


from noise to sound.
Marmonier





When balanced sound
leads to inspiration"...

//Summary

p4. Product beginnings

p5. Areas of use

p6. Operating instructions

p7. The Benefits of Continuum Solutions

p8. Description of Continuum Solutions

/ Low frequency sound absorption / Unique reactive behavior

/ Alpha w sound absorption coefficient / Reverberation time

/ Simulation and prediction software / Clarity index


/ Stationary waves / Level of background noise / Sound insulation

p18. Colors and patterns

/ Color charts / Embossing Patterns / Objects

p30. Contact information



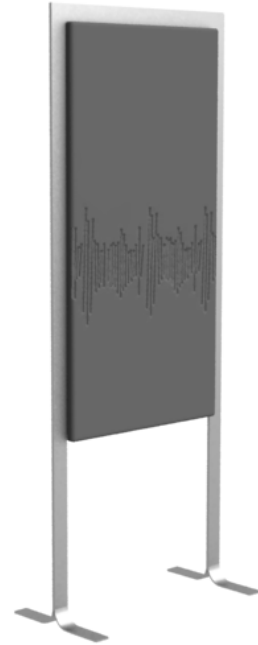
A close-up photograph of a light-colored, textured material, possibly a fabric or paper, against a dark background. The material has a fine, fibrous texture and is shown in a curved, overlapping manner. The lighting is soft, highlighting the texture of the material.

//The Continuum process

Continuum solutions are the result of research into maximum efficiency in absorption functions. Assembled into this new product design are all the physical mechanisms leading to very high efficiency through the optimization of :

- Viscous dissipation
- Strain energy conversion
- Displacement energy conversion

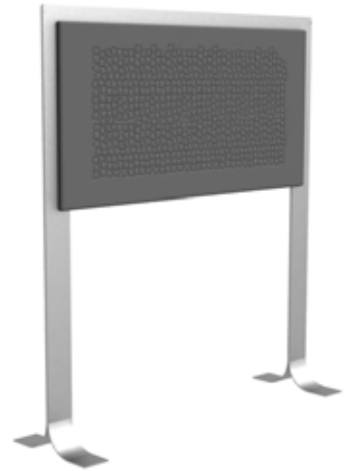
The Integration of all these mechanisms into an industrial production process gave birth to an efficient material composition incorporating corrective broadband sound atmosphere technology and is self adaptive at low frequencies. We have applied to patent this technology. Particular focus was given to making the footprint of the continuum solution as small and autonomous as possible thus making setup as quick as possible. Each setup can have a unique design thanks to various colors, patterns and embossing possibilities available.



Continuum solutions can be applied in any enclosed space where acoustical atmosphere correction is necessary, not only on sound levels but also on spectral balance and sound perception.

This is mostly the case in situations of everyday life, both in professional environments and in private spaces. These are places that inevitably involve human beings, since concepts of discomfort, comfort and sound quality will come into play.

It is obvious that the requirements of a meeting room will be a different to those of a room dedicated to listening to a hi-fi or those of a workshop or a telephone call center. There are many different environments where subjective desires of individuals must be taken into account to guide architects, designers and acousticians and others involved in recommendations. Continuum solutions can best respond to these new requirements without losing the primary qualities sought from conventional absorbents.



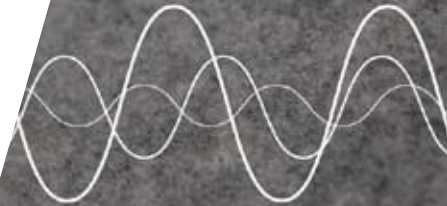
When a sound wave hits a Continuum solution, it will behave differently depending on its frequency. At low frequencies where the wavelength is of similar size or greater than the solution in place, the pressure exerted on the solution surface will be almost in phase and will trigger optimization properties thus leading to displacement energy conversion.

Continuum Solutions have a very low resonant frequency and almost always run over, but their strong depreciation properties provide wide enough bandwidth to self-adapt to the initial natural frequencies of most rooms.

For higher frequencies, those just a fraction of the size of a solution, optimization of strain energy conversion is obtained, since bending vibration is potentially active.

For medium and high frequencies the solution behaves like a layer of porous material allowing small scale viscous dissipation to act according to currently well known laws.

It should be noted that air stiffness trapped in the back has been incorporated into design modeling in order to enhance the performance of absorption at medium frequencies.



Continuum incorporates a broadband acoustical signal correction device which adapts to low frequencies. Some of the many benefits of using Continuum:

- Ability to absorb 63 Hz to 10,000 Hz with a thickness of just 45 mm.
- Balances the acoustic environment of living spaces.
- Reduces tedious acoustic broadband noise including low frequencies.
- Improves the intelligibility of speech.
- Reduces stationary wave phenomena in confined spaces by improving the spatial uniformity of the sound.
- Corrects reverberation time over small surfaces.
- Ensures continuity of sound quality to your ears in spatialized systems.
- Increase soundproofing.

In addition to these qualities, Continuum solutions are very easy to apply and just take minutes to set up.

Usually, absorption performance is mostly represented using its absorption value coefficient, measured at normal incidence using an impedance tube, or the absorption value coefficient as measured in a reverberation chamber at random incidence.

At first glance the latter approach would seem more representative of real usage and immediately provide data usable in most computing software in terms of equivalent area absorption.

It should be noted however that the absorbance values obtained at high frequency using this test method are often greater than 1 for high-performance materials, which is physically absurd and can lead to misinterpretations in computing software.

Furthermore, measurement of absorption using reverberation room methods is not appropriate when describing reactive absorbers as full effectiveness is only ensured with the presence of acoustic excitation.

Continuum solutions operate in reactive mode at low frequencies, we have characterized its performance in two stages.

Medium-high frequency absorption.

Continuum solution component materials were measured in impedance tubes and alpha cabins.

Beyond 1000 Hz, performances are remarkable but not optimal ($\alpha = 1$). We must however bear in mind that to obtain uniform correction across the whole spectrum, one should avoid excessive high frequency absorption.

Failure to do so tends to produce "muted", flat sound. It is for this reason that we have not sought to obtain Continuum solutions with a coefficient above 0.8 just by adding an extra layer of absorbent on them.

Upon request we are able to "boost" or reduce high frequency absorption.

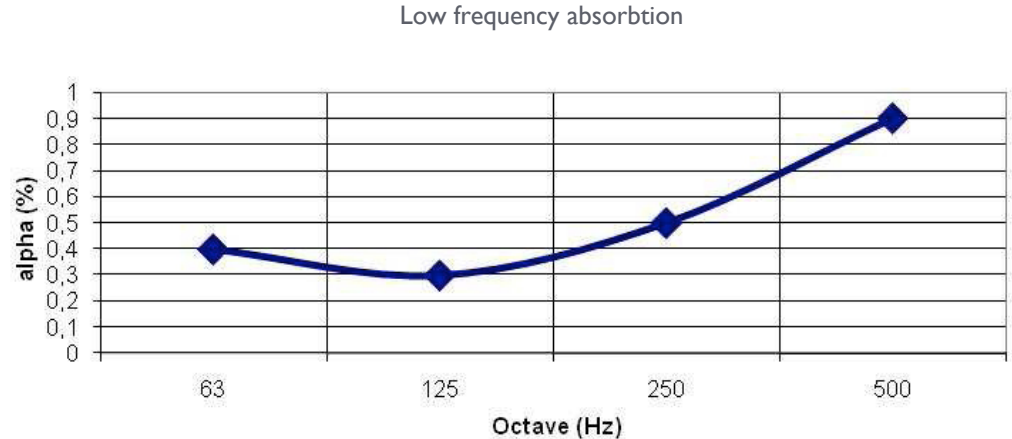
// Sound absorption at low frequency

p9.

The performance of Continuum solutions were measured in a 63m³ room with 5, 10 and 20 units, and subjected to constant noise.

Absorption was calculated with continuous room acoustics equations using the Eyring absorption formula.

The values obtained are shown in the following graph.

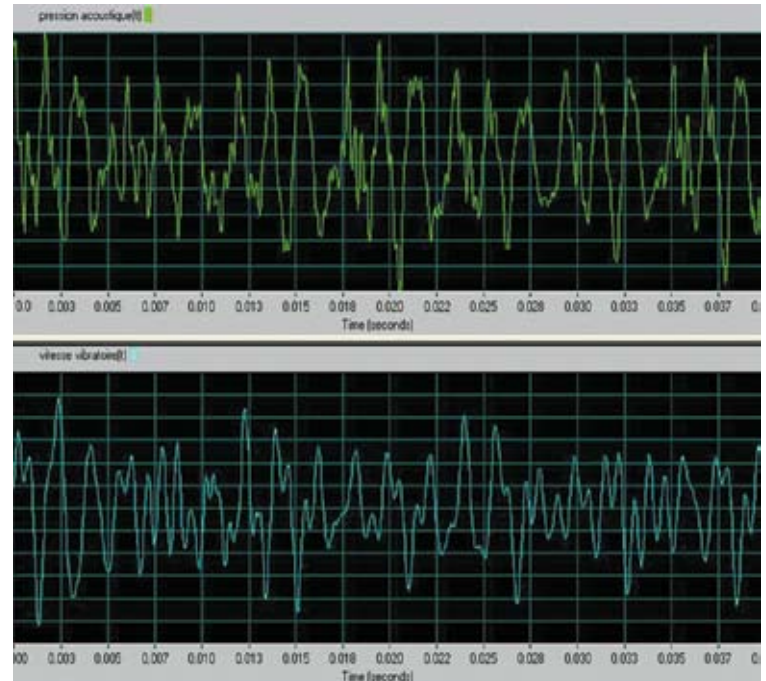


Sensitivity for added uniformity and comfort.

To highlight the sensitivity of Continuum Solutions and to demonstrate their ability to react to the slightest change of sound environment, we recorded in realtime the signal of the instantaneous vibration velocity, itself measured using a laser vibrometer focused at a set point in the panel as well as acoustic pressure induced by the voice of a speaker stood nearby and measured using a microphone.

The experiment is described in the illustration and on page 11.

The illustration shows the correlation between the time signatures of both signals when a sentence is pronounced in a normal voice. This perfectly reflects Continuum Solutions reactive behavior even at very low intensity.



p11.

//Alpha w sound absorption coefficient

Given the above data, Continuum solutions' overall absorption coefficient estimated in accordance with European standard EN ISO 11 654 is equal to: **Alpha w = 0.8 (H)** which puts Continuum solutions in the B class category of absorbers.

It should be noted that this performance is obtained with a footprint of just 45 mm, without the presence of a rear plenum, thus minimizing the surface lost in a typical room at medium volume.

NRC Index.

The NRC index "Noise Reduction Coefficient" of Continuum solutions in accordance with American standard ASTM 423 is equal to: **NRC=0,85**



The reverberation time (RT) is the main criterion for characterizing a confined space. It is directly linked to the absorbing performance of walls. Simple formulations (Sabine) can be used to correlate the performance of a treatment to an RT estimation.

Again there is no universal objective but general business rules, certifying the vocation of the premises.

These rules should be defined in the field of industrial premises.

This example shows the extent of correction it is possible to obtain in a 63m³ confined space with little reverberation using Continuum Solutions.

One should however be careful not to stake everything on the overall value and look first for example at the smallest value.

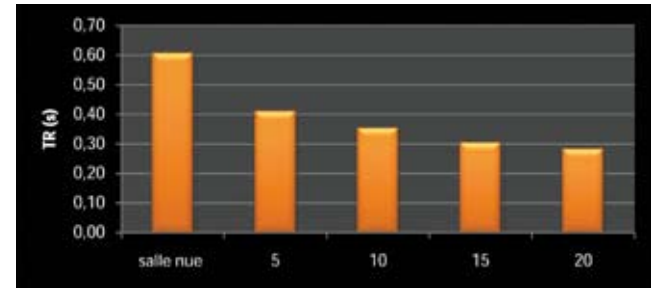
Overall, a good balance of sound is obtained through the balanced distribution of the spectral response of the room.

This can be achieved using broad spectral range correctors.

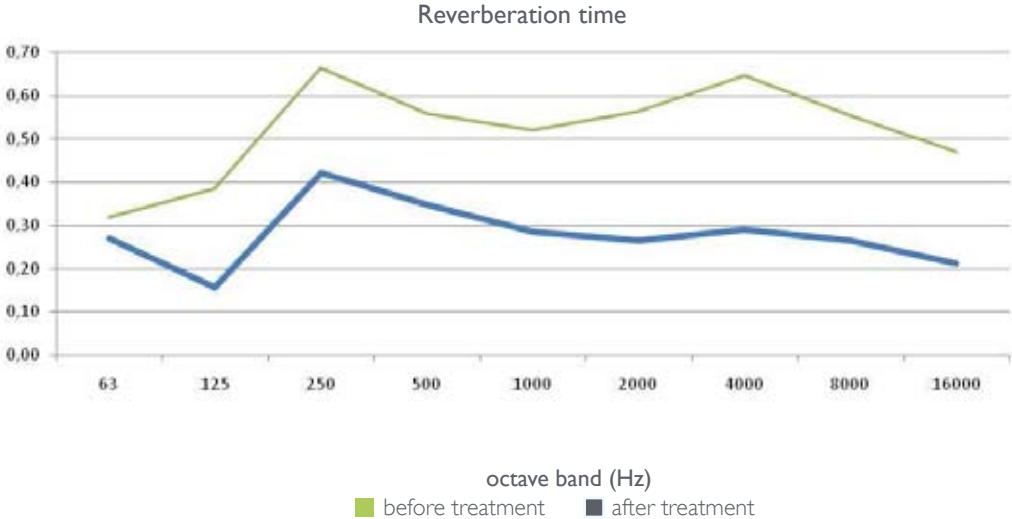
With their wide bandwidth, Continuum Solutions can achieve this goal more easily.

Presented below is an example of room equipped with Continuum solutions where the RT was reduced and relatively constant over a wide frequency range.

TR evolution with the number of Continuum Solutions applied.



The Software developed by Marmonier is dedicated especially to determining the optimum acoustic correction in enclosed spaces depending on their intended use. The software can advise on the ideal number of Continuum solution elements to install using a large number of parameters that simulate a variety of real environments.



The clarity index C50 (speech) or C80 (music) which as a reminder is defined as being the ratio of early sound energy (that which arrives at the listener within 50 or 80 milliseconds of the sound source) to late sound energy, arriving at the listener after (reverberation) is increasingly used to define the sound qualities of a room.

Given the role of said room and the variety of spectral signatures of the signals (speech, music), the geometry of the enclosed spaces and the measuring point, it is not possible to define a universal optimum value, but we give the possible variations as an example of this index in a 63m³ room with a 14m² treated surface (25% of the surface of walls).

	Before treatment	After treatment
Reverberation time	0.59	0.30
Clarity Index C50 in dB (speech)	4.9	10.3
Clarity Index C80 in dB (music)	8.9	17



Laws of sound propagation in confined spaces highlight the stationary wave phenomena that will spread acoustic energy preferentially according to well-defined spatial modes.

Frequencies associated with the first axial and transverse modes are generally very low and have only little impact on sound pressure measurements expressed in dB.

However, their impact on the perception of sound, especially in the field of music reproduction, can be crucial.

Given the success of multi-channel audio systems, it is becoming increasingly important to research acoustics and limit focus points and spatial inconsistency for comfortable listening in an area that is no longer limited to a single chair (smart point).

By inducing reactive impedance on walls equipped with Continuum solutions, stationary waves settling in the room have much less amplitude and audio message return is more homogeneous.

There is currently no normative factor to our knowledge that characterizes this phenomenon because it is relatively difficult to measure.

For example, we identified the first modes in our test room with the swept sine technique and measured a point of maximum mode amplitude both with and without the continuum solutions.

A 2 dB reduction on average was obtained.

Generally, background noise of a room has low frequency components from sources that can be close and distant, and from various sources (nearby factory, mechanical ventilation, elevator shaft ...).

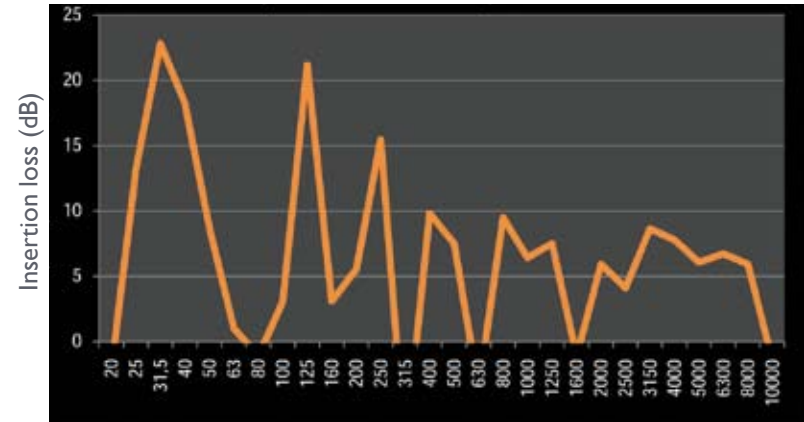
It is now recognized that exposure to even low levels of noise at high BF sound components has a negligible effect on the discomfort felt by an individual, when said individual experiences the noise over a long period. Furthermore, it has been proven that the productive capacity of individuals is reduced in a noisy atmosphere.

In our tests, Continuum solutions have shown that thanks to their low frequency properties, this background noise can be reduced and can therefore contribute to the improvement of comfort in areas where there is no real uncomfortable background noise in terms of sound levels expressed in dB, but a constant background noise at low frequencies (hospital, library, country office...).



Continuum solutions can also improve sound insulation of the partition on which they are installed as soon as a defined part of its surface is covered. Regardless of the fact that the intrinsic absorption qualities of Continuum solutions will reduce noise levels in the confined space subject to the sound source, the sound level provided in an adjacent space will be reduced, not under the law of mass but by the fact that the reactive impedance Continuum solutions will move the maximum sound pressure, initially on the wall, onto the Continuum solution thus, just a few centimeters in front of the partition. This therefore reduces the incidence field hitting the wall and therefore reduces the energy transmitted. The insertion loss measured in our tests on a BA13 type industrial double wall increased by 6 dB overall. We can see the selective mitigation results on the following chart.

Sound Insulation
(on a BA13 type double wall)





//The Continuum range



Touch



Listen



Enjoy

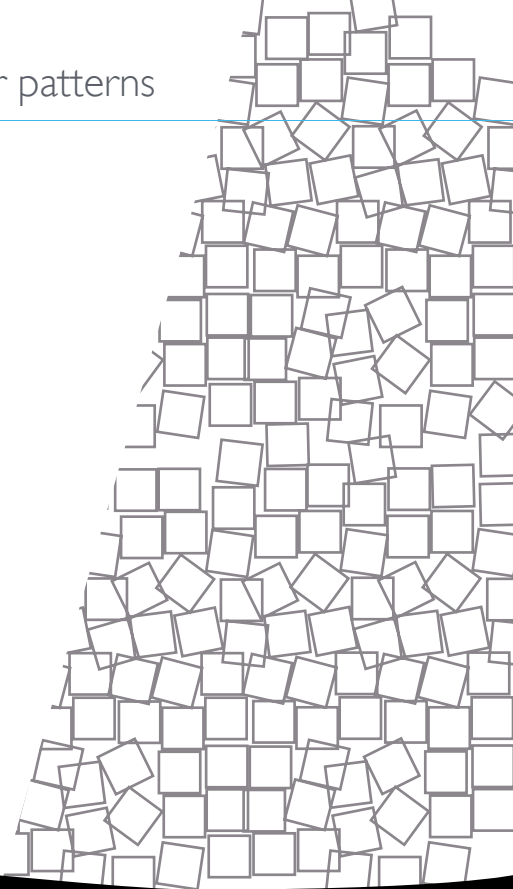
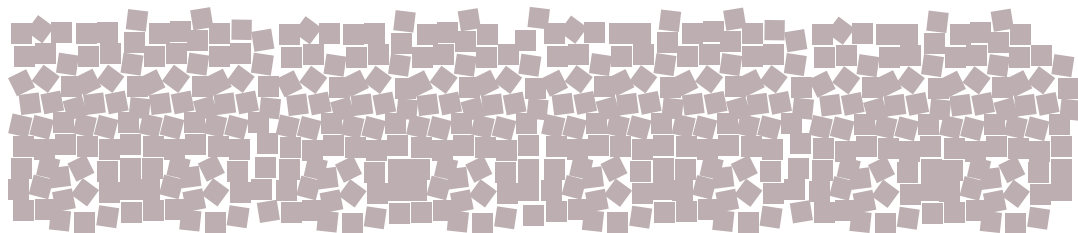
The secret to Continuum solution's specific aesthetics lies in its manufacturing process. A unique collection of delicate, subtle patterns have been designed by the Paradigm Design agency.

Enhance your acoustic comfort





Sound particles are their main theme.
A graphic representation of sound, rhythm and contemporary interpretation of frequency.





Amarande



Moutarde



Taupe



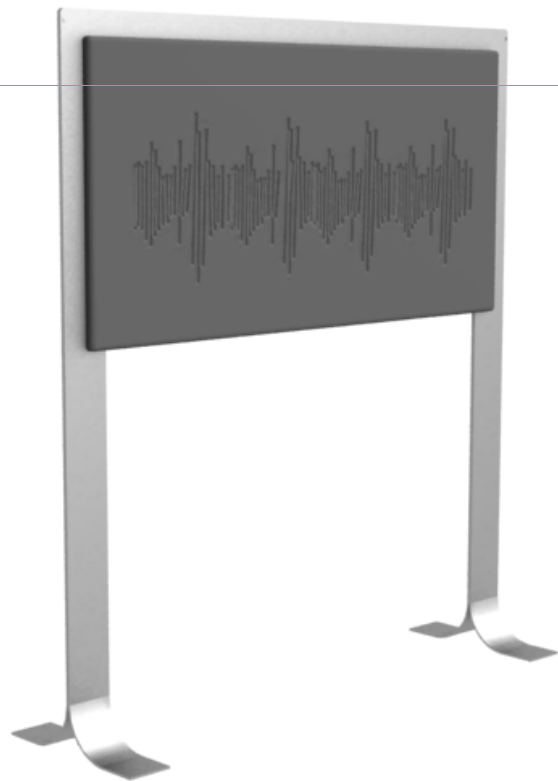
Bleu d'Anvers



Sable



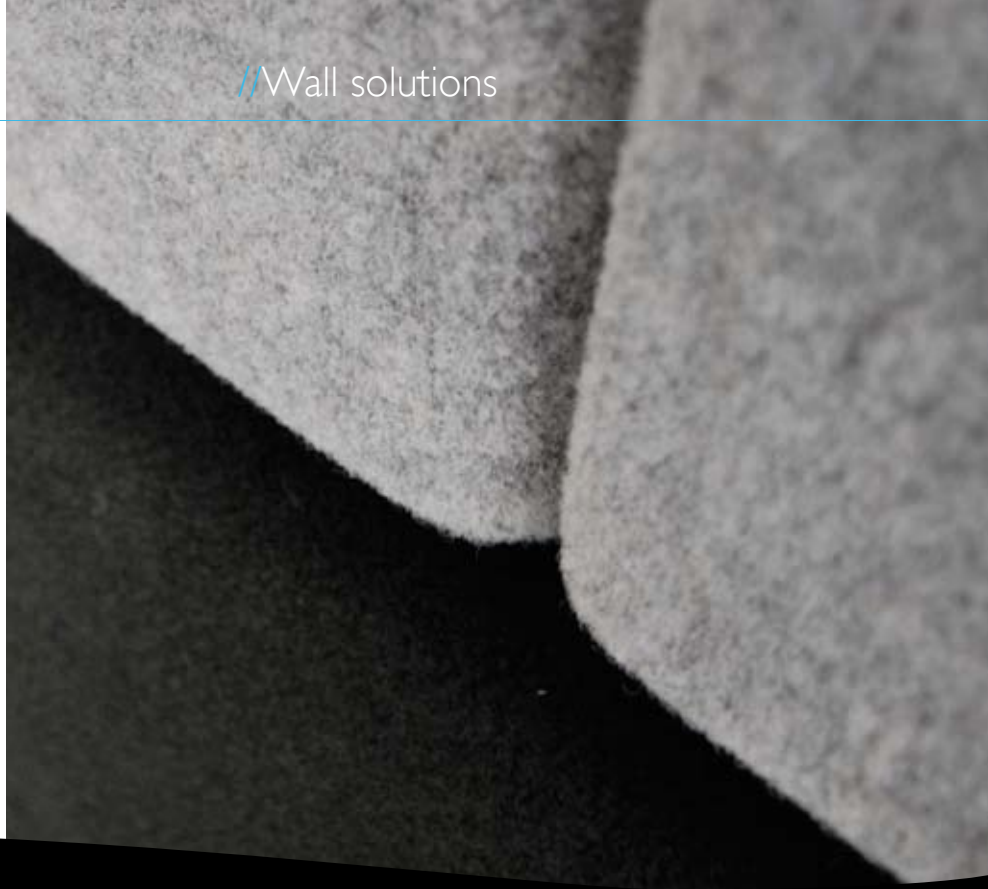
Tourterelle





Thanks to their convenient format, Continuum Wall Solutions allow for great freedom in arrangement. We have developed patterns that can be positioned in any way you please.









//Contact

Marmonier, A team always ready to bring you the solutions you expect.
Feel free to get in touch.

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