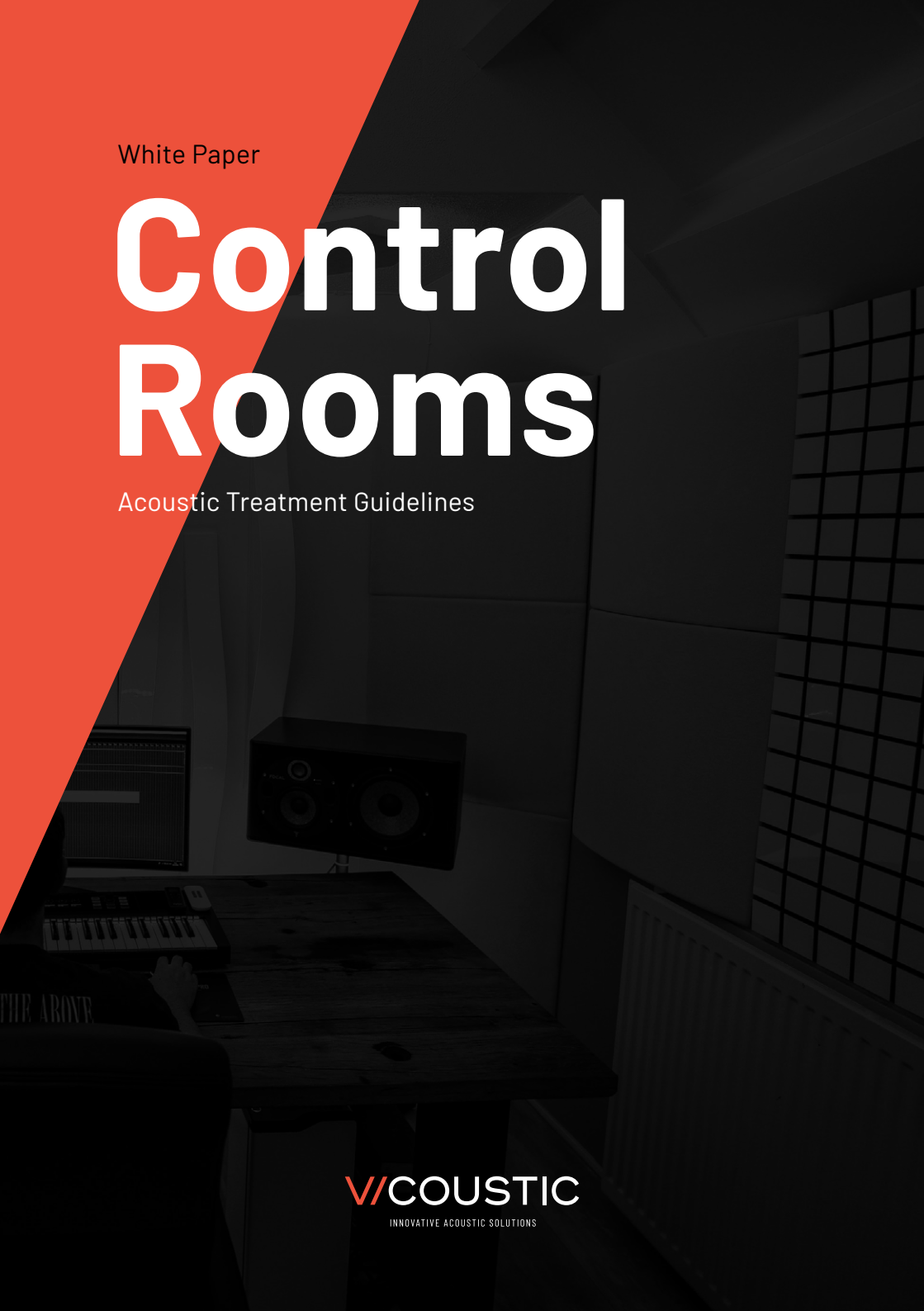
White Paper

Control Rooms

Acoustic Treatment Guidelines



V/COUSTIC

INNOVATIVE ACOUSTIC SOLUTIONS

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Problem

A Control Room for recording, mixing and mastering or broadcast should allow to critically monitor the sound signal being reproduced, i.e. should assure a clear and complete representation of the acoustic message without introducing any distortions that could compromise its perception.

Nowadays a great portion of the investment made in studios is focused on new powerful signal processing and monitoring equipment. Consequently, Control Rooms have seen their acoustic requirements becoming more severe in order to follow and take full advantage of this technology progress.

Additionally, the use of home studios and project studios has increased considerably. Unfortunately, the majority of times these working environments don't have their acoustics properly addressed.

Once that from professional facilities to project and home studios the Control Room is where the critical listening work is carried out, naturally, it requires a controlled acoustic environment.

Achieving proper room acoustics conditions in your control room is paramount to give you confidence on what you are critically monitoring

Basic Acoustic Treatment Steps

First Reflections Control | Optimizing Reverberation Time (RT) | Controlling Sound Field Anomalies

First Reflections Control

- One should be able to clearly hear early reflections that may be recorded or happening in the performance area.
- Early reflections should be controlled in order to avoid any masking effects of these features.
- It is recommended that early reflections are absorbed, in order to decrease their level to, at least, 10 dB below the level of the direct sound.
- By treating well first reflections, comb-filter effects are likely to be avoided and sound quality and clarity improved.
- First Reflections may be controlled by **Vicoustic Sound Absorbing panels**.

Reverberation Time Optimization

- A Control Room should provide a neutral acoustic environment.
- One should be able to feel the ambiance and reverb contained in the recordings.
- Optimum RT for a Control Room should lie within the range of 0,2 s to 0,4 s.
- RT should be steady and continuous in the frequency range from 200 Hz to 4 kHz.
- Higher tolerances for octave bands below 200 Hz and above 4 kHz are permitted.
- RT Optimization can use both **Vicoustic sound absorption and diffusing panels**.

Sound Field Anomalies

In small rooms such as Control Rooms, there are three main sound field anomalies that are likely to occur and should be properly addressed: i) Comb-Filter Effects; ii) Flutter Echoes; iii) Room Modes.

Comb-Filter Effects

- When a direct sound combines with its reflection a comb-filter is produced, with characteristic nulls and peaks in the frequency response.
- During small periods where an almost steady state of speech and music signals may occur, some frequencies may completely disappear or be enhanced by the comb-filter effect.
- This, of course, compromises the correct sound signal perception and may raise doubts on what we are listening or missing.
- It should be noted that by treating first reflections (using sound absorption to take energy from them) one is already addressing comb-filter effects.

Flutter Echoes

- Flutter echoes are caused by repeated sound reflections caused by sound waves traveling between parallel reflective surfaces such as walls, floor and ceiling.
- This compromises correct sound signal perception and therefore should be well addressed in critical listening spaces.
- It should be noted that by treating first reflections and reverberation time one is already dealing with flutter echoes issues.

Room Modes

- In small rooms such as Control Rooms, the correct perception of sound at low frequencies may be compromised due to room modes.
- Room modes may be controlled by using **Vicoustic Membrane Bass Trap solutions** in the corners of the room where sound pressure maximums occurs.

Solution

In order to achieve proper acoustic conditions within your Control Room and in this way allow you to critically monitor the sound signal being reproduced, three acoustic treatment solutions are proposed in this white paper: **Economic**, **Efficient** and **Professional**.

These solutions are meant for standard control rooms (rectangular rooms between 10 m^2 to 20 m^2 and room height between 2,4 and 3 m) and **can be applied in different phases**, i.e. you can start by implementing the Economic solution, and then invest to achieve the Efficient and finally the Professional solution.

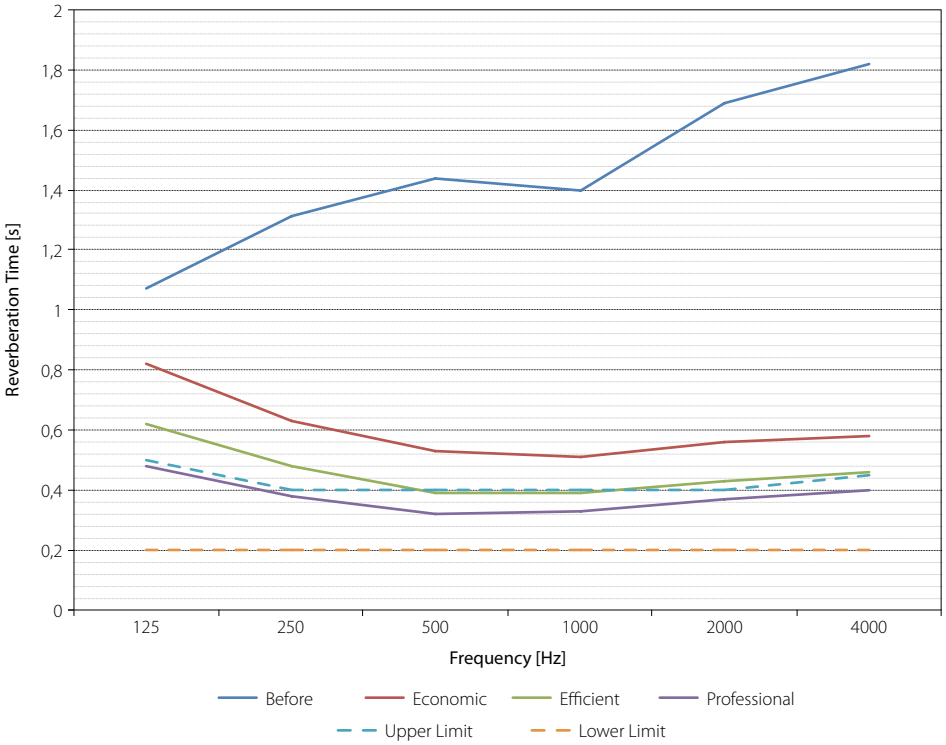
This document is based on best practice guidelines and recommendations (such as AES, ITU-R, etc.)

It should be noted that this document presents general guidelines for acoustic treatment. Sound insulation and more complex situations may require special attention and advice (for further help please contact sales@vicoustic.com).

	Economic	Efficient	Professional
Reverberation Time	★	★★	★★★
First Reflections	★	★★	★★★
Back Wall	★	★	★★★
Low Frequencies	★	★	★★★

Reverberation Time Predictions

The graphic below presents the calculated RT for both untreated and treated room, for the three different proposed solutions.



For these RT calculations, we considered a 4 (W) x 5 (L) x 2,6 (H) m room, with the following finishes: walls and ceiling made of plasterboard and carpet floor.

These predicted values are meant to be used as a guidance to understand the benefit of the acoustic treatment that is being proposed.

It should be noted that if smaller rooms are considered, the RT is likely to have lower values than the ones presented in the images. If different finishes are considered the RT may increase or decrease depending on the finishes.

Economic Solution

3 Boxes of Cinema Round Premium

1 Box of Multifuser DC2

This Economic Solution focuses on the treatment of First Reflections and the Back Wall.

- First Reflections, originating from the front, side walls and ceiling are being treated with absorption panels (Cinema Round Premium). This will: i) improve sound definition and the sound field image at the mixing position (by reducing the interference between the direct sound and specular reflections); ii) control comb-filter effects and iii) control the Reverberation Time within the room.

- Back Wall is being treated with diffusion panels (Multifuser DC2), in order to control specular reflections originating from this surface and to improve the sense of spaciousness within the room.

In this Economical Solution the following Vicoustic Products are being used:

Cinema Round Premium: Cinema Round Premium has a flat absorption performance between 250Hz and 5kHz maintaining, in this way, the spectral content of the original music signal.

Multifuser DC2: Despite being an economical Diffuser, the Multifuser DC2 has a great performance. It won the Best Accessory Award in the HI-FI+ Magazine Awards 2017.

Efficient Solution

3 Boxes of Cinema Round Premium

1 Box of Multifuser DC2

1 Box of Wavewood

4 Boxes of Super Bass Extreme

This Efficient Solution addresses all the acoustic issues approached by the Economic Solution and in addition, it also addresses:

- Low Frequencies: Room modes are being treated by including membrane bass traps (Super Bass Extreme) on room corners, therefore, improving the low frequency response of the room and reducing the RT at low frequencies.

In addition, adding sound absorbing panels (Wavewood) to untreated areas of the side walls and ceiling will decrease the RT to more appropriate values and avoid acoustic defects, such as Flutter Echoes.

In this Efficient Solution the following Vicoustic Products are being used:

Cinema Round Premium: Cinema Round Premium has a flat absorption performance between 250Hz and 5kHz maintaining, in this way, the spectral content of the original music signal.

Multifuser DC2: Despite being an economical Diffuser, the Multifuser DC2 has a great performance. It won the Best Accessory Award in the HI-FI+ Magazine Awards 2017.

Wavewood: Vicoustic's flagship acoustic panel has been specifically developed to treat acoustic problems without destroying the room's ambience, or over-deadening the sound.

Super Bass Extreme: Optimized for corner mounting, Super Bass Extreme was designed to provide effective low frequency absorption between 60–125 Hz, delivering maximum effectiveness between 75–100 Hz.

Professional Solution

3 Boxes of Cinema Round Premium | 1 Box of Multifuser DC2 | 1 Box of Wavewood

8 Boxes of Super Bass Extreme | 4 Boxes of Flexi Wave 60.15 | 2 Boxes of Flexi Wave 120.15

This Professional Solution addresses all the acoustic issues approached by the Efficient Solution and in addition, it also improves:

- Low Frequencies: Room modes are being better controlled by adding more membrane bass traps (Super Bass Extreme) on room corners. This will improve the low frequency response of the room and will likely reduce the RT at low frequencies to the recommended values for a Control Room.

- Back Wall: Specular reflections are being controlled not only by the diffusers (Multifuser DC2) but also by an hybrid acoustic panel (Flexi Wave) that provides not only absorption but also diffusion.

In addition, the RT is being optimised and it will achieve the recommended values by placing Flexi Wave throughout all room's surfaces (front, back, side walls and ceiling). This will also help to avoid acoustic defects, such as Flutter Echoes.

In this Professional Solution the following Vicoustic Products are being used:

Cinema Round Premium: Cinema Round Premium has a flat absorption performance between 250Hz and 5kHz maintaining, in this way, the spectral content of the original music signal.

Multifuser DC2: Despite being an economical Diffuser, the Multifuser DC2 has a great performance. It won the Best Accessory Award in the HI-FI+ Magazine Awards 2017.

Wavewood: Vicoustic's flagship acoustic panel has been specifically developed to treat acoustic problems without destroying the room's ambience, or over-deadening the sound.

Super Bass Extreme: Optimized for corner mounting, Super Bass Extreme was designed to provide effective low frequency absorption between 60–125 Hz, delivering maximum effectiveness between 75–100 Hz.

Flexi Wave: This hybrid acoustic panel acts as an absorber and diffuser simultaneously, bringing performance and design to our control Rooms.

List of Materials Needed

• Cinema Round Premium // Economic (3 Boxes) - Efficient (3 Boxes) - Professional (3 Boxes)

Acoustic Properties
Mid and High Freq.
Absorption

Raw Materials
Foam (M1)
and Fabric

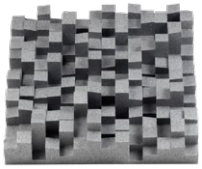
Dimensions
595 × 595
× 75 mm

Available Fabric Colors

87a 04a 22a 32a 31a 116a 117a 29a 23a 82a 97a 92a 30a 40a 99a

More information available on www.vicoustic.com/product/cinema-round-premium

• Multifuser DC2 // Economic (1 Box) - Efficient (1 Box) - Professional (1 Box)



Acoustic Properties
Mid and high freq.
Diffusion

Raw Materials
100% EPS

Dimensions
590 × 590
× 147 mm

Available EPS Colors

White Grey Black

More information available on www.vicoustic.com/product/multifuser-dc2

• Wave Wood // Efficient (1 Box) - Professional (1 Box)

Acoustic Properties
Mid and High Freq.
Absorption

Raw Materials
Wood (MDF)
and Foam (M1)

Dimensions
595 × 595
× 60 mm

Available Wood Colors

Cherry Light Brown Nordik Wenge White

More information available on www.vicoustic.com/product/wavewood

• Super Bass Extreme // Efficient (4 Boxes) - Professional (8 Boxes)

Acoustic Properties

Low Frequencies Absorption

Raw Materials

Wood, Foam

Dimensions

595 × 595 × 155 mm

Available Wood Colors

Cherry | Light Brown | Nordik | Wenge | White

More information available on www.vicoustic.com/product/super-bass-extreme

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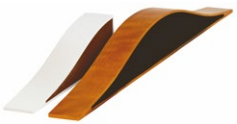
• Flexi Wave 60.15 // Professional (4 Boxes) – Flexi Wave 120.15 // Professional (2 Boxes)



Acoustic Properties

Medium Frequencies Absorption

Raw Materials

Wood , Fabric , Foam

Dimensions

60: 595 × 100 × 150 mm

120: 1195 × 100 × 150 mm

Available Wood Colors

Cherry | Light Brown | Nordik | Wenge | White

Available Fabric Colors

87a | 04a | 22a | 32a | 31a | 116a | 117a | 29a | 23a | 82a | 97a | 92a | 30a | 40a | 99a

More information available on www.vicoustic.com/product/flexi-wave

Glossary

dB (decibel) – The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the root-mean-square pressure of the sound field and reference pressure (2×10^5 Pa).

Direct Sound – Sound that arrives at the listener's position directly from the sound source, i.e. without being reflected from any objects or surface.

Comb-Filter Effects - Characteristic nula and peaks that occur in the sound frequency response due to combination of the direct sound with its reflection coming from untreated surfaces.

First Reflections – Normally defined as the sound reflections that reach the listening position up to approximately 20ms after the direct sound.

Flutter Echoes – Repeated sound reflections caused by sound waves travelling between parallel reflective surfaces such as walls.

Reverberation – An acoustical phenomenon that occurs in enclosed spaces, when sound persists in that space as a result of repeated reflection or scattering from surfaces enclosing the space or objects within it.

Reverberation Time (s) – A measure of the degree of reverberation in a space. It is equal to the time required for the level of a steady sound to decay by 60 dB after it has been turned off.

Room Modes – At specific frequencies, called room resonance frequencies, standing waves are created within rooms. These frequencies depend on the dimensions and shape of the room. This group of resonance frequencies are normally referred to as room modes. When a sound source generates sound with frequencies equal or close to the room resonance frequencies, the room response will be enhanced and patterns of maximum pressure levels and minimum pressure levels will be produced. The shape of these patterns differs with the room resonance frequency.

Sound Absorption – The portion of the sound energy that is absorbed and not returned when a sound wave hits a surface.

Sound Diffusion – Sound diffusion occurs when a sound wave hits a complex surface such as a diffuser and its energy is distributed in many directions.

Sound Reflection – The portion of the sound energy that is returned when a sound wave hits a surface.

Standing Waves – A standing wave is originated from the interaction of two sound waves with equal frequency and amplitude but travelling in opposite directions. Unlike the travelling waves, the standing waves do not cause a net transport of energy, since the two waves that form it are carrying equal energy in opposite directions. The resulting standing wave alternates between maximum and zero amplitude.

Vicoustic Project Assistance

We know that each space deserves and requires individual acoustic needs.

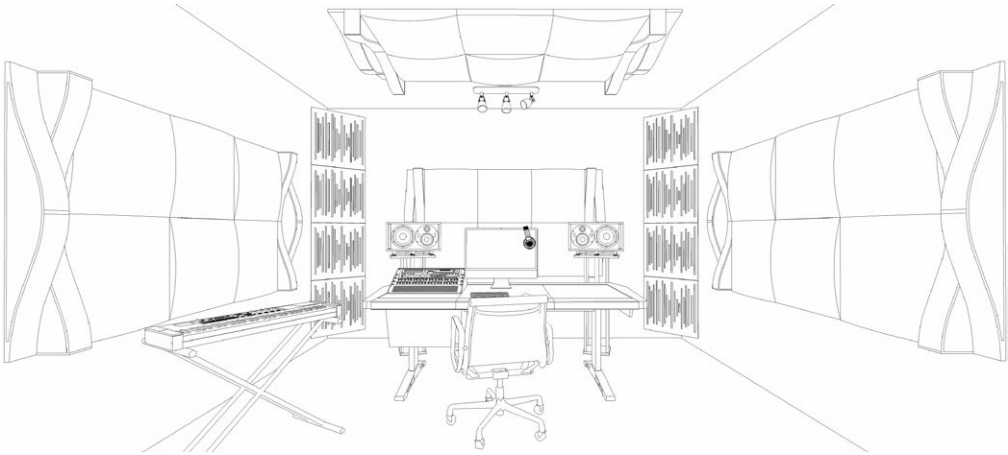
Our Project Team includes Senior Acoustic Engineers and Designers that are experts in taking you on your acoustic and design needs. From conception through to completion, we work closely with architects and designers to deliver a project successfully irrespective of complexity.

The pioneering hardware and software tools we have engineered have proved to be very reliable to support the integration of acoustic treatment and sound insulation solutions through a new-build or a refurbishing project.

Our Research and Development Team is also available to develop customized products to satisfy your needs. Our customers can will also be supported by our Sales, Marketing and Logistics teams to assist with transportation, communication and all information that may be required: pricing; installation guides; catalogues; etc.

Together we have proven that we can provide high levels of value to see our customers through the whole process of installing acoustic solutions. This includes reliable and effective recommendations and products and support services throughout your whole project process from conception through to completion.

This ability has provided us a large base of clients in a relatively short period of time. We are proud in having between our Clients companies such as Sony, BBC, ITV, Facebook, Microsoft and many others.



About Vicoustic

Vicoustic understands sound - and we know what makes a truly exceptional acoustic and audio experience.

Being at the forefront of acoustic technology, we combine engineered systems with stunning design to bring you sound that is free of compromises, but full of high quality performance.

A leading force in the industry, founded in 2007, Vicoustic is found in over 70 countries around the world. We understand the unique sound dynamics of a room or venue. So whether it's an exclusive Home Cinema, hi-end Hi-Fi rooms, any pro-audio room or a large scale venue from sports arena to shopping malls, restaurants or offices, our expertise for peak acoustic performance is second-to-none.

The products from Vicoustic deliver clever and innovative solutions to meet the demands of spaces which require a sophisticated soundscape.

Taking on board the high standards of our customers, we continuously strive to manufacture products of superior functionality, adaptability, but all the while with a sustainable and environmentally conscious mind-set.

Designed and manufactured in Portugal, our facilities underwent great transformation in 2015 to incorporate state of the art equipment and new production and coating systems.

This ensured that Vicoustic was able to maintain the high quality standards expected of its products, increase production volumes, but also create those bespoke products for our custom projects. This is led by our own 'in-house' Quality Department, who oversee all aspects of quality from the company.

Vicoustic's ability to create individually designed items at a premium quality means that our products can meet the needs of most spaces (no matter how unusual) to ensure the best acoustics and environment to enjoy sound...we have it covered.

Leading the Way

We believe that Vicoustic should constantly be paving the way, innovating and driving acoustic technologies to ensure that we are not only leading the field, but producing the best acoustics in every space we are acoustically curating.

What makes us outliers in the industry is our Vicoustic Research Centre, inaugurated in 2012 alongside the Vicoustic HQ. We pride ourselves on developing and continuously advancing our technologies and ways of working to deliver the best product to our customers.

The Research Centre operates on a multidisciplinary platform: the Multifunctional Room and the Innovative Acoustic Chamber. We have a brilliant (and fun!) time using this center to test our products and investigate and challenge the way we use audio and acoustic technologies.

The Multifunctional Room, lined with magnetic walls, allows us to assemble, mount and test different combinations of acoustic products quickly and efficiently. Not only does this allow us to analyze performance, quality and design, it also gives us the opportunity to share this learning with our Vicoustic partners across the world.

The Innovative Acoustic Chamber has exclusive features that continue to be unique in the world. This is an adaptive volume chamber, allowing us to perform acoustic tests in various sized rooms. A 4-ton mechanical wall allows us to adapt the size of the chamber, and in this way deeply study low frequency / room modes solutions.

Also, this cutting edge acoustic chamber is convertible from a reverberation chamber into an anechoic chamber, allowing both diffuse field and free field conditions to be achieved giving Vicoustic the possibility to test and develop different products.

By placing the mechanical wall in different positions it is possible to study any product sample at precise frequencies. The sound behavior is captured using best quality hardware and software, insuring reliable data for our analyses.

Our aim is to invest in programs to optimize acoustic performance within specific architecture and interior spaces. **This means we can produce aesthetically pleasing products, whilst also upholding key safety and environmental regulations.**

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INNOVATIVE ACOUSTIC SOLUTIONS

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