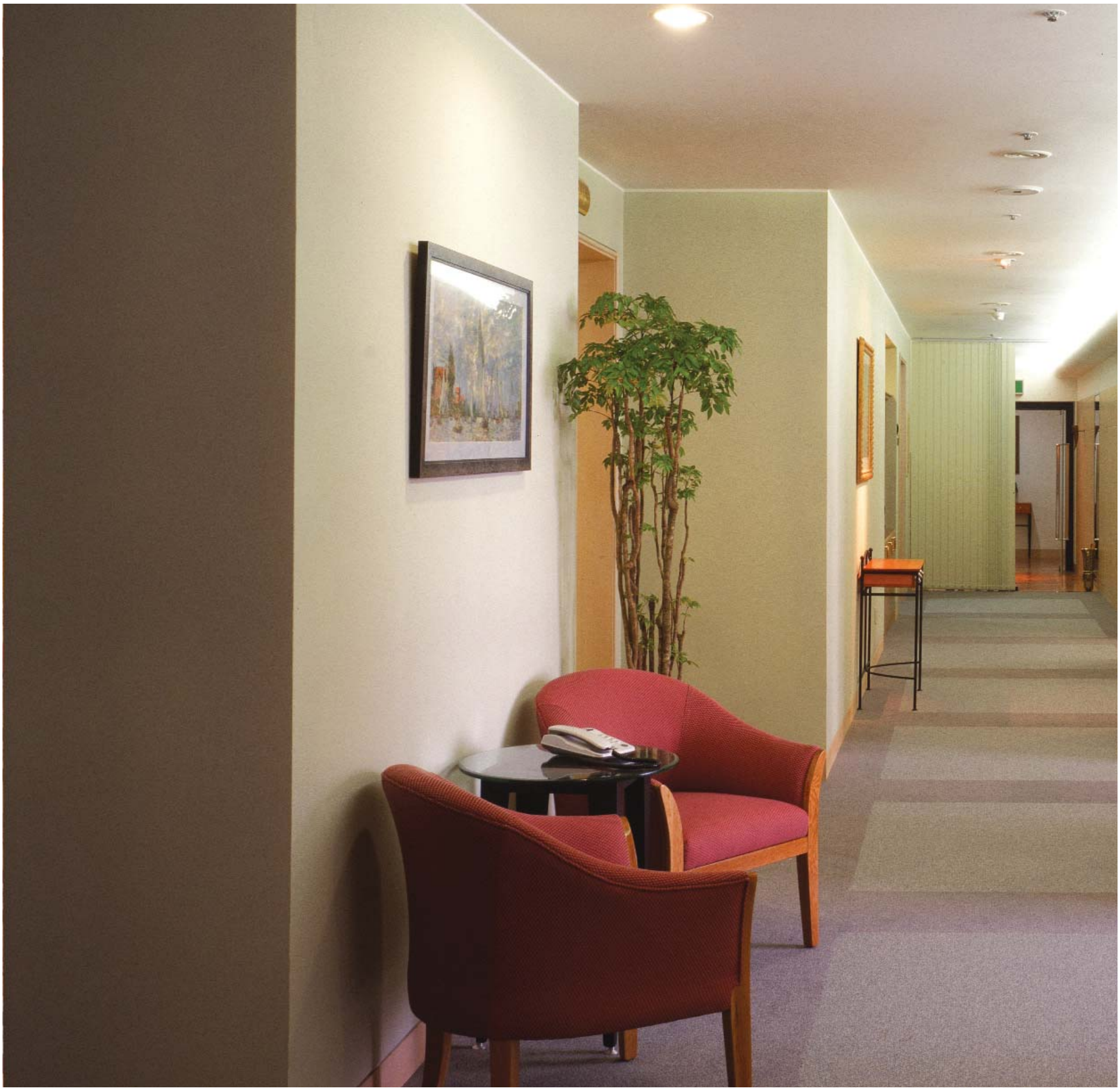
Promat

PROMATECT®-H
Timber Stud Partitions



Introduction

Partitions and external walls are used to separate buildings, enclose compartments and contain fire to provide a barrier to the passage of fire from one side or the other and are able to satisfy each of the relevant fire resistant criteria (integrity, insulation and, if the wall is loadbearing, load bearing capacity) from either side for the prescribed period. The application of partition and external wall systems using Promat boards covers both non loadbearing and loadbearing in commercial, industrial, institutional, residential and high-rise constructions, or in the restoration of existing buildings. Promat's internal partition systems require less material to achieve similar fire resistant level when compared to the industry average wallboard partition systems. The single layer board application leads to simplified construction methods over other equivalents hence increased productivity and reduced overall installation cost.

These partition and external wall systems have been developed by Promat International (Asia Pacific) Ltd. to satisfy standard requirements for intended applications. Such considerations include:

Time & Cost Effectiveness

Single layer application reduces installation cost and time compared to traditional wallboard partitions.

Slim Walls

Partitions can be as thin as 40mm.

Lightweight

Lighter loads on structures compared to industry average wallboard partition systems for equivalent fire resistance.

Thermal Resistance

Excellent thermal resistance performance.

Impact Resistant

PROMATECT® 100 partition systems have been tested and assessed for impact and static loading to satisfy specification Cl.8 of the Building Code of Australia (BCA 2006). PROMATECT®-H partition systems have been tested for resistance to impact, stiffness and robustness in accordance with the criteria of BS5234: Part 2.

Acoustic Performance

Tested and assessed to a range of standards, including ISO140-3 1995, ISO717-1 1996, AS1191 2002, AS/NZS 1276.1, BS5821 1984 and BS2750: Part 3: 1980, to meet the needs of industry. Please refer to pages 4 and 5 for details.

Fire Resistance Performance

Promat partitions and external wall systems have been extensively tested and assessed in accordance with BS476: Part 22 and AS1530: Part 4 to satisfy the integrity, insulation and where applicable loadbearing capacity (structural adequacy) criteria.

General Design Considerations

The following points are some of the factors which should be considered when determining the correct specification to ensure a partition or external wall will provide the required design performance under both fire and ambient conditions. Further advice can be obtained from the local Promat office.

1. Studwork Design

The design of studwork should be adequate for the height of the partition. The studwork details given in the following specifications will be suitable up to the maximum heights stated. For greater heights the dimension of the framing members could change depending on the factors such as movement and deflection and local approvals. Larger or more frequent frame sections will often improve the fire and structural performance.

The studwork shall be appropriately designed for the applied loads, e.g. wind load, and where applicable structural load in the case of load bearing systems. The framing for the partition systems must be securely fixed back to a substrate that has an equal or greater fire performance than the designed partition. All fixings must be non-combustible and must be those listed in the approval documents. The design shall be in accordance with the relevant British, Australian and/or International Standards.

2. Non Loadbearing Partitions

Non loadbearing partitions and external wall systems using Promat boards can be generally divided into framing systems consisting of steel or timber studs and solid partitions. For steel stud systems, selection of suitable stud size shall be in accordance with the maximum partition height given in the stud selection tables. The partition systems in the following pages, where stated, are designed for lateral loads of up to 0.25kPa using the composite action of the frame and boarding.

3. Loadbearing Partitions

Loadbearing capacity of featured partition systems in this handbook are calculated in accordance with BS5950-8: 2003 and AS4600: 1996 for load cases defined by AS1170: 2002. The maximum load bearing capacity is given in kN for a given partition height taking into account the reduction in steel strength at elevated temperature.

Loads considered in this manual are for axial compression only. Wind and other loads have not been taken into consideration. For further information on these loads, please contact Promat Technical Department.

4. Deflection

Where differential movement is expected between the floor or beam above the construction, and/or the floor below, it is generally advisable to incorporate a deflection head track to ensure undue stress is not placed upon the partition. This also allows for the sagging and deflection a floor or structural steel beam will suffer under fire conditions. Even concrete floors will suffer considerable deflection under fire if exposed for any considerable duration.

Some form of movement joint is also required to allow for the expansion of the studs under fire conditions. A partition will also bow in its centre. As the wall bows, it will naturally get shorter. For this reason alone, use should be made of a top track with long side legs. This will allow the stud to bow and as a result drop down, without the studs dropping out of the head track.

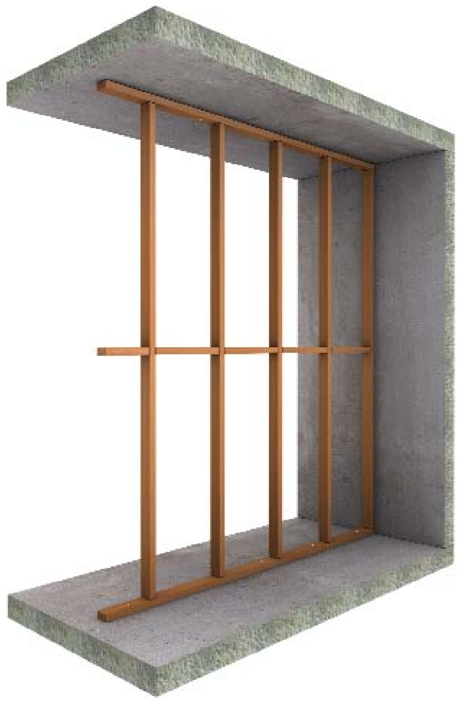
5. Movement Joint

Movement stress from dimensional changes due to varying temperature or moisture conditions can cause cracking and other symptoms of distress in partitions. Other external forces such as impact or vibration can directly affect the structural movement of partitions. This movement can be controlled through a variety of design techniques such as introducing perimeter relief and slip connections to reduce the transfer of stress from the structure to other building sub-elements and/or through the use of expansion joints, control joints and construction joints.

In a partition, expansion joints are needed when the partition abuts a rigid mass. A vertical movement joint should be located at maximum 10m centres in long runs of partition. However, by introducing a control joint into a fire-rated partition, it does create an opening for flame and temperature transmission and therefore has to be properly treated with approved fire-stopping material.

Please refer to page 8 for further details on movement joints.

Timber Frame Components



Timber Frame

Timber has very good performance in fire. Timber does burn but at a relatively slow and predictable depth known as the charring rate. This is one major advantage of using timber over steel because the fire resistance of timber elements of construction may be calculated based on a predictable charring rate.

Timber also has a very low thermal conductivity value and hence does not heat up uniformly. Therefore, timber material a few millimetres inside the burning zone is just warm. The formation of a self insulating char resists further heat penetration.

Unlike materials with a high thermal conductivity materials such as steel, there are less problems associated with expansion or loss of strength over the whole section in timber. This means that, in some instances timber retains its structural integrity better than steel.

There are many different types of timbers and they all char at varying rates. Higher density timbers char more slowly than those of lower density. Denser hardwoods used for structural purposes, such as jarrah, teak, keruing and greenheart, char at a rate of 15mm in 30 minutes. Lower density (< 650kg/m^3) softwood timbers such as Western red cedar is estimated at a charring rate of 25mm in 30 minutes.

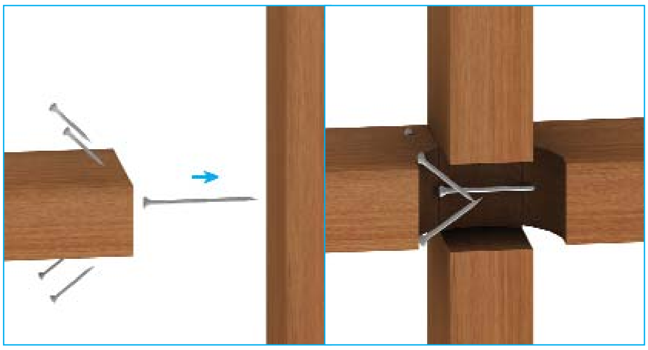
Timber Studs & Cross Noggings

The frame used in the timber stud partitions consists of 90mm deep x 45mm wide softwood timber. The fire performance of the partition system accounts for the loss of the timber section due to charring effect without compromising the fire performance of the partition.

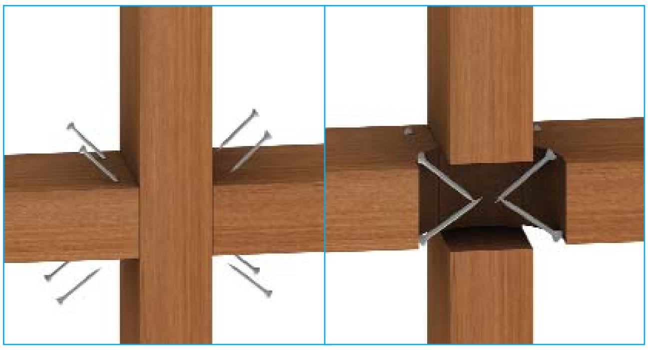
Where the boards are to be installed with their long edges vertical, the studs are located at 600mm or 610mm maximum centres (dependent on board width) with cross noggings at 1200mm or 1220mm centres. Where the boards are to be installed with their long edges horizontal, the studs are located at 600mm or 610mm centres with cross noggings at 1200mm or 1220mm centres.

The cross noggings may be fixed to the studs using nails or woodscrews of at least 100mm long in a manner shown in **Fixing method 1 or 2** at right. Either method can be adopted to fix the cross noggings.

Fixing method 1



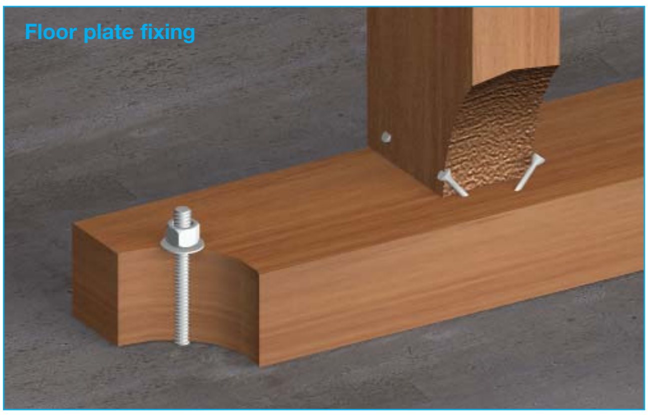
Fixing method 2



Top & Floor Plates

The top and floor plates are to be of the same material and dimensions as the studs. They are to be secured to the surrounding structure with at least M6 x 100mm long anchors at nominal 600mm centres with the drilled depth into the concrete structure of at least 40mm. Polyamide nylon anchor sleeves may be allowed for use with timber framing.

The vertical studs may be fixed to the top and floor plates using either nails or woodscrews of at least 100mm long in a manner shown in **Floor plate fixing** at bottom right.



Floor plate fixing

Loadbearing Partition

Where a partition is loadbearing, the required size of the stud shall be calculated by a suitably qualified structural engineer. Care should be taken to ensure that the loadbearing partition has been designed to resist all applied loads and in accordance with BS5268: Part 4, AS1720: Part 1 or AS1684. Generally, the fire performance and the load carrying capacity will improve by increasing the cross-sectional dimensions of the timber elements and/or decreasing the stud spacing.

Acoustics In Building

Sound is an energy generated by a source, transmitted through a medium and collected by a receiver. It can be pleasant to be heard, such as music and speeches etc, while some, such as scratching a glass surface with a sharp object, are irritating. This offensive sound is commonly termed noise. The acoustic design of buildings can be divided into two basic requirements, noise control and room acoustics.

Noise control relates to the quantity of sound with an objective to ensure the sound level does not adversely affect the comfort of building occupants. This involves control of sound produced in a room, such as telephones ringing, as well as limiting the noise entering from other rooms or outside the building. A common solution targeting this problem is the introduction of sound absorption systems.

Room acoustics relate to the quality of sound with an objective to enhance the quality of desired sound within a room. This involves factors such as speech intelligibility and perception of musical clarity. The most widely applied solution employed by building designers is the use of a sound insulating system.

A point worth noting is that although both noise control and room acoustics have independent objectives, they are however inter-related in practice. As this manual covers partition and ceiling systems, the following concentrates only on issues related to sound insulation which involves transmission loss (TL) of airborne sound.

Sound Transmission & Classification

The sound transmission loss of a building element, such as a partition, is a measure of how much sound is reduced as it passes through the barrier, expressed in dB or decibels, the unit used to quantify sound. The generally accepted term for the single number ratings for sound transmission loss is the Sound Transmission Class or STC (ASTM E413). This is determined by comparing the TL value to the reference curve in ASTM E413. Generally the higher the STC value, the better the performance of the system. The following table provide a rough idea of what various STC levels mean in terms of privacy afforded.

STC	Privacy afforded
25	Normal speech easily understood
30	Normal speech audible, but unintelligible
35	Loud speech understood
40	Loud speech audible, but unintelligible
45	Loud speech barely audible
50	Shouting barely audible
55	Shouting not audible

Source: U.S. Dept of Commerce/National Bureau of Standards Handbook. "Quieting: A Practical Guide to Noise Control".

Another widely accepted equivalent term is the Weighted Sound Reduction Index or Rw (ISO 717: Part 1 or BS 5821: Part 1). It is determined in a similar manner but instead of TL values, an equivalent Sound Reduction Index (R or Rw), is used.

Note should be taken that results obtained in STC and Rw may have a ±3dB deviation from one another.

Most building structures are not built like laboratories and it is very common that the sound insulation rating measured in ideal test conditions will not be achieved in a building. In order to meet the desired level of performance, building designers should therefore carefully consider the compatibility of the selected system with the supporting structure. Note that field performance is typically lower than laboratory performance by approximately 10%.

General Design Considerations

With modern design concepts and technology in building construction, acoustic performance within buildings has become an important element for consideration by building designers. There are many factors involved in establishing an ideal noise level for any particular building space, part of which are as follows:

- To avoid fatigue induced by noise;
- To prevent distraction or disturbance;
- To maintain a good communication & listening environment.

Heavy walls such as concrete have good transmission loss. However, there are some drawbacks which limit its performance. Mass law dictates that a wall will increase its transmission loss by only 5dB for every doubling of mass. Therefore, a single 100mm thick concrete wall of 2300kg/m^3 density might have an STC 45 rating whereas a 200mm thick concrete wall would only achieve STC 50 for a doubling in mass. For most owners and builders, a wall of this size and weight is not desirable. Cost may more than double and the decibel-per-dollar achieved is clearly not acceptable. This limitation can be easily overcome by using a lightweight system, i.e. the partition system, where it is more practical to utilise principals such as air cavity, resilient mountings, sound-absorbing core materials or a combination of these principals without the large increase in mass required for solid walls.

Following are some common practices that are effective for noise control and room acoustics.

1. Double-studding & Air Cavity

With typical drywall partitions, sound striking at the wall surface is transmitted through the first surface material into the wall cavity. It then strikes the opposite wall surface, causing it to vibrate and transmit the sound into the air of the adjoining room. This is termed airborne sound. When the sound strikes the wall at the stud, sound is transmitted direct through the stud and is termed structure borne sound.

The principal of double studding basically means separation of two panels of a drywall partition into a double-leaf wall, integrated with appropriate air spacing (cavity) between the leaves. The introduction of an air-space provides some form of separation or discontinuity between the two wall faces in a double-leaves wall.

As an example, a double stud partition creating an air cavity eliminates direct mechanical connection between the surfaces. The sound transmission is reduced by breaking the sound path. In addition, the air cavity provides vibration isolation between the two sides. Sound in one room striking the one side of the wall causes it to vibrate but because of the mechanical separation and the cushioning effect of the cavity, the vibration of the other side is greatly reduced.

2. Sound-absorbing Core Material

Sound absorption is the effectiveness of a material at preventing the reflection of sound. Generally, the more sound absorption, the fewer echoes will exist. The sound-absorbing core used in the Promat partition designs can be mineral or rock wool, glass wool or polyester, depending upon fire resistance requirements.

These cores will further improve the sound isolation performance of the wall by absorbing sound energy in the cavity before the sound can set the opposite wall surface in motion. They will also provide some damping of the vibrating wall surface.

General Design Considerations

3. Treatment To Flanking Paths

When working with acoustically rated systems, it is critical that strict attention be paid to construction and detailing. 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 especially more dependent on high quality of installation. For example, if there is a gap of 5mm wide around the perimeter of an STC 45 rated wall of 3m x 3m, the actual performance would degrade to some, STC 30. Therefore to make acoustically rated partitions effective, they must be airtight. Any path for air also means there is a path for sound. In order to achieve the designed STC rating closely, the following factors must also be taken into account:

- Sound paths, e.g. windows, doors, floors and ceilings;
- Penetrations through walls, even above ceilings or below floorings, must be sealed;
- Stagger the joints between multiple layers of wall boards or ceiling linings;
- Do not use power points back to back on either side of a wall;
- Openings for return air in ceiling plenum systems must be strictly controlled.

4. Wall & Floor Intersections

A good acoustical partition is only as good as its joint or intersection at wall and floor, like a chain and its weakest link. If this joint or intersection is not treated properly, the acoustical value may be lost. Many joint defects from flanking paths allow sound to travel via air gaps through the structure.

Acoustical sealants are the simplest means to provide a permanent air-tight seal. They are made from materials that are permanently elastic which will allow floor or wall materials to move, as they are prone to do because of expansion and contraction or outside forces such as structural movement. A permanent air-tight seal is the most effective way to maintain the acoustical integrity of the wall. Regardless of which system is employed, all openings, cracks and material joints should be made air-tight with a permanently elastic acoustical sealant.

System Selection Guide

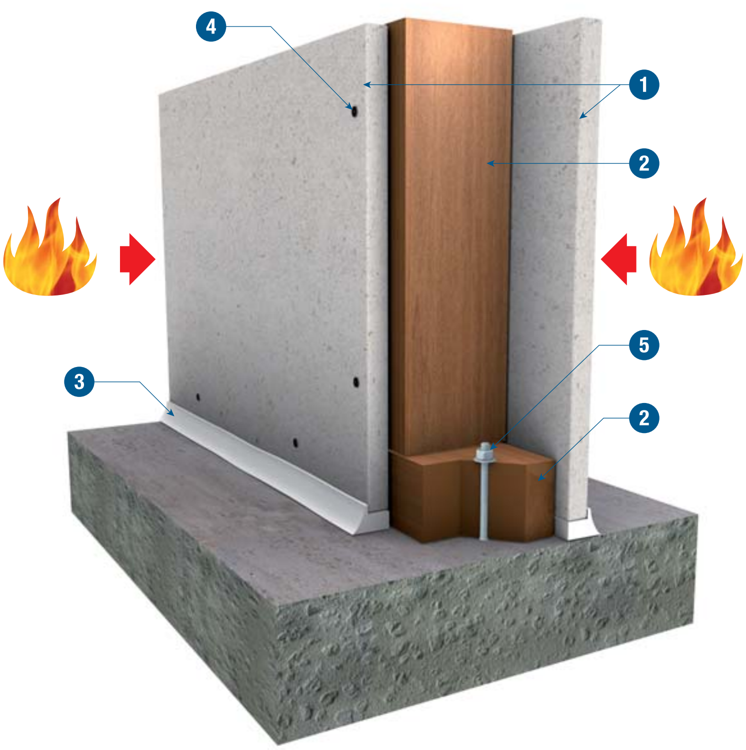
As sound insulation requirements may vary from country to country, the table below suggests acoustic values for some typical partition installations, unless otherwise specified by the architects. Please consult Promat for more information.

STC rating			Applications for separating
Minimum	Average	Luxury	
45dB	50dB	55dB	Bedroom to bedroom
50dB	55dB	60dB	Bedroom to living room
50dB	55dB	60dB	Bedroom to lobby
45dB	50dB	55dB	Office to office
40dB	45dB	50dB	Office to general area
45dB	50dB	55dB	Office to conference room
45dB	50dB	55dB	Office to washroom
40dB	45dB	50dB	Conference room to general area
40dB	45dB	50dB	Conference room to conference room
45dB	–	–	Classroom to classroom
55dB	–	–	Classroom to shop
45dB	–	–	Classroom to recreation area
60dB	–	–	Classroom to music room

Some sources of sound leakage

1. Air leaks through gaps or cracks
2. Doors
3. Light weight panels above doors
4. Electrical outlets and service pipes
5. Partition performance
6. Sound transmission via suspended ceilings or partitions
7. Common floor heating duct
8. Common ventilation system without sound absorbents treatment
9. Lightweight mullion or partition closer
10. Appliances

Fire attack from either side / Non loadbearing



Fire Rating	FRL	-/30/30 -/60/60 -/90/90 -/120/120
	STANDARD	BS476: Part 22: 1987 AS1530: Part 4: 2005
	APPROVAL	WFRA 45713
Acoustic	# STC	36dB (for -/30/30) 39dB (for -/60/60) 39dB (for -/90/90) 39dB (for -/120/120)
	# R_w	35dB (for -/30/30) 39dB (for -/60/60) 39dB (for -/90/90) 39dB (for -/120/120)
	STANDARD	ISO140: Part 3: 1996 ISO717: Part 1: 1996
	PREDICTED ASSESSMENT	Marshall Day 18th Oct 2006
Construction	MAXIMUM HEIGHT	3000mm
	MAXIMUM LENGTH	Unlimited
	PARTITION THICKNESS	From 75mm (for -/30/30) From 81mm (for -/60/60) From 81mm (for -/90/90) From 81mm (for -/120/120)
	PARTITION MASS*	From 20.95kg/m² (for -/30/30) From 27.65kg/m² (for -/60/60) From 29.41kg/m² (for -/90/90) From 31.89kg/m² (for -/120/120)

Margin of error is generally within ±3dB.
* Details for walls above 3000mm high are available on request.

TECHNICAL DATA

1. 1 layer of PROMATECT®-H board, 6mm or 9mm thick in accordance with system specifications.
2. Timber studs 63mm x 50mm or 70mm x 38mm at 610mm centres
3. PROMASEAL® AN Acrylic Sealant, required only where gaps between board and substrate occur.
4. 50mm-60mm steel wire nails at nominal 200 centres or 50-63mm x No.8 screws at nominal 300mm centres
5. M6 expanding anchors at nominal 600mm centres

System Specification

Walls are to be constructed using PROMATECT®-H matrix engineered mineral boards all in accordance with the Architectural Specification in the manufacturer's handbook. Relevant constructions are to be selected according to the required FRL of (.../.../...). All printed installation details are to be followed to ensure approval to BS476: Part 22 and AS1530: Part 4. All work to be certified by installer in an approved manner.

Vertical sheeting / Non loadbearing

TECHNICAL DATA

1 1 layer of PROMATECT®-H board at each side of wall

For FRL of -/30/30	6mm thick
For FRL of -/60/60	9mm thick
For FRL of -/90/90	9mm thick
For FRL of -/120/120	9mm thick

2 1 or 2 layers of mineral wool

For FRL of -/30/30	1 layer of 60mm x ≥23kg/m³
For FRL of -/60/60	1 layer of 80mm x ≥23kg/m³
For FRL of -/90/90	1 layer of 60mm x ≥60kg/m³
For FRL of -/120/120	2 layers of 38mm x ≥80kg/m³ each with all joints staggered between layers

3 Allow appropriate clearance at top track

4 Caulk all perimeter gaps with PROMASEAL® AN Acrylic Sealant to achieve stated fire and/or acoustic performance

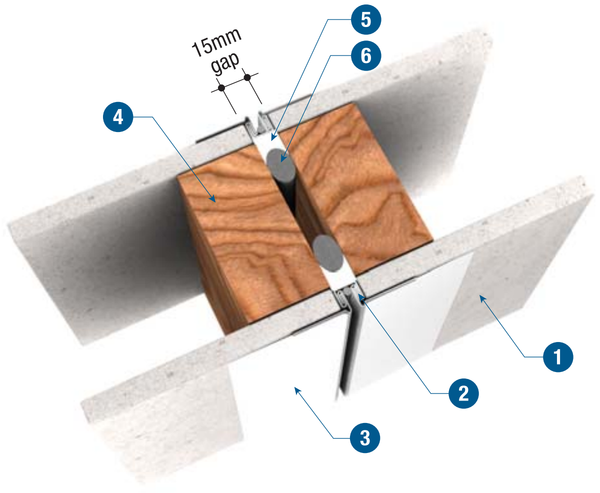
5 Vertical studs 63mm x 50mm or 70mm x 38mm at 610mm centres

6 Horizontal nogging at all board joints

7 For FRL of -/30/30, -/60/60 and -/90/90
50mm wire nails at nominal 200mm centres or 45mm self-tapping screws at nominal 300mm centres

For FRL of -/120/120
63mm wire nails at nominal 200mm centres or 55mm self-tapping screws at nominal 300mm centres

See page 3 for fixings of cross noggings and floor plate; page 8 for detail of wall movement joints.



TECHNICAL DATA

1. PROMATECT®-H board
2. RONDO P35 control joint or similar
3. Flush joints
4. Studs at either side of control joint position
5. PROMASEAL® AN Acrylic Sealant (depth equal to board thickness) to achieve stated fire and acoustic performance
6. Non fire rated backing rod 22mm diameter for acoustic integrity

NOTE: Top and bottom tracks must be discontinuous at control joint.

Architectural Specification

The following are standard Architectural Specifications for internal partition systems using PROMATECT®-H. The designer must determine the suitability of the design to the application and requirements before undertaking or constructing any works relating to the specifications and where in doubt should obtain the advice of a suitably qualified engineer.

Fire Attack From Either Side / Non Loadbearing

Up to ___________ [1] minutes of fire rating, integrity and insulation in accordance with the criteria of **BS476: Part 22: 1987** and **AS1530: Part 4: 2005**.

Acoustic Performance

The partition system shall have a Weighted Sound Reduction Index of R_w __________.[2]

Supporting Structure

Care should be taken that any structural element that the partition system is supported from, e.g. steel stud or perimeter steel channel, has equivalent fire resistance of ___________ [3] minutes.

Lining Boards

Single layer of 6mm and 9mm PROMATECT®-H matrix engineered mineral boards as manufactured by Promat International (Asia Pacific) Ltd. All joints to be coincident with steel framing or PROMATECT®-H board strip. Standard board dimensions 1220mm x 2440mm.

Fixing

Softwood timber, 63mm deep x 50mm wide will be fixed to the perimeter of the opening where the partition system is to be installed using M6 expanding anchors at 610mm centres.

Where the board are to be installed with their long edges vertical, the studs are located at 610mm maximum centres with cross noggings at 2440mm centres. Where the boards are to be installed with their long edges horizontal, the studs are located at 610mm centres with cross noggings at 1220mm centres.

The PROMATECT®-H board are fixed to the framework using wire head nails of an appropriate length, not less than 50mm, or No.8 screws of an appropriate length at nominal 300mm centres, a minimum of 12mm from the board edge.

Mineral wool will be contained within the cavity.

Tests & Standards

The complete system along with the material and framing is tested in accordance with BS476: Part 22: 1987. The partition system should meet the requirements as specified under Clause 5.

Jointing

Plain butt joints between machined edges of boards. [4]
Joints filled in preparation for painting. [5]
Joints filled and taped in preparation for decoration. [6]

Follow-on Trades

Surface of boards to be prepared for painting/plastering/tiling[7] in accordance with manufacturer's recommendations.

NOTES:

- [1] insert required fire rating, integrity and insulation durations.
- [2] insert acoustic values by reference to Marshall Day assessment.
- [3] insert required fire resistance level (not exceeding 120 minutes).
- [4], [5], [6], [7] delete as appropriate.
- Perimeter gaps will be filled with fire resistant PROMASEAL® AN Acrylic Sealant.

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For latest information of the Promat Asia Pacific organisation,
please refer to www.promat-ap.com

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