POLYMAX™

Premium Insulation

Acoustic Design Guide

www.**polymaxinsulation**.com.au

by Martini

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✔✔ **Recommended** ✔ **Suitable for limited applications** ✖ **Not recommended**

Polymax Insulation Acoustic Design Guide

This Design Guide attempts to clarify the basic properties of sound, and the various Polymax products used to control it. It does not provide definitive solutions for every potential noise problem. Acoustics is a complex science, and we recommend the services of a specialist acoustic consultant be engaged where appropriate for the type of project or system being designed.

Products and applications covered in this design guide include:

Polymax Prime: Designed for use in high performance walls and ceilings used in multi-residential apartments / sole occupancy units (SOU) and other developments where high performance low frequency sound transmission control is required.

Polymax MSB: Designed for use in commercial partition walls and ceilings in offices, healthcare and community projects.

Polymax Easy Baffle: An effective, easy-to-install barrier to prevent "cross talk" or noise that can travel through ceiling voids above suspended ceilings in office and commercial projects.

Polymax Acoustic Thermal Batts: High density batts designed for use in residential walls and ceilings that are affected by external noise sources such as traffic, aircraft, and industrial noise. These batts have high thermal ratings and are designed to provide an acoustic solution where high thermal performance is also required. Also recommended for internal walls and floors in homes where they provide high sound transmission performance between rooms.

Polymax Absorb: Sound absorptive insulation used in single space architectural applications such as studios, theatres, sports halls and auditoriums to provide reverberation control. Absorb is also recommended for use in plant rooms and industrial applications and is ideal for noise reduction for rooftop plant enclosures, absorptive panels, silencers and machinery enclosures.

Polymax HVAC: For internal lining and external lagging of rigid air-conditioning ducts. Designed to absorb mechanical noise from chillers, fans and other AC plant. Polymax HVAC also provides thermal performance to comply with AS 4859.1 for rigid duct systems.

Substitution of Products can Affect Performance!

The substitution of materials for specified products detailed in this guide could affect performance. The acoustical properties will vary due to product thickness, density and fibre characteristics, in particular fibre diameter or denier. Fibre diameter is of major importance for acoustic insulation products. The air trapped between the fibres reacts with sound energy and is converted to heat. The more fibres per square metre of insulation, the more trapped air pockets, the better the acoustic performance of the building element.

Two insulation products of the same density and thickness can vary significantly in their acoustic properties due to a difference in fibre diameters.

Polymax acoustic insulation products are manufactured with specific blends of fibre, which use a percentage of very fine low denier fibres.

Other products may utilise blends which are coarser (large diameter) fibres and this will have an adverse effect on acoustic performance.

Sound Transmission

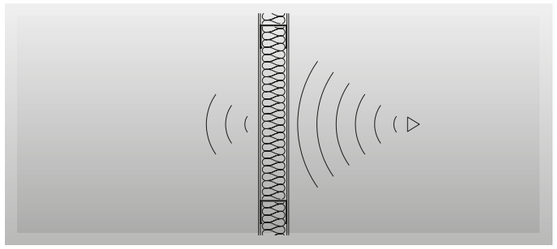
Building elements such as plasterboard ceilings and walls are normally laboratory tested to establish their sound insulation performance.

A laboratory test generally involves the installation of a specimen between two rooms which are isolated from each other to prevent flanking noise interference so that only direct transmission can take place.

A steady known sound level of various frequencies is generated on one side of the specimen and then measured on the other side. Sound transmission loss through the specimen can be calculated for each frequency. The higher the transmission loss, the better the sound insulation performance of the building element.

Rw

Sound transmission loss performance of walls and floors is described as Rw which stands for weighted sound reduction Index. An increase of one Rw point is equivalent to a one decibel reduction in noise transmission through the element.



Rw + ctr

The National Construction Code requires some building elements in multi-residential or apartment buildings to have increased sound transmission performance to deal with low frequency noise generated from hi-fi and home theatre systems. ctr is a spectrum adaptation factor to Rw.

The higher the Rw + ctr value of the wall system the more effective it will be at reducing low frequency sound transmission.

Rw + ctr performance is influenced by the material properties of the element including weight, thickness, stiffness and type of insulation used in the cavity.

Common walls and ceilings used in multi-residential buildings require a minimum performance of Rw + ctr 50.

Polymax Prime for Residential Apartment Systems

The National Construction Code Acoustic Provisions

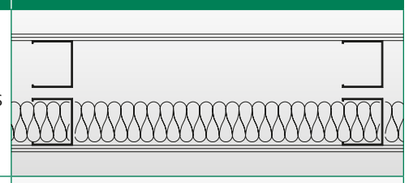
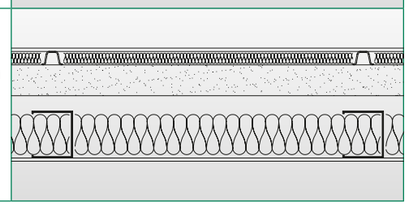
The National Construction Code mandates certain minimum acoustic requirements for building elements in Apartment projects. The following is an extract from The National Construction Code.

Rw + Ctr ≥ 50
Default rating for walls and floors between SOUs.* In some cases the partition may also need to be of discontinuous construction. For floors, there may also be a minimum sound impact (Ln, w + Cl) rating requirement.

Rw ≥ 50
Walls between a SOU and a plant room or lift (discontinuous construction) or public corridor, public lobby, stairway or similar.

Rw + Ctr ≥ 40
Walls or floors separating a duct, soil, waste or water supply pipe or storm water pipe (Class 2 and 3 Buildings). Walls or floors separating a duct, soil, waste or water supply pipe or storm water pipe from a habitable room (Class 1 Buildings).

Polymax Prime Systems

System	Wall Construction	
PP01	**Rw 61, Rw + ctr 51**** Two rows of 64mm decoupled steel studs set in separate tracks separated by 20mm gap with two layers of 13mm fire rated plasterboard to each external face with Polymax Prime 50mm fitted into one cavity.	
PP02	**Rw 62, Rw + ctr 51**** One layer of 13mm fire rated plasterboard fixed to 28mm furring channel, 75mm Hebel Powerpanel, 35mm gap, 64mm steel studs, 1 layer 13mm fire rated Plasterboard, Polymax Prime 30mm in 28mm furring channel gap and Polymax Prime 75mm in the steel stud cavity.	

*Sole Occupancy Unit.
**Opinion based on empirial data.

Polymax MSB in Commercial Plasterboard Wall Systems

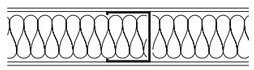
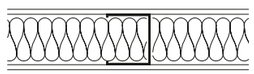
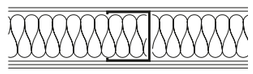
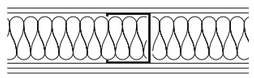
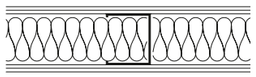
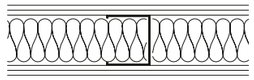
Polymax MSB Is ideal for use in plasterboard partition walls and suspended ceilings used in offices, healthcare, education, and other such developments. Used in partition walls MSB provides excellent sound transmission loss performance and also thermal performance, reducing heat transfer between rooms. Used in conjunction with **Polymax Easy Baffle** fitted in the ceiling void very high levels of acoustic privacy can be achieved. See page 9 for details.

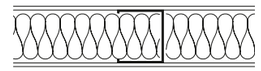
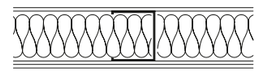
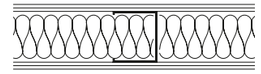
SYSTEM SPECIFICATION

- Lining material as per system table.
- Cavity infill material as per system table.
- Steel studs at 600mm maximum centres.

NOTES

- Acoustic performance valid studs of 0.50 to 0.80 BMT.
- Acoustic tests and opinions performed by Day Design P/L.
- All tests in accordance to Australian Standard AS ISO 354-2006.

System No	Wall Construction		Cavity Infill	Frame Depth 64Mm Rw (Rw + Ctr)	92Mm
SF 01	One x 13mm fire rated plasterboard applied vertically or horizontally with noggings to both sides of steel frame.		MSB 2 MSB 3 MSB 4 MSB 5	44 (35) 44 (45)	
SF 02	One x 16mm fire rated plasterboard applied vertically or horizontally with noggings to both sides of steel frame.		MSB 2 MSB 3 MSB 4 MSB 5	46 (37) 46 (37)	47 (39) 47 (39) 47 (39)
SF 03	One x 13mm fire rated plasterboard applied vertically to one side and two layers applied to the other side of steel frame. First layer vertical, second layer vertical or horizontal.		MSB 2 MSB 3 MSB 4 MSB 5	49 (39) 49 (39)	
SF 04	One x 16mm fire rated plasterboard applied vertically to one side and two layers applied to the other side of steel frame. First layer vertical, second layer vertical or horizontal.		MSB 2 MSB 3 MSB 4 MSB 5	51 (42) 51 (42)	
SF 05	Two x 13mm fire rated plasterboard applied to both sides of steel frame. First layer vertical, second layer vertical or horizontal.		MSB 2 MSB 3 MSB 4 MSB 5	53 (45) 53 (45)	
SF 06	Two x 16mm fire rated plasterboard applied to both sides of steel frame. First layer vertical, second layer vertical or horizontal.		MSB 2 MSB 3 MSB 4 MSB 5	55 (48) 55 (48)	55 (50) 55 (50) 55 (50)

System No	Wall Construction		Cavity Infill	Frame Depth 64mm Rw (Rw + Ctr)	92mm
SF-NF 01	One x 13mm plasterboard applied vertically or horizontally to both sides of steel frame.		MSB 2 MSB 3	41 (33) 41 (33)	
SF-NF 02	One x 13mm plasterboard applied to one side and two x 13mm plasterboard applied to the other side of steel frame.		MSB 2 MSB 3	47 (38) 47 (38)	
SF-NF 03	Two x 13mm plasterboard applied vertically or horizontally to both sides of steel frame.		MSB 2 MSB 3	51 (41) 51 (41)	

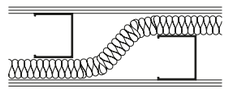
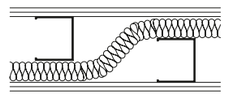
Steel Frame Staggered Walls

SYSTEM SPECIFICATION

- Lining material as per system table.
- Cavity infill material as per system table.
- Steel studs at 300mm maximum centres.

NOTES

- Acoustic performance valid studs of 0.50 to 0.80 BMT
- Acoustic tests & opinions performed by Day Design P/L
- All tests in accordance to Australian Standard AS ISO 354-2006

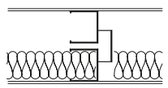
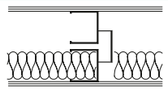
System No	Wall Construction		Cavity Infill	Frame Depth 64mm Rw (Rw + Ctr)	92mm
SF-S 01	Two x 13mm fire rated plasterboard applied to both sides of staggered steel stud wall frame – first layer vertical, second layer vertical or horizontal, positioned in 92mm top & bottom track.		MSB 2 MSB 3 MSB 4 MSB 5	57 (50) 57 (50) 57 (50)	
SF-S 02	Two x 16mm fire rated plasterboard applied to both sides of staggered steel stud wall frame – first layer vertical, second layer vertical or horizontal, positioned in 92mm top & bottom track.		MSB 2 MSB 3 MSB 4 MSB 5	57 (53) 57 (53) 57 (53)	

Polymax MSB in Commercial Plasterboard Wall Systems

Steel Frame Chase Walls

SYSTEM SPECIFICATION
- Lining material as per system table.
- Cavity infill material as per system table.
- Steel studs at 300mm maximum centres.

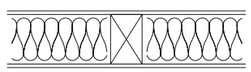
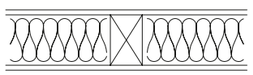
NOTES
- Acoustic performance valid studs of 0.50 to 0.80 BMT.
- Acoustic tests & opinions performed by Day Design P/L.
- All tests in accordance to Australian Standard AS ISO 354-2006.

System No	Wall Construction	Cavity Infill	Frame Depth 64mm Rw (Rw + Ctr)	Frame Depth 92mm Rw (Rw + Ctr)
SF-S 01	One x 16mm fire rated plasterboard applied to both sides of a steel stud chase wall system, comprising two parallel 64mm studs and braced between each pair of adjacent studs. 	MSB 3 MSB 4 MSB 5 MSB 6	45 (41) 45 (41) 45 (42)	
SF-S 02	Two x 16mm fire rated plasterboard applied to both sides of a steel stud chase wall system, comprising two parallel 64mm studs and braced between each pair of adjacent studs. 	MSB 2 MSB 3 MSB 4 MSB 5	51 (48) 51 (48) 51 (49)	

Timber Frame Walls

SYSTEM SPECIFICATION
- Lining material as per system table.
- Cavity infill material as per system table.
- Timber studs at 600mm maximum centres.

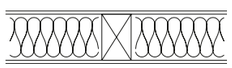
NOTES
- Acoustic tests & opinions performed by Day Design P/L.
- All tests in accordance to Australian Standard AS ISO 354-2006.

System No	Wall Construction	Cavity Infill	Frame Depth 75x50mm Rw (Rw + Ctr)	Frame Depth 100x50mm Rw (Rw + Ctr)
TF 01	One x 13mm fire rated plasterboard applied to both sides of a timber wall frame, with staggered butt joints on opposite side of wall. 	MSB 2 MSB 3 MSB 4 MSB 5 MSB 6	42 (33) 42 (33)	
TF 02	One x 16mm fire rated plasterboard applied to both sides of a timber wall frame, with staggered butt joints on opposite side of wall. 	MSB 2 MSB 3 MSB 4 MSB 5 MSB 6	43 (36) 43 (36)	43 (38) 43 (38)

Polymax Acoustic Thermal Batts

High-density batts designed for use in residential walls and ceilings that are affected by external noise sources such as traffic, aircraft, and industrial noise.

These batts have high thermal ratings and are designed to provide an acoustic solution where high thermal performance is also required. Also recommended for internal walls and floors in homes where they provide high sound transmission performance between rooms.

System No	Wall Construction	Cavity Infill	Frame Depth 90mm Rw (Rw + Ctr)	Frame Depth 75mm Rw (Rw + Ctr)
AT 01	One x 10mm plasterboard applied to both sides of timber wall frame at 450mm centres with timber noggings. 	Acoustic/ Thermal R2.0 90mm Acoustic/ Thermal R2.0 75mm	42	42

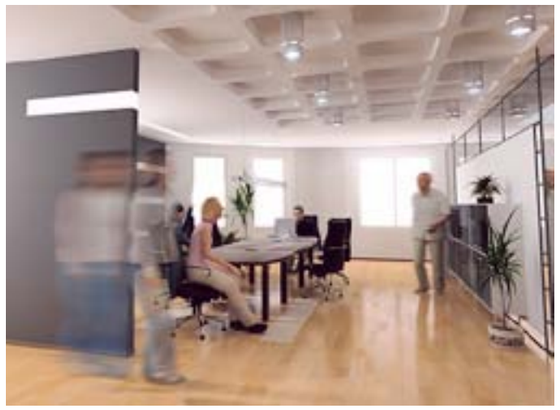
Polymax Easy Baffle for Commercial Ceiling Systems

Flanking Noise

Care should be taken with plasterboard wall systems that do not continue above the suspended ceiling to the soffit. The service void space above suspended ceilings is a major pathway for flanking noise, that is, nuisance noise that travels from one space to another. Flanking can also occur via doors and corridors as well as stairwells. Even though the wall system has been designed to high acoustic standards, the design can be compromised by flanking paths.

Polymax Easy Baffle

In order to limit flanking via ceiling cavities, it is recommended to construct a baffle above wall and ceiling junctions. These baffles can be constructed from plasterboard with the inclusion of Polymax MSB in the cavity, however this type of construction is expensive and labour intensive. Polymax Easy Baffle is an easy-to-install inexpensive product that can reduce flanking transmission by up to 90% at speech range frequencies.



Polymax Easy Baffle, when placed between a concrete slab soffit and the top junction of a plasterboard partition wall, can achieve up to 9 decibel reduction in noise transmission in speech range frequencies. This type of noise is the most common nuisance noise in commercial buildings.

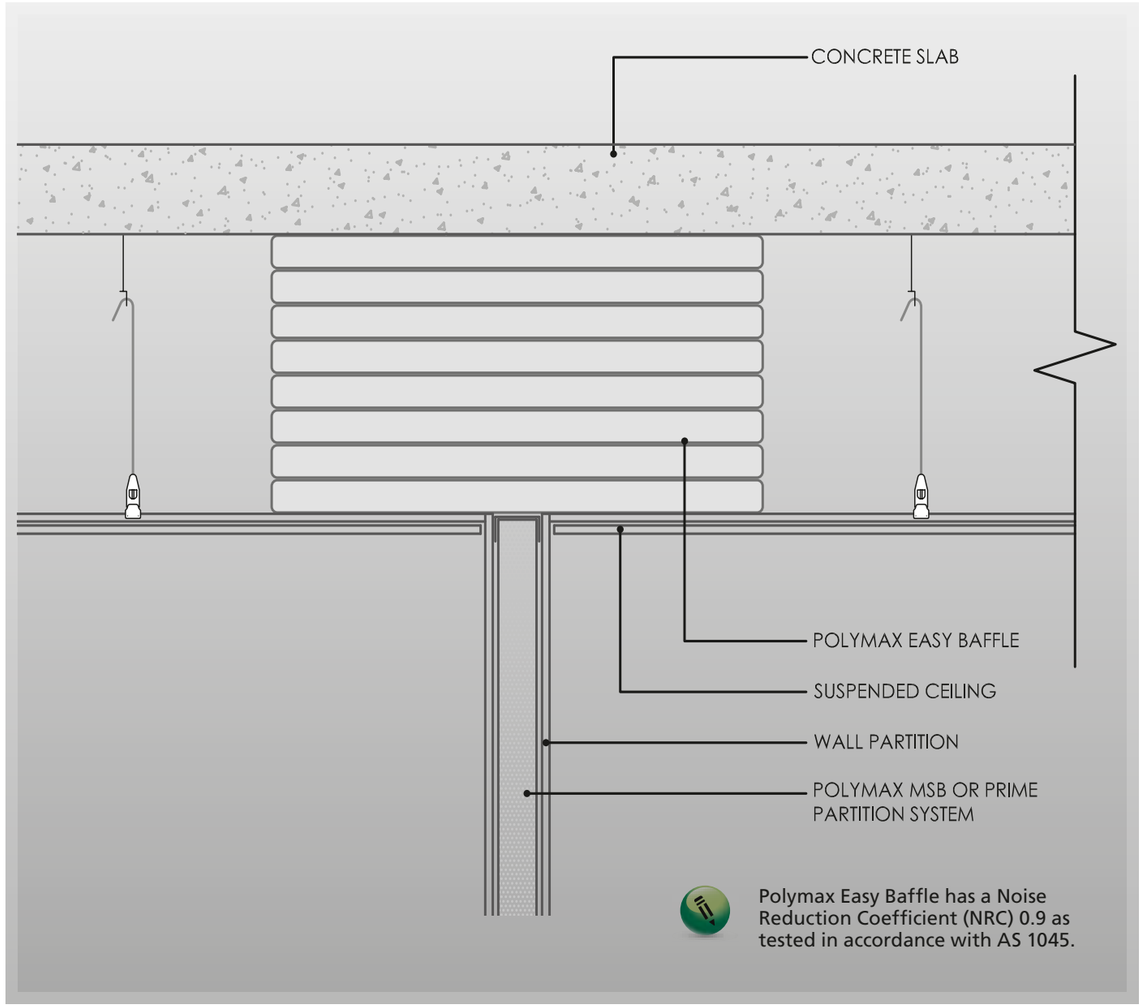
Polymax Easy Baffle is easy to install in ceiling voids. The product comes in a pack which is compressed to a maximum thickness of 450mm. The pack is 1.2 metres in length x 600 mm in width. One pack is designed to fit in a ceiling to soffit height of 600 mm (the product can be made to order to suit other void heights subject to minimum quantities). If the void is greater than 600mm in height, add one extra batt for every 65mm over 600mm.

The product is installed in five easy steps:

1. Cut of both ends off the pack leaving the batts in the remaining sleeve.
2. Insert the batts, still in their sleeve, into the void.
3. Centre the pack lengthways to follow the partition centre line.
4. Slit the remaining plastic sleeve and remove. The batts will then expand to fill the void.
5. Adjust batts to form an even stack for the next pack to butt up to.

For areas where services such as AC ducts, pipes and cable trays run through the void, then batts should be installed individually under, over and around the obstruction, to a suitable compression.

Pack Length mm	Pack Width mm	Pack Depth mm	Batts Per Pack	NRC
1200	600	450	8	0.9



Polymax Easy Baffle has a Noise Reduction Coefficient (NRC) 0.9 as tested in accordance with AS 1045.

Sound Absorption

The term Sound Absorption is most often used to describe single space acoustic applications where reverberation of noise or echo is the main problem.

Projects such as indoor arenas, sporting facilities, cinemas, theatres and studios need to be designed to minimise this type of reverberant noise. Polymax Absorb has been specifically developed to provide an environmentally friendly solution to reduce single space reverberant noise. Polymax Absorb, due to its high density and very fine fibre blend, is especially recommended where low frequency reverberant noise is a problem.

Sound absorptive materials are not all alike, and do not absorb sound of all frequencies equally well. Sound absorption is influenced by factors such as material density, thickness and, in the case of fibrous insulation products, fibre size and diameter, generally fine small diameter fibres will give superior absorption than coarser fibre blends. Polymax Absorb utilises the finest fibre blends available to maximise sound absorption.

Polymax Absorb

Can be used in perforated wall panelling, perforated ceiling systems behind decorative open weave fabric panels, hung as suspended baffles or fixed to slab soffits where chilled beam cooling systems are used.

Polymax Absorb is also recommended for use in plant rooms behind perforated metal or foil laminate and can be used in outdoor areas where it is semi exposed such as rooftop mechanical plant enclosures.

Flow resistivity testing conducted by Acoustic Studio Pty Ltd and Acoustic Directions Pty Ltd

Noise Reduction Coefficient (NRC)

NRC is the arithmetic average of four frequencies: 250hz, 500hz, 1000hz and 2000hz.

In sound absorption applications the NRC is often used as a performance measure, the higher the NRC the greater the sound absorption at those frequencies.

However, NRC does not rate sound absorption at frequencies less than 250hz. Low frequency absorption is often the most critical to the application. Absorptive insulation products should also be rated by their performance at 125hz.

The tables and graphs following show the Sound Absorption of various Polymax Absorb products at various frequencies.

Flow Resistivity

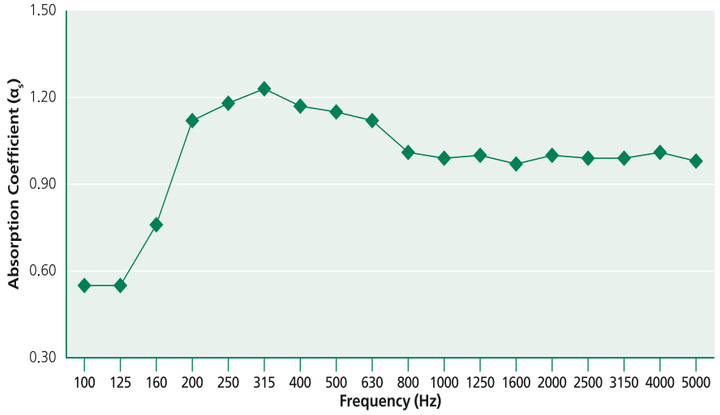
Insulation products used for sound absorption applications can also be rated by their resistance to air flow called Flow Resistivity. This measure of performance is helpful when comparing products of the same density and thickness but having differing fibre characteristics or sizes. Fine fibre products will have a greater Flow Resistivity than coarser fibre blends and therefore better sound absorption.

The table below rates the flow resistivity of Polymax Absorb products in MKS rayls.

Product	Flow Resistivity mks rayl / m
Absorb HD	7994
Absorb XHD	14,693

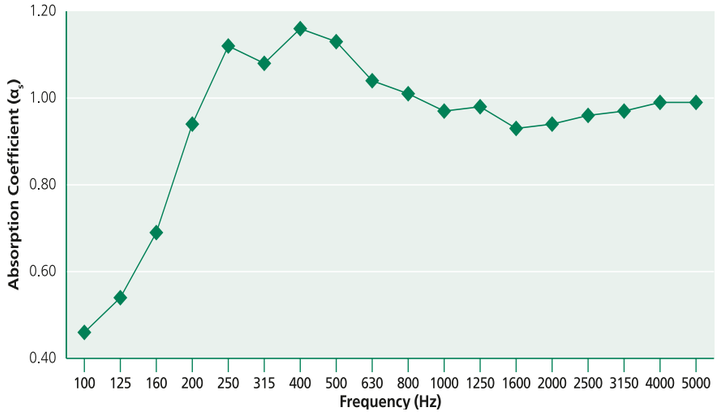
Polymax Absorb – Random Incidence Absorption as Tested in a Reverberation Chamber

Polymax-Absorb XHD 100mm*



Frequency (Hz)	Absorption Coefficient (a_p)
125	0.60
250	1.00
500	1.00
1000	1.00
2000	1.00
4000	1.00
Noise Reduction Coefficient **NRC**	1.00

Polymax-Absorb HD 100mm*

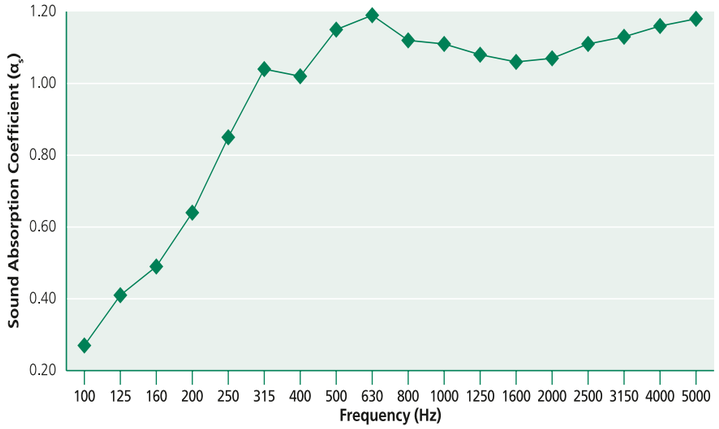


Frequency (Hz)	Absorption Coefficient (a_p)
125	0.55
250	1.00
500	1.00
1000	1.00
2000	0.95
4000	1.00
Noise Reduction Coefficient **NRC**	1.00

**Testing conducted by Day Design at The National Acoustics Laboratory & Boral Acoustic Laboratory Sydney.*

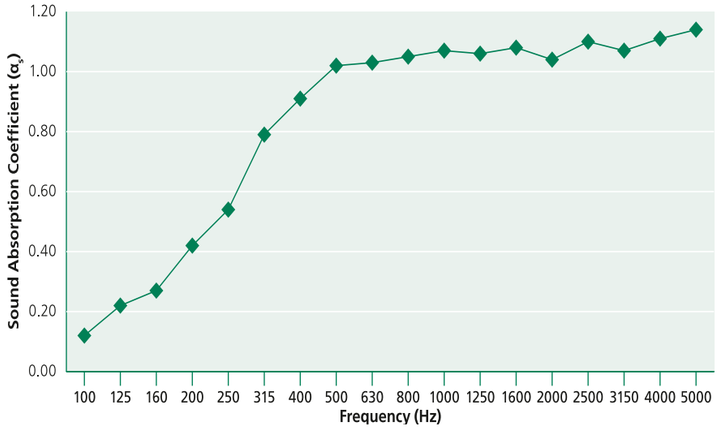
Polymax Absorb – Random Incidence Absorption as Tested in a Reverberation Chamber

Polymax-Absorb HD 75mm*



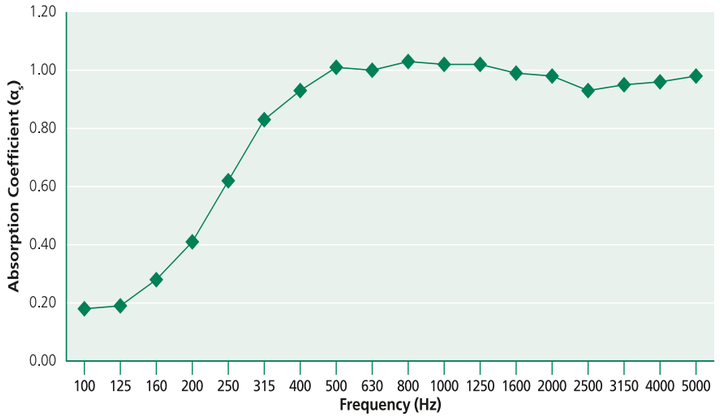
Frequency (Hz)	Absorption Coefficient (a_p)
125	0.40
250	0.85
500	1.00
1000	1.00
2000	1.00
4000	1.00
Noise Reduction Coefficient **NRC**	1.00

Polymax-Absorb HD 50mm*



Frequency (Hz)	Absorption Coefficient (a_p)
125	0.20
250	0.60
500	1.00
1000	1.00
2000	1.00
4000	1.00
Noise Reduction Coefficient **NRC**	0.95

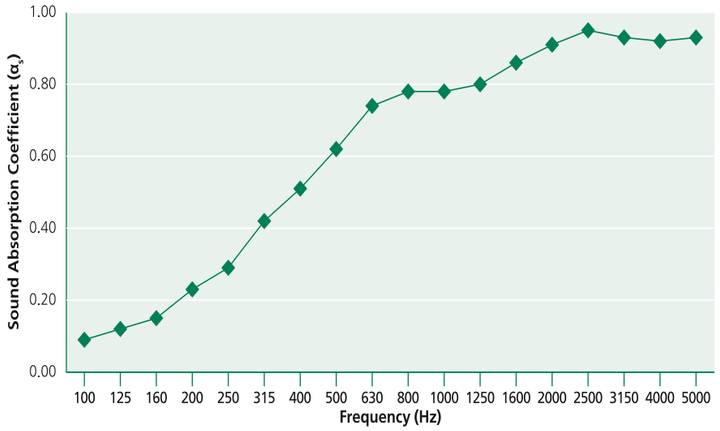
Polymax-Absorb XHD 50mm*



Frequency (Hz)	Absorption Coefficient (a_p)
125	0.20
250	0.60
500	1.00
1000	1.00
2000	0.95
4000	0.95
Noise Reduction Coefficient **NRC**	0.90

**Testing conducted by Day Design at The National Acoustics Laboratory & Boral Acoustic Laboratory Sydney.*

Polymax-Absorb HD 25mm*

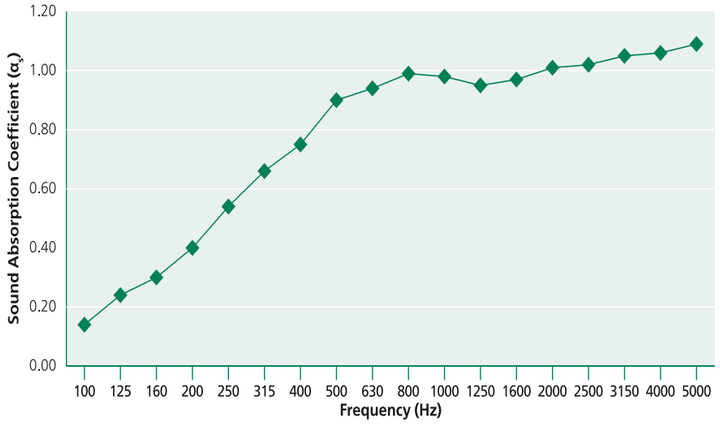


Frequency (Hz)	Absorption Coefficient (a_p)
125	0.10
250	0.30
500	0.60
1000	0.80
2000	0.90
4000	0.90
Noise Reduction Coefficient **NRC**	0.65

**Testing conducted by Day Design at The National Acoustics Laboratory & Boral Acoustic Laboratory Sydney.*

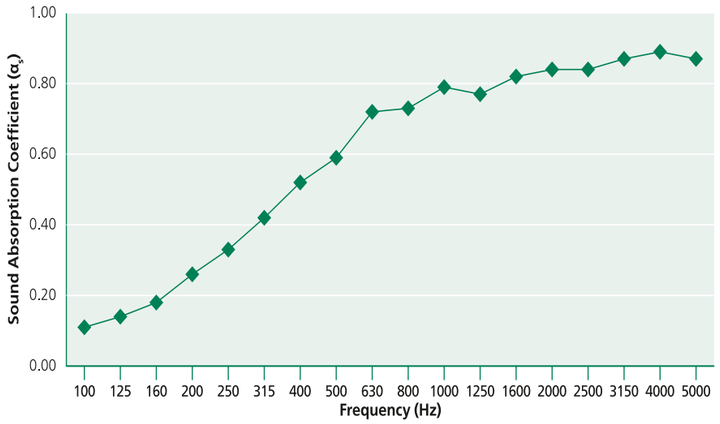
Polymax Absorb – Random Incidence Absorption as Tested in a Reverberation Chamber

Polymax-Absorb MD 50mm*



Frequency (Hz)	Absorption Coefficient (a_p)
125	0.25
250	0.55
500	0.85
1000	1.00
2000	1.00
4000	1.00
Noise Reduction Coefficient **NRC**	0.85

Polymax-Absorb MD 25mm*



Frequency (Hz)	Absorption Coefficient (a_p)
125	0.15
250	0.35
500	0.60
1000	0.75
2000	0.85
4000	0.90
Noise Reduction Coefficient **NRC**	0.65

**Testing conducted by Day Design at The National Acoustics Laboratory & Boral Acoustic Laboratory Sydney.*

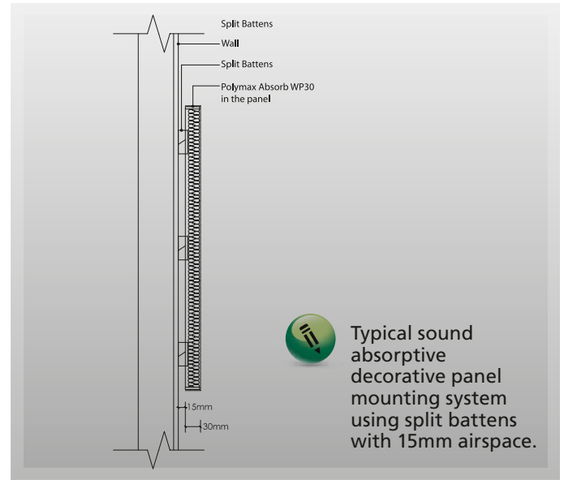
High Performance Sound Absorbing Designer Panels

Interior design professionals not only look for aesthetically pleasing and fashionable finishes for projects such as conference rooms, foyers, theatres, auditoria, restaurants and other public areas. They also require good acoustic design in the form of sound absorptive elements.

Polymax Absorb WP has been specifically developed for use in decorative fabric upholstered wall and ceiling panels and slotted or perforated timber panels.

Absorb WP has a maximum thickness of 30mm and has a very fine fibre blend which gives the product exceptional sound absorption.

When mounted in a decorative panel with a woven screen fabric facing• and a split batten mounting system which allows a minimum 15 mm airspace between the rear of the panel and the wall substrate. Has achieved an NRC of 0.9. This is exceptional performance from such a thin panel.



Typical sound absorptive decorative panel mounting system using split battens with 15mm airspace.

Test conducted by Renzo Tonin and Associates at the National Acoustics Laboratory Sydney

Frequencies	125 hz	250 hz	500 hz	1000 hz	2000 hz	4000 hz	NRC
Sound Absorption coefficient	0.20	0.45	1.0	1.0	1.0	1.0	0.9

•Performance can vary depending on the air flow resistivity of the selected fabric facing or the open area of the perforated or slotted timber panel. We recommend un-backed screen fabrics and a minimum 20% open area for slots or perforations in timber panelling.

Polymax HVAC for Rigid Ducting & Silencers

HVAC ducts in many buildings are internally lined with insulation to absorb noise generated by air conditioning plant. Polymax-HVAC is designed as an effective lining material for these systems.

Polymax HVAC gives high performance sound absorption across a broad range of frequencies

The product is Non-friable, therefore reducing the risk of erosion and fibre breakage leading to contamination of conditioned air. The product contains no resin binders and is classified as ultra low VOC.

Made in MD (medium density), HD (high density), XHD (extra high density) – and thicknesses, with a fine small diameter fibre blend providing maximum thermal and acoustic performance.

Comes in standard White colour and is laminated with heavy-duty perforated foil or black scrim fabric.

HVAC HD 75mm

Frequency (Hz)	Absorption Coefficient (a_s)
125	0.40
250	0.85
500	1.00
1000	1.00
2000	1.00
4000	1.00
Noise Reduction Coefficient **NRC**	1.05

HVAC XHD 25mm*

Frequency (Hz)	Absorption Coefficient (a_s)v
125	0.15
250	0.35
500	0.60
1000	0.80
2000	0.85
4000	0.95
Noise Reduction Coefficient **NRC**	0.70

HVAC HD 25mm

Frequency (Hz)	Absorption Coefficient (a_s)
125	0.10
250	0.30
500	0.60
1000	0.80
2000	0.90
4000	0.90
Noise Reduction Coefficient **NRC**	0.65

HVAC HD 50mm

Frequency (Hz)	Absorption Coefficient (a_s)
125	0.25
250	0.55
500	1.00
1000	1.00
2000	1.00
4000	1.00
Noise Reduction Coefficient **NRC**	0.95

HVAC XHD 50mm

Frequency (Hz)	Absorption Coefficient (a_s)
125	0.20
250	0.60
500	1.00
1000	1.00
2000	0.95
4000	0.95
Noise Reduction Coefficient **NRC**	0.90

Acoustic Performance tested to AS 354-2006 and expert opinion based on empirical data, marked with *
Acoustic testing conducted at the National Acoustic & Boral Laboratories by Day Design Pty Ltd

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