance.  
                          • A machine made sheet composed of a high density gypsum core encased in a heavy duty linerboard.  
                          • Long edges are recessed for flush jointing. | 13          | 13.0       | ✓            | ✓                 | ✓                      | ✓                      | ✓                | ✓              | ✓                  | ✓                  |
| Impactchek™            | • Fire grade board reinforced with a woven fiberglass mesh to produce a high strength plasterboard which resists soft body impact damage.  
                          • Ideal for high traffic areas such as hallways, stairways, playrooms and garages.  
                          • Long edges are recessed for flush jointing. | 13          | 10.5       | ✓            | ✓                 | ✓                      | ✓                      | ✓                | ✓              | ✓                  | ✓                  |
| Fyrchek™               | • Fire grade board composed of a specially processed glass fibre reinforced gypsum core encased in a heavy duty linerboard.  
                          • Ideal for high performance fire and acoustic rated walls and ceilings.  
                          • Long edges are recessed for flush jointing. | 13          | 10.5       | ✓            | ✓                 | ✓                      | ✓                      | ✓                | ✓              | ✓                  | ✓                  |
| Fyrchek™ MR            | • Fire grade board with moisture resistant properties.  
                          • Both the core and the liner board are treated in manufacture to withstand the effects of high humidity and moisture.  
                          • Long edges are recessed for flush jointing. | 13          | 10.8       | ✓            | ✓                 | ✓                      | ✓                      | ✓                | ✓              | ✓                  | ✓                  |
|                       |                                                     | 16          | 12.5       | ✓            | ✓                 | ✓                      | ✓                      | ✓                | ✓              | ✓                  | ✓                  |

**COMMERCIAL – SPECIALTY OPTIONS**

| EC08™ Impact          | • This product features higher levels of recycled content, making it a superior choice for Green Building projects.  
                          • EC08 Impact is a fire grade board offering increased density for greater resistance to soft and hard body impact for high traffic areas such as hallways and stairs in education and health facilities.  
                          • Long edges are recessed for flush jointing. | 13          | 12.1       | ✓            | ✓                 | ✓                      | ✓                      | ✓                | ✓              | ✓                  | ✓                  |
| EC08™ Impact MR       | • This product features higher levels of recycled content, making it a superior choice for Green Building projects.  
                          • A fire grade board specially treated for wet area/high humidity locations subject to increased impact risk, such as bathrooms, kitchens, laundries, walkways for hospitals, aged care, educational and commercial buildings.  
                          • Long edges are recessed for flush jointing. | 13          | 12.4       | ✓            | ✓                 | ✓                      | ✓                      | ✓                | ✓              | ✓                  | ✓                  |
| EC08™ Complete        | • This product features higher levels of recycled content, making it a superior choice for Green Building projects.  
                          • Gyproc EC08 Complete is a premium internal lining solution which integrates an efficient mould inhibitor, scuff resistance, soft and hard body impact resistance, moisture resistance, sound resistance and fire resistance into a low VOC plasterboard.  
                          • Long edges are recessed for flush jointing. | 13          | 12.4       | ✓            | ✓                 | ✓                      | ✓                      | ✓                | ✓              | ✓                  | ✓                  |
|                       |                                                     | 16          | 14.8       | ✓            | ✓                 | ✓                      | ✓                      | ✓                | ✓              | ✓                  | ✓                  |
| Shaft Liner Panel     | • Fire grade board used extensively in Gyproc shaft systems, services systems, party wall and intertenancy wall applications.  
                          • A 25mm thick sheet composed of a glass fibre reinforced gypsum core encased in a heavy duty linerboard.  
                          • 600mm wide square edge sheets. | 25          | 19.8       | ✓            | ✓                 | ✓                      | ✓                      | ✓                | ✓              | ✓                  | ✓                  |
| Shaft Liner Panel MP  | • Fire grade board with antifungal additives to resist mould formation.  
                          • A 25mm thick sheet composed of a glass fibre reinforced gypsum core encased in a heavy duty ivory linerboard.  
                          • 600mm wide square edge sheets. | 25          | 19.8       | ✓            | ✓                 | ✓                      | ✓                      | ✓                | ✓              | ✓                  | ✓                  |
| Flexible              | • A 6.5mm thick plasterboard with an enhanced core to allow bending to small radii for curved walls and ceilings.  
                          • Designed for installation as a two layer system.  
                          • Long edges are recessed for flush jointing. | 6.5         | 4.3        | ✓            | ✓                 | ✓                      | ✓                      | ✓                | ✓              | ✓                  | ✓                  |
| Glasroc F             | • A 30mm thick paperless gypsum board with glass fibre reinforced core.  
                          • Designed for single-layer installation, without jointing, to provide fire protection to structural steel columns and beams.  
                          • 1200mm wide square edge boards. | 30          | 25.5       | ✓            | ✓                 | ✓                      | ✓                      | ✓                | ✓              | ✓                  | ✓                  |
Excellence in design is achieved with a balance of aesthetics and functional performance. The Gyprock range of perforated plasterboard and access panels allows architects and designers to create beautiful ceilings and walls that achieve high levels of acoustic performance. The perforations together with fleece linings and insulation where used, reduce echo and noise reverberation to create more comfortable environments for work and leisure.

<table>
<thead>
<tr>
<th>TABLE B2: GYPROCK PERFORATED PLASTERBOARD FEATURES, APPLICATIONS &amp; SPECIFICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GYPROCK® PERFORATED PLASTERBOARDS</strong></td>
</tr>
<tr>
<td><strong>APPLICATIONS – WALLS &amp; CEILINGS</strong></td>
</tr>
<tr>
<td><strong>FEATURES</strong></td>
</tr>
<tr>
<td><strong>THICKNESS</strong> (mm)</td>
</tr>
<tr>
<td>STANDARD RANGE</td>
</tr>
<tr>
<td>Standard Perforated 6mm Round</td>
</tr>
<tr>
<td>• Featuring six large rectangular groupings per sheet, each with 2,100 x 6mm diameter perforations at 15mm centres to provide an open area of 8.3%.</td>
</tr>
<tr>
<td>• Long edges are recessed for flush jointing.</td>
</tr>
<tr>
<td>13 7.8 ✓ ✓</td>
</tr>
<tr>
<td>GYPTONE RANGE</td>
</tr>
<tr>
<td>Gyptone 12mm Square</td>
</tr>
<tr>
<td>• Featuring eight large square groupings per sheet, each with 400 x 12mm square perforations at 25mm centres, providing a 16% open area.</td>
</tr>
<tr>
<td>• Supplied with either black or white acoustic fabric backing.</td>
</tr>
<tr>
<td>• Manufactured with patented Activ’Air technology, which removes formaldehyde and improves the environment for people working and living in the space.</td>
</tr>
<tr>
<td>• All four edges are recessed for flush jointing.</td>
</tr>
<tr>
<td>• Matching access panel available.</td>
</tr>
<tr>
<td>12.5 8.3 ✓ ✓</td>
</tr>
<tr>
<td>Gyptone 12mm Square Minigrid</td>
</tr>
<tr>
<td>• Featuring eight large square groupings per sheet, each with nine mini grids of 16 x 12mm square perforations at 25mm centres. This subtle pattern provides an open area of 6%.</td>
</tr>
<tr>
<td>• Supplied with black acoustic fabric backing.</td>
</tr>
<tr>
<td>• Manufactured with patented Activ’Air technology, which removes formaldehyde and improves the environment for people working and living in the space.</td>
</tr>
<tr>
<td>• All four edges are recessed for flush jointing.</td>
</tr>
<tr>
<td>• Matching access panel available.</td>
</tr>
<tr>
<td>12.5 8.4 ✓ ✓</td>
</tr>
<tr>
<td>Gyptone Slotted Minigrid</td>
</tr>
<tr>
<td>• Featuring eight large square groupings per sheet, each with 16 mini grids of six 6mm x 80mm slot perforations. This contemporary design provides 13% open area.</td>
</tr>
<tr>
<td>• Supplied with black acoustic fabric backing.</td>
</tr>
<tr>
<td>• Manufactured with patented Activ’Air technology, which removes formaldehyde and improves the environment for people working and living in the space.</td>
</tr>
<tr>
<td>• All four edges are recessed for flush jointing.</td>
</tr>
<tr>
<td>• Matching access panel available.</td>
</tr>
<tr>
<td>12.5 8.6 ✓ ✓</td>
</tr>
<tr>
<td>Gyptone Flexible 12mm Square</td>
</tr>
<tr>
<td>• Flexible board suitable for curving to 1.2m minimum radius.</td>
</tr>
<tr>
<td>• Perforated gypsum board with square holes of 12mm x 12mm.</td>
</tr>
<tr>
<td>• Total perforated area of 16%.</td>
</tr>
<tr>
<td>• Supplied with black acoustic fabric backing.</td>
</tr>
<tr>
<td>6.5 6.5 ✓ ✓</td>
</tr>
<tr>
<td>Gyptone Flexible Slotted Minigrid</td>
</tr>
<tr>
<td>• Flexible board suitable for curving to 1.2m minimum radius.</td>
</tr>
<tr>
<td>• Perforated gypsum board with rectangular holes of 6mm x 80mm.</td>
</tr>
<tr>
<td>• Total perforated area of 13%.</td>
</tr>
<tr>
<td>• Supplied with black acoustic fabric backing.</td>
</tr>
<tr>
<td>6.5 6.5 ✓ ✓</td>
</tr>
</tbody>
</table>
### GYPROCK CEILING TILE SELECTION

#### TABLE B3: CEILING TILE FEATURES, APPLICATIONS & SPECIFICATIONS

<table>
<thead>
<tr>
<th>GYPROCK® CEILING TILES</th>
<th>APPLICATIONS – GRID CEILING SYSTEMS</th>
<th>THICKNESS (mm)</th>
<th>MASS (kg/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Supatone</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Gyproc Supatone is a plasterboard tile with a ‘wipe clean’ smooth polycoated surface paper laminate. Supatone is available in ‘white’, and used in basic commercial ceiling applications. Supatone’s core features the sag resistance properties of Supaceil. 1200 x 600mm nom.</td>
<td>10</td>
<td>7.0</td>
<td></td>
</tr>
<tr>
<td><strong>Freshtone™ Diamond White</strong></td>
<td></td>
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</tr>
<tr>
<td>• Freshtone is a Gyproc plasterboard tile finished with a finely textured vinyl laminate which resists fading and is easily wiped clean. Freshtone is available in ‘white’, and is ideal for shopping centres, offices and industrial premises. Freshtone’s core features the sag resistance properties of Supaceil. 1200 x 600mm nom.</td>
<td>10</td>
<td>8.0</td>
<td></td>
</tr>
<tr>
<td><strong>Perforated Tile</strong></td>
<td></td>
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</tr>
<tr>
<td>• Gyproc Perforated Tiles have been specifically developed for use in ceilings where additional sound absorption is required. Perforations are approximately 10% of the tile area, and combined with suitable insulation, provide a medium level of acoustic absorption. 1200 x 600mm nom.</td>
<td>13</td>
<td>10.0</td>
<td></td>
</tr>
</tbody>
</table>
GYPROCK CORNICE SELECTION

Gyprock Cornice is designed to provide an attractive finish at the junction of the wall and ceiling. It can be used on Gyprock plasterboard, fibrous plaster, fibre cement or cement rendered surfaces. Gyprock cornice is composed of gypsum plaster encased in a strong linerboard.

<table>
<thead>
<tr>
<th>TABLE B4: GYPROCK CORNICE RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GYPROC CORNICE</strong></td>
</tr>
<tr>
<td>Cove</td>
</tr>
<tr>
<td>Aria™ Duo Presto</td>
</tr>
<tr>
<td>Alto™ Trio Tempo™ Concerto™ Symphony</td>
</tr>
</tbody>
</table>

**COVE RANGE**

Gyprock Cove Cornice

**CONTEMPORARY RANGE**

Gyprock Aria Cornice

Gyprock Duo Cornice

Gyprock Symphony Cornice
CEMINTEL RANGE

CEMINTEL WALLBOARD

Cemintel CeminSeal Wallboard features an embedded micro water block technology that prevents water penetrating into the sheet, repelling water and providing a more stable sheet.

Wallboard is a superior lining for wet areas such as bathrooms, laundries and semi-exposed ceilings, and for the construction of impact resistant walls.

Cemintel Wallboard has a recess on both long edges so that sheets may be taped and set. Once jointed it may be tiled, painted or wall papered as desired.

FACADES AND SOFFITS

Cemintel has a selection of façades with classics such as weatherboards and profiled sheets, and contemporary products such as the pre-finished Territory™ and Surround™ ranges.

Cemintel ceiling solutions that can be used in residential or commercial applications are also available.

FLOORING & DECKING

Choose from our range of advanced lightweight fibre cement flooring and high strength compressed sheet solutions – suitable for both residential and commercial applications.

BRADFORD RANGE

INSULATION PRODUCTS

The Red Book’s fire, acoustic and thermal systems are designed around a range of Bradford insulation products including, Bradford Gold, SoundScreen, Acoustigard and Martini Polyester.

These products are specifically designed to achieve high performance results in a wide range of applications throughout the Red Book.

Bradford Gold™ insulation for walls and ceilings is specifically designed to deliver optimal thermal performance for the building envelope. Up to 25% of heat can be lost through the walls and up to 35% through the ceiling in winter. Essentially, Bradford Gold acts as a barrier to slow down heat loss and make a substantial difference to the energy efficiency and temperature inside the building. Bradford Gold Hi-Performance wall batts are also available for even higher thermal performance.

Bradford SoundScreen™ is a high-density acoustic insulation that is designed for hollow internal walls to provide exceptional noise reduction benefits. SoundScreen fills the empty space inside internal walls, effectively absorbing unwanted noise transfer between rooms for greater acoustic comfort.

Bradford Acoustigard™ is a glasswool fibre insulation specifically engineered to reduce sound transmission in walls and ceilings. The product comes in a range of densities and is also certified as a thermal insulation for non-combustible external walls.
WALL WRAP PRODUCTS

The installation of wall wrap can greatly increase weather resistance of the building both during and after construction. Wall wrap can assist in reducing the amount of wind driven rain that can enter the internal wall and protect the building from water damage. Additionally, Class 4 vapour permeable wall wraps allow internally generated water vapour to escape the inside of the building and minimise the risk of condensation formation.

Thermoseal Wall Wrap™ is a Class 1 vapour barrier wall wrap that provides additional weather protection to the building frame and minimises the entry of outside moisture into the wall system. Thermoseal Wall Wrap is recommended for use behind masonry construction only, however, may be used behind lightweight clad in humid, tropical regions.

Vapour Tough™ is a Class 3 vapour permeable wall wrap that provides additional weather protection to the building frame. Vapour Tough is for use behind masonry and light weight clad construction and can be used in cool to warm climate regions.

Enviroseal™ RW is a Class 4 highly vapour permeable wall wrap that can greatly reduce this risk of mould growth and condensation formation in the wall envelope while still providing exceptional weather resistance. Enviroseal RW is suitable behind masonry and light weight clad construction in cold to warm climates. It is not recommended in tropical or high humidity regions.

ROOF SARKING PRODUCTS

The installation of roof sarking can greatly increase weather resistance of the building both during and after construction. Roof sarking assists in reducing the amount of wind driven rain that can enter the roof and protect the building from water damage. Some roof sarking products provide additional thermal performance while others help minimise the risk of condensation.

Thermoseal™ Roof Tile Plus is an extra heavy duty, reflective foil weather barrier for use under tiled roofs. Thermoseal Roof Tile Plus can reflect up to 97% of radiant heat and minimises the entry of wind driven rain into the roof cavity.

Enviroseal™ HTS is a highly durable, high water hold-out vapour permeable roof underlay for use in residential or commercial tiled, slate and metal roof applications. Enviroseal HTS provides an additional layer of protection under tiles or metal roofs and minimises the risk of condensation damage.

---

**TABLE B5: WALL WRAP PRODUCT SPECIFICATION**

<table>
<thead>
<tr>
<th>Product</th>
<th>Vapour Permeance Class AS/NZS 4200.1</th>
<th>Weather exposure limit prior to cladding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermoseal 733</td>
<td>Class 1</td>
<td>1 month</td>
</tr>
<tr>
<td>Thermoseal Resiwrap</td>
<td>Class 1</td>
<td>1 month</td>
</tr>
<tr>
<td>Thermoseal Wall Wrap/XP</td>
<td>Class 1</td>
<td>1 month</td>
</tr>
<tr>
<td>Thermoseal Firespec</td>
<td>Class 2</td>
<td>1 month</td>
</tr>
<tr>
<td>Thermoseal Wall Wrap Prime</td>
<td>Class 2</td>
<td>1 month</td>
</tr>
<tr>
<td>Vapour Tough</td>
<td>Class 3</td>
<td>6 weeks</td>
</tr>
<tr>
<td>Enviroseal ProctorWrap CW, Enviroseal ProctorWrap CW-IT</td>
<td>Class 4</td>
<td>2 month</td>
</tr>
<tr>
<td>Enviroseal ProctorWrap HTS</td>
<td>Class 4</td>
<td>2 month</td>
</tr>
<tr>
<td>Enviroseal ProctorWrap RW</td>
<td>Class 4</td>
<td>1 month</td>
</tr>
<tr>
<td>Product</td>
<td>Abbreviation</td>
<td>Non-Combustible</td>
</tr>
<tr>
<td>---------</td>
<td>--------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>60mm Bradford Soundscreen R1.7</td>
<td>60 Soundscreen 1.7</td>
<td>✔</td>
</tr>
<tr>
<td>70mm Bradford Soundscreen R2.0</td>
<td>70 Soundscreen 2.0</td>
<td>✔</td>
</tr>
<tr>
<td>89mm Bradford Soundscreen R2.5</td>
<td>88 Soundscreen 2.5</td>
<td>✔</td>
</tr>
<tr>
<td>110mm Bradford Soundscreen R3.1</td>
<td>110 Soundscreen 3.1</td>
<td>✔</td>
</tr>
<tr>
<td>25mm Bradford Acoustigard (18kg/m³)</td>
<td>25 GW Acoustigard 18kg</td>
<td>✔</td>
</tr>
<tr>
<td>25mm Bradford Acoustigard (32kg/m³)</td>
<td>25 GW Acoustigard 32kg</td>
<td>✔</td>
</tr>
<tr>
<td>50mm Bradford Acoustigard (11kg/m³)</td>
<td>50 GW Acoustigard 11kg</td>
<td>✔</td>
</tr>
<tr>
<td>50mm Bradford Acoustigard (14kg/m³)</td>
<td>50 GW Acoustigard 14kg</td>
<td>✔</td>
</tr>
<tr>
<td>75mm Bradford Acoustigard (11kg/m³)</td>
<td>75 GW Acoustigard 11kg</td>
<td>✔</td>
</tr>
<tr>
<td>75mm Bradford Acoustigard (14kg/m³)</td>
<td>75 GW Acoustigard 14kg</td>
<td>✔</td>
</tr>
<tr>
<td>100mm Bradford Acoustigard (14.5kg/m³)</td>
<td>100 GW Acoustigard 14.5kg</td>
<td>✔</td>
</tr>
<tr>
<td>110mm Bradford Acoustigard (11kg/m³)</td>
<td>110 GW Acoustigard 11kg</td>
<td>✔</td>
</tr>
<tr>
<td>165mm Bradford Acoustigard (11kg/m³)</td>
<td>165 GW Acoustigard 11kg</td>
<td>✔</td>
</tr>
<tr>
<td>90mm Bradford Acoustigard (14kg/m³)</td>
<td>90 Acoustigard R2.2 OR 90 GW Acoustigard 14kg</td>
<td>✔</td>
</tr>
<tr>
<td>75mm Bradford Gold Batts R1.5</td>
<td>75 Gold Batts 1.5</td>
<td>✔</td>
</tr>
<tr>
<td>75mm Bradford Gold HP Batts R2.0</td>
<td>75 Gold Batts 2.0</td>
<td>✔</td>
</tr>
<tr>
<td>90mm Bradford Gold Batts R2.0</td>
<td>90 Gold Batts 2.0</td>
<td>✔</td>
</tr>
<tr>
<td>90mm Bradford Gold HP Batts R2.5</td>
<td>90 Gold Batts 2.5</td>
<td>✔</td>
</tr>
<tr>
<td>90mm Bradford Gold HP Batts R2.7</td>
<td>90 Gold Batts 2.7</td>
<td>✔</td>
</tr>
<tr>
<td>140mm Bradford Gold Batts R2.5</td>
<td>140 Gold Batts 2.5</td>
<td>✔</td>
</tr>
<tr>
<td>165mm Bradford Gold Batts R3.0</td>
<td>165 Gold Batts 3.0</td>
<td>✔</td>
</tr>
<tr>
<td>185mm Bradford Gold Batts R3.5</td>
<td>185 Gold Batts 3.5</td>
<td>✔</td>
</tr>
<tr>
<td>215mm Bradford Gold Batts R4.1</td>
<td>215 Gold Batts 4.1</td>
<td>✔</td>
</tr>
<tr>
<td>50mm Martini MSB2 Polyester</td>
<td>MSB2 Polyester</td>
<td>–</td>
</tr>
<tr>
<td>65mm Martini MSB3 Polyester</td>
<td>MSB3 Polyester</td>
<td>–</td>
</tr>
<tr>
<td>75mm Martini MSB4 Polyester</td>
<td>MSB4 Polyester</td>
<td>–</td>
</tr>
<tr>
<td>85mm Martini MSB5 Polyester</td>
<td>MSB5 Polyester</td>
<td>–</td>
</tr>
<tr>
<td>100mm Martini MSB6 Polyester</td>
<td>MSB6 Polyester</td>
<td>–</td>
</tr>
<tr>
<td>90mm Bradford Polymax R2.0</td>
<td>90 Polymax 2.0</td>
<td>–</td>
</tr>
<tr>
<td>90mm Bradford Polymax R2.5</td>
<td>90 Polymax 2.5</td>
<td>–</td>
</tr>
<tr>
<td>Martini Prime 30</td>
<td>Prime 30</td>
<td>–</td>
</tr>
<tr>
<td>Martini Prime 65</td>
<td>Prime 65</td>
<td>–</td>
</tr>
<tr>
<td>Martini Prime 75</td>
<td>Prime 75</td>
<td>–</td>
</tr>
<tr>
<td>Martini Prime 100</td>
<td>Prime 100</td>
<td>–</td>
</tr>
<tr>
<td>25mm Bradford Fibertex 450 Rockwool (80kg/m³)</td>
<td>25mm Bradford Fibertex 450</td>
<td>✔</td>
</tr>
<tr>
<td>110mm Bradford Glasswool Building Blanket R2.5</td>
<td>110 Glasswool Building Blanket</td>
<td>✔</td>
</tr>
<tr>
<td>100mm Autex GreenStuf® AAB Acoustic Blanket (32kg/m³)</td>
<td>100mm AAB32-100</td>
<td>–</td>
</tr>
<tr>
<td>25mm Acoustilag Acoustic Pipewrap (4.5kg/m²)</td>
<td>Acoustilag</td>
<td>–</td>
</tr>
<tr>
<td>60mm Bradford Anticon Medium Duty R1.3</td>
<td>Anticon 60 MD</td>
<td>✔</td>
</tr>
</tbody>
</table>

*Base material only*
HIMMEL RANGE

HIMMEL CEILING TILE SELECTION

CSR Himmel offers a range of ceiling tiles for exposed grid ceiling systems, each with various surface finishes and different properties to suit a variety of commercial applications. For more information please contact the Himmel team on 1300 374 253 or visit www.Himmel.com.au.

<table>
<thead>
<tr>
<th>OWA CEILING TILES</th>
<th>APPLICATIONS – GRID CEILING SYSTEMS</th>
<th>FEATURES</th>
<th>THICKNESS (mm)</th>
<th>MASS kg/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>OWA Alto</td>
<td>A mineral fibre ceiling tile that offers high acoustic properties and a traditional fissured face pattern.</td>
<td>• Suitable for many commercial applications such as offices and education projects. • Available in a variety of sizes and edge details.</td>
<td>15</td>
<td>4.5</td>
</tr>
<tr>
<td>OWA Finetta</td>
<td>A mineral fibre ceiling tile that offers good acoustic properties and a pinhole face pattern.</td>
<td>• Perfect for commercial projects where acoustics are essential to the environment. • Available in a variety of sizes and edge details.</td>
<td>15</td>
<td>4.5</td>
</tr>
<tr>
<td>OWA New Sandila</td>
<td>A mineral fibre ceiling tile that offers good premium acoustic properties and durable face pattern.</td>
<td>• Ideal for commercial applications with large noisy areas such as classrooms, retail spaces and hotels.</td>
<td>15</td>
<td>4.5</td>
</tr>
<tr>
<td>OWA Sinfonia Privacy</td>
<td>A mineral fibre ceiling tile that offers premium acoustic properties and a modern, clean face pattern.</td>
<td>• Perfect for commercial projects such as healthcare and retail where design and acoustics are essential. • Available in white, grey and black, and in a variety of sizes and edge details.</td>
<td>20</td>
<td>4.9</td>
</tr>
<tr>
<td>OWA Brillianto A</td>
<td>A premium acoustic ceiling tile that offers high acoustic properties and a clean white face pattern.</td>
<td>• Perfect for general commercial spaces such as hallways and open plan office spaces.</td>
<td>15/19</td>
<td>4.2</td>
</tr>
</tbody>
</table>

AFS RANGE

afs logicwall®

AFS Logicwall is a load bearing fibre cement-based permanent formwork system consisting of lightweight panels created by bonding hard-wearing CSR Cemintel fibre-cement sheeting against galvanised steel stud frames. Logicwall panels are CodeMark Certified, meeting demands for acoustic, fire and weatherproofing performance, and is suitable for design in accordance with AS3600.

afs redivall®

AFS Rediwall is a PVC permanent formwork system and a time-saving alternative to conventional masonry and blockwork. Its precision-extruded components easily interconnect for rapid installation. CodeMark Certified, Rediwall panels are load bearing for multi-level structures, is suitable design in accordance AS3600, and provides a consistently clean, even and water-resistant surface.

For more information on permanent formwork systems contact AFS on 1300 727 237 or visit afsformwork.com.au
**MATERIAL PROPERTIES**

**MANUFACTURING STANDARDS**

CSR Gyprock and Cemintel products, as referenced in this design guide, comply with the following manufacturing standards.

- **Plasterboard**
  - AS/NZS2588 Gypsum Plasterboard.
- **CeminSeal Wallboard**

**THERMAL & MOISTURE STABILITY**

Gyprock plasterboard and Cemintel fibre cement products are stable building materials when subjected to the normal range of interior temperature and humidity conditions.

- **Plasterboard**: \( \alpha = 16.2 \times 10^{-6} \text{ mm/mm/°C} \) in the temperature range 4°C to 38°C
- **Fibre cement**: \( \alpha = 7.5 \times 10^{-6} \text{ mm/mm/°C} \) in the temperature range 0°C to 60°C

**Hygrometric coefficient of expansion (\( \delta \)).**

- **Plasterboard**: \( \delta = 7.2 \times 10^{-6} \text{ mm/mm/%} \) (in the range 5% to 90% R.H.)
- **Fibre cement**: \( \delta = 6.6 \times 10^{-6} \text{ mm/mm/%} \) (in the range 30% to 90% R.H.)
- **The value of total expansion from equilibrium to saturated condition for fibre cement is 5.0 \times 10^{-4} \text{ mm/mm}.**

Note that these values are approximate only and will vary across the range of product formulations.

**INTERNAL MOISTURE**

Gyprock plasterboard must not be used where it will be in contact with liquid water or an atmosphere of constant relative humidity above 90%.

For wet area walls and external ceilings subject to intermittent high humidity where plasterboard is specified, any of the moisture resistant Gyprock plasterboards are recommended. CeminSeal Wallboard products are highly suitable for wet areas and semi-exposed ceilings. In all cases follow product installation brochures.

**THERMAL PERFORMANCE**

The R value, or thermal resistance of a material, expresses the ability of a particular material to resist heat flow.

Gyprock and Cemintel products have been tested to ASTM C518 for thermal performance.

The ‘R’ values for Gyprock plasterboards are:

- 10mm plasterboard \( R = 0.04 – 0.05 \) (0.04 – 0.05 m²K/W).
- 13mm plasterboard \( R = 0.05 – 0.07 \) (0.05 – 0.07 m²K/W).
- 16mm plasterboard \( R = 0.07 – 0.09 \) (0.07 – 0.09 m²K/W).

The ‘R’ values for Cemintel products are:

- 6mm fibre cement \( R = 0.02 \) (0.02 m²K/W).
- 7.5mm fibre cement \( R = 0.03 \) (0.03 m²K/W).
- 9mm fibre cement \( R = 0.03 \) (0.03 m²K/W).

**RESISTANCE TO IMPACT**

Wall lining materials may be selected for properties delivering resistance to damage. These properties include bending strength (resistance to static load), soft body impact resistance (resistance to damage from people impact, measured with a swung sand bag), and surface damage resistance (resistance to indent from small, solid objects). Refer to TABLE B8 for a selection of linings and relative performance for the various properties.

**TABLE B8: STRENGTH AND IMPACT PROPERTIES**

<table>
<thead>
<tr>
<th>Lining</th>
<th>Bending Strength</th>
<th>Soft Body Impact Resistance</th>
<th>Surface Damage Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>10mm Gyprock Plus</td>
<td>✰</td>
<td>✰</td>
<td>✰</td>
</tr>
<tr>
<td>10mm Superchek</td>
<td>✰</td>
<td>✰ ✰</td>
<td>✰</td>
</tr>
<tr>
<td>13mm Impactchek</td>
<td>✰ ✰ ✰ ✰</td>
<td>✰</td>
<td>✰</td>
</tr>
<tr>
<td>13/16mm EC08 Impact and EC08 Complete</td>
<td>✰ ✰ ✰</td>
<td>✰</td>
<td>✰</td>
</tr>
<tr>
<td>13/16mm Fyrchek</td>
<td>✰ ✰ ✰</td>
<td>✰</td>
<td>✰</td>
</tr>
<tr>
<td>6mm CeminSeal Wallboard</td>
<td>✰</td>
<td>✰</td>
<td>✰</td>
</tr>
</tbody>
</table>

Note: More ✰’s indicates higher performance.

Gyprock plasterboard of 10mm and 13mm thickness provide adequate resistance to soft body impacts likely in domestic or light commercial use respectively.

Walls lined with Gyprock Fyrchek, Impactchek and CeminSeal Wallboard can meet the requirements of Specification C1.8 of the BCA. This clause specifies resistance to Uniform Distributed Loads (UDLs), surface indentation and impact from a weighted sand bag that is dropped from a specified height.
FIRE HAZARD PROPERTIES

The BCA limits the materials used in Class 2 to 9 buildings by controlling the Fire Hazard properties of linings. These properties are assessed using AS5637.1.

Please refer to TABLE B9 for Gyprock plasterboard and Cemintel product performance details. Contact Himmel for properties of other acoustic ceiling products.

<table>
<thead>
<tr>
<th>TABLE B9: FIRE HAZARD PROPERTIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gyprock Plasterboard</td>
</tr>
<tr>
<td>----------------------------------</td>
</tr>
<tr>
<td>10mm Gyprock Plus</td>
</tr>
<tr>
<td>10mm Supaceil</td>
</tr>
<tr>
<td>13mm Standard Plasterboard</td>
</tr>
<tr>
<td>10 – 13mm Aquachek</td>
</tr>
<tr>
<td>13mm Soundchek</td>
</tr>
<tr>
<td>10mm Superchek</td>
</tr>
<tr>
<td>13mm Impactchek</td>
</tr>
<tr>
<td>13 – 16mm Fyrchek</td>
</tr>
<tr>
<td>13 – 16mm Fyrchek MR</td>
</tr>
<tr>
<td>13mm EC08 Impact</td>
</tr>
<tr>
<td>13mm EC08 Impact MR</td>
</tr>
<tr>
<td>13-16mm EC08 Complete</td>
</tr>
<tr>
<td>25mm Shaft Liner Panel</td>
</tr>
<tr>
<td>25mm Shaft Liner Panel MP</td>
</tr>
<tr>
<td>6.5mm Flexible</td>
</tr>
<tr>
<td>13mm Perforated Panel</td>
</tr>
<tr>
<td>12.5mm Gyptone Perforated Ceiling Panels</td>
</tr>
<tr>
<td>12.5mm Rigitone Perforated Ceiling Panels</td>
</tr>
<tr>
<td>Cemintel Fibre Cement</td>
</tr>
<tr>
<td>CeminSeal Wallboard</td>
</tr>
<tr>
<td>Gyprock Ceiling Tiles</td>
</tr>
<tr>
<td>10mm Freshtone Diamond White</td>
</tr>
<tr>
<td>10mm Supatone</td>
</tr>
<tr>
<td>13mm Perforated Tile</td>
</tr>
</tbody>
</table>

NOTES:
SMOGRARc = Smoke Growth Rate Index
Report: WF 45759

COMBUSTIBILITY

In accordance with BCA Clause C1.9, plasterboard and fibre cement sheet may be used wherever a non-combustible material is required by the Code.

DESIGN CONSIDERATIONS

WIND LOADS

All linings and framing are to be designed for the appropriate wind loads. Contact CSR Gyprock for loads higher than those stated in this guide.

Wind pressure can occur on walls and ceilings that form part of the building perimeter enclosure due to air flow through the façade and lining elements. It can also occur on any wall and ceiling when openings are present in the building facade such as doors and windows that are left open or are damaged in a wind event. The spacing of framing for these elements is dependent on the plasterboard lining span limits. Refer to TABLE B10 and TABLE B11 for maximum framing centres.

Gyprock plasterboard and Cemintel wallboard linings for all systems may be fixed with fasteners alone, using nails or screws as appropriate. Linings for some walls and ceilings may be fixed with a combination of fasteners and adhesive, for example, non-fire rated systems. Refer to specific framing sections for more information.

SEISMIC LOADS

Seismic actions must be considered for building elements in accordance with the BCA. The loads and effects of earthquakes may be determined in accordance with AS1170.4 ‘Earthquake Actions in Australia’. The Standard has design procedures for houses with a roof height over 8.5m and to buildings with importance levels 2, 3 or 4 as defined in the BCA.

Framed walls and ceilings lined with plasterboard and fibre cement products are subject to inertial forces and the effect of movement such as inter-storey drift. The calculated seismic forces may be equated to pressures as is done for wind loads and are resisted by the lining product’s strength properties and by the fastening methods that attach them to the framing.

Design pressures for linings are given in TABLE B10 & TABLE B11. Values for the design of framing elements may be calculated by standard engineering practices or may be provided by product manufacturers.

The effects of both building movement and the inertial forces require specific design of the connection of wall and ceiling framing to the structure. This should be considered as part of the building structural design and information may be available from the frame supplier.
### TABLE B10: MAXIMUM FRAMING CENTRES FOR PLASTERBOARD AND WALLBOARD LININGS ON WALLS

<table>
<thead>
<tr>
<th>Linings (horizontal or vertical sheet orientation)</th>
<th>Wind Load (kPa) Ult.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.25</td>
</tr>
<tr>
<td>10mm Gyprock Plus</td>
<td>600</td>
</tr>
<tr>
<td>Other 10mm Gyprock plasterboards</td>
<td>600</td>
</tr>
<tr>
<td>13 and 16mm Gyprock plasterboards</td>
<td>600</td>
</tr>
<tr>
<td>6 and 9mm CeminSeal Wallboard</td>
<td>600</td>
</tr>
</tbody>
</table>

**Note:**
- For Gyptone and Rigitone products, please refer to the appropriate installation guide.
- Includes an allowance for up to 5kg/m² insulation
- Low humidity includes air conditioned spaces
- High humidity includes non-air conditioned spaces

### TABLE B11: MAXIMUM FRAMING CENTRES FOR PLASTERBOARD AND WALLBOARD LININGS ON CEILINGS

<table>
<thead>
<tr>
<th>Linings</th>
<th>Room Conditions</th>
<th>Wind Load (kPa) Ult.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0.25</td>
</tr>
<tr>
<td>10mm Gyprock Plus</td>
<td>Low humidity</td>
<td>450</td>
</tr>
<tr>
<td></td>
<td>High humidity</td>
<td>450</td>
</tr>
<tr>
<td>Other 10mm Gyprock plasterboards</td>
<td>Low humidity</td>
<td>600</td>
</tr>
<tr>
<td></td>
<td>High humidity</td>
<td>450</td>
</tr>
<tr>
<td>13mm Gyprock plasterboards</td>
<td>Low humidity</td>
<td>600</td>
</tr>
<tr>
<td></td>
<td>High humidity</td>
<td>600</td>
</tr>
<tr>
<td>16mm Gyprock plasterboards</td>
<td>Low humidity</td>
<td>600</td>
</tr>
<tr>
<td></td>
<td>High humidity</td>
<td>600</td>
</tr>
<tr>
<td>6mm CeminSeal Wallboard</td>
<td>Low humidity</td>
<td>600</td>
</tr>
<tr>
<td></td>
<td>High humidity</td>
<td>450</td>
</tr>
</tbody>
</table>

**Note:**
- For Gyptone and Rigitone products, please refer to the appropriate installation guide.
- Includes an allowance for up to 5kg/m² insulation
- Low humidity includes air conditioned spaces
- High humidity includes non-air conditioned spaces

### CONTROL JOINTS

Movement and stresses created by temperature and humidity fluctuation can result in deformation and damage to internal linings and partitions.

Control joints must be installed to allow for structural movement. Allowance for movement must be made through the frame, lining and any tiles.

Door frames extending from floor to ceiling constitute control joints. For doors less than ceiling height, a control joint extending from one corner of the frame may be used.

Control joints must be installed at all construction joints in the building and at the following locations:
- Non-tiled internal walls with plasterboard outer layer – at 12m maximum centres.
- Non-tiled internal walls with fibre cement outer layer – at 7.2m maximum centres.
- Tiled internal walls – at 4.8m maximum centres.
- Internal ceilings – at 12m maximum centres.
- External ceilings – at 6m maximum centres.
- For ceilings lined with CeminSeal Wallboard, refer to FC129 Cemintel Ceiling Systems.
- At junctions with other building elements.
- At changes of lining material.
- At changes of structural support systems.
- At each storey or rise of studs.

### HEATING

The following situations may give rise to localised high temperature conditions (≥52°) which may be detrimental to wall and ceiling linings:
- Radiant heaters,
- Halogen lighting,
- Heat pumps,
- Reverse cycle air conditioners,
- Solid fuel stoves.

Recessed lights must be installed in a way which prevents damage from temperature rise and to prevent the risk of fire. Refer to AS/NZS3000.

Refer to heating unit manufacturer for more information.

### GAS SERVICES & APPLIANCES

Where a gas stove in a residential or commercial application is required to be installed to AS/NZS5601 Gas Installations, there are requirements stipulated for the protection of surrounding construction. In this case a fire resistant material must be used that meets the specification provided in the code.

In residential applications, where a burner is within 200mm of a wall, protection methods include:
- A splashback attached to the stove intended to protect the rear wall.
- 12mm fibre cement lining covered with 0.4mm steel sheet.
- 5mm ceramic tiles attached to 10mm plasterboard or 6mm fibre cement lining.
- 5mm toughened glass attached to 10mm plasterboard or 6mm fibre cement lining.

Note that Gyprock plasterboards and Cemintel fibre cement products do not meet the code definition of fire resistant material.
ATTACHING FIXTURES

For non-fire rated plasterboard walls, light weight fixtures such as picture frames may be attached with proprietary fixings. Check with the fixing manufacturer for allowable loadings.

Heavier loads such as shelves and appliances must be fixed through the linings to the framing, such as studs or noggings.

For fire rated plasterboard walls, fixtures such as handrails and other lightweight items may be attached to framing, such as studs or noggings with maximum 10g screws.

Refer to details in Book 3. For the use of proprietary fixings in fire rated walls, refer to the manufacturers’ details.

SEQUENCE OF WORKS

The sequence of works should be considered on a situation-by-situation basis, but generally will follow the following order:

- Framing installation.
- Wet trades.
- Roughing in of mechanical and electrical services.
- Building made weathertight.
- Plasterboard installation on ceilings then walls.
- Penetrations.
- Finishing of services.
- Sealants and junction treatment.
- Jointing of plasterboard.
- Installation of insulation in ceilings.
- Decorative finishing.

FIRE RESISTANT DESIGN

CSR Gyprock has developed systems with ‘Fire Resistance Levels’ (FRL) up to –/180/180. The systems and performance specifications detailed in this manual are guaranteed only for the construction specified. Any variation or substitution of materials or assembly requirements, or any compromise in assembly may result in failure under critical conditions. It is recommended that only accredited plasterboard fixers install fire rated systems.

FIRE TESTING

CSR Gyprock fire rated systems have been tested or assessed to AS1530.4 – Fire Resistance Tests of Elements of Building Construction, at approved testing laboratories.

This standard gives the test method and criteria of failure for the various elements of construction such as partition walls, floor/ceilings and roof/ceilings.

The specimen assemblies are built into the test furnace and subjected to furnace temperatures in accordance with AS1530.4 Standard Time vs Temperature Curve.

FIRE RESISTANCE LEVEL (FRL)

The fire rating of systems is determined by laboratory testing to determine the time to failure of three performance measurements, which combine to give a Fire Resistance Level (FRL). They are:

Structural Adequacy

Failure occurs when the specimen collapses under load.

Integrity

Failure occurs when the specimen develops cracks or openings through which flames or hot gases can pass.

Insulation

Failure occurs when the average temperature of the unexposed surface of the specimen increases by more than 140°C above the initial temperature, or the temperature at any point of the unexposed surface increases by more than 180°C above the reference temperature.

The test performance of the specimen is expressed as a Fire Resistance Level, which indicates the number of minutes for which the specimen fulfils the requirements of the three fire test criteria. These numbers are then rounded down to the nearest regulatory requirement.

The common regulatory FRL requirements are:

<table>
<thead>
<tr>
<th>Non-Loadbearing</th>
<th>Loadbearing</th>
</tr>
</thead>
<tbody>
<tr>
<td>–/30/30</td>
<td>30/30/30</td>
</tr>
<tr>
<td>–/60/60</td>
<td>60/60/60</td>
</tr>
<tr>
<td>–/90/90</td>
<td>90/90/90</td>
</tr>
<tr>
<td>–/120/120</td>
<td>120/120/120</td>
</tr>
<tr>
<td>–/180/180</td>
<td>180/180/180</td>
</tr>
</tbody>
</table>

For Example: – /120/120.

The dash indicates no requirement for Structural Adequacy, which applies to all non-loadbearing systems.

The first 120 indicates Integrity for 120 minutes.

The second 120 indicates Insulation for 120 minutes.
Resistance to the Incipient Spread of Fire

Ceiling systems may be required to achieve a Resistance to the Incipient Spread of Fire. This requires the ceiling to provide adequate thermal insulation to prevent combustibles in a roof/ceiling or floor/ceiling cavity from igniting for the specified time.

The Building Code of Australia requirement for some ceilings is to provide Resistance to the Incipient Spread of Fire (RISF), into the space above it, for not less than 60 minutes.

Fire Hazard Properties

Fire hazard properties of wall and ceiling linings in some classes of building are specified by the BCA. Refer to TABLE B9.

Smoke Proof Walls

Smoke proof walls are required in some Class 9a buildings, and, where they do not require an FRL, must be built from non-combustible materials. Steel framed wall systems clad with Gyprock Standard Plasterboard may be used.

Fire rated smoke proof walls should be selected from the steel framed systems with an appropriate FRL.

Smoke proof walls required for Class 9c buildings may use steel or timber framing with linings of 13mm Gyprock Standard Plasterboard.

Penetrations

Service penetrations in fire rated walls and ceilings that can be effectively rated include electrical and data cables, switches and GPOs, hydraulic pipes, vents and mechanical ducts. Access panels and control joints can also be installed with appropriate fire resistance levels.

Power outlets and light switches can be installed in fire rated walls using fire rated switch boxes. When installed correctly, these maintain the FRL of the wall system in which they are installed.

Where fire and acoustic rated switch boxes are specified, refer to the manufacturer for appropriate products and installation details.

Metal pipe penetrations may be treated as per BCA deemed-to-satisfy details or in accordance with a proprietary assessed detail. These details typically involve mastic sealants. Recommended sealants include Gyprock Fire Mastic and CSR FireSeal. Plastic pipes, and pipes with insulating lagging, are usually treated with fire collars in accordance with manufacturers’ details, in both walls and ceilings.

Building Acoustics

Building acoustics can be separated into sound absorption and sound transmission.

Sound absorption relates to control of sound that is generated within a room and how it affects people in that room.

Sound transmission relates to sound that passes through a dividing element (direct sound, controlled by the element’s sound insulation), and through the surrounding structure (indirect or flanking transmission).

Methods of controlling noise in buildings can be based on systems, structure and lining materials and their absorption and transmission properties.

CSR Gyprock recommends that an acoustic engineer be consulted for all projects where acoustics are important.

Flanking Transmission

Flanking sounds reach adjoining areas by indirect paths, rather than through the dividing element. The perimeter junction of walls, floors and ceilings that surround the dividing element are the main paths for flanking transmission. Other paths include open windows, ducts, doorways and suspended ceilings. Common flanking paths are shown in FIG B1.

Noise sources that have a high degree of low frequency noise such as traffic, aircraft and surround sound systems have potential for transmission through the building structure. Transmission of this type of noise follows structural load paths and can be controlled by breaking these load paths or providing complete separation of the structure.

Noise sources that generate a high amount of mid and high frequency noise, such as services and speech, tend to transmit via air paths and direct transmission in lightweight construction.

Typical problem areas for this type of transmission include doors and door frames, glazing, suspended ceiling cavities and ductwork. Practical methods for addressing common situations within buildings can be seen in Section J.

Sound Impact Ratings

The BCA has performance requirements relating to sound impact for floors and some walls.

For floors, this is specified as a maximum value such as: $L_{NW} = 62$. Note that lower values of $L_{NW}$ indicate better acoustic impact performance.

Walls may be required to meet the definition of Discontinuous Construction. This means that wall leaves must be separated by at least 20mm and no mechanical connection is permitted, except that masonry may have resilient ties.
Systems that meet this specification are noted in the appropriate system specifications.

FIG B1: COMMON FLANKING TRANSMISSION PATHS

1. Ceiling plenums, floors, walls.
2. Poor seals between structural elements and around service penetrations.
3. External air-borne paths.
4. Heating and ventilation ducting.
5. Rigid plumbing connections and penetrations.

SYSTEM PERFORMANCE

The $R_w$, $R_w + Ctr$ and $L_n,w$ values in this manual refer to expected results of a laboratory test on an element.

Extensive testing over many years has been carried out by CSR at laboratories including the Commonwealth Experimental Building Station (later CSIRO) at North Ryde NSW, National Acoustic Laboratory at Lindfield NSW, CSIRO Laboratories at Highett, and Clayton, VIC, RMIT acoustic laboratories, VIC and even, up to 1978, at the Gyprock NATA registered laboratory. Extensive development testing has been carried out at Resolute (formally kilargo) Acoustic Laboratories, QLD and Rintoul Laboratories, NSW.

Performance values provided by PKA Acoustic Consulting use a prediction system based on these tests, and the system has been updated to include the most current CSR sponsored testing. The prediction system has been calibrated against the round robin European test of a standard plasterboard wall in 24 European acoustic laboratories, and has successfully predicted the performance of a calibration wall for the Resolute Acoustic Laboratory.

As testing from different laboratories can vary (the European 24 laboratory test of the standard plasterboard wall was $R_w=47$ to $R_w=52$), it is possible that laboratory tests may be 1 to 2 $R_w$ points above a prediction.

All care has been taken with preparation of these predictions and it is assumed that construction is strictly in accordance with this manual and relevant Gyprock and Cemintel installation guides.

SITE PERFORMANCE vs LABORATORY PERFORMANCE

As houses are not built like laboratories, it is unlikely that performance measured in ideal test conditions will be achieved in a building. Designers should take care to select systems compatible with the support structure to provide the desired level of insulation.

The BCA specifies deemed to satisfy acoustic values that are laboratory results, and in some cases allows lower values when site tested. For example, in a Class 2 building the separating wall can have $R_w + Ctr = 50$ (a laboratory result), or $D_{nT,w} + Ctr = 45$ (tested on site). The difference of 5 is that expected between site and laboratory, although it might not always be the case. CSR Gyprock recommends that where designers are selecting systems based on expected site performance, an acoustic engineer be consulted.

ACOUSTIC INTEGRITY

The acoustic integrity of a system can be influenced by the combination of elements that make up the system. Single leaf and uninsulated systems are more dependent on high quality installation, as relatively minor defects can cause major degradation of the system performance.

Building systems that allow defects to be hidden from view have a higher chance of gaps being left unsealed, making them more vulnerable to performance degradation.

The likelihood and effect of defects occurring with typical systems is shown in TABLE B13.
### TABLE B13: ACOUSTIC INTEGRITY

<table>
<thead>
<tr>
<th>Wall System</th>
<th>Chance of Gaps Being Left Unsealed</th>
<th>Effect of Defects on Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single skin masonry wall</td>
<td>High</td>
<td>High Degradation</td>
</tr>
<tr>
<td>Masonry with stud, uninsulated</td>
<td>High</td>
<td>High Degradation</td>
</tr>
<tr>
<td>Single stud, uninsulated</td>
<td>Low</td>
<td>High Degradation</td>
</tr>
<tr>
<td>Single stud, insulated</td>
<td>Low</td>
<td>Moderate Degradation</td>
</tr>
<tr>
<td>Double stud, insulated</td>
<td>Low</td>
<td>Low Degradation</td>
</tr>
</tbody>
</table>

### BACKGROUND NOISE

Low levels of noise transmitted from other areas can be partially obscured by background noise.

Where the background noise level is low, such as in remote areas, consideration should be given to providing a higher than standard level of sound insulation.

### VARIATION IN OCCUPANT PERCEPTION OF NOISE

Tolerance for noise varies greatly between people, and variations of up to 15dB can be considered acceptable. This means consideration should be given to the occupant’s expectation of the internal acoustic environment. Users of concert halls and practice rooms may have higher acoustic expectations than guests of inner city hotels.

### MINIMUM PERFORMANCE LEVELS FOR INTERNAL WALLS & CEILINGS

The BCA sets out minimum performance levels for internal walls and ceilings based on acceptable standards for affordable housing. The performance requirements are in terms of $R_w$, $R_{w+Ctr}$ and $L_n,w$.

These levels may need to be increased for:

- Variation in occupant perceptions of noise, e.g. high, medium or low cost housing.
- Local authorities have higher or additional requirements.
- Background noise levels are low.
- Flanking transmission of the surrounding structure. Lightweight structures can be more prone to low frequency flanking.
- The presence of services will vary which BCA provisions are applicable, and could mean separate construction is required.
- The lack of simplicity in construction could reduce actual performance.

### MINIMUM PERFORMANCE LEVELS FOR SERVICES

The BCA sets out minimum performance levels for isolation of noise from services based on acceptable standards for affordable housing. The performance levels are in terms of $R_w$ and $R_{w+Ctr}$.

These levels may need to be increased for:

- The nature of the noise source and adjacent occupant activity. Some noises are particularly annoying to occupants.
- Variation in occupant perceptions of noise, e.g. high, medium or low cost housing.
- Background noise levels may be very low.
- The lack of simplicity in construction could reduce actual performance.

### MINIMUM PERFORMANCE LEVELS FOR EXTERNAL WALLS

The BCA does not set minimum performance levels of transmission for external walls, although some State and local government rules apply, for example Qld Development Code MP4.4 for Noise Corridors. Guidance should be sought from an acoustic consultant or local authority for setting the design requirements of these elements, as they may be affected by road or aircraft noise.
Issues that may affect the design levels for external walls are:

- Variation in occupant perceptions of noise, e.g. high, medium or low cost housing.
- Background noise levels are low.
- Flanking transmission of the surrounding structure, particularly at windows and doors.
- The lack of simplicity in construction could reduce actual performance.

**PENETRATIONS**

The acoustic performance of walls and ceilings can be reduced by penetrations for plumbing, electrical switches, light fittings, etc. For construction that is acoustically sensitive, it is recommended that, wherever possible, such penetrations are avoided. In other cases, rated proprietary sealants and products should be used.

There is a wide range of services and materials that may be required to penetrate sound rated walls and ceilings, and in varied configurations and concentrations. CSR Gyprock recommends that an acoustic engineer be consulted for advice on all details for projects with specific acoustic objectives.

The patented Gyprock Silencer has been developed for use in Gyprock walls to provide fire and acoustic ratings for various penetrations. For use with steel framed stud walls, StrataWall and SecurityWall, it can maintain fire rating up to –/120/120 FRL and maintain the system acoustic rating. Taps, pipes, power outlets, light switches and similar penetrations can be installed in the Silencer.

Fire and acoustic rated switch boxes are available from manufacturers such as PROMAT, CLIPSAL and HPM to assist in maintaining the acoustic integrity of wall systems.

**GAPS, CRACKS & HOLES**

Small openings allow airborne sound to pass through an element and can significantly reduce sound insulation performance. For optimum sound insulation, the element must be airtight.

Perimeters and penetrations for services must be sealed with an acoustic sealant that is capable of accommodating the expected building movement.

For systems that are multi-layered, such as masonry composite systems, each layer must be air tight, as services such as power points and switches can act as airborne flanking paths. To remedy this, consider using acoustic rated power boxes, the Gyprock Silencer, and insulation in the cavity. Refer to appropriate details in this guide.

**ACOUSTIC TERMINOLOGY DEFINITIONS**

**Rw** – Weighted Sound Reduction Index. A measure of the sound insulation performance of a building element. Rw is a laboratory measurement similar to STC.

Rw is measured and calculated using the procedures from the relevant Australian and International Standards. The related field measurement is abbreviated as DnT,w.

The higher the number the better the insulation performance.

**DnT,w** – Weighted Standardised Field Level Difference. A measurement of the sound insulation performance of a building element. It describes the difference in noise level on each side of a wall or floor, and indicates the level of speech privacy between spaces. It is measured in the field and is therefore subject to the inherent inaccuracies involved in such a measurement.

The higher the number the better the insulation performance.

**Ctr** – A spectrum adaptation value used to modify the sound insulation performance of a wall or floor. Sound insulation performance can be described by Rw or the DnT,w but these are not accurate for all noises, especially for low frequency bass noise from modern stereo systems. Ctr values are negative values which are added to either the Rw or DnT,w. The standards set out testing methodologies for the sound insulation properties of building elements and incorporates these factors and explains their use.

Smaller negative Ctr values are more favourable than large negative values.

**dB(A)** – The ‘A’-scale and dB(A) noise level are used to degrade the performance of a sound level meter to simulate what humans hear. The human ear is not a perfect listening device, it is poor at hearing low frequency noise. dB(A) is used to compare measured sound with perceived sound.

A number of noise criteria refer to, and are measured in dB(A). The larger the dB(A) level the louder the noise.

**Ln,w** – Weighted Normalised Impact Sound Pressure Level. A measure of the noise impact performance of a floor/ceiling. It is measured in very controlled conditions in a laboratory and is characterised by how much impact
sound reaches the receiving room via the ceiling/floor from a standard tapping machine test.

The lower the number the better the performance.

**L’nT,w** – Weighted Standardised Field Impact Sound Pressure Level. A measure of the noise impact performance of a floor/ceiling. It is similar to **L’nT,w** except it is measured in the field and is therefore subject to the inherent inaccuracies involved in such a measurement.

The lower the number the better the performance.

**NRC** – Noise Reduction Coefficient. A measure of the ability of a material to absorb sound.

NRC is generally a number between 0 and 1. A material with an NRC rating of 1 absorbs 100% of incoming sound, that is, no sound is reflected back from the material.

**STC** – Sound Transmission Class. A measure of the sound insulation performance of a building element used in the BCA prior to 2000. It is measured in very controlled conditions in a laboratory.

**CAC** – Ceiling Attenuation Class. A single number rating from a laboratory test to measure sound reduction between rooms via the ceiling.

**Dnc,w** – Weighted Suspended Ceiling Normalised Level Difference. Similar to **CAC**.

Source: Building Code of Australia, Sound Insulation Guideline.

**α**<sub>w</sub> – Weighted Sound Absorption Coefficient

Calculated According to AS ISO 11654-2002

A Weighted reference curve from 250Hz to 4000Hz is shifted until an octave band result exhibits deviation.

Shape indicators mean that one or more frequencies is considerably higher than the weighted reference curve.

(L) denotes excess performance at 250Hz

(M) denotes excess performance at 500Hz, 1000Hz

(H) denotes excess performance at 2000Hz, 4000Hz

**THERMAL PERFORMANCE**

External wall and roof systems in this manual have thermal Total R-values expressed as **Rt (WIN)** and **Rt (SUM)**. These are intended for use in various Climate Zones to suit the direction of heat flow, that is, Winter for upward heat flow through roofs, outward for walls, and Summer for downward heat flow through roofs and inward for walls.

The Total R-values presented have been calculated using Bradford’s Thermal Calculation software version 1.6 and are in accordance with the methods of AS/NZS4859.1 – Materials for thermal insulation of buildings – General criteria and technical provisions. Any included bulk insulation is a CSR Bradford product that has a material R-Value compliant with the standard, and building elements have thermal values sourced from the ICANZ Technical Handbook. Wall cavities provided behind light weight claddings are assumed to be ventilated in line with weather resistance details, while masonry veneer walls and roofs are treated as non-ventilated in accordance with guidance in the ICANZ handbook.

Thermal performance values quoted are based on an assessment through the insulation path. This method is consistent with the definition of Total R-Value given in Volume Two of the BCA and excludes thermal bridging effects. The calculation for Total R-Value in accordance with BCA Volume One requires consideration of an element’s framing components and arrangement and, for walls, any glazing areas. CSR recommends that an energy consultant is used for project specific calculations.

**CONDENSATION & MOISTURE CONTROL**

**CONDENSATION CONTROL**

Gyprock plasterboard will give many years of satisfactory performance under a wide range of climatic conditions, but to ensure long term performance to both lining material and paint finishes, care should be taken in design of the external envelope to ensure that damaging condensation does not occur.

Condensation within a building is the result of a temperature difference from one side of a building element to the other. The temperature differential forces water vapour contained in the warmer air to flow towards the cooler region where it condenses on any surface below the dew point temperature of the air.

For walls and ceilings, vapour barriers are incorporated into the structure to prevent the flow of water vapour from the warm to the cool regions. As a general rule, locate the vapour barrier as close as possible to the surface which will normally be at the higher temperature at the time of the condensation hazard.

For ceilings, unheated roof spaces should be adequately ventilated. Ventilation solutions are available from Edmonds, part of the Bradford Insulation Group. In rooms such as bathrooms, kitchens, and laundries, moisture laden air should be exhausted to the outside of the building, not to the roof or floor space.

Condensation is a complex problem and can occur under a variety of conditions, not just in cold and tropical climates. There are a large number of factors that need to be considered in assessing and managing condensation risk. Such factors include the local climate,
Moisture can be evident within a building for varied reasons and may include:

- **Failure of the building fabric to protect the building from the ingress of external water, such as defective roofs, external claddings, flashings, etc.** Wind loads can produce lower air pressures within buildings than on the outside, forcing water through small gaps in the building envelope around penetrations and joints, even at low wind speeds.

- **Dampness within the building sub-floor due to poor sub-soil drainage and ponding of water under the building.**

- **Excess moisture from within the building including due to the condensation of water vapour, including from sources including cooking, bathing, and the vapour expelled in the breath of its occupants.** Condensation within a building is the result of a temperature difference from one side of a building element to the other. The temperature differential forces water vapour contained in the warmer air to flow towards the cooler region where it condenses on any surface below the dew point temperature of the air.

- **Failure of appliances within the building and the leakage of water, including from Hot Water Systems, plumbing fittings and drains, etc.**

Methods to control moisture within buildings include:

- **Providing adequate ventilation of the building sub-floor.**

- **Ensuring the roof space is adequately ventilated, as failure to do so may result in the plasterboard sagging, or the excessive moisture movement of the timber framing causing nail popping or joint deformation.** Attics or similar unheated spaces above ceilings can be adequately ventilated to provide effective cross-ventilation by screened louvres or other approved and acceptable means. The ratio of total net free ventilating area to area of ceiling shall not be less than 1/150.

- **In rooms such as bathrooms, kitchens, and laundries, moisture laden air should be exhausted to the outside of the building, not into the roof space.**

- **Installing wall wraps/sarking into the structure to control the flow of water vapour from the warm to the cool regions to prevent condensation within the structure.** This is a complex problem and can occur under a variety of conditions (not just in cold and tropical climates) so selection of the right wall wrap/sarking needs to consider the local climate, building use and orientation, material R-Value of the insulation, as well as the degree and location of ventilation.

Additional literature on condensation is available from sources including the CSIRO, BRANZ, ASHRAE, and the ABCB.

The control of moisture within a building is a requirement of the Building Code of Australia and is the responsibility of the designer.

### TABLE B14: RECOMMENDED PRODUCTS FOR MOISTURE MANAGEMENT OF WALLS

<table>
<thead>
<tr>
<th>Climate (BCA Zone)</th>
<th>Guidance on Vapour Control</th>
<th>Performance and Category</th>
<th>Recommended CSR Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm-Humid, or Tropical climates (Zone 1)</td>
<td>Where vapour flow is typically inward, such as where the building is air-conditioned for cooling, the membrane should function as a vapour barrier</td>
<td>Vapour Barrier - Class 1 or 2</td>
<td>Bradford Thermoseal membranes, Bradford Thermoseal Firespec Cemintel Rigid Air Barrier with a Vapour Barrier Membrane</td>
</tr>
<tr>
<td>Temperate or Hot-Dry (inland) climates (Zones 2, 3, 4, 5)</td>
<td>These climates have varying diurnal and seasonal temperature changes that can affect the direction of the water vapour flow. In most cases a vapour permeable membrane outside the insulation is recommended to avoid creating a moisture trap, allowing drying in either direction. Where a high level of thermal insulation is used, a high degree of permeability may be required, and in some locations a vapour barrier is required. Expert guidance based on local experience should be sought.</td>
<td>Vapour Permeable or Vapour Barrier Class 2, 3 or 4 as required</td>
<td>Bradford Envirosel membranes, Bradford Thermoseal membranes, Bradford Thermoseal Firespec Cemintel Rigid Air Barrier Cemintel Rigid Air Barrier with a Vapour Barrier Membrane</td>
</tr>
<tr>
<td>Cold climates(1) (Zones 6, 7, 8)</td>
<td>Where there is a strong tendency for outward migration of vapour and a high risk of condensation, vapour permeable membranes should be installed on the cold, external side of the insulation.(1)</td>
<td>Vapour Permeable Class 3 or 4</td>
<td>Bradford Envirosel membranes, Cemintel Rigid Air Barrier</td>
</tr>
</tbody>
</table>

(1) The use of a Class 3 membrane such as Cemintel Rigid Air Barrier may not be sufficient in some cold climates. If a Class 4 membrane cannot be used, a solution may include the use of a material to the interior side of the insulation that acts as a vapour barrier, e.g. a Class 1 or 2 membrane or a vapour sealed plasterboard lining coupled with a mechanical ventilation solution. Seek expert advice prior specifying systems for these regions.
LEVELS OF FINISH

Levels of finish are defined in the Australian/New Zealand Standard AS/NZS2589.1 Gypsum linings – Application and Finishing for non-fire rated applications. This standard is intended to provide builders, plasterboard installers and finishers, and their customers with the various defined methods and practices necessary to meet the customer’s expectations in terms of the ‘Level of Finish’.

Three Levels of Finish (3, 4 and 5) are defined, and minimum specifications to achieve each level of finish are detailed in the standard for each of the installation processes from framing preparation to finishing. All details may not be suitable for fire rated systems or multilayer systems.

It is essential to determine the level of finish required before the frame construction begins, as specific tolerances are required for frame alignment as well as for plasterboard fixing and finishing for each of the levels of finish. Unless these requirements are met throughout construction, it may not be possible to attain the desired finish level without extensive corrective measures.

The level of finish specified also affects the methods of jointing, particularly butt joints and back-blocking requirements, the number of coats of joint compound applied, and the fitting and finishing of stopping beads. Refer to FIG B3.

It should be noted that, generally, residential applications should be prepared to a minimum Level 4 Finish unless specifically a higher or lower level of finish is agreed to by all contracting parties. Other commercial applications should be specified in contract documents.

SELECTION OF LEVEL OF FINISH

Factors affecting the level of finish include the surface’s visibility, the texture and gloss level of the final decoration and the lighting conditions. Critical or glancing light is that projected across the surface at low angles of incidence, as opposed to diffused lighting or light striking the surface at close to right angles. Refer to the following section “Surface Finishing & Lighting” on page B25.

A good method to overcome differences in opinions of quality is to prepare a sample area in a suitable position and for all parties to agree on the finish. The flow chart FIG B3 and TABLE B15 will assist in selecting the most appropriate Level of Finish for each area.

For further information on levels of finish, refer to Plasterboard Expectations, available from the Association of Wall & Ceiling Industries.

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**FIG B3: SELECTING A LEVEL OF FINISH**

[Flowchart showing selection process]
Level 3

For use in areas that do not require a finish, such as above ceilings and inside service shafts and other inaccessible spaces. All joints are to be taped with two applications of compound and all fastener heads are to be covered. Compound is to be finished smooth, such as by scraping ridges etc with a trowel.

Level 4

This is generally the accepted level of finish for residential construction. Joints are to have a tape coat, and two separate coats are to be applied over the tape coat and fastener heads. All joint compound should be sanded to a smooth finish free of tool marks and ridges. Refer to Gyprock Installation guides for details.

Gyprock One Finish is a pre-mixed acrylic compound designed to create a uniform surface on interior walls and ceilings affected by critical lighting conditions. The application of One Finish over a standard level 4 finish will improve the final surface and minimise the effects of critical light, however it will not automatically upgrade the work to a level 5 finish.

Level 5

This level of finish should be used wherever gloss or semi-gloss paints are to be used, where paint is mid or dark coloured, or where critical light conditions occur such as from windows, skylights, or silhouette and spot lighting.

A three coat jointing system is required as for level four. All joint compound should be sanded to a smooth finish free of tool marks and ridges. This should be followed by the application of proprietary surface preparations by skim coating to remove differential surface textures and porosity.

Skim coating is a term used to describe a thin finish coat, rolled, trowelled or airless sprayed and then possibly sanded, to achieve a smooth and even finish. It is normally less than 1mm in thickness and is applied over the entire surface to fill imperfections in the joint work, smooth the paper texture and provide a uniform surface for decorating.

### TABLE B15: SUMMARY OF GYPROCK ‘LEVEL OF FINISH’ DEPENDENT REQUIREMENTS – NON-FIRE RATED CONSTRUCTION

It should be noted that, generally, residential applications should be prepared to a minimum level 4 finish unless specifically a higher or lower level of finish is agreed to by all parties.

Key to Symbols:  – = Not Applicable. ✓ = Required. Other symbols, see notes.

<table>
<thead>
<tr>
<th>Level of Finish</th>
<th>Max. Frame Alignment Deviation mm</th>
<th>Joint Between Frame Members and Back-block</th>
<th>Jointing and Finishing (minimum)</th>
<th>Butt and Recessed Joints Internal and External Corners</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ceilings</td>
<td>Walls</td>
<td>* Adhesive + Fastener Fixing OR * Fastener Only Fixing</td>
<td>Tape Coat + Second Coat</td>
</tr>
<tr>
<td></td>
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**NOTES**

1. Where a butt joint in a wall is less than 400mm long and is located more than 2 metres from the floor, there may be no need to provide back-blocking.
2. Back-blocking required only where 3 or more recessed joints occur in a continuous ceiling area.
3. Back-blocking is not required in suspended ceilings with no rigid connection between ceiling and walls.
4. Tiled installations MUST be all fastener fixed, adhesive is not permitted.
SURFACE FINISHING & LIGHTING

Builders, plasterers and painters work hard to achieve the appearance of a flat surface when installing walls and ceilings. However, some surface variation is inevitable due to the following factors:

- Natural variations in the framing.
- The hand-finished nature of a plasterboard wall or ceiling.
- Subtle differences between the textures of plasterboard and the jointing compounds.

Under the majority of lighting conditions a plasterboard surface finished to a Level 4 standard, as defined in AS/NZS2589 ‘Gypsum Linings - Application and finishing’, will appear flat. In critical lighting conditions, an effect referred to as ‘glancing light’, will highlight any surface variations.

This section will assist in minimising glancing light issues and enhance the occupant’s enjoyment of their premises.

What is Glancing Light?

Glancing light (or critical light) is a condition which exists when light hits the plasterboard surface at an acute angle and casts shadows that highlight any surface irregularities. On plasterboard walls and ceilings this can make the surface look uneven and highlight the appearance of joints.

This is most commonly found in situations where there are:

- Floor to ceiling windows.
- Windows directly adjacent to walls.
- Unshaded batten holder ceiling lights.
- Ceiling mounted fluorescent lights.

CONSIDERATIONS TO MINIMISE GLANCING LIGHT

The best time to consider potential glancing light issues is during the design phase, which allows choices to be made that can greatly reduce the impact of glancing light.

Large window areas are a popular feature of modern design and the preference for open plan living and working often results in ceilings and walls that extend through a number of different spaces. These features can lead to challenging lighting conditions for wall and ceilings surfaces.

When designing a project it is important to consider the effects of both natural and artificial light and how it will fall on the walls and ceilings across the whole day.

In particular, attention should be given to light entering the building in mornings and evenings when the sun is lower in the sky and casts elongated shadows that can highlight any surface variations in walls and ceilings.

Shading

For windows that are positioned where glancing light can be an issue, the use of external shading or vertical louvres may help to mitigate any problems. Curtains or interior blinds are also helpful in this situation.

Window Placement and Orientation

Ideally windows should not abut walls or ceilings and should be oriented away from the east and west. External reflective surfaces, such as pools or neighbouring buildings, can reflect light into the space, should also be considered as they can exacerbate the problem.

Rooms with windows in two orientations provide a more uniform natural light, and can reduce the effects of critical light.

Joint Orientation

The installation of plasterboard walls and ceilings should also be considered as there are a number of design and installation choices which can significantly impact the appearance of the surface.

Running the plasterboard so that the long joints are parallel to the direction of the light will help reduce the effects of glancing light. The use of longer sheets to reduce the number of butt joints is also beneficial.
Artificial & Natural Lighting

Any imperfection in a completed lining installation will be made obvious by a condition called critical lighting or glancing light, where the incident light from an artificial or natural light source is nearly parallel to the surface. Glancing light also greatly exaggerates the size of imperfections making them glaringly obvious.

The worst result is achieved by an unshaded light source located directly on a ceiling or wall where the light shines parallel to the surface.

Cases where this situation may exist include:

- Unshaded batten holder light fittings.
- Fluorescent lights mounted on the ceiling.
- Wall mounted up lights and downlights.

Methods to minimise glancing/critical lighting effects from artificial lighting sources

The following lighting solutions will provide diffused light and reduce the appearance of surface variations:

- Shaded batten holder light fittings.
- Ceiling mounted pendant lights.
- Recessed ceiling lights such as downlights and recessed fluorescents (although recessed lights are more likely to be associated with glare problems).
- Consider the use of more lights of lower intensity at regular spacings, ensuring lit areas overlap. This will improve ambiance and reduce the visible effects of glancing light, and minimise shadows that can occur from a single row or single light source.
- Allow a generous angle of incidence to the surface for feature lighting such as spotlights, to minimise the highlighting of imperfections.
- Do not use uplights, wall-washers and spotlights in areas with a smooth wall finish to eliminate light being emitted at a glancing angle to the surface.
- Preferably, locate fluorescent lights about 450mm below the ceiling as this will give a more even distribution of light.
- When installing ceiling mounted fluorescent lights it is recommended to position the light fittings over the long edge joints. Refer to the following illustration.
Methods to minimise glancing/critical lighting effects from natural lighting sources

- Do not take window glazing right up to the ceiling level.
- Avoid placing windows or glass doors immediately adjacent to the end of a wall.
- Provide sun shades over the windows and glass doors.
- Recess the window to stop the sunlight reaching the wall.

APPLIED FINISH SELECTION

The chosen finish selected for walls and ceilings plays a very important role in determining the effects of glancing light.

A Level 4 finish presents the painter with a surface comprised of two different materials, namely the plasterboard paper surface and the jointing compound, which have different textures and porosity.

In order to achieve a consistent finish across these materials it is vital that a plasterboard primer sealer is applied.

AS/NZS2311, ‘Guide to the painting of buildings’, requires that a sealer plus two coats of water based paint must be applied as a minimum. Such a system will provide a surface with minimal difference in texture and porosity.

Roller application for all coats is strongly recommended as it imparts a light texture to the surface and minimises visible differences. If spray application is used, each paint coat should be back rolled while still wet, to create a lightly textured finish, and allowed to dry completely before applying the next coat. Paint applied with a longer pile roller tends to mask imperfections better than those applied with a short pile roller.

A similar paint system is recommended for a level 5 finish to ensure the best possible result.

Paint Finishes

The choice of gloss level can also have a significant impact on the perceived quality of the surface in glancing light conditions.

A matt paint finish provides the highest level of light diffusion and helps to disguise any surface irregularities. It is recommended that a matt finish be used in areas where a higher gloss is not required for functional reasons, such as ceilings. Textured or heavy patterned finishes tend to hide imperfections.

Higher gloss levels, such as satin, semi gloss and gloss, can accentuate any minor variations in the surface and are recommended only for use over a level 5 finish.

Colour Selection

Light colours diffuse light more effectively than dark shades and reduce the effects of glancing light. In rooms where a dark colour is to be used a level 5 finish is recommended.

Wall Paper Finishes

Gyprock plasterboard walls may be finished with wall paper. A Level 4 Finish is recommended. A primer sealer should be applied to the surface prior to wall paper application. This will also assist with future removal.

Thin wall papers may still highlight imperfections in the wall surface. Textured or heavy patterned finishes tend to hide imperfections.

INSPECTION OF PLASTERBOARD

The Guide to Standards and Tolerances (Victorian Building Authority 2015) outlines the following standard for inspection of vertical and horizontal surfaces.

“Generally, variations in the surface colour, texture and finish of walls, ceilings, floors and roofs, and variations in glass and similar transparent materials are to be viewed where possible from a normal viewing position. A normal viewing position is looking at a distance of 1.5 m or greater (600 mm for appliances and fixtures) with the surface or material being illuminated by ‘non-critical light’. ‘Non-critical light’ means the light that strikes the surface is diffused and is not glancing or parallel to that surface.

Slight variations in the colour and finish of materials do not always constitute a defect”.

![FIG B7: INSPECTION OF PLASTERBOARD]
Health & Safety

Information on any known health risks of our products and how to handle them safely is on their package and/or the documentation accompanying them.

Additional information is listed in the Safety Data Sheet. To obtain a copy, telephone 1300 306 556 or visit www.gyprock.com.au.

Warranty

Gyprock products are designed to achieve optimal performance when part of a CSR integrated system.

CSR Building Products Limited warrants its Australian made Gyprock products to remain free of defects in material and manufacture for the usual lifetime of the product (25 years).

CSR warrants its International Alliance Gyprock products to remain free of defects in material and manufacture for 7 years.

For details on our product warranty, please visit www.gyprock.com.au, or contact us on 1300 306 556.