Construction Systems and Products

ACOUSTIC AND THERMAL INSULATION FOR BUILDINGS

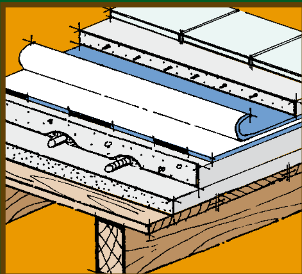
Solutions and products for the acoustic insulation of floors, walls, ceilings and roofs (DPCM 5/12/97) and thermal-acoustic assessment of walls and roofs (Legislative Decree 311/06)

ERRORS TO BE AVOIDED AND CONSEQUENT DETERIORATIONS
page 24 and page 62

index "GBC Italia" Associated

Acoustic insulation of floor against foot-traffic noise
page 11

Acoustic insulation of floor against foot-traffic noise in floor heated rooms
page 36



Acoustic insulation of wood floor against foot-traffic noise
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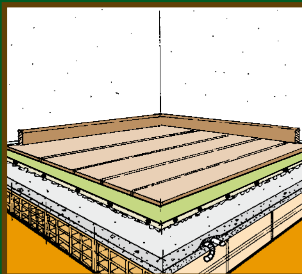

Acoustic insulation of floating wood floors against foot-traffic noise
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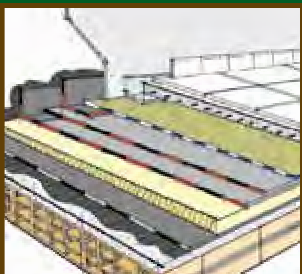

Thermal and acoustic insulation of terraces against foot-traffic noise
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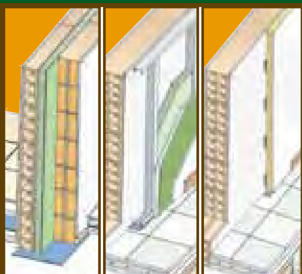

Thermal and acoustic insulation of internal wall against airborne noise
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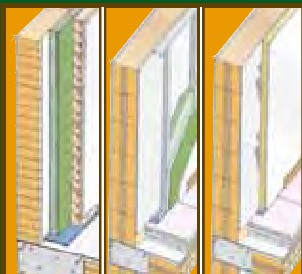

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Thermal and acoustic insulation of ceilings against airborne and foot-traffic noise
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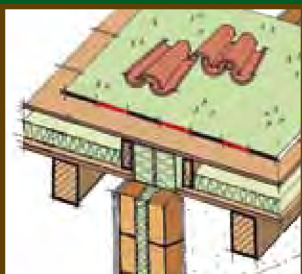

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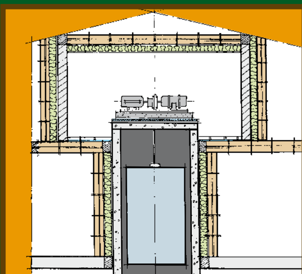

Thermal and acoustic insulation of the lift well
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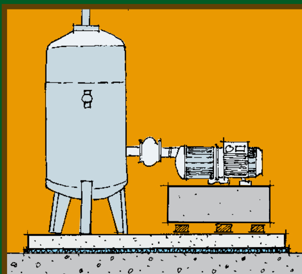

Acoustic insulation of technological systems
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Ed. 2010-1

Structure and organization

Research, innovation and training are the foundations on which Index has concentrated its efforts since the beginning of its business.
Established in 1978, Index soon became one of the most important companies in the world for the production of technologically advanced waterproofing mate-rials destined for the protection of residential, commercial, industrial buildings, major works and civil engineering. In the early 1990s, the company branched out its production, introducing new systems and products into the market like thermal and acoustic insulation, damp-proofing and tile adhesives.
Index is present throughout all the Italian regions and abroad with branches in Great Britain and France and over 100 distributors in the main countries of the five continents. It cooperates with a company called BITEC in America and with a company called UBE in Japan. Through its engineering division Index has sold production lines and Know-How in the United States of America, Japan and China.
Index is structured around five divisions that manufacture advanced systems and materials for the building market:

- **1st division. Waterproofing membranes, special, special multifunctional and also for the protection of man and environment. Lighterflex Strong - Waterproofing membranes. Super-adhesive waterproofing membranes: self-adhesive, self-heat-adhesive and heat-adhesive. Waterproofing and transpiring under-tile sheets. Canadian-style bituminous shingles.**
- **2nd division. Thermal insulation, in rolls and panels, coupled with waterproofing membranes. Acoustic and thermal insulation materials for floors, walls, ceilings and roofs.**
- **3rd division. Waterproofing liquids. Paints. Mastics. Sealants. Primer. Products for refurbishing asbestos cement sheets.**
- **4th division. Damp-proofing renders. Finishing coats restoration. Renewal of historical and modern buildings. Waterproofing cements. Shrink-resistant mortars. Protective coatings. Additives. Special resins for concrete and masonry.**
- **5th division. Adhesives and accessories for application of flooring and tiling in ceramic, natural and composite stones, mosaics and wood.**

YOU MAY FIND US IN OVER 100 COUNTRIES WORLDWIDE

Research and innovation

Index continuously invests in research and development of systems and innovative products in its own laboratories in association with University Institutes and Italian and foreign Quality Control Institutes to supply the market with high-quality and long-lasting products.
Research is what created INDEX and INDEX does indeed find its future in research.
The Research and Development Centre continuously and constantly works at developing and optimising the products. This Centre employs technicians of various specialised skills who often use sophisticated instruments that are often an exclusive patent by Index.
Thanks to its laboratories, INDEX is able to regularly test the performance of the products and invest many resources to develop and design new hi-tech, easy-to-use products. The innovation of production processes is also of prime importance and must go hand in hand with laboratory research.

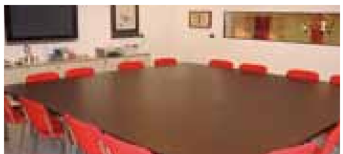
Training advancement and Auditorium

Index is a firm believer in the importance of training, since human resources, at any position they hold in a Company, play an ever-increasingly important role every day. Therefore they must be constantly trained and updated in order to obtain the best performance, professionalism, and adaptation to the continuous changes of the market, that is innovation and constant improvement.
Based upon these principles, we have established our AUDITORIUM, a modern, rational and welcoming structure consisting of an Aula Magna hall which seats up to 250 people, a Training room seating 40, a Meeting room seating 20 and a Training and Technical Refresher Course Centre, where master craftsmen from Italy and abroad teach the correct application of systems and products. Since 1997, the year in which it started, the Auditorium has hosted tens of thousands of people.

External view

Lecture Hall

Training Room



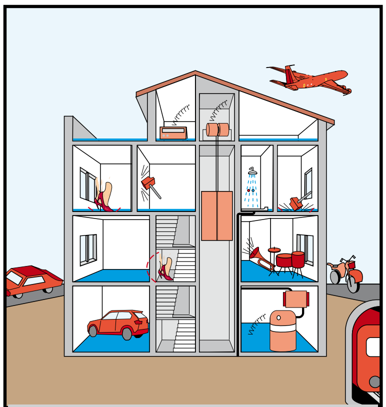
Meeting Room

Centre for training

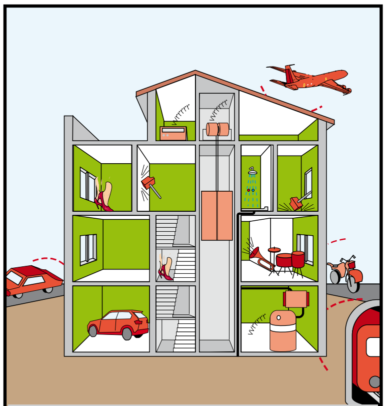
Centre for training

INDEX

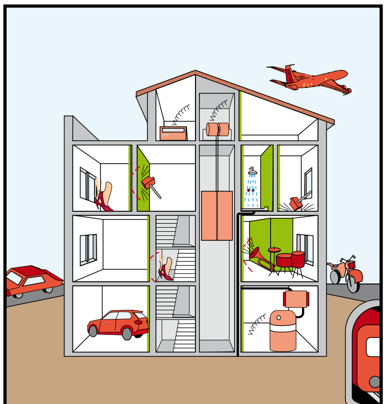
note: The images of the products illustrated in the Guide are to scale.



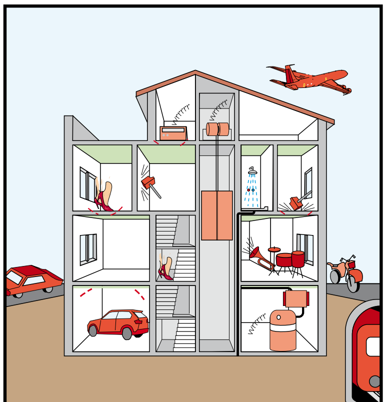
Acoustic insulation
of floors



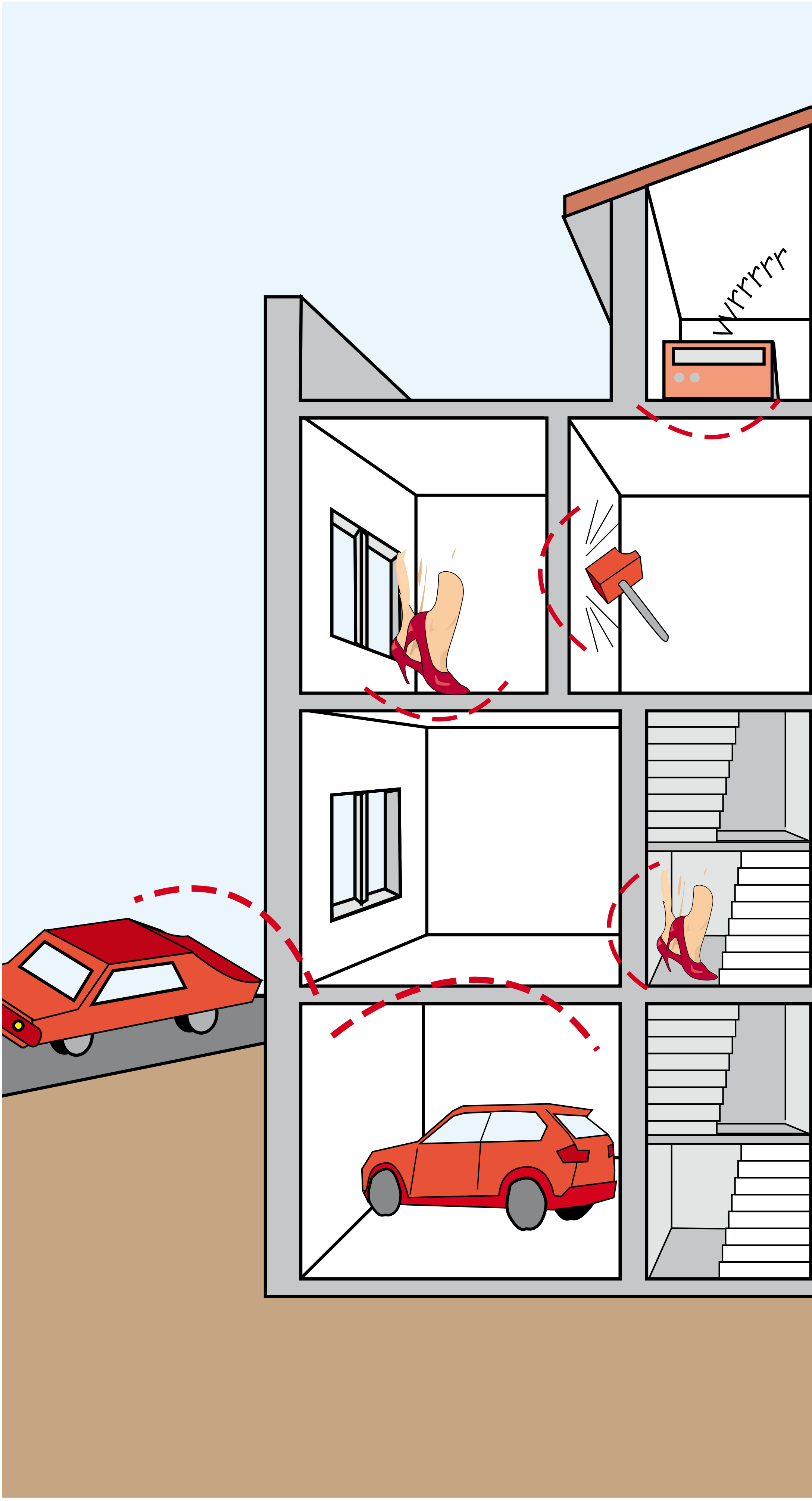
Thermal and acoustic
insulation of external wall

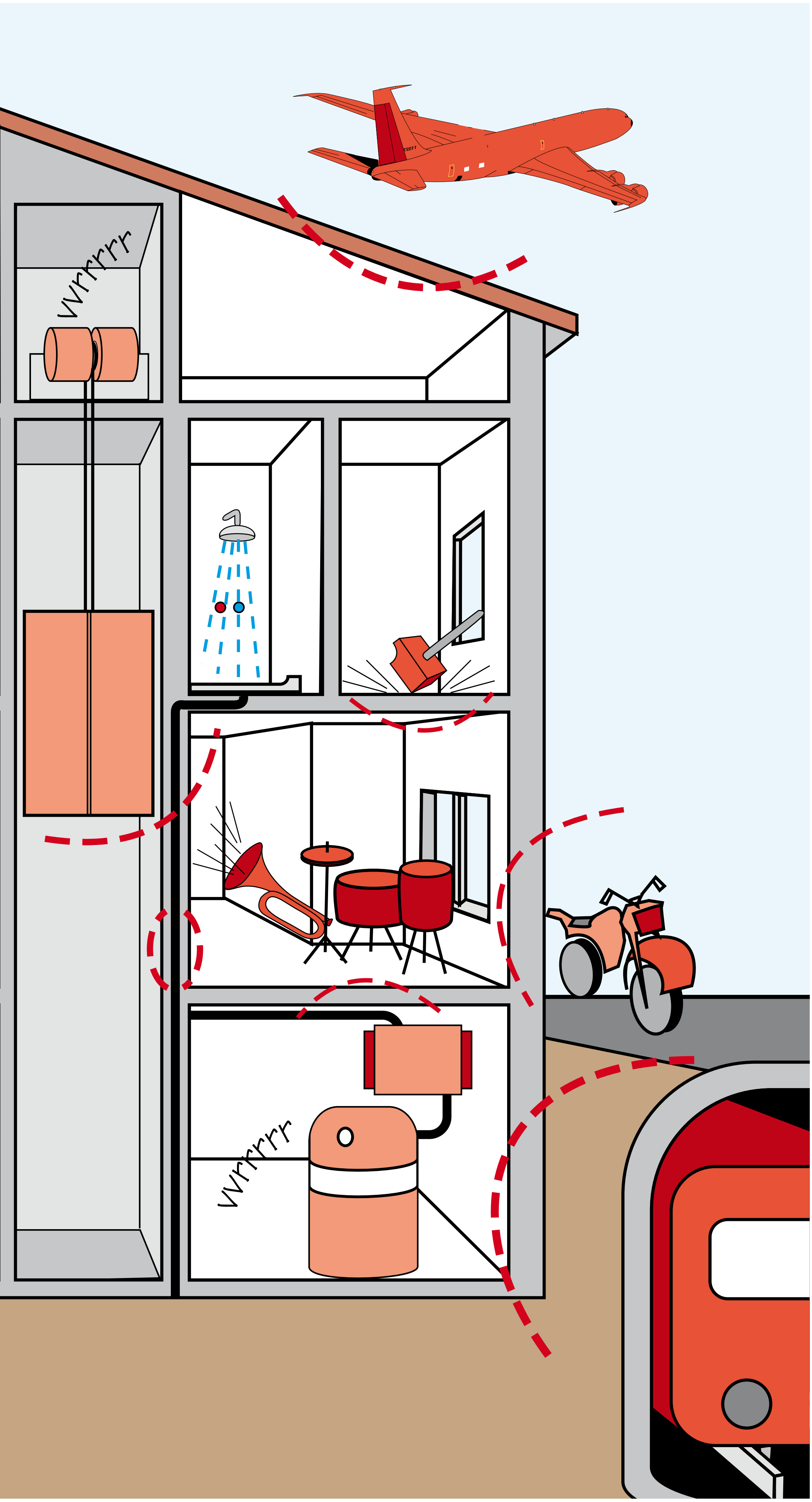


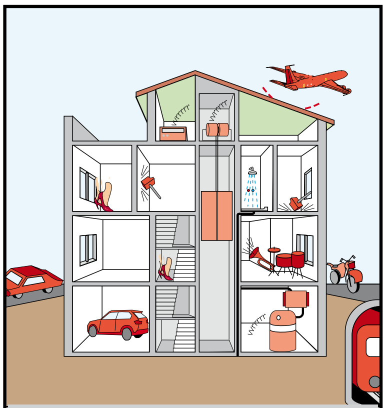
Thermal and acoustic
insulation of internal wall



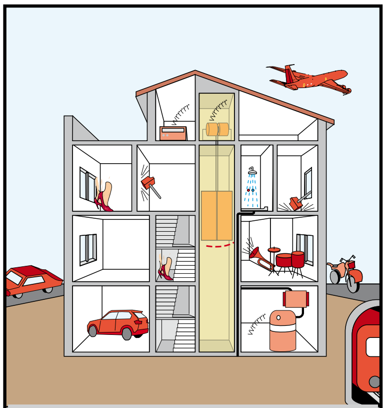
Thermal and acoustic
insulation of ceilings



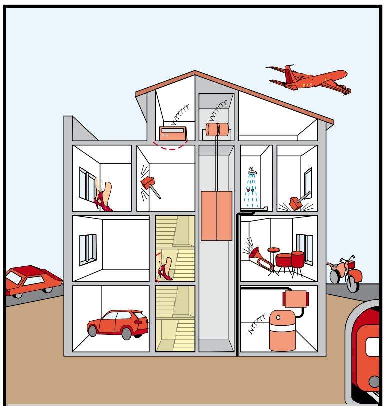




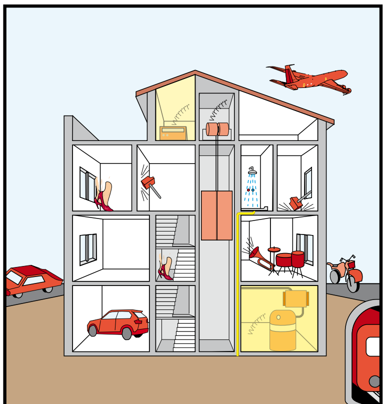
Thermal and acoustic insulation of roofs



Thermal and acoustic insulation of lifts



Acoustic insulation of stairs



Acoustic insulation of systems

D.P.C.M. December 5th, 1997

ESTABLISHING THE PASSIVE ACOUSTIC REQUIREMENTS OF THE BUILDINGS

Art 2 of DPCM of 5 December 1997, distinguishes dwellings - as specified in art 2, sub-paragraph 1, letter b), of law 26 October 1995, no. 447 - in the categories shown in the following table:

The DPCM of 5th December 1997 lays down the following limit values of the quantities determining the passive acoustic requirements of buildings and their components during construction and of the internal sources of noise.

CATEGORIES		THE APPARENT SOUND INSULATING POWER OF THE WALLS SEPARATING TWO DIFFERENT DWELLINGS R'_w	ACOUSTIC INSULATION OF THE BUILDING'S FAÇADE $D_{2m,nT,w}$	THE FOOT-TRAFFIC NOISE LEVEL OF A STANDARD-CONFORMING FLOOR L'_{nw}	THE LEVEL OF ACOUSTIC PRESSURE OF THE SYSTEMS OR SERVICES AT NON-CONTINUOUS OPERATION L'_{ASmax}	THE LEVEL OF ACOUSTIC PRESSURE OF THE SYSTEMS OR SERVICES AT CONTINUOUS OPERATION L'_{Aeq}
A	Residential buildings or buildings assimilated as such	50	40	63	35	35
B	Office buildings or buildings assimilated as such	50	42	55	35	35
C	Building used as Hotels and pensions, and buildings assimilated as such	50	40	63	35	35
D	Bdgs. used as Hospitals, clinics, nursing homes and buildings assimilated as such	55	45	58	35	25
E	Bdgs. used for school activities at all levels, and buildings assimilated as such	50	48	58	35	25
F	Buildings used for recreation, worship and buildings assimilated as such	50	42	55	35	35
G	Buildings used for commercial activities and buildings assimilated as such	50	42	55	35	35

The classification, limits and physical quantities prescribed by DPCM of 05/12/97

The Decree classifies buildings according to their intended use and then establishes the following parameters:

- Acoustic insulation of the building's façade: $D_{2m, nT, w}$
- The apparent sound insulating power of the walls separating two different dwellings: R'_w
- The foot-traffic noise level of a standard-conforming floor: $L'_{n w}$
- The level of acoustic pressure of the systems or services at
  - non-continuous operation: L_{ASmax}
  - continuous operation: L_{Aeq}

note: important - the higher the sound insulating power R'_w, the higher the insulation. On the contrary, the lower the fooot traffic noise level L'_{nw}, the higher the obtained or aimed for level of insulation.

NOISE

Noise is an unpleasant, non-harmonic sound. At very loud levels, it can cause permanently alterations to human physiology. But, even at lower levels, it can cause stress and imbalance of the nervous system.

Noise is becoming more and more typical of modern life. It ranges from 20 dB of leaves moved by a breeze in the countryside, to 200 dB measured at the launch of Saturn missiles.

NOISE INSIDE BUILDINGS

Noise in buildings can be broken down into 3 categories according to origin:

• airborne noise;
• impact or percussive noise;
• noise produced by technical systems.

Airborne noise causes a wall to vibrate by means of pressure waves in the air, whereas percussive noise is produced by direct impact of a body on a wall or ceiling.

Airborne noise disturbs adjoining rooms, whereas percussive noise causes vibrations which spread through materials at a much greater speed than airborne spread and are transmitted through the entire building. This also applies to noise generated by the technical systems - this noise runs along the pipes.

SPREADING SPEED OF VIBRATIONS IN MATERIALS

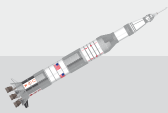
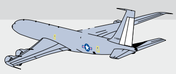
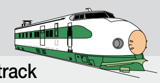
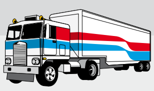
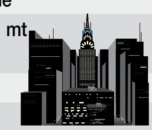
Material	Spreading speed
Steel	5000 m/sec.
Concrete	3000 m/sec.
Solid wood	1500 m/sec.
Water	1000 m/sec.
Air	340 m/sec.

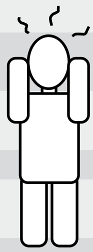
Walls are, in general, affected by airborne noise (voices, television sets, etc.) which generate pressure waves in the air to make the walls vibrate. These vibrations are transmitted to the air of nearby rooms thus transmitting the sound. Walls are only incidentally affected by impact, whereas floors, in addition to being affected by airborne vibrations, are mainly affected by impact (treading, dragging of furniture, etc.). In this case, impact energy, which translates into floor vibrations, is directly transmitted to the floor, and is much greater than the energy that can be transmitted by air from a sound source. Therefore, contrary to insulation from airborne noise - which can be obtained by increasing the weight of the partition - the problem of insulation against impact noise cannot be solved by increasing the weight of the floor.

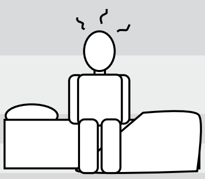
SCALE INDICATING THE INTENSITY LEVELS OF NOISE (dB A)

(abstract from "The noise primer" included in "Il mondo della tecnica" - UTET 1962 - vol. 2 - page 43 by Branch - 1970 page 2 and J.C. Migneron - "Acoustique Urbaine" - 1980 - page 12-13).

200	Saturn missile at launch at distance of 1 mt
140	Four-engined jet at take-off at distance of 25 mt
130	Automatic rock drill
130	High powered hydraulic press at a distance of 1 mt
125	Aircraft engine at distance of 7 mt
	– Threshold of pain –
120	Pneumatic drill
110	Car acoustic alarma at a distance of 1 mt
102	Train passing through an station
100	Outside of a train on overhead track High volume radio
97	Rotary press
93	Heavy traffic in city road
90	Authomatic lathe at a distance of 1 mt Noisy building site
84	Diesel truck at 60 km/h at a distance of 15 mt
80	Interior of a subcompact car at 80 km/h Heavy traffic
79	Printing press
77	Car at 100 km/h at a distance of 7,5 mt
75	City motorway 15 mt from edge
72	Background noise in an office
70	Television set at medium volume
60	Conversation at a distance of 1 mt Noisy office
44	New York at midnight
42	Background noise in air conditioned rooms
30	Sound level in a reading room
25	A whisper at 2 mt
15	Average hearing limit
0	High acoustic frequency hearing limit





ACOUSTIC PROTECTION OF BUILDINGS

Acoustic protection should be designed and executed jointly with thermal insulation. As is already the case in some European countries, the value of a building depends not only on the degree of thermal insulation, but also on the degree of acoustic insulation against noise coming from the outside, noise transmitted between apartments in the same building, and between rooms of the same apartment.

LEGISLATION FOR PROTECTION AGAINST ACOUSTIC POLLUTION

Italian legislators have issued a series of laws aimed at limiting the noise problem. The Italian law no. 447 of 26/10/95 defines the remit of the public bodies assigned to regulate plan and control both of public and private entities which can cause acoustic pollution.

This law deals with acoustic pollution both outdoors and inside dwellings, sufficient to cause bother, disturb rest and human activities, endanger human health, and worsen the ecosystem, etc. This law has already blossomed a series of implementing decrees and regional laws enabling application of the law, and other decrees and laws will follow. The new acoustic regulations refer to airport

noise, sources of noise in dance halls and discos, to the definition of acoustic technicians, and identify the competence of the Municipalities, etc.
These regulations and laws could not ignore acoustics in buildings. **The decree of the President of the Council of Ministers (hereafter "DPCM") of 05/12/97 was issued in regard to buildings. The decree was published in the Italian Official Gazette no. 297 of 22/12/97, and was entitled "Determination of the passive acoustic requirements of buildings". Not only does it specify the quantities to be measured, but it also prescribes the test methods and functional limits of the different intended uses of a building.**

THE NEW ASPECTS INTRODUCED BY THE DPCM OF 05/12/97 REGARDING THE LEVEL OF ACOUSTIC INSULATION OF BUILDINGS

As laid-out by outline law 447 dated 26/10/95, DPCM dated 05/12/97 sets the passive acoustic requirements of the components of the building on site. Prior to the decree, Italian laws prescribed some values just for subsidised buildings and for school buildings. The new legal system now introduces some important novelties, among which is one that stands out due to the deriving consequences, being that of measuring the requirements on site.
All this obliges additional awareness in laying the insulating materials, extra care in the constructional details preceded by meticulous planning of the acoustic project of the building with the assistance of a technician specialised in acoustics. Seeing as it is extremely costly to insulate a building once it has already been completed or while it is being built, if the project has not been assessed from the acoustics point of view and the spaces needed to include the thickness of the insulation are no longer available, it is appropriate to point out some fundamental points.
Laboratory tests on building components and/or insulating materials must be performed by qualified Institutes, in strict compliance with technical standards, to issue valid certificates for the forecast calculation, pursuant to current European standards, which the acoustics expert utilises to assess the building project, identifying the best solutions of insulation and reduction in lateral transmissions, assisted by the planner and the builder.
When the building project is presented, some regional and/or municipal regulations request adequate documents that prove compliance to DPCM 5/12/97, and in some cases, also identify some compliant solutions that can be "exempted" from testing.
This is why it is so important to check the laying conditions on site, not just of the acoustic insulation, but of all the various materials making up the building elements and that contribute in establishing the acoustic performance, avoiding unplanned initiatives on site that do not comply with the project.
To obtain the acoustic requirements foreseen by law, we believe the following is useful:

Art 2 of DPCM of 5 December 1997, distinguishes dwellings - as specified in art 2, sub-paragraph 1, letter b), of law 26 October 1995, no. 447 - in the categories shown in the following table:

The DPCM of 5 December 1997 lays down the following limit values of the quantities determining the passive acoustic requirements of buildings and their components during construction and of the internal sources of noise.

	Categories	R'_w	$D_{2m,nT,W}$	$L'_{n,W}$	L_{ASmax}	L_{Aeq}
A	Residential buildings or buildings assimilated as such	50	40	63	35	35
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  - continuous operation: L_{Aeq}

note: important - the higher the sound insulating power R'_w, the higher the insulation. On the contrary, the lower the fooot traffic noise level L'_{nw}, the higher the obtained or aimed for level of insulation.

- The building project should be assessed and/or written-out with the assistance of an acoustics expert.
- Materials and/or components certified by qualified laboratories should be used, making sure the test methods are those envisaged by national and European forecast calculation standards, without any deviations or differences compared to the original test method.
- The correct laying of the various materials making up the stratified elements of the building, for which a specific acoustic requirement is requested, should be checked on site.

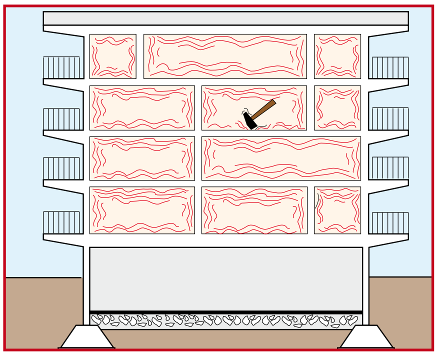
It could also be convenient to identify some "standardised solutions" for horizontal and vertical partitions on which some acoustic measurements shall be made on site to be able to continue the work and/or to file experience for future projects.
Consequently, with a slight increase in costs, the standard obligation could even become a resource and buildings are springing up on the market that are advertised to be insulated against noise at levels much superior to the minimum legal requirements and that are sold with certification of the acoustic measurement on site.

INDEX COLLABORATES WITH BUILDING COMPANIES AND PLANNERS

to obtain the legal requirements and firmly believes that the only way to achieve this is by training personnel. For this reason, on a periodic basis and on specific request, Index organises Technical Updating courses and Meetings concerning the various aspects of acoustic insulation for building companies, planners, acoustics experts and operators of the industry, which are held in the Aula Magna of its AUDITORIUM.
In this same structure, Index has also set-up a "Laying School" to teach workers how to apply the various insulating materials correctly with special attention to care for details.

ACOUSTIC INSULATION OF FLOOR AGAINST FOOT-TRAFFIC NOISE

As we said in the introduction, noise generated by direct impact on the structure of the building spread very rapidly indeed throughout the building.

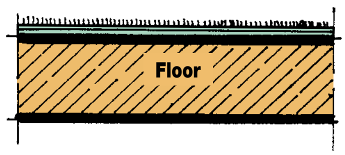


Such noise is described as “foot-traffic noise” because this is the type of noise that is repeated most frequently and continuously affects the building’s floors. If a floor is generally a sufficiently heavy structure to offer satisfactory protection against airborne noise, the structures most used in Italian construction offer sound insulating power $\mathbf{R_w}$ ranging from 47.5 to 53.4 dB (see the measuring campaign promoted by ANDIL). But such levels cannot be obtained when the floors are subjected to impact noise. In fact, such noise puts into play much higher energy levels than those of airborne noise and, by directly affecting the structure, they make it vibrate and transmit a louder noise.
During the standard-conforming foot-traffic test, the above mentioned floors normally transmit to the adjoining room foot-traffic noise levels $\mathbf{L_{nw}}$ of 70÷80 dB. Increasing the weight of the floor to reduce the disturbance is not a practical solution for impact noise, and the only possible solutions are:

INSULATION SYSTEMS AGAINST FOOT TRAFFIC NOISE

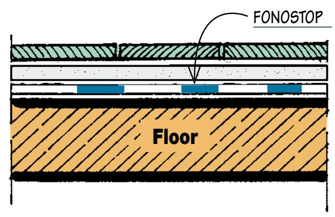
- Reduce impact energy at time of impact by inserting resilient flooring material between the blunt instrument and the floor.
  Carpets, frequency used in hotels, offers both excellent reduction of impact noise and high acoustic absorption.

FOOT-TRAFFIC NOISE
SOLUTION: MOQUETTE



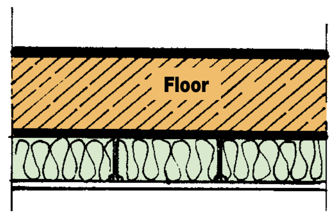
- Interrupt the continuity of the structure with soft, flexible material to stop vibrations. This is the case of the “floating floor”, which floats over flexible materials such as FONOSTOPDuo. A screed insulated from the structure is built, and can be floored with any type of material on which foot-traffic noise is localised and contained.

FOOT-TRAFFIC NOISE
SOLUTION: FLOATING FLOOR



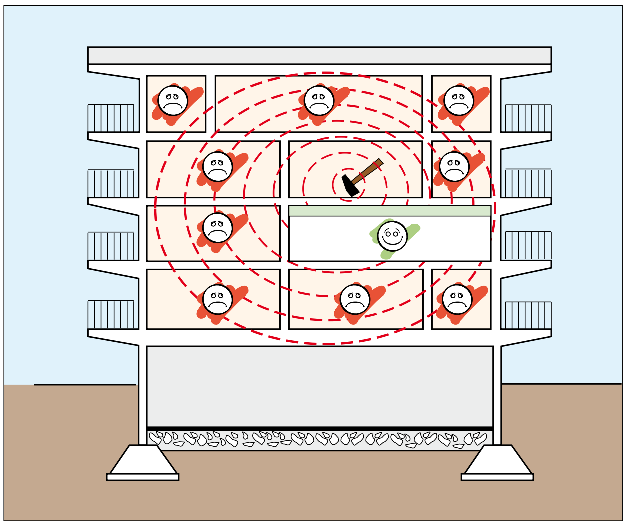
- Line the room “disturbed” by the noise with a false-ceiling of adequate weight suspended with anti-vibration hooks and with light false-walls in lined plaster and mineral or synthetic wool (see previous chapter). This is the ideal solution for inhabited rooms when no other type of action is possible.
  Nei primi due casi si blocca il rumore alla radice, impedendone la trasmissione alla struttura dell’edificio. Nell’ultimo caso si interviene solo sugli ambienti disturbati e le vibrazioni sono libere di propagarsi in tutta la struttura.

FOOT-TRAFFIC NOISE
SOLUTION: FALSE CEILING

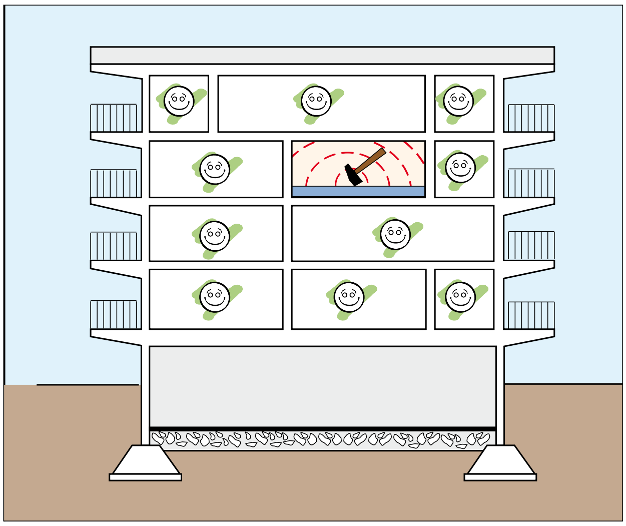


INSULATION OF FOOT-TRAFFIC NOISE

With the FALSE-CEILING, just the room with the false-ceiling is insulated.



With the FLOATING FLOOR, vibrations are not transmitted and the whole building is insulated.



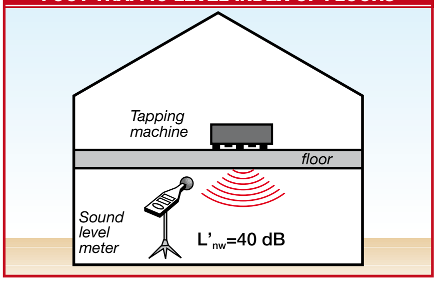
MEASURING THE LEVEL OF FOOT TRAFFIC NOISE OF THE FLOOR SLAB

DPCM dated 5th December 1997 (Premier's Decree) establishes the maximum levels of foot traffic noise admitted based on what the buildings are to be used for and also how they are to be measured on site. The test is carried out by measuring the level of noise produced in the room underneath/next door when a standardised tapping machine is tapped on the floor slab involved (see test schedule and equipment in the illustrations that follow). From the test schedule, you will notice that **higher the level of insulation of the floor slab, lower will be the level of noise measured in the room underneath.**

TAPPING MACHINE

SOUND LEVEL METER

L'n,w - TESTING OF THE STANDARDISED FOOT-TRAFFIC LEVEL INDEX OF FLOORS



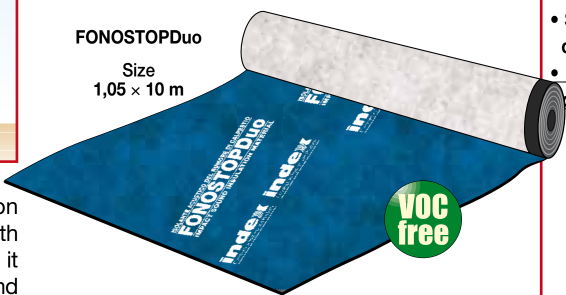
The index of the noise level measured on site, as requested by law, is expressed with symbol L'_{nw} and is measured in linear dB's; it represents the noise transmitted directly and indirectly, which is measured in the receiving room. The index of the reduction in the level of foot traffic noise ΔL_w, again expressed in linear dB's, is used to plan the insulation of rigid cement floor slabs with mass per unit area of 100÷600 kg/m²; it represents the typical insulation contribution added to a bare cement floor slab by a screed with known mass per unit area (weight per m²) floating on a specific resilient insulation product that has been measured through lab tests or that has been calculated, knowing the dynamic stiffness of the insulation material. Research institutes have still to prepare calculation models for elastic floors in wood and similar material, therefore, whilst waiting for experiments to result in a dedicated forecasting model, the ΔL_w involved cannot be applied to these as they are, as is the case for rigid floor slabs, but must be reduced by an amply cautionary factor. Outline law 447/95 states that measurements on site must be carried out by an acoustics expert registered with a competent regional department, and whose name is registered in the regional rolls published by each individual region. Tests carried out by a technician who is not registered with a competent authority or by the supplier of the insulation material may provide an indication to guide and correct the laying work of the insulation, whilst in the building phase, but they actually have no legal validity in terms of approval of competent authorities. The test is generally carried out by measuring the level of the noise caused by the tapping machine placed on the floor slab above the disturbed room, but can also be carried out in a room of a different dwelling on the same floor. The measurement is made when all the doors and windows have been installed, respecting the minimum distances and volumes foreseen in the UNI EN 140 p7e method in the living rooms of the dwelling. A solution to limit measuring problems is that of physically dividing the kitchen from the living room. Basically speaking, for most housing solutions, the bathrooms and kitchens are excluded and the measurements are made in the living rooms and the bedrooms.

■ THE FLOATING FLOOR WITH FONOSTOP SYSTEM

To prevent the transmission of impact noise in floor slabs, a soft and elastic material must be installed, either directly between the contusive body and the floor slab as, for example, in the case of carpets, or in the stratified layers of the floor slab. This second possibility is that which is commonly called a "floating floor". Index offers this solution with the combined use of FONOSTOPDuo, FONOSTOPTrio, FONOCELL and FONOCELL ROLL.

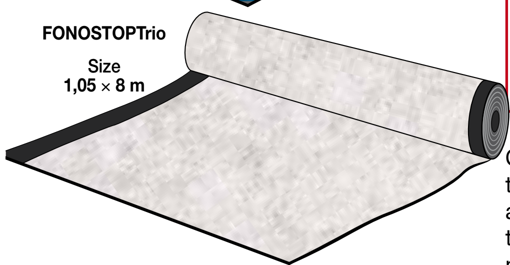
FONOSTOPDuo

Size
1,05 × 10 m

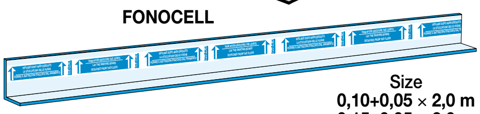


FONOSTOPTrio

Size
1,05 × 8 m

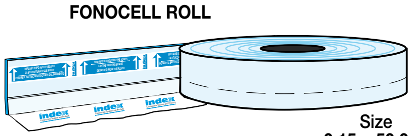


FONOCELL



Size
0,10+0,05 × 2,0 m
0,15+0,05 × 2,0 m

FONOCELL ROLL



Size
0,15 × 50,0 m

ADVANTAGES OF ACOUSTIC INSULATION BY A FLOATING FLOOR

- **It insulates against foot traffic noise and airborne noise.**
- **It blocks the noise at the root and prevents the transmission of vibrations throughout the whole building.**
- **The floating screed can be covered with all types of flooring.**

FONOSTOPDuo'S ADVANTAGES

- **FONOSTOPDuo is a highly efficient insulation product that complies with the acoustic requirements of foot traffic noise foreseen by DPCM dated 5th December 1997 that implements law 447/95. The law states that the level must be measured on site once the building has been completed, consequently the result also depends on the laying quality on site and not just on the materials used. It is certainly a sturdy and secure insulation material that does not move when the screed is laid and offers greater certainty of the required result.**
- **It insulates foot traffic noise with a thinner layer.**
- **FONOSTOPDuo is a punch-proof floor insulation product resistant to building site traffic.**
- **FONOSTOPDuo consists of resistant and elastic synthetic fibres that do not break and do not crush when folded or compressed.**
- **FONOSTOPDuo, even if thin and light, on the contrary to sheets of plastic foam material, does not move when the screed is laid thanks to the "Velcro effect" of the bottom face that stops if from moving, avoiding the formation of "acoustic bridges" which could annul the insulation work.**
- **It does not contain harmful substances.**
- **It resists foot traffic and punching.**
- **It is elastic, flexible and easy to lay.**
- **It is waterproof, rot-proof and resistant to microorganisms.**
- **Secure during laying, does not emit fibres, dust or gas when handling and laying it.**
- **Ministerial approval for its reaction to fire classification: Class 1**

FONOSTOPDuo achieved an important award

Compared to other systems, insulation with the floating floor system involves further advantages because, by installing the insulation against foot traffic noise in-between, the mass of the screed is separated from that of the floor slab, thus creating a "double horizontal wall", as is indeed normally done when insulating walls (see relative chapter), therefore the floating floor is not just insulated from foot traffic noise, but it also:

- reduces the lateral transmission of airborne noise of walls that cross the floor slab
- reduces the direct transmission of airborne noise of the floor slab

One must also bear in mind that a textile flooring is not always appreciated and other types of resilient floors do not always reach the same level of insulation as carpet.
Furthermore, one must also remember that in these cases, it is subsequently not possible to change the type of floor without having to create a floating screed. The “floating floor” solution in the case of new builds or total renovations similar to new builds, offers the widest freedom of choice of flooring materials, prevents the transmission of vibrations to the structure and offers a natural contribution in insulating against airborne noise.
FONOSTOPDuo is an acoustic insulation against foot traffic noise made up of a soundproofing foil coupled with non-woven elastic polyester fabric.
It is produced in rolls of 10×1.05 meters and has an overlap wing of 5 cm without non-woven polyester fabric.
FONOSTOPTrio is a triple layer insulation product against foot traffic noise for floor slabs made up of a sound-resistant foil coupled on both faces with non-woven soundproofing polyester fabric.
FONOSTOPTrio is an acoustic insulation for floors, which when combined with FONOSTOPDuo, reaches extremely high levels of insulation.
By combing the materials, modular foot traffic insulation projects can be accomplished that satisfy absolutely all requirements.
FONOSTOPTrio has two overlap wings so that the non-woven fabric on both faces of the sheet are laid over each other without seams when laying the sheets.

MODULAR ACOUSTIC INSULATION AGAINST FOOT TRAFFIC NOISE

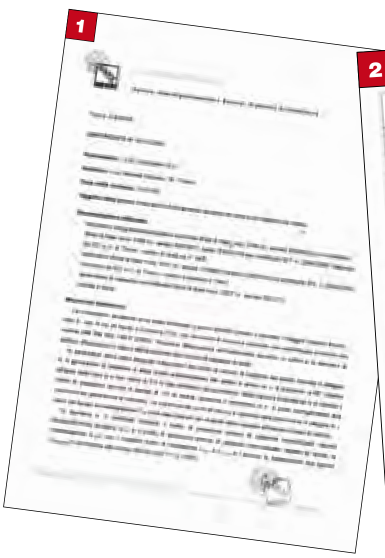
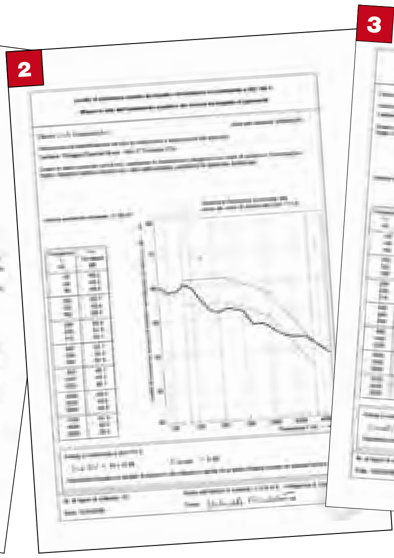
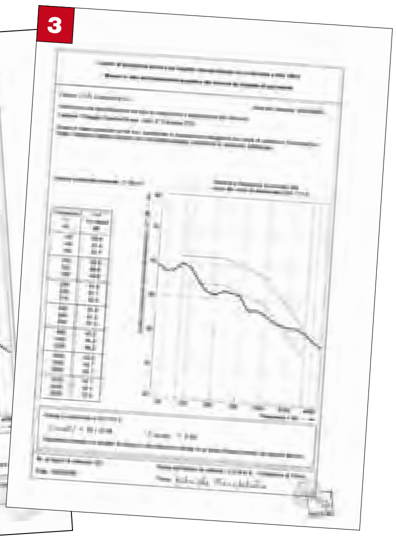
INDEX has designed and certified three insulation systems with dynamic stiffness range of 21 and 9 MN/m³.
The first, that of 21 MN/m³, is based on the laying of one layer of FONOSTOPDuo and is able to resolve insulation problems of the most commonly used floor slabs in the residential building trade.
By laying two layers of FONOSTOPDuo, instead of just one, you obtain a higher level of insulation.
By increasing the thickness of the soundproofing material, you reduce the dynamic stiffness of the insulating layer, which becomes 11 MN/m³ and consequently you increase the degree of acoustic insulation. In such case, the first layer is laid with the light blue face against the laying surface while the second layer is laid over the joining lines of the first with the light blue face facing upwards so that the two white non-woven fabric faces that represent the springs of the insulating system are laid against each other. To further increase the degree of insulation, you can use FONOSTOPTrio, the acoustic foot traffic insulation product, which combined with FONOSTOPDuo, allows you to achieve high insulation performance with dynamic stiffness of 9 MN/m³ that guarantees even superior levels of acoustic comfort.
The table that follows indicates the levels of foot traffic noise L'_{nw} and the increase in soundproofing power ΔR_w for a floor slab of 20+4 in clay-cement mix of 237 kg/m², with 7 cm of lightened foundation with a density of 800 kg/m³ that starts from a level of foot traffic noise of $L_{nw,eq}$=77,66 dB and soundproofing power of R_w=48,74 dB (screed included) insulated with floating screed of 5 cm (d:2000Kg/m³) on the three afore-mentioned systems, which can be calculated with the simplified calculation method foreseen in standard EN 12354-2.

	System	Dynamic stiffness	ΔL_w	L_{nw} insulated floor (K=3 dB)	ΔR_w
A	FONOSTOPDuo	21 MN/m³	28,0 dB	53 dB	7,63 dB
B	FONOSTOPDuo+FONOSTOPDuo	11 MN/m³	32,0 dB	48 dB	10,63 dB
C	FONOSTOPTrio+FONOSTOPDuo	9 MN/m³	33,5 dB	47 dB	10,63 dB

From the table, you will notice that for rigid floor slabs in concrete and cement-clay mix, bearing in mind the applicable safety coefficients, FONOSTOPDuo laid with the single layer method satisfies the requirements of 63 dB in almost all cases. System B, of FONOSTOPDuo laid with the double layer method, face against face is recommended when the maximum level requested is 55 dB while system C is reserved for particular cases where a superior degree of insulation is requested.

Measurements on site – Certificate of the “Institute of Technology of Turin”

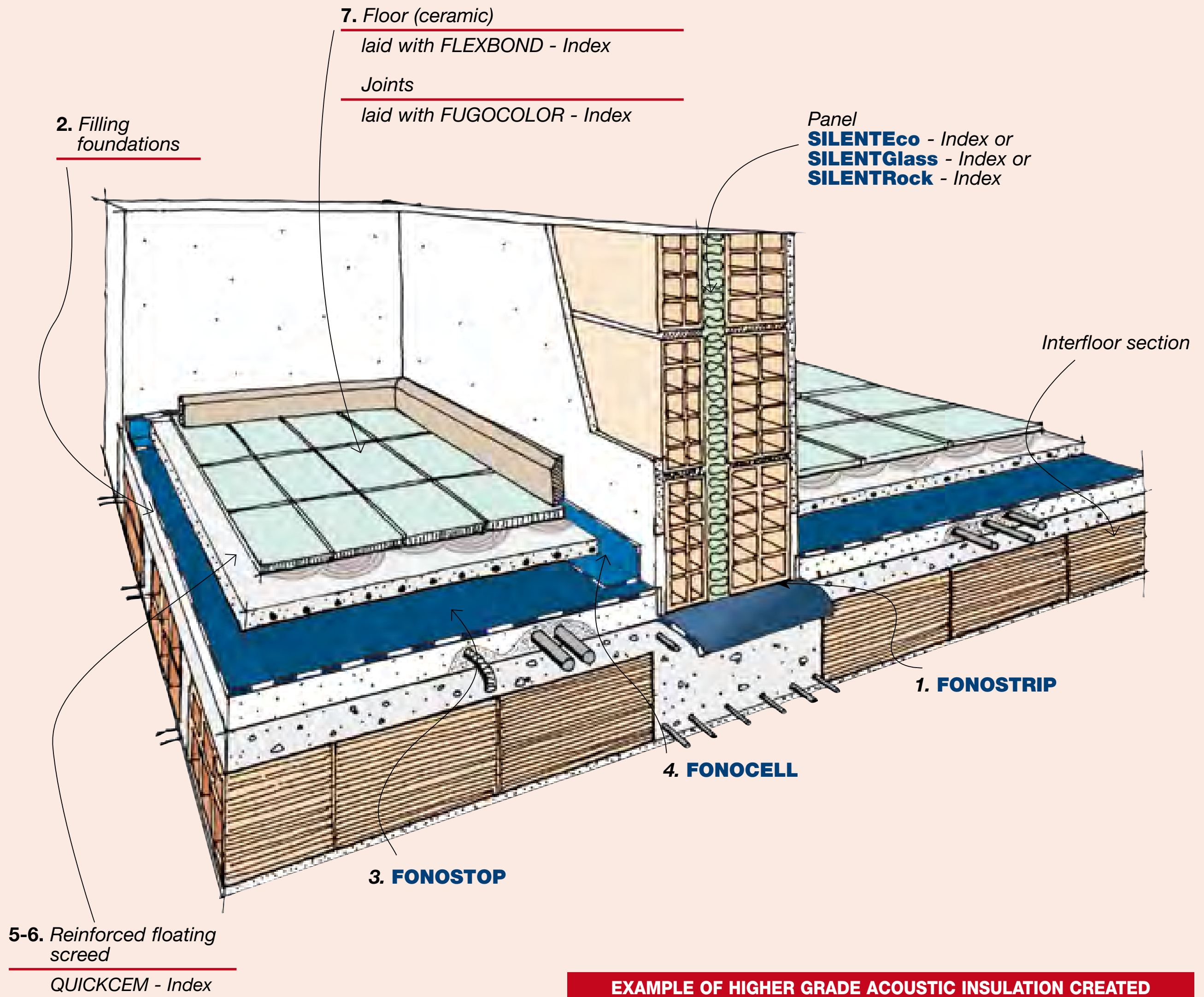
As you can see from the certificate illustrated, which was written by the Institute of Technology of Turin following measurements taken on site of a civil building in Cumiana (TURIN) insulated with one layer of FONOSTOPDuo, if the insulation product is applied correctly, paying particular attention to details, the results on site are very close to those obtained with the forecasting calculation; on this theme, please compare the measurements of 52 dB and 53 dB with the 52 dB calculated in the previous table for a floor slab of 20+4 insulated with a single layer of FONOSTOPDuo.

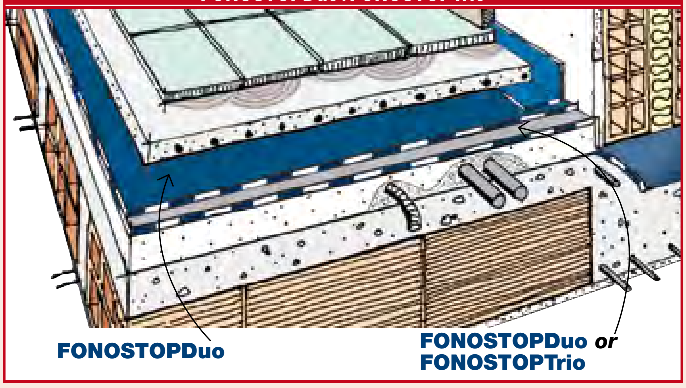

TECHNICAL INTERVENTION SOLUTIONS

NEW BUILDINGS OR FULL REFURBISHMENTS

ACOUSTIC INSULATION WITH FLOATING FLOOR TECHNIQUE



EXAMPLE OF HIGHER GRADE ACOUSTIC INSULATION CREATED BY MEANS OF A DOUBLE LAYER OF FONOSTOPDuo OR FONOSTOPDuo+FONOSTOPTrio

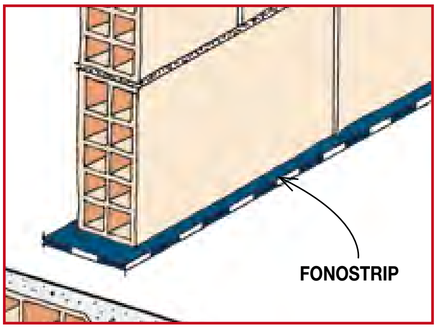


The specifications items are on page 91

LAYING METHOD

SUBSTRATE PREPARATION

Laying FONOSTRIP. The load-bearing floor slab is generally made of cement and brick. The insulating strips on which the dividing walls will be built are laid on this floor slab. FONOSTRIP is an elastomeric insulation product supplied in strips of different heights. It dampens vibrations on the walls. *A wall that is not insulated increases lateral noise transmissions.*



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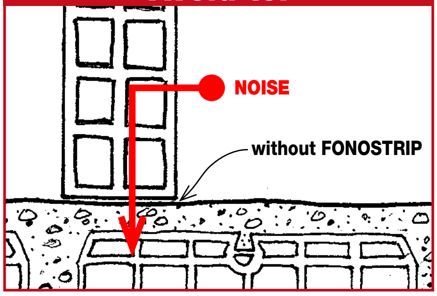
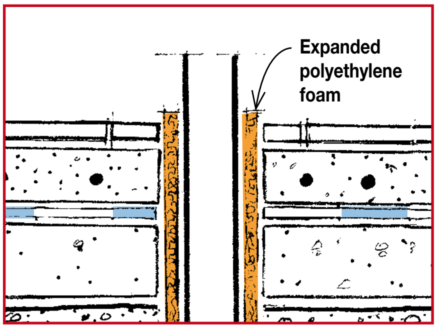


Acoustic insulation of piping. Wrap any pipes that cross the floor slab with adhesive elastic strips. *A pipe that is not insulated transmits noise.*



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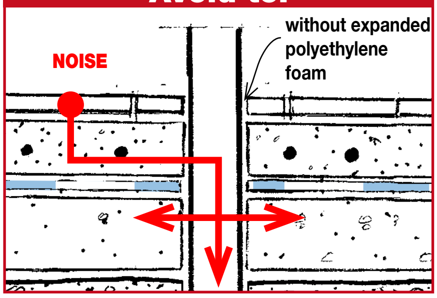
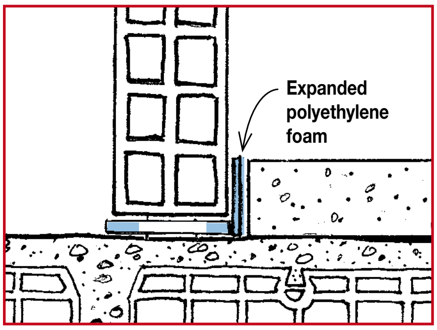


Lateral separation. Insulate the foundations from the walls with adhesive extruded polyethylene strips measuring 2÷3 mm in thickness and 1÷2 cm higher than the foundations. *Lateral noise transmissions will increase if the strip is not used.*



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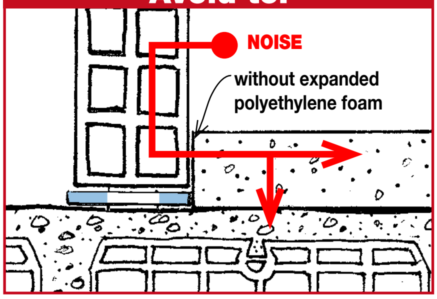
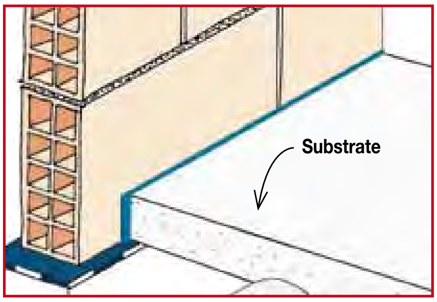


Filling substrate. The piping laid previously on the floor slab are embedded in the filling foundations and joined with cement mortar. Filling can be done using lightened concrete or sand stabilised with lime or cement (ratio 50÷100 kg/m³). The foundations shall be smooth and flat, free from bumps and dips. *Irregular foundations will cause the insulation to be squashed excessively, consequently noise will be transmitted.*



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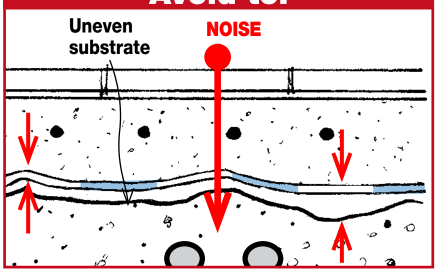
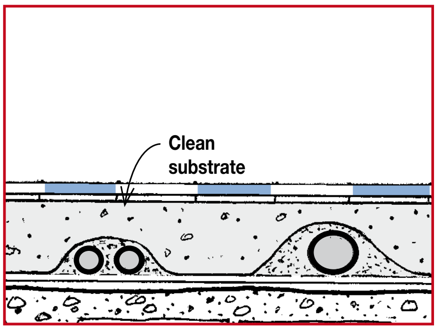


PLASTERING THE WALLS

Once the foundations have been laid, plaster the walls before laying FONOSTOP.

LAYING THE FONOSTOP

Clean the support. Make sure no dirt, lumps of mortar and plaster are left on the laying surface.
Dirt and irregularities could perforate the insulation material and reduce its acoustic insulation performance.



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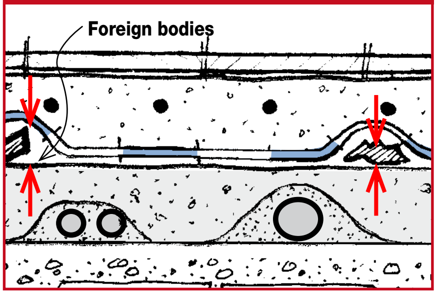
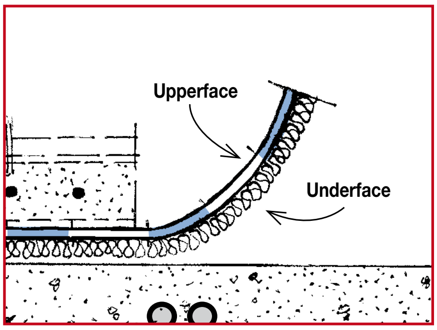


Laying FONOSTOPDuo in single layers. The insulation layer must withstand site traffic and must be made of durable and non-rotting materials.
FONOSTOPDuo is an acoustic insulation product against foot traffic noise that meets the afore-mentioned requirements. It offers very high performance even if rather thin. Lay the rolls out in their natural unrolling direction, making sure to arrange the bottom face (downwards) and the top face (upwards) as indicated for each type of FONOSTOP product.
If FONOSTOP is laid upside down, it would be soaked with mortar and consequently lose its insulating power.



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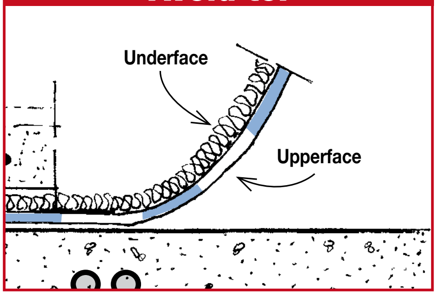
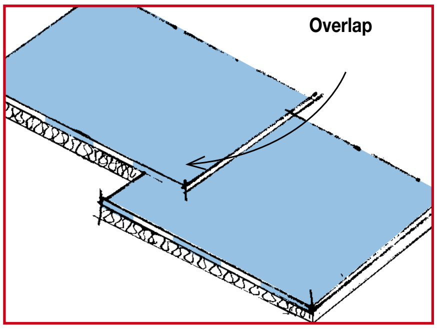


Side overlaps. FONOSTOPDuo has a built-in overlap wing of 5 cm. Overlap the sheets in the longitudinal direction along the special overlap strip, matching them up with care (except for FONOSTOPBar and FONOSTOPCell which are just set next to each other).
Incorrect overlapping could cause an acoustic bridge and reduce the insulating performance.



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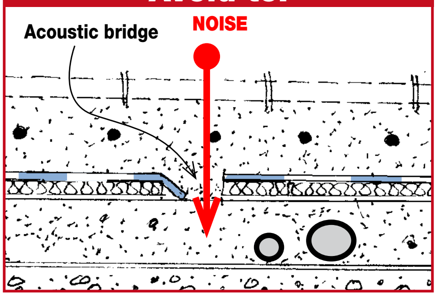
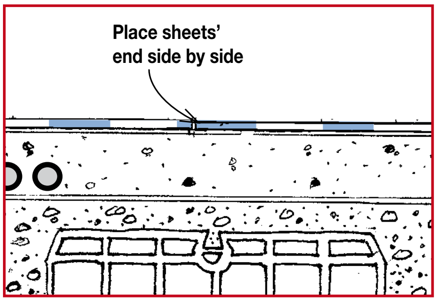
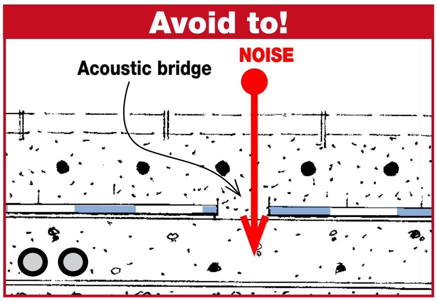
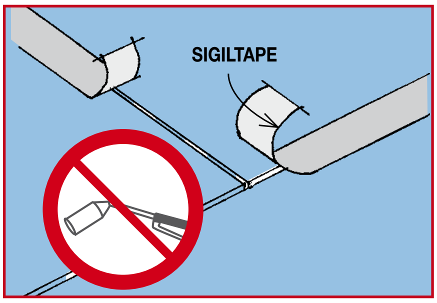


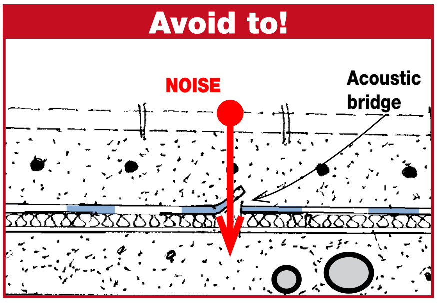
Sheet ends. Bring the ends of the sheets up to each other without overlapping them.
If they are not matched-up perfectly, they could cause an acoustic bridge and reduce the insulation performance.

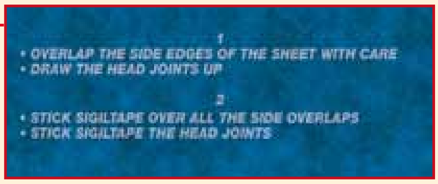




Sealing the sheets. Seal the side overlaps and joining lines using the special SIGILTAPE.
<u>There is absolutely no need to torch seal.</u>
If they are not sealed properly, cement mortar could seep through and create an acoustic bridge.



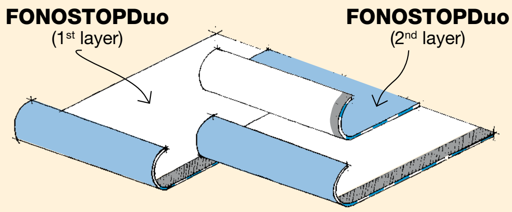




INDEX has customised the top surface finish of FONOSTOPDuo, by printing some important laying instructions on it in order to help the builder when preparing the floating screed to insulate against foot traffic noise.

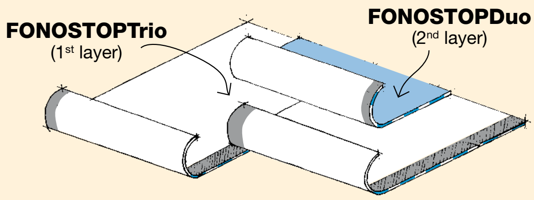
Laying in double layers. FONOSTOPDuo+FONOSTOPDuo

If FONOSTOPDuo is used in double layers, the **first one** will be laid "back-to-front", with the white part facing upwards, overlapping the sheets longitudinally along the special overlap strip and bringing the ends of the sheets up to each carefully without overlapping them.
The joining and overlap lines are not to be sealed and the sheets are trimmed-off at the foot of vertical parts. The sheets of the **second layer** will be laid with the white part facing downwards, parallel with the sheets of the first layer and over their joining lines. The sheets overlapped longitudinally along the special overlap strip, in the transversal direction, will be carefully brought together, end-to-end without overlapping and will be trimmed-off at the foot of vertical parts. The overlaps and the joining lines will then be sealed with the special adhesive tape. The rest of the laying phases are the same as for the single layer.



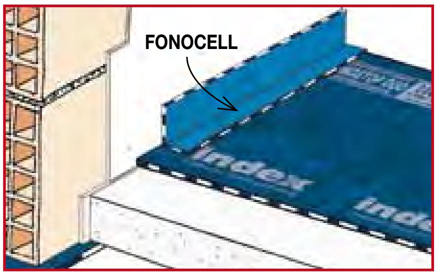
Laying in double layers. FONOSTOPTrio+FONOSTOPDuo

When laying FONOSTOPTrio combined with FONOSTOPDuo, the **first layer** will be FONOSTOPTrio having white non-woven fabric on both faces and two overlap wings set opposite each other. The sheets will be laid on the laying surface, overlapping them longitudinally along the special overlap strips. The ends of the sheets will be brought up to each other carefully without overlapping them. The sheets will then be trimmed-off at the foot of vertical parts and the overlap and joining lines will not be sealed.
The **second layer** will be sheets of FONOSTOPDuo laid over the overlaps of the first layer and parallel with it. The sheets will be overlapped in the longitudinal direction along the overlap strip arranged on the sheets and brought together carefully in the transversal direction without overlapping the ends. The sheets will be trimmed-off at the foot of vertical parts and the overlap and joining lines will be sealed carefully using the special adhesive tape. The rest of the laying phases are the same as those for single layer.



CREATING THE SCREED

Laying FONOCELL. The reinforced floating screed will be separated from the projecting walls using a self-adhesive strip of extruded polyethylene, which is available in two versions - FONOCELL and FONOCELL ROLL. *If FONOCELL is not used, an acoustic bridge would be created, consequently reducing the insulation performance.* <u>*Do NOT turn FONOSTOP over so as not to damage the screed.*</u>



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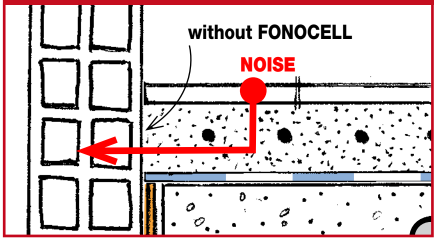
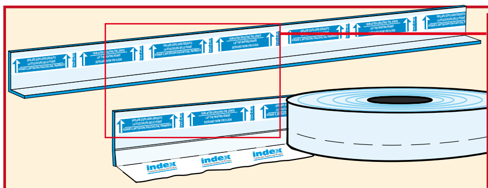




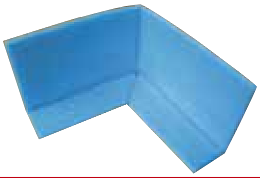
INDEX has customised FONOCELL and FONOCELL ROLL, by printing some important laying instructions on it in order to help the builder when preparing the floating floor to insulate against foot traffic noise.

The corners

FONOCELL is also to be laid so that it sticks into the corners and must perfectly follow the perimeter of the room. *If FONOCELL is not laid in adherence with the walls, it could be damaged when laying the screed.*

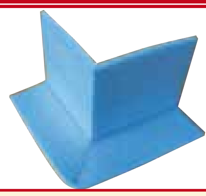
FONOCELL ANGLE

<u>Internal angle</u> version



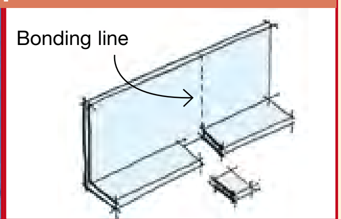
FONOCELL ANGLE

<u>External angle</u> version

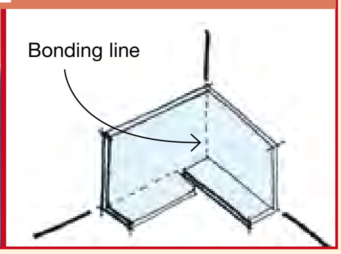


INTERNAL ANGLE made with FONOCELL

1

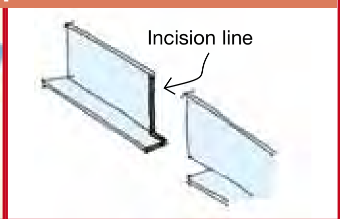


2

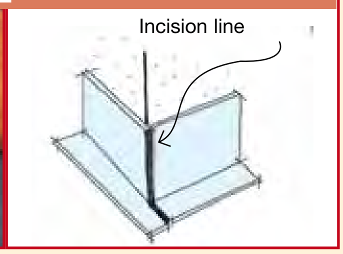


EXTERNAL ANGLE made with FONOCELL

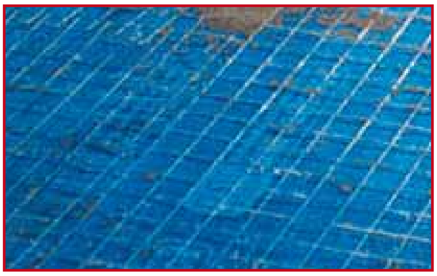
1

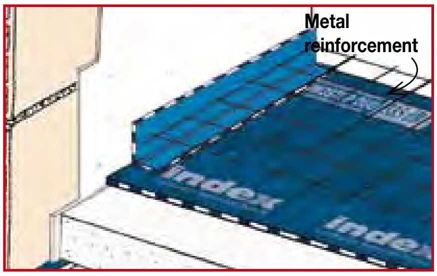


2



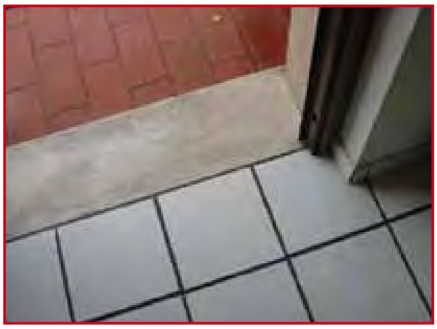
Laying the metal reinforcement. Always lay reinforced cement-based screeds. The reinforcement of the screed will consist of electro-welded galvanised metal mesh (mesh size 5x5 cm approx.) or of reinforcements with similar performance. *If no reinforcement is used, the screed could break with possible deterioration in performance.*

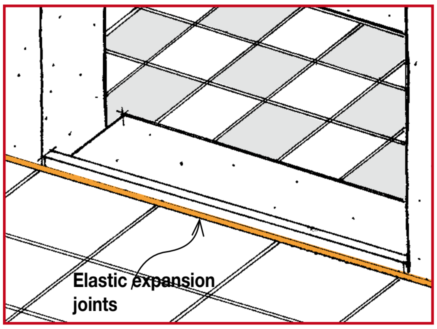


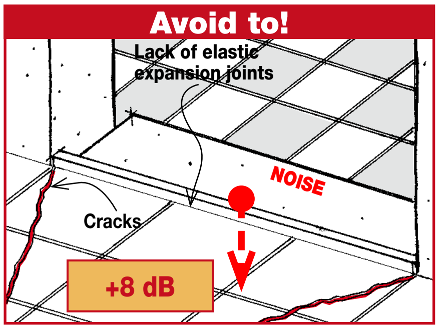


Avoid to!

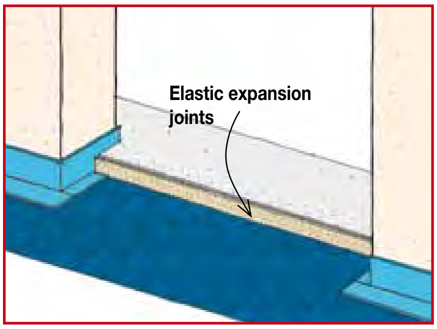
Joints by thresholds. Prepare a joint and an elastic seal between floorings and the entrance door threshold and terrace entrances. *Rigid joints of mortar between the threshold and the flooring would cause an acoustic bridge, consequently deteriorating the acoustic insulation, even by 8 dB.*

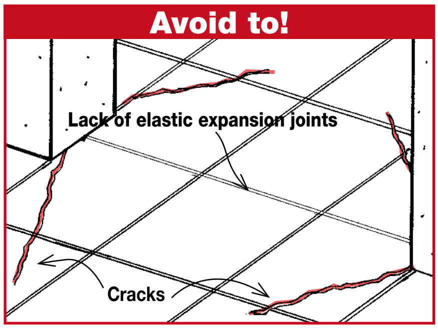






Expansion joints. Create elastic expansion joints every 4-6 m (linear), to be positioned preferably by the thresholds. *Without such joints in the screed, the latter could crack and consequently also the flooring.*





Expansion joints

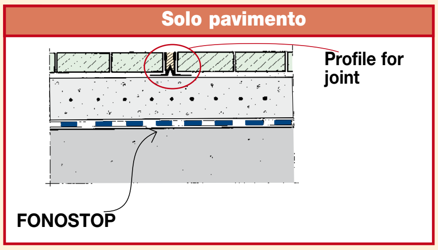
To ensure the best results of tiled floorings, it is very important to control the strain induced by expansions of the floors and wall tiles on the surfaces.

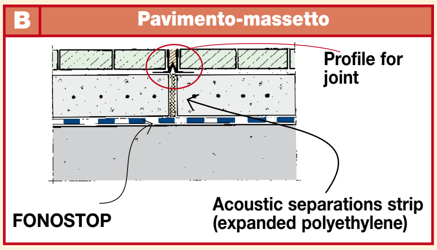
As for the floorings and the screeds, they must:

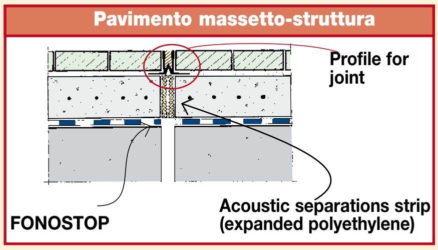
- **be separated from the fixed elements of the building (walls, columns, door shoulders etc.);**
- **have suitably sized joints.**

FONOCELL is turned-over vertically to create the perimeter joint by walls, columns and door shoulders. In the seamless zones of the floor, based on the type of floor involved, its dimensions or the composition of the load-bearing structure, the joints normally foreseen refer to one of the following schemes.

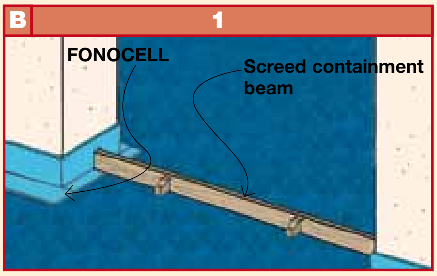
Profile for joint

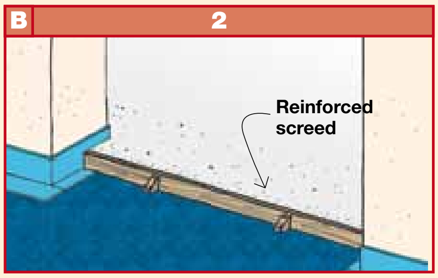


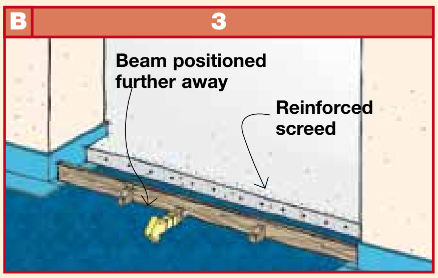


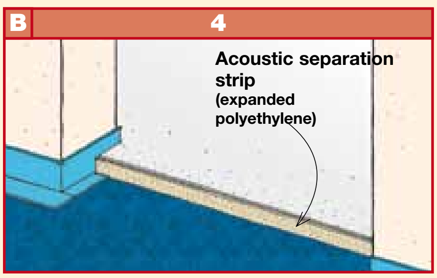


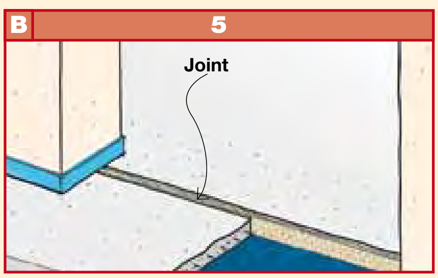
Creation phases of a floor-screed joint by a door threshold



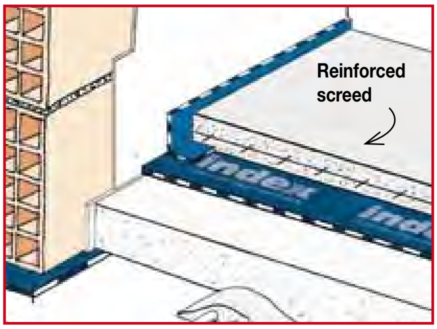




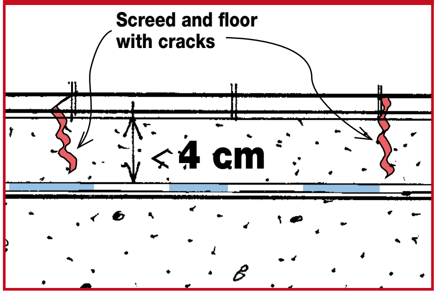




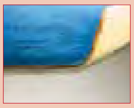
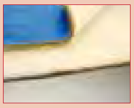
Laying the screed. The reinforced floating screed is made up of a bedding screed in reinforced concrete of at least 4 cm in thickness (Quickcem - Index).
It must not have any rigid connections to the floor slab or walls; even just one rigid connection is able to considerably reduce the acoustic performance of the system. It is therefore important for there not to be any embedded pipes that could create an “acoustic bridge”. *If the thickness if less than 4 cm, the screed could break and the insulation would become inefficient.*



Avoid to!



MINIMUM AND RECOMMENDED THICKNESSES PER TYPE AND DENSITY OF THE SCREED

Acoustic insulation systems FONOSTOP	Lightened screeds Density between 1,100 and 1,500 kg/m^3	Sand/cement screeds Density between 1,600 and 1,800 kg/m^3	Self-levelling screeds Density no less than 2,000 kg/m^3
 **Single layer**	Minimum thickness 6 cm *(Recommended thickness 7 cm)*	Minimum thickness 4 cm *(Recommended thickness 5 cm)*	Minimum thickness 3,5 cm *(Recommended thickness 4 cm)*
 **Double layer**	Minimum thickness 7 cm *(Recommended thickness 8 cm)*	Minimum thickness 5 cm *(Recommended thickness 6 cm)*	Minimum thickness 4,5 cm *(Recommended thickness 5 cm)*
 **Double layer FONOSTOPTrio+FONOSTOP**	Minimum thickness 8 cm *(Recommended thickness 9 cm)*	Minimum thickness 6 cm *(Recommended thickness 7 cm)*	Minimum thickness 5,5 cm *(Recommended thickness 6 cm)*

Consistency of the screeds

On FONOSTOP, anhydrite or cement screeds can be used. Anhydrite screeds do not require any reinforcement.
Cement screeds are normally prepared with “wet” consistency (*class s1*)* or “plastic” consistency (*class s2*)*.
If mixes are foreseen, they will have “semi-fluid” consistency (*class s3*)*, “fluid” consistency (*class s4*)* or “super-fluid” consistency (*class s5*)*.
Alternatively to sealing the overlaps with SIGILTAPE, a 0.01-mm thick polyethylene sheet can be laid over the whole surface, which will be turned-over by the walls by at least 10 cm.
SIGILTAPE will also be used to seal pipes wrapped with FONOCELL. This will avoid the formation of acoustic bridges deriving from the possible seepage of more fluid parts of the mix through the overlaps of the acoustic insulation.
(*) Standard UNI 9417

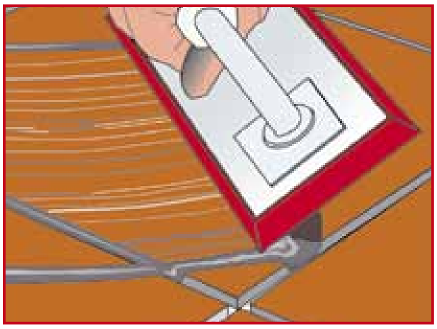
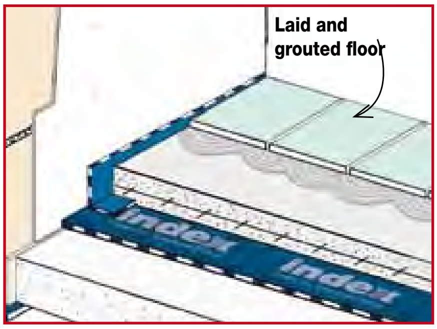
SEMI-FLUID, FLUID OR SUPER-FLUID SLATE

POLYETHYLENE FILM

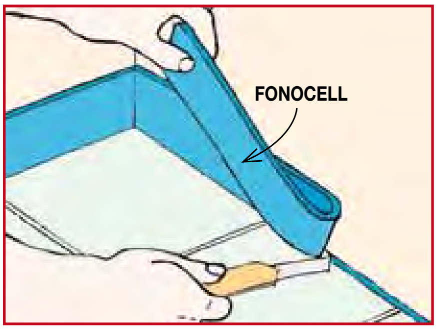
HUMID OR PLASTIC SLATE

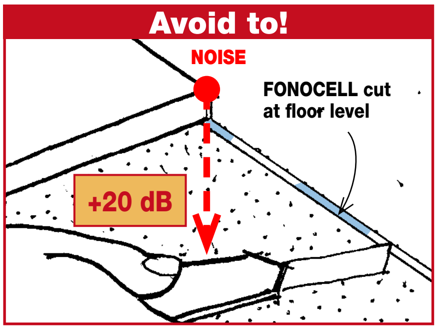
ADHESIVE TAPE SIGILTAPE

Laying and grouting the flooring. Once dried, the floor will be laid on the screed for which, based on the type of flooring involved (ceramic, stone or wood), the most suitable glue and grouting will be used according to INDEX instructions.

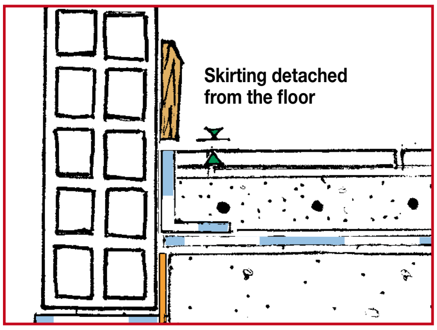




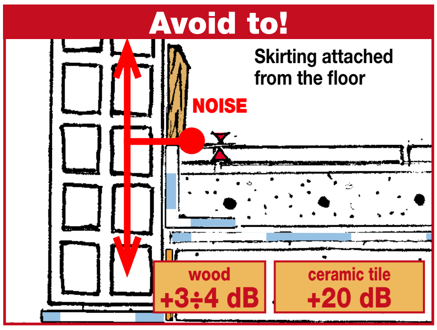
Eliminating any FONOCELL in excess. Trim and remove any excess FONOCELL from the wall only after having laid and sealed the joins in the floor. The surplus material is easily eliminated using a Stanley knife. *If any FONOCELL material is missing because it has been trimmed incorrectly before laying the flooring, there would be a rigid connection between the floor and the wall, consequently creating an acoustic bridge that deteriorates the efficient result of the acoustic insulation.*



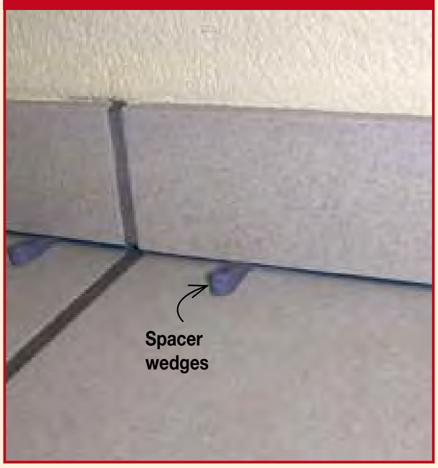
Laying the skirting board. The skirting board must be laid so that it does not touch the flooring. *If the skirting board touches the floor it would cause an acoustic bridge, consequently damaging the outcome of the acoustic insulation by 3÷4 dB (for skirting board made of wood) or even by 20 dB (for skirting board made of ceramic material).*



We are illustrating three possible ways of elastically connecting the skirting board to keep the floating screed detached.

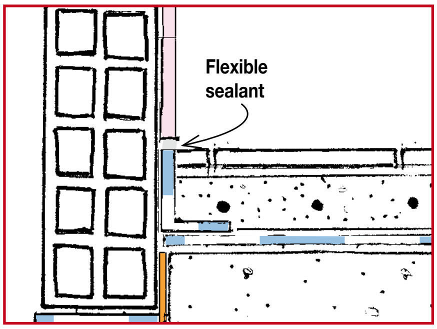
SPACER WEDGES



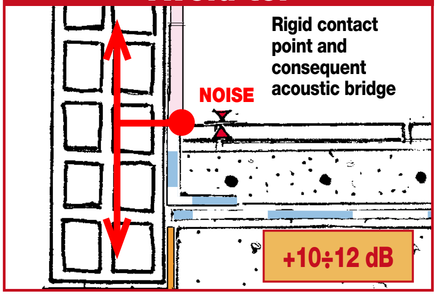
ADHESIVE SPACER STRIP

SPACER PROFILE

Elastic sealing. Once you have laid the skirting board or the ceramic wall tiles detached from the flooring, you can arrange an elastic sealing seam. *In this last phase again, you must avoid creating rigid contacts with the floor that would cause an acoustic bridge, consequently deteriorating the insulation performance.*

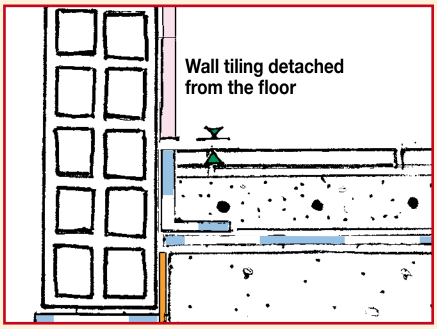


Avoid to!

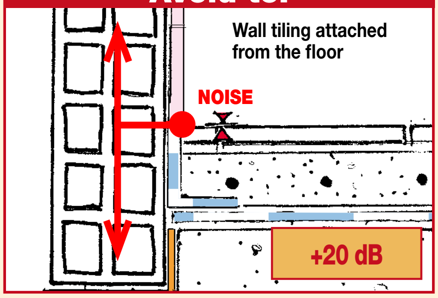


The kitchen corner

Laying the ceramic tiles. Lay the ceramic tiles on the wall so that they are detached from the flooring. *A rigid contact between the wall tiles and the floor would cause an acoustic bridge, consequently deteriorating the insulation performance by up to 12 dB.*



Avoid to!

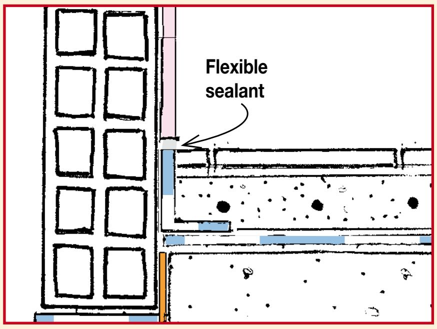


SPACER WEDGES

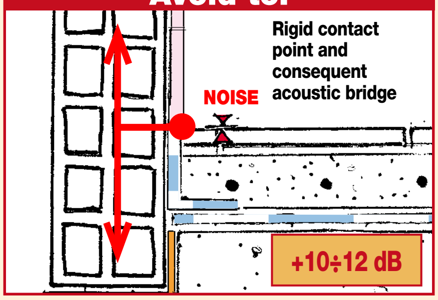
ADHESIVE SPACER STRIP

SPACER PROFILE

Elastic sealing. Once you have laid the skirting board or the ceramic wall tiles detached from the flooring, you can arrange an elastic sealing seam. *In this last phase again, you must avoid creating rigid contacts with the floor that would cause an acoustic bridge, consequently deteriorating the insulation performance.*



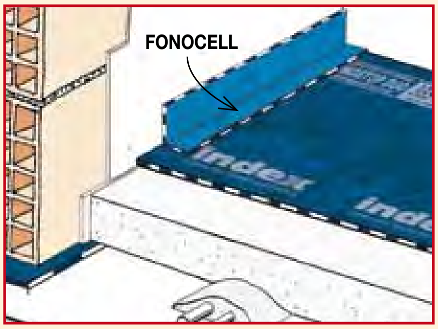
Avoid to!



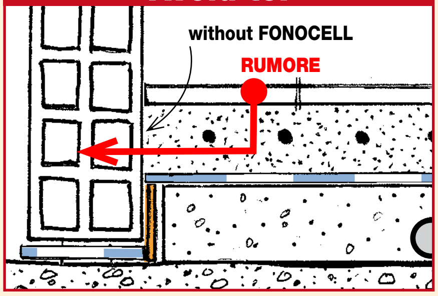
The bathroom

The acoustic insulation against foot traffic noise in bathrooms is to be carried out, just like in all the other parts of the dwellings, by creating a floating screed; the screed involved will be kept detached from any pipes coming out of the floor slab and from the shower base or bath tub installed when laying the insulation material of the FONOSTOP line.

Laying FONOCELL. The reinforced floating screed will be separated from the projecting walls using a self-adhesive strip of extruded polyethylene, which is available in two versions - FONOCELL and FONOCELL ROLL. *If FONOCELL is not used, an acoustic bridge would be created, consequently reducing the insulation performance.* *Do NOT turn FONOSTOP over so as not to damage the screed.*



Avoid to!

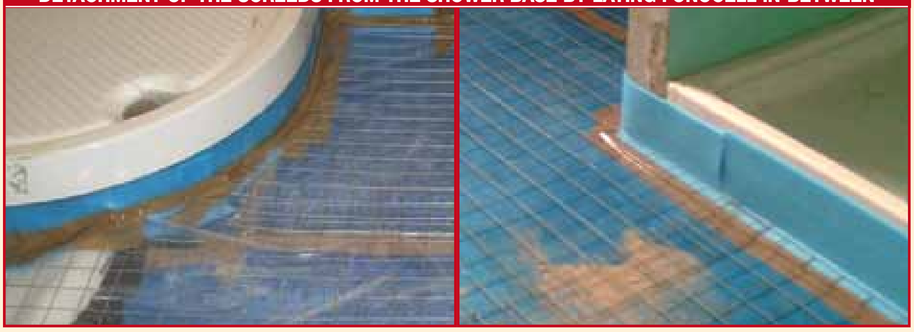


DETAILS

Insulation against foot traffic noise in bathrooms

The acoustic insulation against foot traffic noise in bathrooms is to be carried out, just like in all the other parts of the dwellings, by creating a floating screed; the screed involved will be kept detached from any pipes coming out of the floor slab and from the shower base or bath tub installed when laying the insulation material of the FONOSTOP line.

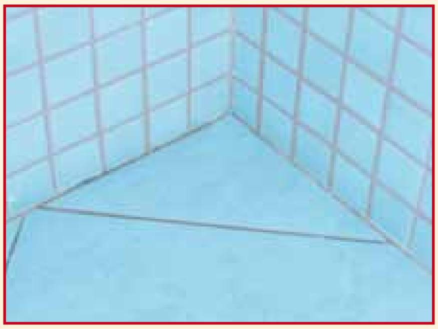
DETACHMENT OF THE SCREEDS FROM THE SHOWER BASE BY LAYING FONOCELL IN-BETWEEN



SEPARATION OF THE DRAINS TOWARDS THE BEDDING SCREED

DETACHMENT OF THE SCREEDS OF THE BATH TUB BY LAYING FONOCELL IN-BETWEEN

Laying ceramic wall tiles. As explained previously, you must make sure to lay the ceramic wall tiles so that they are detached from the flooring. Once laid, you can arrange an elastic sealing seam. *Rigid contacts between the wall tiles and the floor will cause an acoustic bridge, consequently deteriorating the insulation performance by up to 12 dB.*



DETERIORATIONS OF STANDARDISED FOOT-TRAFFIC NOISE INSULATION LEVELS OF FLOORS DUE TO LAYING ERRORS

This information aims at providing a useful guide in laying the solutions indicated in this guide on-site, in relation to laying errors that occur most frequently in the daily study of themes related to the passive insulation of buildings and in particular the laying on-site of floor insulation. Even if further laying errors may occur in the "floating screed" system, the following laying errors are currently considered to be those that are mostly harmful in obtaining the correct level of acoustic comfort of the occupants:

- Wrong or insufficient levelling of the layer where the pipes of the electrical and hydraulic systems pass.
- Affect of rigid contacts due to the presence of connections between the floating element (screed and flooring) and the containment partitions (floor and side walls).

Foreword

Up-to-date, after having carried out and attended several sound level surveys on-site and **presuming the correct and scrupulous planning of the foot-traffic insulation package,** Index s.p.a. is able to affirm that **whenever the value of the index is near or exceeds the limits imposed by DPCM dated 5th December 1997 (Premier's Decree), the cause can be directly attributed to the presence of rigid contacts or connections** between the screed and the containment partitions (extreme case due to the lack of parts of foot-traffic insulation FONOSTOP or parts of perimeter strip FONOCELL) or between the flooring (cement joints) and the perimeter walls (including door thresholds or French windows).

On this subject, we would like to confirm the efficiency of our technical solutions and the absolute guarantees that such solutions are able to offer, provided they are completed with the correct laying on-site of the whole system (especially the accuracy of the work of those who floor the rooms), as demonstrated by the list of tests carried out on-site, in page 76 and available on request.

INCORRECT OR INSUFFICENT LEVELLING OF THE LAYER WHERE THE PIPES OF THE ELECTRICAL AND HYDRAULIC SYSTEMS PASS

Even if it has been hoped for some time, the planning of the passive requirements of buildings integrated with the other themes related to building planning has still not been sufficiently implemented. Despite the problems expressed by the passive requirements, we have rapidly increased the threshold of awareness towards the "actors" involved in the planning and building procedure, but "planning with acoustic sensitivity" is still not common practice.

This situation carries a series of executive problems along with it, which often risk modifying or strongly penalising, through to even compromising the whole project, the acoustic insulation work of building elements.

A typical problematic case encountered in renovation jobs (where in such case planning involves restraints imposed by preset parameters) but which unfortunately is often found also in new builds, concerns the lack of sufficient thickness to be able to create the "double screed", in other words of being able to place the foot-traffic insulation over the levelling layer that covers the systems.

The lack of sufficient thickness and the poor sensitivity or competence regarding problems related to the foot-traffic insulation of the floors, can cause strong deteriorations in relation to the acoustic indices requested by law ($L'_{n,w}$) and create further complaints in relation to the mechanical strength provided by the floating setting screed (this is why it is advisable to add reinforcement mesh) that has different thicknesses where the covering layer over pipes sags or bulges.

Situations such as those that follow can cause problems related to:

- **Differentiated strain on the resilient layer and therefore deteriorations of legal requirements**: the failed uniformity of the thickness of the screed in contact with the resilient layer can cause abnormal reactions of the foot-traffic insulation system; the strain caused by the tapping machine placed on a thinner part of the screed would definitely detect a more penalised reaction compared to the same strain made on a section of screed of the correct weight and thickness.
- **Compromised mechanical strength and therefore possible cracking of the screed and breakage of the flooring**: the laying of the resilient layer on a surface that is not perfectly flat and that is incoherent causes the creation of small gaps of air between the insulation material and the foundation (in the crossing points between pipes it is not possible to consider a perfect adhesion of the material).
  Where these gaps of air are created, the material has a limited screed thickness (and consequently not very heavy) and this means that a feasible subsequent conspicuous work load (for example, large wardrobes) could reduce the thickness of the material causing the setting screed to crack and even the flooring to break.

Possible solution

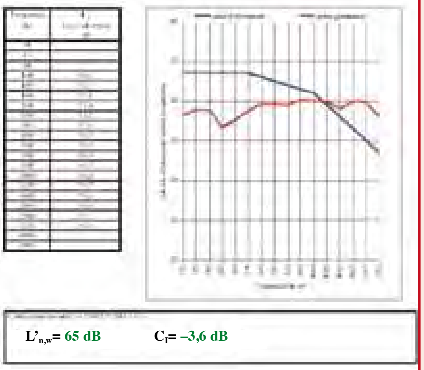
Considering the impossibility to have a sufficient thickness in the planning phase, it is very important to suggest, for the cases just presented, a further possibility of restoring the correct laying conditions by creating shells in mortar with high curve radius so that the insulating layer rests solidly on the support made up of the foundation. Having done this, it will be important to reinforce the setting screed, paying special care (possibly by adding another "reinforcement bridge") where the section of the actual screed tends to become worryingly thin (less than 3 cm).

AFFECT OF RIGID CONTACTS ATTRIBUTABLE TO THE PRESENCE OF CONNECTIONS BETWEEN THE FLOATING ELEMENT AND THE CONTAINMENT PARTITIONS

The information that follows is the summary of the site experiment campaign carried out in depth by Index s.p.a. with the aim to characterise the performance of the floating screeds insulated with our systems and to identify, and possibly quantify, the risks related to the incorrect laying on-site of the foot-traffic insulation system, also evaluating and measuring consequent deteriorations. Before we enter into the details of the site experiments, we should discuss the experiment parameters, not merely to boast our skills, but more so to provide a valid support in interpreting the meaning of the test reports following the experimental site tests.

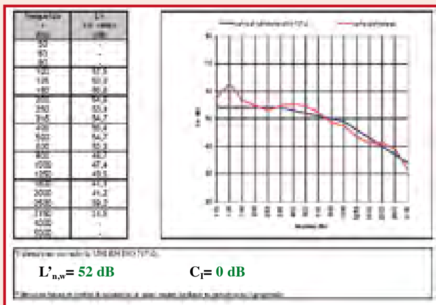
Analysis of the test parameters

The test report provided following the instrumental site survey, if read with attention, may provide considerable indications on the state of laying on-site related to the work being discussed.
Within the test report, you can observe the graph related to the measurements carried out for all the frequencies involved in standard UNI (from 100 to 3150 Hz); the curve foreseen by the ISO standard (Blue curve of following drawing) has a trend that faithfully reproduces the reaction expected from a perfectly floating system, free from rigid connections and contact points; **it is the "standard" curve that guarantees the correct performance of the insulation with the "floating screed" technique**.
The experimental curve (red curve in following drawing) obtained following a survey on-site, which on the other hand illustrates the real state of performance of the floating screed; **if the system has been made with the due solutions (such as those illustrated) the two curves have a very similar trend and the spectral adaptation coefficient indicated is quite limited (in the case illustrated, it is equal to zero).**
Following tests on-site on a clay-cement floor slab (thickness: 20 + 4 cm) insulated with FONOSTOPDuo in one single layer and sand-cement screed with minimum thickness of 4 cm, with ceramic flooring (test carried out by STUDIO PELUCCHI of Perugia):
In the frequency interval considered, great importance lies in the trend of the experimental curve (to be compared with that of the "standard" curve) above all at high frequencies (to the right in the graph): further apart the curves, greater are the probabilities that there are rigid contact points that inhibit the performance of the "floating screed".
The example given hereafter relates to a site test that gave completely different results to the previous test, even if the insulating materials and stratification of the floor were kept constant (same thicknesses of the system levelling foundation and same thicknesses of the screed).



As you can see, the curves differ in the last section (high frequency) and the C_I spectral adaptation coefficient is greater than that calculated in the previous example.

In this situation there are definitely rigid contacts that have certainly penalised the performance of the floating system; the photographs that follow will prove what has been declared.



The C_I spectral adaptation coefficient is a term capable of assessing the difference between the performance of a screed that floats correctly (very slight C_I 2/3 or almost zero) and a floating screed with rigid contact points (higher C_I 10/11)

The rigid contacts are clearly visible by the thresholds and between the floor and the tiles of the kitchen corner in the living room where the noise level is tested

DETERIORATIONS OF THE FOOT-TRAFFIC INSULATION INDEX ATTRIBUTABLE TO RIGID CONTACT POINTS OF THE FLOORING

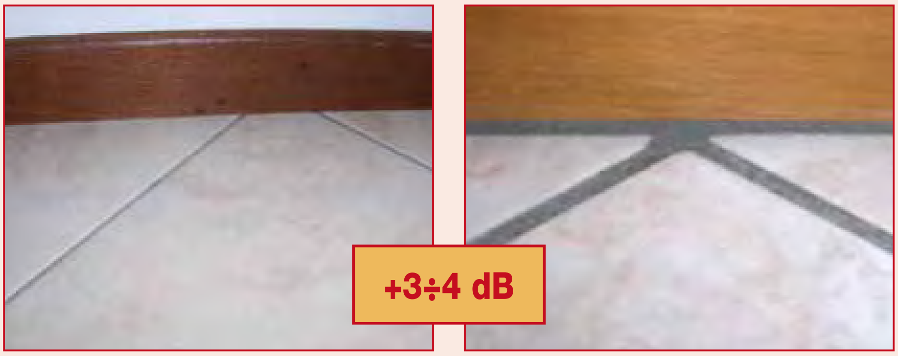
With reference to the information published in the deeds of the 32nd National Convention of the AIA, held in Ancona in 2005, in relation to the affect of rigid contact points in the floating screed system, even if it is difficult to export all the cases possible, it is of great interest to study the awareness of the deteriorations and to quantify (even if not absolutely) the entity of such possible deteriorations. The report takes into consideration a clay-cement floor slab (beams and filler blocks with thickness of 24 cm) insulated with the technique of the floating screed according to the methods listed below:
Looking back on what has been experimented, to search for a complex bond between the acoustic result and the rigid contact points, we could summarise the brilliant experience demonstrated through numerical deteriorations that are to be considered as purely indicative:

- **rigid contact points of around 2% can lead to deteriorations of even 8 dB!**
- **rigid contact points of around 50% can lead to deteriorations of even more than 20 dB!**

Description	Foot traffic sound level index
Test on “naked” floor slab (just beams, hollow bricks and reinforcement composite slab)	87 dB
Test on perfectly insulated and rigidly connected floor slab (from the floor) on 2 sides	71 dB
Test on perfectly insulated and rigidly connected floor slab (from the floor) on just one side	68 dB
Test on perfectly insulated and rigidly connected floor slab (from the floor) on a length of 2.60 m	65 dB
Test on perfectly insulated and rigidly connected floor slab (from the floor) on a length of 0.90 m	60 dB
Test on perfectly insulated and rigidly connected floor slab (from the floor) on a length of 0.30 m	56 dB
$L'_{n,w}$ test on perfectly insulated floor slab without rigid contacts	48 dB

DETERIORATIONS CAUSED BY COMMON MISTAKES

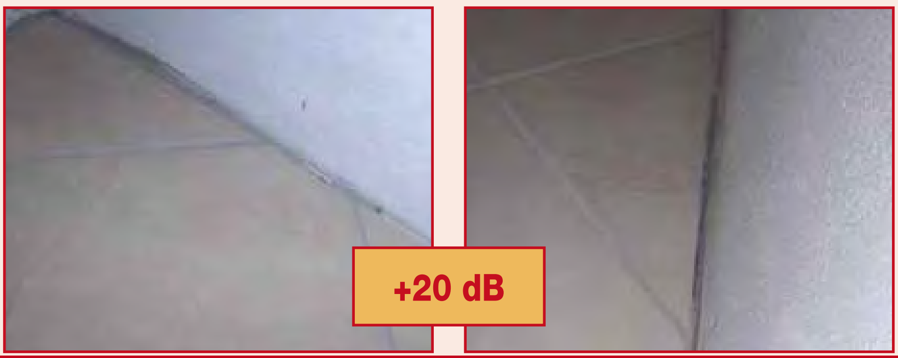
If the wooden skirting board is laid in perfect adherence with the floor, it could be the cause for deteriorations in performance of even 3÷4 dB. If the skirting board is then sealed with mortar, the level of leakage could be even higher.



The lack of a flexible joint between the threshold of the entrance door and the indoor flooring of the apartment (likewise for possible French windows leading out to a patio/terrace) creates an acoustic bridge that could be the cause for deteriorations in performance of even 8 dB.

The covering of the kitchen area of the living room rigidly connected to the floor could involve deteriorations in performance that depend on the contact surface. Such deteriorations in performance on index $L'_{n,w}$ may even be 12 dB.

The skirting board rigidly connected to the floor or the floor rigidly connected to the walls, could involve deteriorations in performance that depend on the contact surface. Such deteriorations in performance on index $L'_{n,w}$ may even exceed 20 dB.

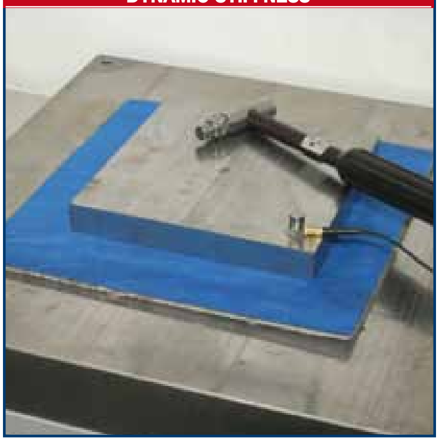


■ MAIN CHARACTERISTICS OF THE ACOUSTIC INSULATION OF FLOATING FLOORS

DYNAMIC STIFFNESS AN ACOUSTIC INSULATION AGAINST MODULAR FOOT-TRAFFIC

Dynamic stiffness is the characteristic that determines the insulating properties of floating floor materials, and defines the capacity of the material to deform elastically and dampen dynamic stresses - foot-traffic - it is subjected to when it is pre-loaded with the weight of the screed.
Dynamic stiffness is reduced as the thickness of the material increases.
As concerns insulation against foot-traffic, it is considered in the construction industry, that the dynamic stiffness of a good quality insulation material must be in the range from 35 to 7 MN/m³ and acoustic attenuation is higher the lower the dynamic stiffness (see graph C1).
A higher rigidity means that the material is too rigid under the stress specified for floors and does not deform elastically. It may be suitable for dampening the vibrations of a heavy machine or those of a railway track when a train passes through, but it is unsuitable for dampening 'light' stress such as foot-traffic.
For example, the rigidity of an elastic material, as rubber is commonly believed to be, is too high for it to be used for insulating floors. To ensure that it works, it must be lightened or steps must be taken to increase the unit preload, perhaps by reducing the support surface by suitable measures.
However, dynamic stiffness must not be too low either, otherwise this means that the material is too compressible and is crushed.
INDEX has designed and patented three insulation systems with dynamic stiffness in the range from 21 to 9 MN/m³.
The first one, i.e. 21 MN/m³, is based on laying of a layer of FONOSTOPDuo, as we have already described.
If we increase the thickness of the phono-resilient material, the dynamic stiffness of the insulating layer is reduced, dropping to 11 MN/m³ and, therefore, the degree of acoustic insulation increases. Consequently, if we lay two layers of FONOSTOPDuo instead of just one, we can obtain a higher degree of insulation.
In this case, the first layer is laid with the blue face toward the laying surface, whereas the second layer is laid across the joining lines of the first, with the blue face directed upward in order to oppose the two white non-woven fabrics which are the springs of the insulating system.
To further increase insulation, we created a new insulation material called FONOSTOPTrio.

DYNAMIC STIFFNESS



RESISTIVITY TO AIR FLOW

FONOSTOPTrio is a foot-traffic acoustic insulation product, which, when combined with FONOSTOPDuo, makes it possible to create insulation systems. Dynamic stiffness is 9 MN/m³ which guarantees even higher acoustic comfort levels.
With the introduction of this latter product, modular insulation solutions which satisfy any requirements are now possible, starting from the FONOSTOPDuo single-layer system.
The following table indicates the foot-traffic noise levels L'_{nw} and the increase of phono-insulating power ΔR_w for a floor of 20+4 in clay/cement weighing 237 Kg/m² with a 7 cm foundation lightened to a density of 800 Kg/cu.m. It starts from a level of foot-traffic noise $L_{nw,eq}$=77.66 dB and phono-insulating power R_w=48.74 dB (screed included) insulated with 5 cm (d:2000Kg/m³) of floating screed on the three systems described above, which can be calculated with the simplified forecasting method specified in standard EN 12354-2.

Index constantly checks the characteristics of dynamic stiffness and of resistance to air flow in its own acoustics laboratory, both on raw materials and on finished products. It is consequently able to guarantee high standards of constant quality, compliant with the requirements imposed by standard UNI EN ISO 9001.

SYSTEM A
FONOSTOPDuo

SYSTEM B
FONOSTOPDuo+FONOSTOPDuo

SYSTEM C
FONOSTOPTrio+FONOSTOPDuo

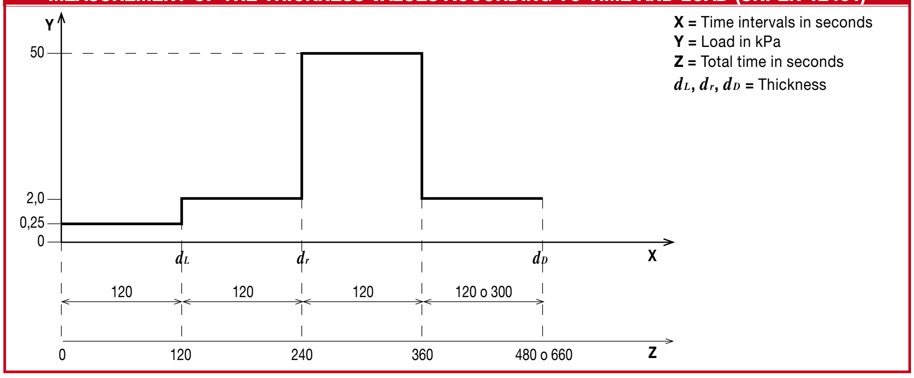
		Characteristics measured in the laboratory		Performance calculated pursuant to EN 12354-2		
	System	Certificate I.T.C. n.	Dynamic stiffness	ΔL_w	$L_{n,w}$ insulated floor (K=3 dB)	ΔR_w
A	FONOSTOPDuo	3402/RP/01	21 MN/m³	28 dB	53 dB	7,63 dB
B	FONOSTOPDuo+FONOSTOPDuo	3403/RP/01	11 MN/m³	32 dB	48 dB	10,63 dB
C	FONOSTOPTrio+FONOSTOPDuo	3404/RP/01	9 MN/m³	33,5 dB	47 dB	10,63 dB

COMPRESSION CAPABILITY AND MAINTENANCE OF PERFORMANCE

Another important characteristic of insulating material for floating floors is resistance to crushing under the loads it is subjected to.
Clearly, if the material is crushed by the weight of the screed and of the expected overloads, it is no longer able to perform the insulation functions.
There are specific test methods to evaluate this characteristic:

- UNI EN 12431. Determination of the thickness of insulating materials for floating floors, where the thickness is determined after a series of compression cycles under a load of 2 kPa and 50 kPa
- UNI EN 1606. Determination of creep under compression, where thickness is measured after the material was kept under a constant load of 2 kPa for 122 days.

MEASUREMENT OF THE THICKNESS VALUES ACCORDING TO TIME AND LOAD (UNI-EN 12431)



Compression capability was measured according to UNI EN 12431 on both single and double layer FONOSTOPDuo.

COMPRESSION CAPABILITY

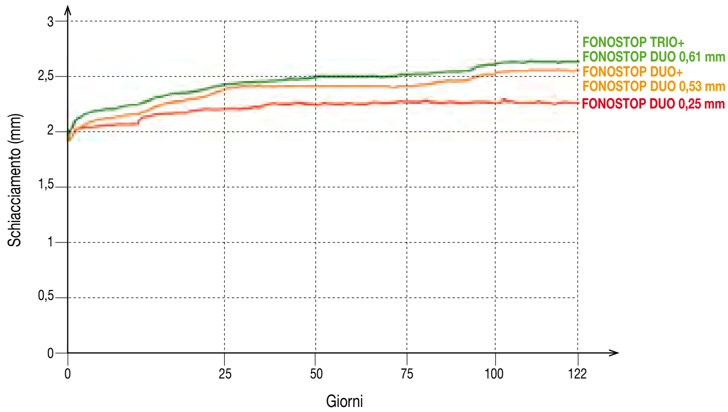
COMPRESSION CAPABILITY OF FONOSTOPDuo

	Comprimibilità	Livello
FONOSTOPDuo	2 mm	CP2
FONOSTOPDuo+FONOSTOPDuo	3 mm	CP3

Crushing under a constant load of 200 Kg/m² conforming to UNI EN 1606 was measured on all the systems described above.

CRUSHING UNDER CONSTANT LOAD

	Schiacciamento
FONOSTOPDuo	0,25 mm
FONOSTOPDuo+FONOSTOPDuo	0,53 mm
FONOSTOPDuo+FONOSTOPTrio	0,61 mm



The maintenance of the acoustic performance of FONOSTOPDuo when subjected to foot-traffic on a reference floor (INDEX's internal method) was also measured. The ΔL_w was measured of a sample placed under a concrete slab of 50x70 cm at a load of 200 Kg/m².

The results show the excellent long-term stability of the FONOSTOPDuo systems both in terms of resistance to crushing and maintenance of the insulating capacities.

MANTEINING THE ACOUSTIC PERFORMANCE

FONOSTOPDuo	Time	ΔL_w
	• New	27 dB
	• 30 days	29 dB
	• 90 days	29 dB
	• 270 days	30 dB

RESISTANCE TO PUNCHING

The insulation's resistance to punching caused by accidental impact or strain is no less important than its compressibility rating.
Experience tells us that materials with excellent characteristics of elasticity and compressibility, once laid on site, do not give the foreseen results because they are damaged before they are actually used.
The situation of the site is merciless towards light and delicate materials that are too sensitive to site traffic; only materials that are resistant to punching (static punching, to withstand the roughness of the irregular foundations under the load of the screed and dynamic punching to withstand impact caused by dropped objects and the traffic of site equipment) are able to ensure the planned levels of acoustic insulation.
To assess resistance to static and dynamic punching of FONOSTOPDuo we used the test methods EN 12730 and EN 12691 respectively; these standards are used to assess the resistance of waterproofing membranes that are subjected to similar strain when laid under the flooring and when walked over during laying and subsequently when in use; the results are written in the table that follows:

- STATIC PUNCHING EN 12730: resistant under a load of 35 kg applied for 24 hours on a spherical punch of 10 mm in diameter placed on the material.

STATIC PUNCHING

- DYNAMIC PUNCHING EN 12691: resistant to the impact of a 1 kg weight dropped from a height of 200 mm complete with a spherical punch of 12.7 mm in diameter.

DYNAMIC PUNCHING

The resistance values obtained exceed the minimum levels foreseen by the standards for waterproofing membranes, which confirms the tendency to use FONOSTOPDuo in aggressive environments, as are building sites.

■ LEVEL OF FOOT-TRAFFIC NOISE L'nw, ON-SITE MEASUREMENT AND FORECASTING CALCULATION

As we saw in the previous chapter, if we know the dynamic stiffness of the insulating material, we can calculate beforehand the noise level of foot-traffic of the floors. To do this, the following information about the floor is required.: type, area mass of its layers, floating screed included, and the weight of the walls in the disturbed room.
Below we shall illustrate the calculation method specified by standard EN 12354-2. Several data calculation programs with a data-bank of the more common types can be found on the market.

ESTIMATE CALCULATION OF FOOT-TRAFFIC INSULATION OF FLOORS IN CONCRETE AND CLAY/CEMENT CONFORMING TO THE SIMPLIFIED MODEL SPECIFIED IN STANDARD EN 12354-2, AND IN THE FEBRUARY 2004 VERSION OF THE "GUIDELINES FOR PROJECT CALCULATION AND VERIFICATION" (PREVIOUSLY UNI-U20000780)

The laboratory tests carried out by inserting the insulation material under a small rigid plate, are useful for comparing the performances of different insulation materials measured in the same way, but are not representative for forecasting the insulation level of floors of real dimensions which must then be measured during the laying operations.
Instead, one can forecast, with sufficient approximation, the level of acoustic protection offered by the floor during laying operations, and evaluate to what extent it must be insulated to bring it within the limits specified by Italian DPCM 5/12/97, following the simplified calculation method specified in European standard EN 12354-2, when the dynamic stiffness of the insulation material to be used is known beforehand. The calculation applies solely to rigid floors in concrete or tile-concrete with an area mass (weight per m2) from 100 to 600 kg/m2, and cannot be extended to cover other types of floors e.g. wooden floors.
As the degree of faultiness of the laying operations cannot be quantified, the calculation model cannot take it into account, and, therefore, it is assumed that laying was expertly carried out, avoiding acoustic bridges and avoiding the floor form 'floating' on the insulation material without any constraint. The standard foot-traffic noise level index of floors $L'_{n,w}$ can be calculated with the following formula:

$$L'_{n,w} = L_{n,w,eq} + K - \Delta L_w$$

where "$L_{n,w,eq}$" is the evaluation index of the equivalent level of Standard-conforming acoustic pressure produced by foot-traffic on a non-insulated floor and on a floating floor, which can be calculated with the following formula, if we know the weight per m² of the bare floor:

$$L_{n,w,eq} = 164\text{-}35 \log m$$

where "m" is the area mass of the floor in Kg/m²

"K" is the corrective factor which represents the lateral transmissions of noise, which are added to direct transmission of noise. It depends on the relation between the surface masses of the bare floor with respect to the surface mass of the walls of the disturbed room, not covered by acoustic insulation materials. The table below indicates the amount of dB of corrective factor K (version updated to February 2004).

The table shows the loss in dB according to the relationship between the mass of the floor and the average area mass of the walls of the 'disturbed' room. It can be seen how a heavy floor bearing on light walls causes significant lateral transmission (up to 4 dB). If the floor bears on heavier walls, lateral transmission drops even to 0.

"ΔL_w" is the index for evaluating the reduction of foot-traffic noise of the "screed + elastic layer" floating system. It can be deduced from graph C1, specified by the simplified calculation model described in standard UNI EN 12354-2:2002, if we know the dynamic stiffness of the resilient layer (**FONOSTOPDuo**) measured in conformity with European standard UNI EN 29052/1, and the area mass of the floating screed.

The dynamic stiffness of FONOSTOPDuo was certified by ICITE (now ITC-CNR) with:
• Certificate No. 3402/RP/01 for 1 layer of **FONOSTOPDuo** s'=21 MN/m³
• Certificate No. 3403/RP/01 for 2 layers (*) of **FONOSTOPDuo** s'=11 MN/m³
(*) Laid opposite each other, white face against white face.

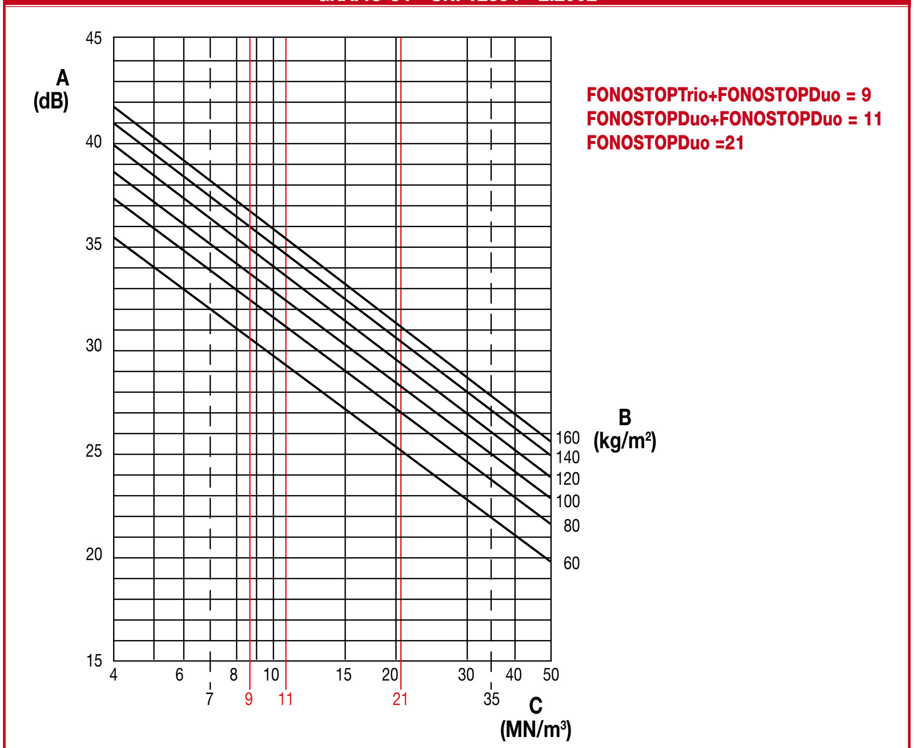
"**A**" = ΔL_w in dB
"**B**" = area mass of the floating screed in kg/m²
"**C**" = dynamic stiffness s' in MN/m³ of the insulation layer (UNI EN 29052/1)
s' = 21 of a single layer of **FONOSTOPDuo**
s' = 11 of a double layer of **FONOSTOPDuo**

Example. A screed of 100 kg/m² floating on a layer of FONOSTOPDuo determines an index for evaluating the reduction of foot-traffic noise $\Delta L_w \cong 28$ dB and in the case of double-layer insulation of the said screed $\Delta L_w \cong 32$ dB.

CORRECTIVE FACTOR "K"

Surface mass of the separation threshold (kg/m²)	Average surface mass of walls not covered by insulation lining								
	100	150	200	250	300	350	400	450	500
150	2	1	1	1	1	0	0	0	0
200	2	1	1	1	1	0	0	0	0
250	3	2	2	1	1	1	1	1	1
300	3	2	2	1	1	1	1	1	1
350	3	2	2	2	1	1	1	1	1
400	3	3	2	2	2	1	1	1	1
450	3	3	2	2	2	2	1	1	1
500	3	3	2	2	2	2	1	1	1
550	4	3	3	3	2	2	2	2	2
600	4	3	3	3	2	2	2	2	2

GRAFIC C1 - UNI 12354 - 2:2002



EXAMPLE OF CALCULATION OF $L'_{n,w}$

In this case of a 20+4 floor in clay/cement with the lower face plastered for 1.5 cm, with trellis beams, with a between axes distance of 50 cm, and area mass of m = 340 kg/m²

$L_{n,w,eq}$ = 164-35 log 340 = 75 dB.

Assuming that the floor bears on walls of 150 kg/m² in conformity with the previous table **K**=2dB.

placing over the floor a floating screed of 100 kg/m² for

- 1 layer of FONOSTOPDuo ΔL_w = 28 dB
- 2 layers of FONOSTOPDuo ΔL_w = 32 dB

Therefore the level of foot-traffic noise of the insulated floor:

with 1 layer of **FONOSTODuo**: will be

$L'_{n,w}$ = 75+2-28 = 49 dB

with 2 layers of **FONOSTODuo**: will be

$L'_{n,w}$ = 75+2-32 + = 45 dB

Both values are well below the level specified by law, which prescribes a maximum level of 63 dB for residential buildings. However, the overabundance of insulation obtained with the calculation is often apparent, because, at the laying stage, the decibels are lost due to laying errors, e.g. pipes which wrongly cross the floating creed, or points of contact between the screed and the skirting board.

It is therefore important to use materials with a certain amount of insulation "reserve", to avoid nasty surprises, following controls when the works are finished.

WARNING

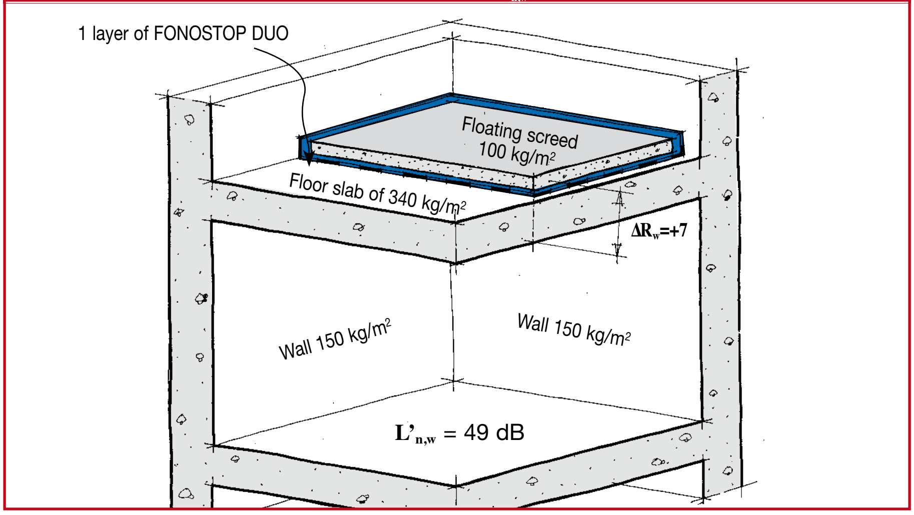
The acoustic benefit provided by insulating materials for the floating floor varies according to the type of insulated floor. The level of insulation obtainable on a cement floor, in concrete and clay-cement mix cannot be compared to that obtained in a wood floor. The latter value is much lower, and for which, the verification carried out with a foot-traffic simulation machine is not sufficiently representative of the disturbance effect typical of wood floors subjected to foot-traffic.

By using the following table, you can calculate the foot-traffic insulation level $L'_{n,w}$ and the increased insulation of aerial noises ΔR_w of the most common floors, on which a floating screed is laid over:

In the following table, by using the above method, the foot-traffic noise level of the most common floors was calculated, for which ANDIL experimentally determined the aerial noise evaluation index R_w. Below we have calculated the foot-traffic noise levels, taking into account that the floor bears on the disturbed room, where the average weight of the walls is 100 and 150 kg/m², and that a screed of 100 and 140 kg/m² was placed over it, floating on one or two layers of FONOSTOPDuo. Starting off with the ANDIL experimental value R_w of the floor, we also calculated the increase of the phono-insulating power due to the laying of a screed of 100 and 140 kg/m², floating on three FONOSTOPDuo insulation systems. The calculation was effected by following the "Guidelines for the project and verification calculation of the acoustic performances of buildings", a project conforming to the UNI U 20000780 standard, February 2004 version.

FLOORS Description of materials used	Thickness (cm)	Surface density (kg/m²)	Valuation index R_w (dB)
Trellis joists, distance between axis 50, type A 16+4 tiles, with plaster on intrados	21,5 1,5+16+4,0	270	49,0
Trellis joists, distance between axis 50, type A 20+4 tiles, with plaster on intrados	25,5 1,5+20+4,0	340	50,0
Joists in pre-compressed concrete, distance between axis 50, type A 16+4 tiles, with plaster on intrados	21,5 1,5+16+4,0	269	48,5
Joists in pre-compressed concrete, distance between axis 50, type A 20+4 tiles, with plaster on intrados	25,5 1,5+20+4,0	284	47,5
Joists in pre-compressed concrete, distance between axis 50, type B 16,5+4 tiles, with plaster on intrados	22,0 1,5+16,5+4,0	273	47,5
Joists in pre-compressed concrete, distance between axis 50, type B 20+4 tiles, with plaster on intrados	25,5 1,5+20+4,0	362	50,0
Floors with panels with loose reinforcement, type B 16,5+4 tiles, with plaster on intrados	22,0 1,5+16,5+4,0	321	48,5
Floors with panels with loose reinforcement, type B 20+4 tiles, with plaster on intrados	25,5 1,5+20+4,0	369	52,5
Slabs in pre-compressed concrete, distance between axis 120, and polystyrene	24,0 4,0+16+4,0	261	50,5
Slabs in pre-compressed concrete, distance between axis 120, and polystyrene	28,5 4,0+20,5+4,0	296	53,5
Slabs in pre-compressed concrete, distance between axis 120, tiles type B	24,0 4,0+4,0+12+4,0	419	51,5
Slabs in pre-compressed concrete, distance between axis 120, tiles type B	28,5 4,0+4,0+16,5+4,0	458	53,5

ELEMENTS TO BE CONSIDERED FOR $L'_{n,w}$ ESTIMATE CALCULATION



Example

(see the boxes ringed in red in the table)

You want to know the foot-traffic noise level of a “Type A” 20+4 floor of 340 kg/m² which bears on a room with walls with an area mass of 150 kg/m², which was insulated with 1 layer of FONOSTOPDuo on which a screed weighing 100 kg/m² was laid.

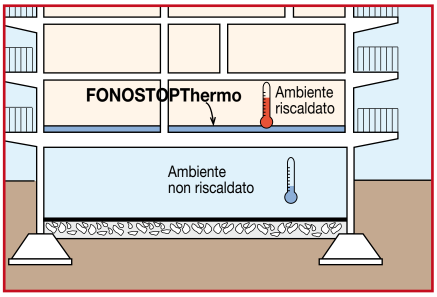
According to the table, $L'_{n,w}$ =49 dB, and the expected improvement of phono-insulating power R_w will be ΔR_w =+7 dB.

Calculation of the foot traffic noise level index, according to current regulations $L'_{n,w}$ (dB)												Calculation of the increase of soundproofing power due to presence of a floating floor ΔR_w (dB)					
FLOATING SCREED																	
100 kg/m²						140 kg/m²											
WALLS						WALLS						FLOATING SCREED					
100 kg/m²			150 kg/m²			100 kg/m²			150 kg/m²			100 kg/m²			140 kg/m²		
1 layer of FONOSTOPDuo	FONOSTOPDuo +FFONOSTOPDuo	FONOSTOPTrio +FONOSTOPDuo	1 layer of FONOSTOPDuo	FONOSTOPDuo +FFONOSTOPDuo	FONOSTOPTrio +FONOSTOPDuo	1 layer of FONOSTOPDuo	FONOSTOPDuo +FFONOSTOPDuo	FONOSTOPTrio +FONOSTOPDuo	1 layer of FONOSTOPDuo	FONOSTOPDuo +FFONOSTOPDuo	FONOSTOPTrio +FONOSTOPDuo	1 layer of FONOSTOPDuo	FONOSTOPDuo +FFONOSTOPDuo	FONOSTOPTrio +FONOSTOPDuo	1 layer of FONOSTOPDuo	FONOSTOPDuo +FFONOSTOPDuo	FONOSTOPTrio +FONOSTOPDuo
54	50	48	53	49	47	51	47	46	50	46	45	+7,50	+10,50	+10,50	+10,50	+10,50	+10,50
50	46	45	49	45	44	48	44	42	47	43	41	+7,00	+10,00	+10,00	+10,00	+10,00	+10,00
54	50	48	53	49	47	51	47	46	50	46	45	+7,75	+10,75	+10,75	+10,75	+10,75	+10,75
53	49	48	52	48	47	51	47	45	50	46	44	+8,25	+11,25	+11,25	+11,25	+11,25	+11,25
54	50	48	53	49	47	51	47	46	50	46	45	+8,25	+11,25	+11,25	+11,25	+11,25	+11,25
49	45	44	48	44	43	47	43	41	46	42	40	+7,00	+10,00	+10,00	+10,00	+10,00	+10,00
51	47	46	50	46	45	49	45	43	48	44	42	+7,75	+10,75	+10,75	+10,75	+10,75	+10,75
49	45	44	48	44	43	47	43	41	46	42	40	+5,75	+8,75	+8,75	+8,75	+8,75	+8,75
54	50	49	53	49	48	52	48	46	51	47	45	+6,75	+9,75	+9,75	+9,75	+9,75	+9,75
52,5	48,5	47	51,5	47,5	46	50	46	44	49	45	43	+5,25	+8,25	+8,25	+8,25	+8,25	+8,25
47	43	42	47	43	42	45	41	39	45	41	39	+6,25	+9,25	+9,25	+9,25	+9,25	+9,25
46	42	40	46	42	40	43	39	38	43	39	38	+5,25	+8,25	+8,25	+8,25	+8,25	+8,25

ACOUSTIC INSULATION AGAINST FLOOR FOOT TRAFFIC NOISE AND THERMAL INSULATION OF FLOOR SLABS

In addition to the provisions of the Prime Minister's Decree (DPCM) dated 5th December 1997 concerning the acoustic requirements of building partitions, for new buildings, the builder is obliged also to observe Legislative Decree 311 dated 29th December 2006 in force as of 2nd February 2007. This Decree lays down the minimum thermal insulation values of the building shells, as of 1st January 2008 and 1st January 2010, based on the various weather zones A, B, C, D, E and F.

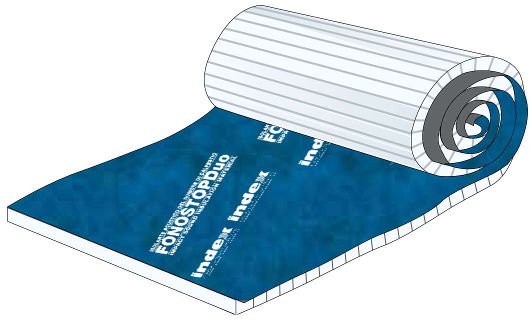
Furthermore, for all categories of buildings, as they are classified, based on the purpose for which they are built, according to art. 3 of the Decree of the President of the Republic no. 412 dated 26th August 1993, with the exception of category E.8, to be built in weather zone C, D, E and F, the transmittance value (U) of the vertical and horizontal separation constructional structures between boundary buildings or dwellings, bearing in mind the observance of DPCM dated 5th December 1997, must be lower or equal to 0.8 W/m²K. This limit must be observed for all the vertical, horizontal and sloped opaque structures that delimit rooms without heating systems from the external environment.



Observance of the current legislation for the cases described hereafter determines the need to insulate floor slabs acoustically but also thermally, which is usually done using two different products.

In the case of cement and brick floor slabs, the need to also insulate them thermally usually only arises when they separate heated rooms from unheated rooms or from the external environment where the transmittance limits foreseen for the different weather zones related to the shell must be observed. Such cases are represented by floor slabs over garages or other open areas, but which must however also be insulated against foot traffic noise, remembering that this is easily transmitted to different building units on the same floor and upper floors and law does indeed state that they must be insulated whatever the case. As for intermediary floor slabs between different dwellings, the limit of 0.8 W/m²K imposed by L.D. 311/06 is generally respected by the stratified elements normally used in cement and brick floor slabs 20+4 and 16+4 with lightened filling screeds, of appropriate thermal resistance, without having to integrate them with thermal insulation panels. In the case of concrete floor slabs, the need to increase their thermal insulation with insulation panels arises in the cases illustrated previously for cement and brick floor slabs, but may also be required to respect the transmittance limit of 0.8 W/m²K foreseen for intermediary floor slabs, which are also to be insulated against foot traffic noise.

FONOSTOPThermo



Sizes
height of roll: 1.05
variable length based on the thicknesses: 5÷10 m

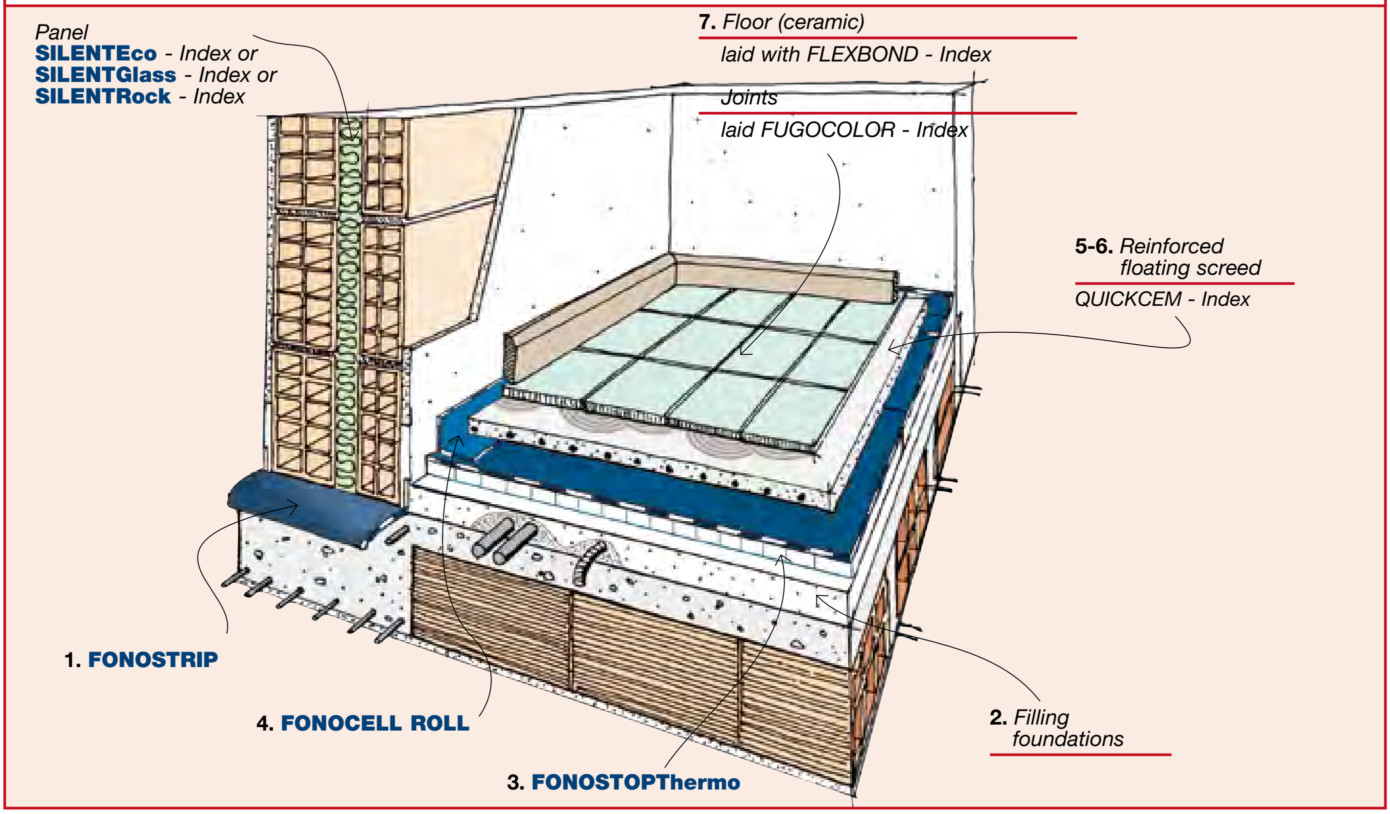
To resolve such problems, INDEX has created FONOSTOPThermo, which alone, is able to insulate against foot traffic noise but also thermally.

FonostopThermo is a thermal-acoustic insulation of floor slabs supplied in rolls and is the result of coupling FONOSTOPDuo, the insulation against foot traffic noise, with an expanded polystyrene panel cut in strips, so

TECHNICAL INTERVENTION SOLUTIONS

NEW BUILDINGS OR FULL REFURBISHMENTS

ACOUSTIC INSULATION WITH FLOATING FLOOR TECHNIQUE



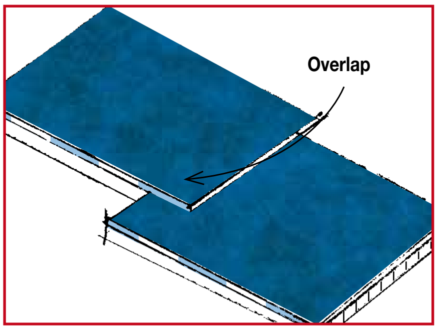
The specifications items are on page 92

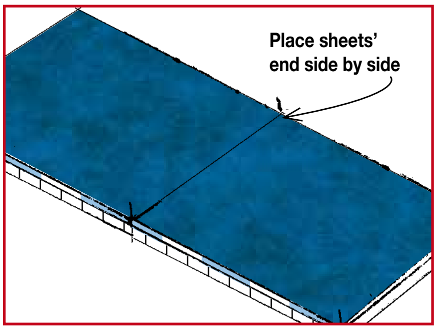
that it can be wound in rolls making it easier and quicker to lay than products supplied in panels.
The efficiency of the thermal insulation is provided mainly by the layer of self-extinguishing AE sintered expanded polystyrene EPS 120 with high resistance to compression, which stops the thickness from altering over time. The EPS 120 material is a stable waterproof insulation product, with conductivity coefficient λ=0.035 W/mK, which is cut in 50 mm strips.
FONOSTOPThermo is supplied in 100 cm wide rolls, complete with 5 cm overlap wing made up of the soundproof foil; the top face of the product has a light-blue textile finish whereas the bottom face is made up of the insulation strips in white EPS 120.
The soundproof foil of FONOSTOPDuo is a seamless waterproof and airtight element, which optimises acoustic performance by filling-in pores that may occur in the building work; the foil prevents the "non-woven fabric" from getting soaked with fresh cement mortar that would annul its elasticity, plus it also acts as a vapour barrier for the underlying thermal insulation when the floor slab borders with unheated rooms.
FONOSTOPThermo is used mainly when the acoustic insulation against foot traffic noise needs to be integrated with a thermal insulation product, but it can also be beneficially used as a base for underfloor heating systems, before laying the heating pipes, under a reinforced cement-based screed or screed in unreinforced self-levelling anhydrite.

LAYING METHOD

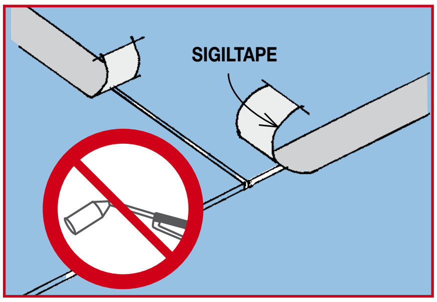
LAYING FONOSTOPThermo

Laying FONOSTOPThermo. The product is very simple to lay and the method is the same as that for the FONOSTOPDuo foil. The rolls of FONOSTOPThermo are to be unrolled in their natural unrolling direction with the top light-blue face facing upwards and are to be overlapped at the sides by arranging the overlap wing on the adjacent sheet and carefully matching-up the polystyrene strips of the faces underneath. On the short side, the sheets of FONOSTOPThermo are carefully brought together end-to-end. They will cover the whole floor slab and are to be blocked and trimmed-off at the foot of the perimeter walls of the room to be insulated.



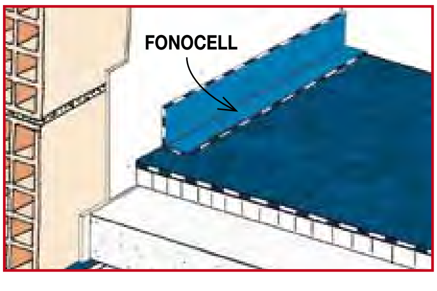


Sealing the sheet. All the longitudinal overlap lines and the transversal joining lines of the sheets are then to be carefully sealed with the special adhesive SIGILTAPE, stuck over the same.

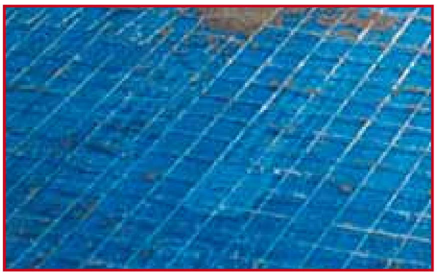


CREATING THE SCREED

Laying FONOCELL. The floating screed must be completely detached not just from the floor slab but also from the walls and from anything coming out of the slab that should cross it.
To do this, starting from the insulation material laid on the floor slab surface, the perimeter walls are to be lined by 15 cm with the special FONOCELL angular self-adhesive elements in expanded polyethylene, which will be turned up and over the surface by 5 cm to glue them to the sheets of FONOSTOPThermo on which they will be further blocked with the adhesive SIGILTAPE
The pipes or anything else that should cross the insulation sheet and the floating screed vertically, shall be carefully lined with FONOCELL.

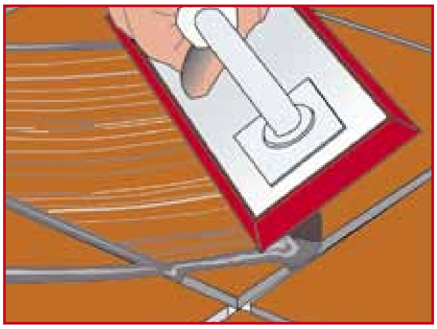
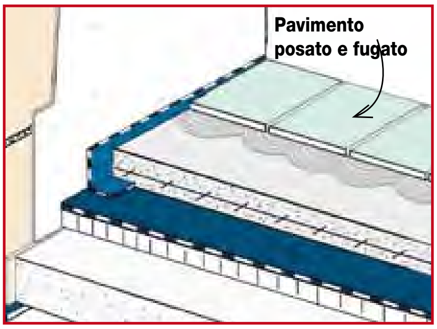


Laying the metal reinforcement and the screed. The screed will be reinforced with electrically welded galvanised metal mesh (mesh size 5×5 cm approx.) or with reinforcement systems that have similar performance. Be very careful not to perforate the insulation or to move its overlaps.
The cement-based screed will be cast in a minimum thickness of 5 cm (Quickcem - Index).
It must not have any rigid connections to the floor slab or walls; even just one rigid connection is able to considerably reduce the acoustic performance of the system.
It is therefore important for there not to be any embedded pipes that could create an "acoustic bridge".

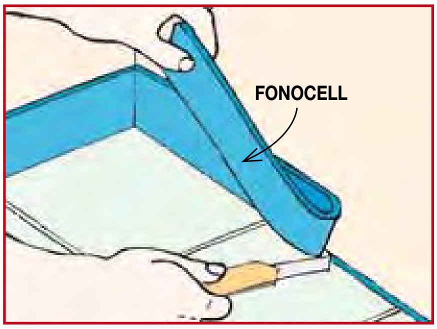


LAYING THE FLOOR

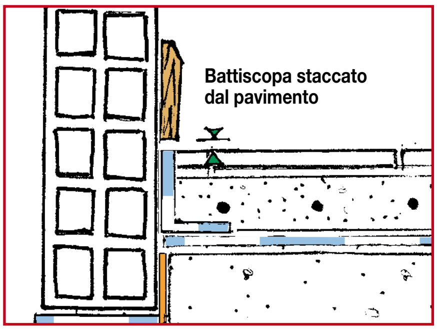
Laying and grouting the flooring. Once dried, the floor will be laid on the screed for which, based on the type of flooring involved (ceramic, stone or wood), the most suitable adhesive and joint grouting will be used according to INDEX instructions.
It is extremely important that the vertical part of FONOCELL that lines the wall and that comes out of the screed layer to be left where it is until the flooring has been laid completely, so that the same does not touch the wall and create an acoustic bridge, which could make the insulation completely inefficient.

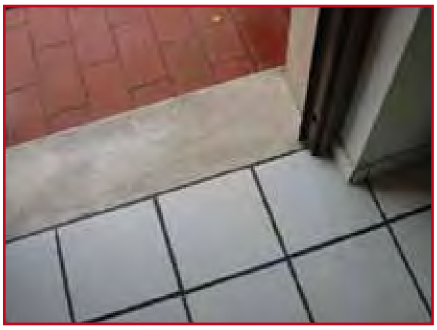
Remove any FONOCELL in excess. Only after laying the flooring is it possible to remove the excess part of FONOCELL. The surplus material is easily eliminated using a Stanley knife.

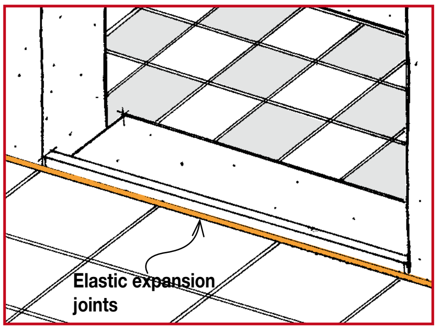



Laying the skirting board and elastic sealing. The skirting board must be detached from the flooring. To do so, while laying, put a spacing solution between the floor and the skirting board to lift it by approx. 2 mm; the spacing solution will then be removed once the adhesive has set. Once you have laid the skirting board or the ceramic wall tiles detached from the flooring, you can arrange an elastic sealing seam.

Joints by thresholds. Just as important is the care to be taken near the threshold tiles of entrance doors and French windows of the room to prevent the flooring from connecting to rigid mortar; FONOCELL must be left in place until the floor has been laid and will be removed and replaced with a profile of soft and elastic material.





ACOUSTIC PERFORMANCE

The insulation performance against foot traffic noise is guaranteed by the layer of FONOSTOPDuo, with dynamic stiffness s'= 21 MN/m3, which determines, in compliance with the simplified calculation method TR UNI 11175 (Guide to standards of series UNI EN 12354 for the forecasting of acoustic performance of buildings), a ΔL_w = 28 dB sufficient to respect the limits imposed for the most commonly used floor slabs in residential buildings by DPCM 05/12/97.
For superior levels of insulation, simply lay another layer of FONOSTOPDuo over the overlaps of FONOSTOPThermo, which determines a ΔL_w = 32 dB.

THERMAL PERFORMANCE

FONOSTOPThermo is produced in thicknesses of 26, 36, 46 and 56 mm, which are sufficient to comply with the most commonly requested thermal insulation needs. The table that follows shows the corresponding thermal resistance values.

THE THERMAL PERFORMANCE OF FONOSTOPThermo

Type	25	35	45	55
Thickness	26 mm	36 mm	46 mm	56 mm
Thermal resistance (EN 12667)	0,65 m²K/W	0,95 m²K/W	1,20 m²K/W	1,50 m²K/W

COMPRESSION STRENGTH

The compression strength is an important feature for materials to be used under floating screeds subject to a constant load over time.
The compressibility under a constant load of FONOSTOPThermo is affected by the component that provides the acoustic performance, which must imperatively be the most deformable of the composite material, made up of the non-woven fabric of FONOSTOPDuo glued over the expanded polystyrene that dampens vibrations in the screed under foot traffic strain by elastic deformation.
The expanded polystyrene coupled on the bottom face is basically non-deformable under the load of the floating floor.
The consequent result is that the reduction in the thickness under a constant load of 200 kg/m² (EN 1606) is that of FONOSTOPDuo equal to ≤1mm.

ACOUSTIC INSULATION OF FLOORS AGAINST FOOT-TRAFFIC NOISE IN FLOOR HEATED ROOMS

The heating of residential rooms with the "floor heating" system initially came to a stop due to the first applications in the 60s based on recirculation of water at a high temperature, without any regulations, which causes physiological damage to the occupants. However, sales were newly boosted with the advent of new boilers and technologies based on the recirculation of low temperature water, which has no hygienic-sanitary contra indications

The stratigraphy of the system consists of a grid of heating pipes, usually in polyethylene, laid and secured on smooth or shaped insulation pannels laid on the floor. These pipes are covered with a screed on which the floor is then built.

The insulation panel used often has thermal insulation properties only, and acoustic insulation of foot-traffic noise is almost non-existent.

To ensure thermal expansion of the screed to the perimeter, the screed is insulated from the wall by strips of compressible material (polyethylene foam) with a procedure similar to that used for acoustically insulated "floating floors".

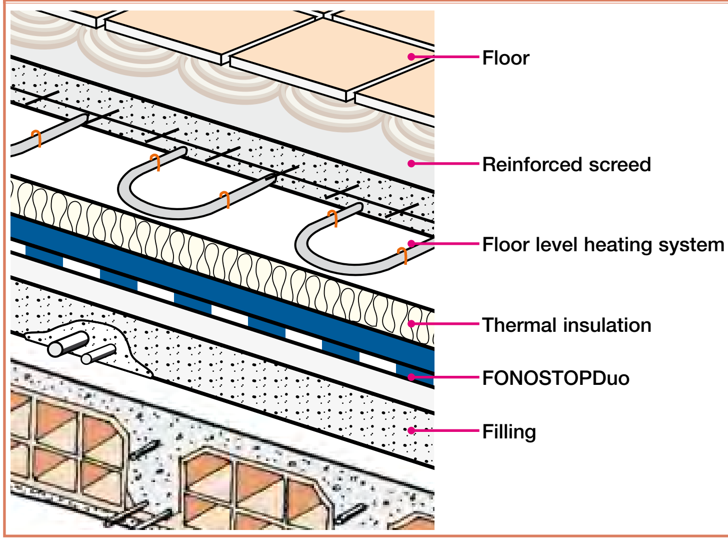
Therefore, the acoustic insulation technology with FONOSTOPDuo integrates perfectly with floor heating technology.

FONOSTOPDuo is widely used also under thermal insulation panels in foamed material over which the heating system with a traditional floor is installed.

FONOSTOPDuo is compatible with the floor heating system and is laid before thermal insulation.

As this type of heating already specifies, the expansion of the floor to floor to perimeter will be absorbed by FONOCELL, which had been applied on the walls.

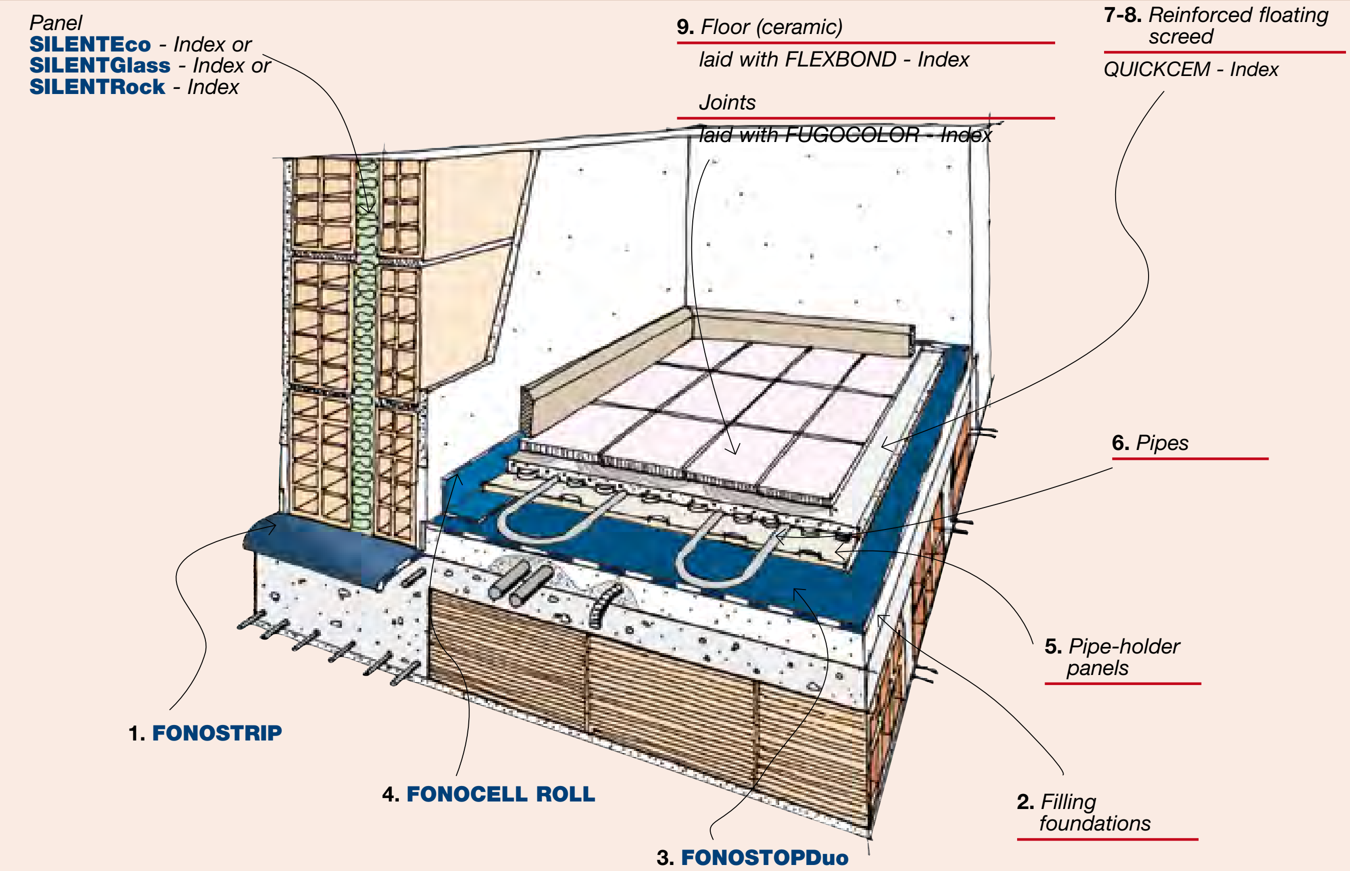
TRADITIONAL SYSTEM



TECHNICAL INTERVENTION SOLUTIONS

NEW BUILDINGS OR FULL REFURBISHMENTS

ACOUSTIC INSULATION WITH FLOATING FLOOR TECHNIQUE



The specifications items are on page 93

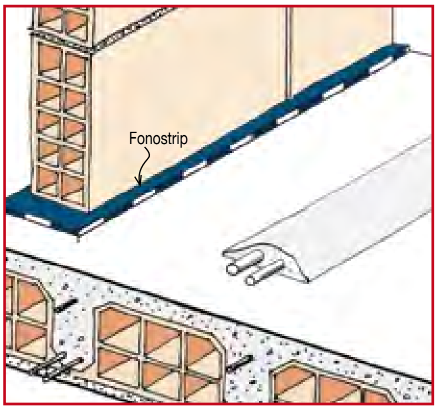
METHOD OF USE AND DETAILS

Attention! We are illustrating the main laying phases for creating a floating floor to obtain acoustic insulation against foot traffic noise of floor slabs in the case of heated floors that complies with the legal requirements of DPCM 5/12/97.
For further details and information on this subject, please consult the laying methods and details given previously in pages 15-23.

1

Laying FONOSTRIP

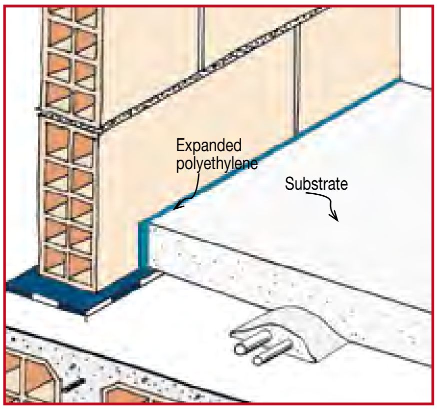
The floor which is the bearing element is generally built in clay/cement mix. The insulating strips are placed over the floor, and the partition walls will be erected over the strips. FONOSTRIP is an elastomer insulating material supplied in strips of different width, for dampening wall vibrations.



2

Filling foundations

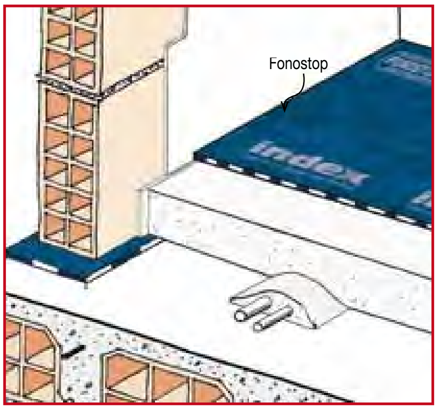
The pipes, which had been laid on the floor and connected with cement mortar, are buried in the filling foundation. Filling can be done with lightened concrete or with sand stabilised with lime or cement (50-100 Kg/m³) and the filling should preferably be insulated from the walls with strips of expanded polyethylene with a thickness of 2÷3 mm and 1÷2 cm higher than the foundation.



3

Laying FONOSTOPDuo

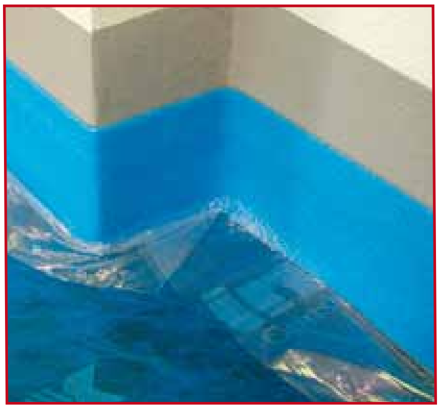
The insulation layer must support yard traffic, and must consist of durable, non-rotting materials.
FONOSTOPDuo is the acoustic insulation material against foot-traffic noise, that satisfies the above requirements. With its limited thickness, it offers high performance. FONOSTOPDuo is equipped with a 5 cm built-in overlapping tab.

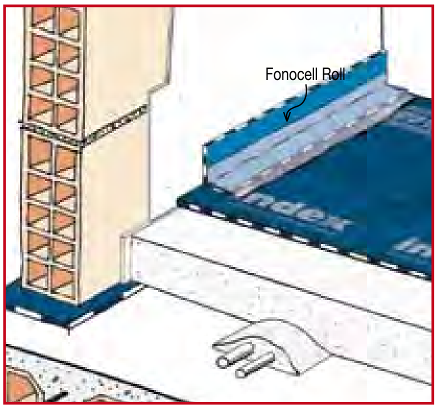


4

Laying FONOCELL ROLL

Once the walls have been plastered, the reinforced floating screed will be detached from the protruding walls with a self-adhesive strip of extruded polyethylene that has a tab at the foot, again made of polyethylene film.



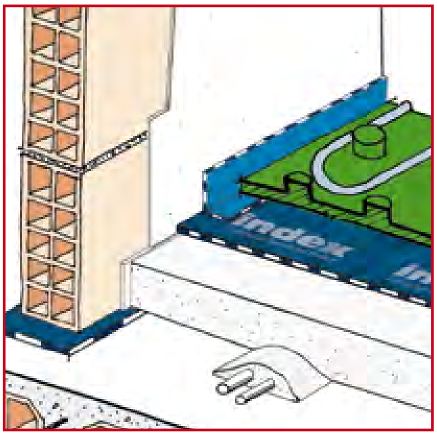


METHOD OF USE AND DETAILS

5

Laying the pipe carrying panels and inserting the pipes

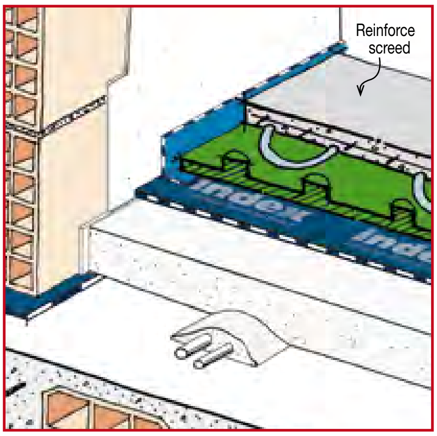
The pipes are inserted in the dedicated seats in compliance with the heating project.



6

Laying the metal reinforcement and laying the screed

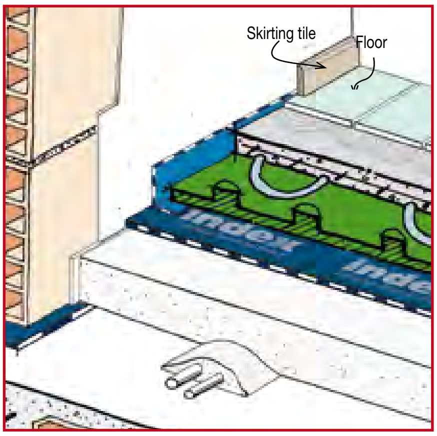
The reinforcement of the screed consists of an electro-welded galvanised metal mesh with links of about 5×5 cm. It consists of a bedding screed in reinforced concrete with a thickness of 4 cm (Quickcem - Index).
It must not have any rigid connections with the floor or walls. Even a single rigid connection can reduce the system's acoustic efficiency by half.
Therefore, there must not be any buried pipes which could create an "acoustic bridge".



7

Laying the floor

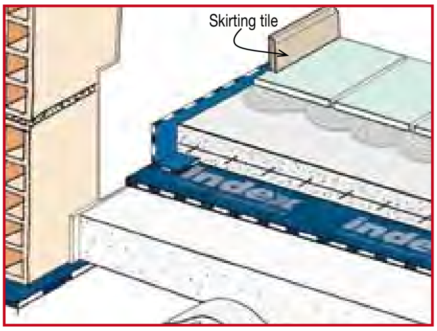
After seasoning, the floor is laid over the screed. The most appropriate Index glue will be applied according to type of floor (ceramic, stone, wood, etc.). The most suitable Index product will also be applied to the joints, according to type of floor and its intended use.
The skirting must not touch the floor. If it is considered necessary to close the gap between skirting and floor, a kerb of flexible seal material can be applied for this purpose.



8

Laying the skirting board

The skirting board must not touch the floor and if you need to fill-in the gap between the skirting board and the floor, you can apply a seam of elastic sealer.



TECHNICAL INTERVENTION SOLUTION WITH FONOSTOPAlu

Insulation panels normally used in heated floors act as thermal insulators but not as sufficient acoustic insulators against foot traffic noise according to the levels imposed by the Prime Minister's Decree (DPCM) dated 05/12/1997. What's more, the parameters usually foreseen in the building plans often impose the simultaneous reduction in the screed layer that incorporates the piping network, which could cause uneven heating of the floor, creating "strips of heat".

FONOSTOPAlu

Size
1,05 × 10 m

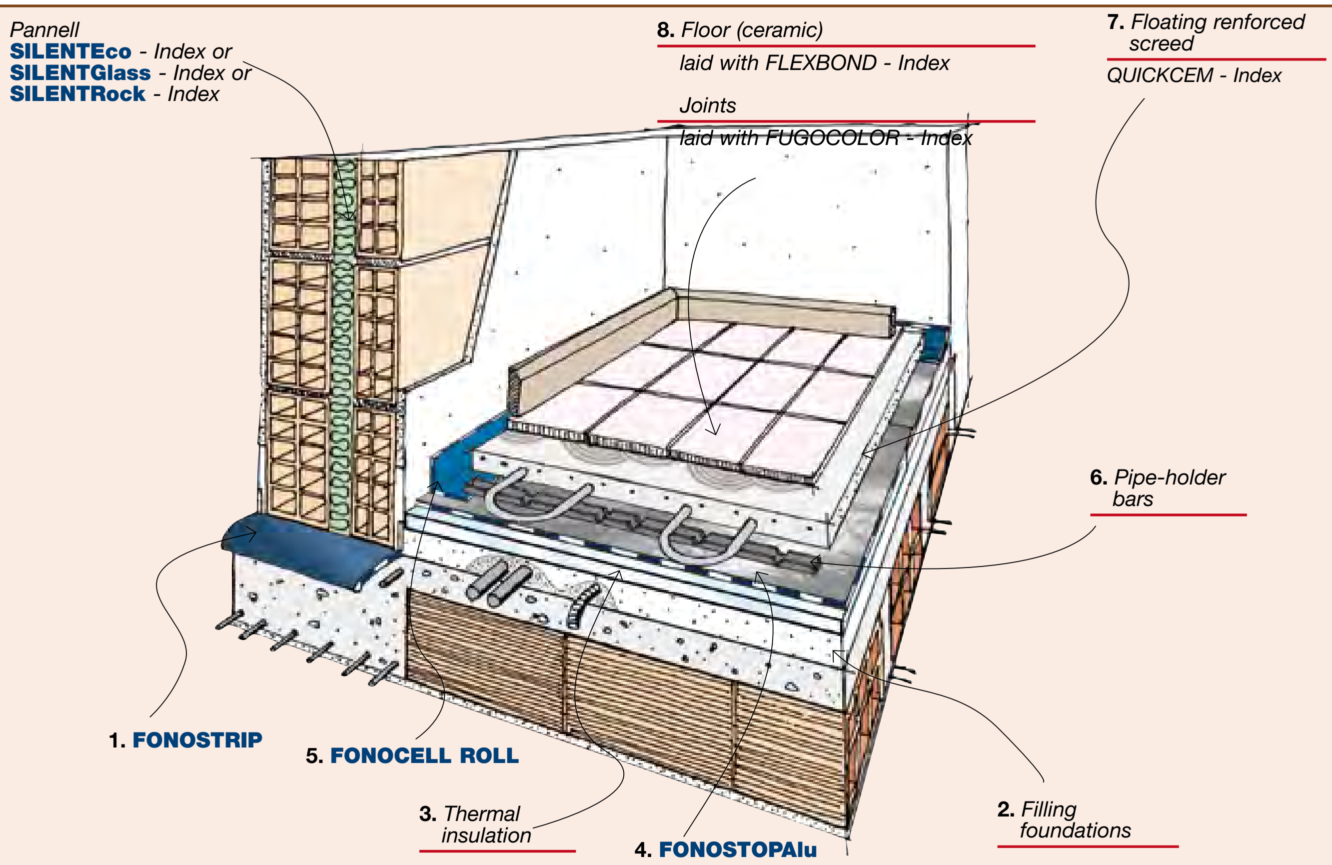
FONOSTOPAlu is a multi-purpose acoustic insulation against foot traffic noise made up of a soundproof foil with top face lined with reflecting aluminium foil protected by a plastic film (reflectance ~ 90%) with high thermal conductivity (λ ~ 236 W/mK) and very high heat diffusion rate (diffusivity α = 8,2 · 10-5 m²/s).

It is consequently a specific insulation product designed for floor slabs with underfloor heating, where the top aluminium coated face distributes the heat in the floating floor evenly by conduction, consequently distributing the temperature of the floor surface and eliminating the problem of "strips of heat", even in rather thin screeds.
The foil is impermeable to water, gas and water vapour, it protects the underlying layers while laying the screed and protects the thermal insulation against water vapour, which starting from the warm face of the same, tends to dampen it and reduce its insulation capacities. The soundproof foil on the bottom face is coupled with non-woven polyester sound-resilient fabric obtained through a special "elastic needling" process, being an exclusive INDEX project. The fibres are elastic and do not crumble when compressed or bent.
FONOSTOPAlu is used for the acoustic insulation against foot traffic noise of intermediary floor slabs with underfloor heating. It is generally laid over standard flat and smooth insulation panels, before laying the heating pipes.
When there is not enough room for the thermal insulation, FONOSTOPAlu can be used on its own, laying it on the cement-based foundations before laying the pipe.

FONOSTOPAlu is very simple to lay and the method is the same as that for the FONOSTOPDuo foil.
In the case of FONOSTOPAlu, the thermal insulation panels are laid first.
To create a floating floor that complies with the legislative requirements of DPCM 5/12/97 to obtain the acoustic insulation against foot traffic noise, you are recommended to consult the methods and laying details explained previously on pages 15-23.

NEW BUILDINGS OR FULL REFURBISHMENTS

ACOUSTIC INSULATION WITH FLOATING FLOOR TECHNIQUE

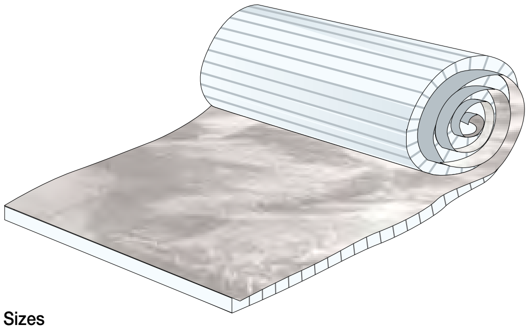


The specifications items are on page 93

TECHNICAL INTERVENTION SOLUTION WITH FONOSTOPThermoAlu

FONOSTOPThermoAlu as well as performing the function of insulating against foot traffic noise, it also replaces conventional shaped insulation panels. INDEX has designed FONOSTOPThermoAlu to resolve the thermal-acoustic insulation problems of floor slabs with underfloor heating with just one product. FONOSTOPThermoAlu is the result of coupling FONOSTOPAlu with an expanded polystyrene panel cut in strips, so that the product can be wound in rolls making it easier and quicker to lay than products supplied in panels. The top layer of FONOSTOPAlu is a seamless waterproof and airtight element, which optimises acoustic performance; the foil prevents the "non-woven fabric" from getting soaked with fresh cement mortar that would annul its elasticity, plus it also acts as a vapour barrier for the underlying thermal insulation when the floor slab borders with unheated rooms. The efficiency of the thermal insulation is provided mainly by the layer of self-extinguishing AE sintered expanded polystyrene EPS 120 with high resistance to compression, which stops the thickness from altering over time. The EPS 120 material is a stable waterproof insulation product, with conductivity coefficient λ=0,035 W/mK, which is cut in 50 mm strips.

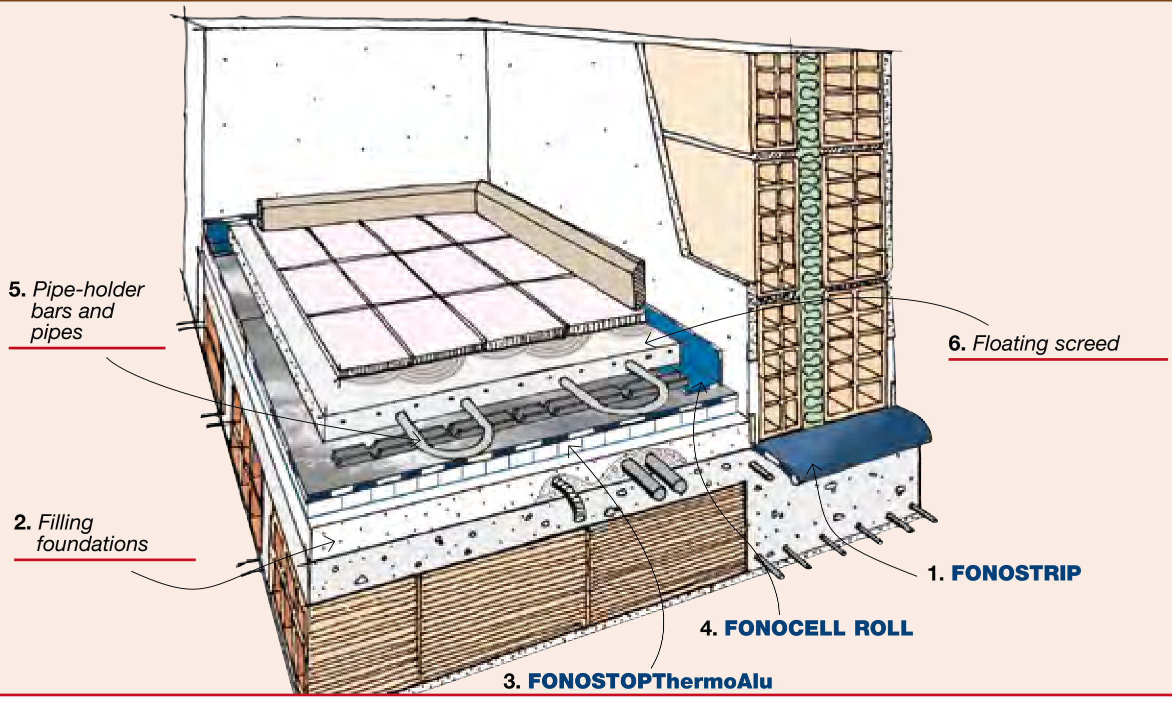
FONOSTOPThermoalu



Sizes
height of roll: 1.05
variable length based on the thicknesses: 5÷10 m

NEW BUILDINGS OR FULL REFURBISHMENTS

ACOUSTIC INSULATION WITH FLOATING FLOOR TECHNIQUE

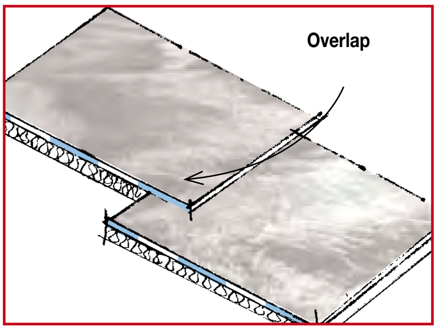


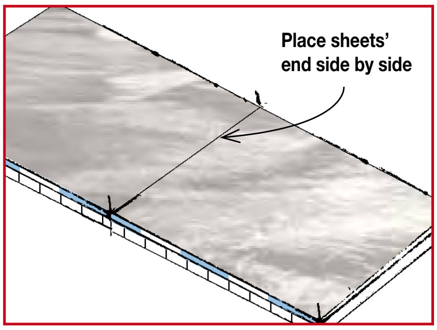
The specifications items are on page 94

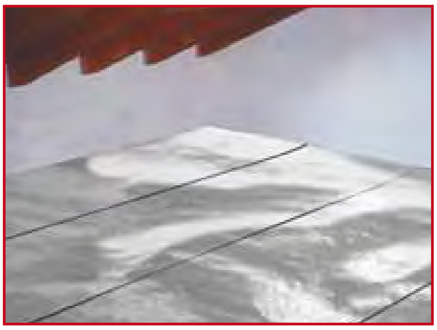
METHOD OF USE

LAYING FONOSTOPThermoAlu

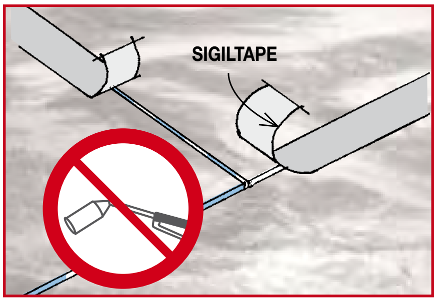
Laying FONOSTOPThermo. The product is very simple to lay and the method is the same as that for the FONOSTOPDuo foil. FONOSTOPThermoAlu is laid directly on the substrate. The rolls of FONOSTOPThermoAlu are to be unrolled in their natural unrolling direction with the top aluminium-coated face facing upwards and are to be overlapped at the sides by arranging the overlap wing on the adjacent sheet and carefully matching the elements up. On the short side, neither materials are overlapped but are carefully brought together end-to-end. They will cover the whole floor slab and are to be blocked and trimmed-off at the foot of the perimeter walls of the room to be insulated.





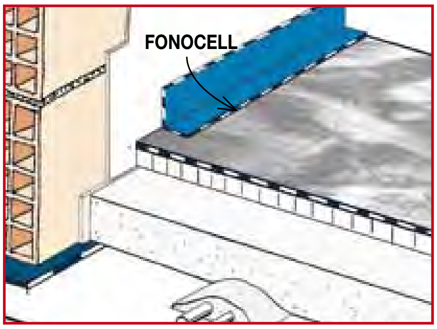


Sealing the sheet. All the longitudinal overlap lines and the transversal joining lines of the sheets are then to be carefully sealed with the special adhesive SIGILTAPE, stuck over the same.



SEPARATION WITH FONOCELL

Laying FONOCELL. The floating screed must be completely detached not just from the floor slab but also from the walls and from anything coming out of the slab that should cross it.
To do this, starting from the insulation material laid on the slab surface, the perimeter walls are to be lined by 15 cm with the special FONOCELL angular self-adhesive elements in expanded polyethylene, which will be turned up and over the surface by 5 cm to glue them to the insulation layer on which they will be further blocked with the adhesive SIGILTAPE
Any parts or pipes that should cross the insulation sheet and the floating screed vertically shall be lined carefully with FONOCELL.



INSULATING WRAPPING OF PIPING AND UTILITY COMPARTMENTS

HEATING SYSTEM MOUNTING

Laying the pipe carrying bars and inserting the pipes in the seats of the bars. The heating pipes will then be laid and held in position by special modular plastic bars in which the seats for the pipes are arranged, every 5 cm (this fixing method of heating pipes is available in the catalogues of many suppliers of underfloor heating systems). These bars are to be glued in advance to the aluminium-coated face with a strip of hot extruded glue using the special electrical glue gun.

Details of the heating system

INSULATING WRAPPING OF VERTICAL PIPES

INSULATING DEVICE OF VERTICAL PIPES

HEATING SYSTEM

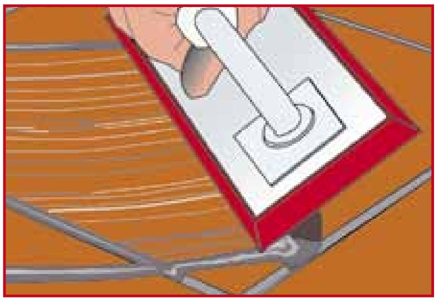
LAYING THE SCREED

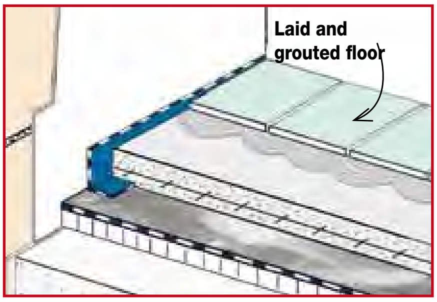
Laying of the anhydrite screed. The screed will be prepared and sized according to the instructions of the designer of the heating system: in the case of a cement-based screed, its thickness can usually be contained within 6 cm, whereas in the case of an anhydrite screed, the thickness can be reduced to 5 cm.

The heating pipes, in the case of reinforced cement-based screeds, can be bound or secured with appropriate devices to the electrically welded metal reinforcement but for both systems, what's most important <u>is never to perforate or secure the pipes across the insulation material FonostopThermo</u>, otherwise its insulating properties will be jeopardised. The screed is then laid without perforating the insulation or moving the overlaps.

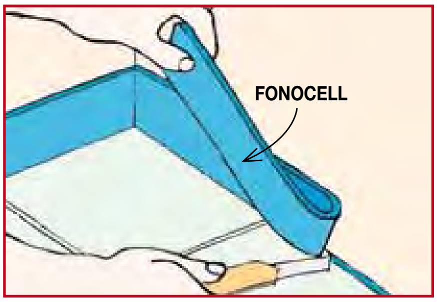
LAYING THE FLOOR

Laying and grouting the flooring. Once dried, the floor will be laid on the screed for which, based on the type of flooring involved (ceramic, stone or wood), the most suitable glue and joint grouting will be used according to INDEX instructions.
It is extremely important that the vertical part of FONOCELL that lines the wall and that comes out of the screed layer to be left where it is until the flooring has been laid completely, so that the same does not touch the wall and create an acoustic bridge, which could make the insulation completely inefficient.

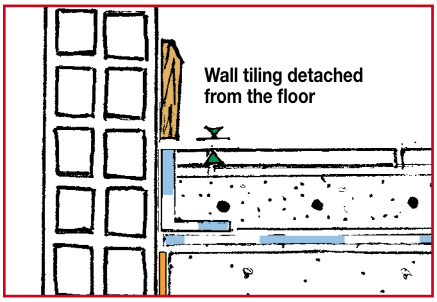




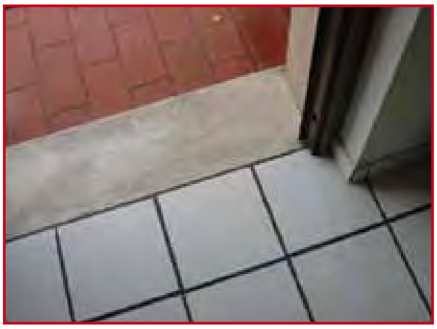
Remove any FONOCELL in excess. Only after laying the flooring is it possible to remove the excess part of FONOCELL. <u>The surplus material is easily eliminated using a Stanley knife.</u>

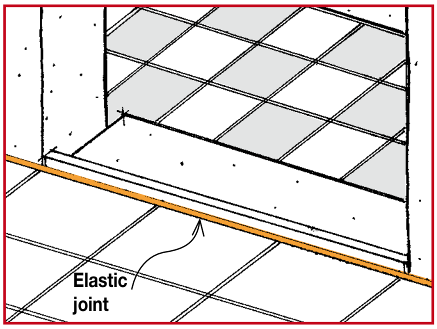


Laying the skirting board and elastic sealing. The skirting boards must be detached from the flooring. To do so, while laying, put a spacing solution between the floor and the skirting board to lift it by approx. 2 mm; the spacing solution will then be removed once the glue has set. Once you have laid the skirting board or the ceramic wall tiles detached from the flooring, you can arrange an elastic sealing seam.



Joints by thresholds. Just as important is the care to be taken near the threshold tiles of entrance doors and French windows of the room to prevent the flooring from connecting to rigid mortar; FONOCELL must be left in place until the floor has been laid and will be removed and replaced with a profile of soft and elastic material.





ACOUSTIC PERFORMANCE

The insulation performance against foot traffic noise is guaranteed by the layer of FONOSTOPAlu, with dynamic stiffness s'= 21 MN/m^3, which determines, in compliance with the simplified calculation method TR UNI 11175 (Guide to standards of series UNI EN 12354 for the forecasting of acoustic performance of buildings), a ΔL_w = 28 dB sufficient to respect the limits imposed for the most commonly used floor slabs in residential buildings by DPCM 05/12/97.
For superior levels of insulation, simply position another layer of FONOSTOPDuo or FonostopTrio on the foundation before laying the insulation panels or FONOSTOPThermoAlu.

THERMAL PERFORMANCE

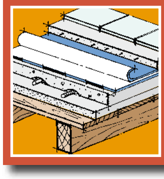
FONOSTOPThermoAlu is produced in thicknesses of 26, 36, 46 and 56 mm, which are sufficient to comply with the most commonly requested thermal insulation needs. The table that follows shows the corresponding thermal resistance values.

THE THERMAL PERFORMANCE OF FONOSTOPThermoAlu

Type	25	35	45	55
Thickness	26 mm	36 mm	46 mm	56 mm
Thermal resistance (EN 12667)	0,65 m^{2}K/W	0,95 m^{2}K/W	1,20 m^{2}K/W	1,50 m^{2}K/W

COMPRESSION STRENGTH

The compression strength is an important feature for materials to be used under floating screeds subject to a constant load over time.
The compressibility under a constant load of FONOSTOPThermoAlu is affected by the component that provides the acoustic performance, which must imperatively be the most deformable of the composite material, made up of the non-woven fabric of FONOSTOPAlu glued over the expanded polystyrene that dampens vibrations in the screed under foot traffic strain by elastic deformation.
The expanded polystyrene coupled on the bottom face is basically non-deformable under the load of the floating floor.
The consequent result is that the reduction in the thickness under a constant load of 200 kg/m^2 (EN 1606) is that of FONOSTOPAlu equal to ≤1mm.



ACOUSTIC INSULATION OF WOOD FLOORS AGAINST FOOT-TRAFFIC NOISE

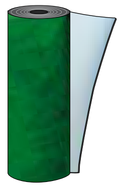
This is usually a case of old floors that are to be renovated. They consist of a load-bearing structure of beams enclosed by wooden boards. This type of floor slab is almost always too light and has both airborne and foot-traffic noise problems. Moreover, it is often not totally solid, and noise is thus able to pass also through holes, slits, and porous elements. In this case there is no use in referring to mass law. We recommend you seek advice from an expert in the acoustics field on a case-to-case basis, who will be able to reconcile the different needs since, in this case, acoustic insulation solutions often clash with the aesthetic needs of the customers - their hair stands on end if the technician suggests a false-ceiling or enclosing the exposed beams.
Another complication concerns foot-traffic noise: this is because both the insulating materials of floating floors and resilient flooring do not have the same efficiency as they do on cement floor slabs, which are heavy and rigid with considerable differences in ΔL_w, even as much as 10-20 dB. This problem occurs especially at low frequencies, where a light, flexible wood floor has severe acoustic shortcomings and in a range of frequencies where insulating materials are not very efficient.
We can sum up the guidelines for wood floors as follows:

- Make sure the floor slab is airtight. Materials such as TOPSILENTBitex and TOPSILENTDuo can satisfy this need.
- Increase the weight and rigidity of the floor slab as far as possible.

TOPSILENTBitex

Size
0,60 × 11,5 m
1,20 × 11,5 m
0,60 × 8,5 m
1,20 × 8,5 m

TOPSILENTDuo



Size
0,60 × 8,5 m

Whenever possible, build a false ceiling. This will be the type that provides better performance, with the air space insulated with mineral or synthetic wool, such as SILENTGLASS or SILENTEco, and with the hung in-filling element made up of several layers of lined plaster, preferably in sandwich style with TOPSILENTBitex soundproofing foil.
The latter type of intervention will surely also provide good insulation against airborne noise.

The illustration at the side shows the stratification of a wood floor, with insulation provided by solution B:
FONOSTOPDuo laid in a double layer with faces set opposite each other. The solution was measured on-site and resulted in L'_{nw} = 58 dB.

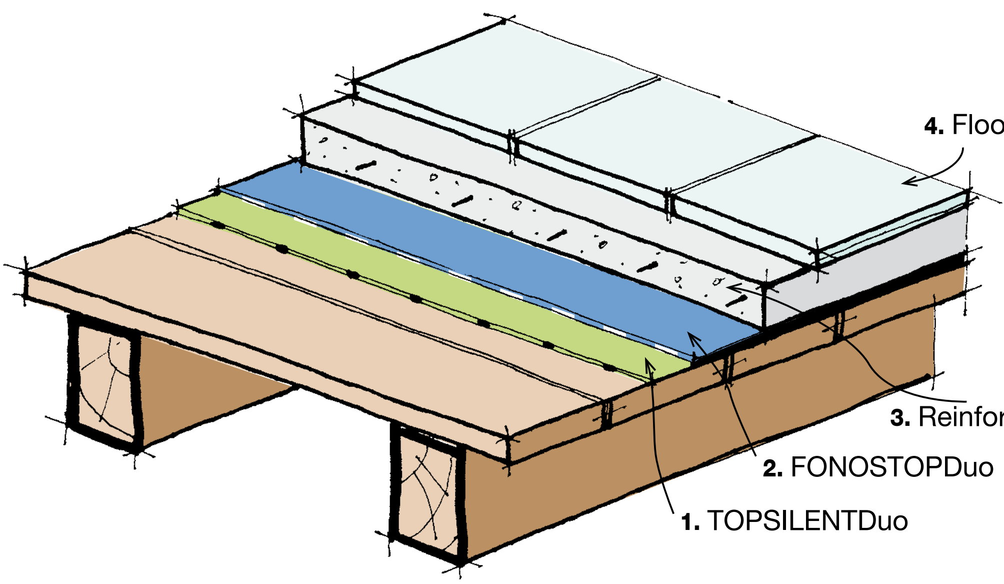
FONOSTOPDuo

Size
1,05 × 10 m

TECHNICAL INTERVENTION SOLUTION

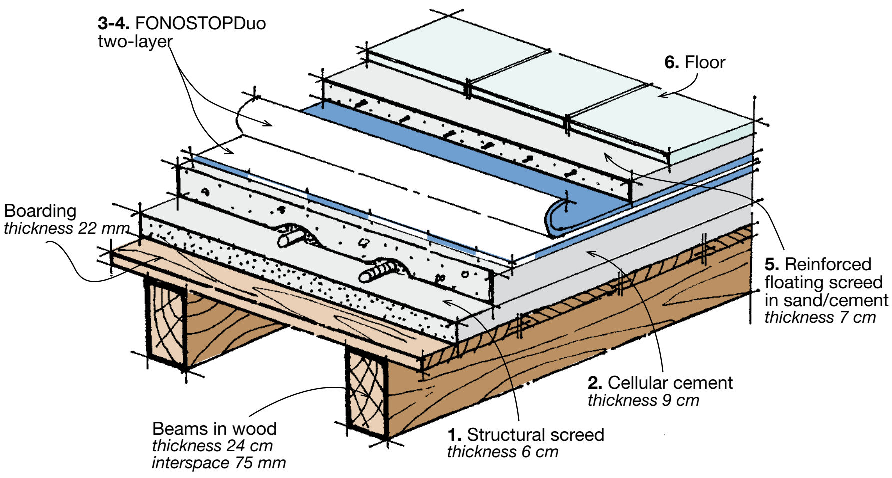
NEW BUILDINGS OR FULL REFURBISHMENTS

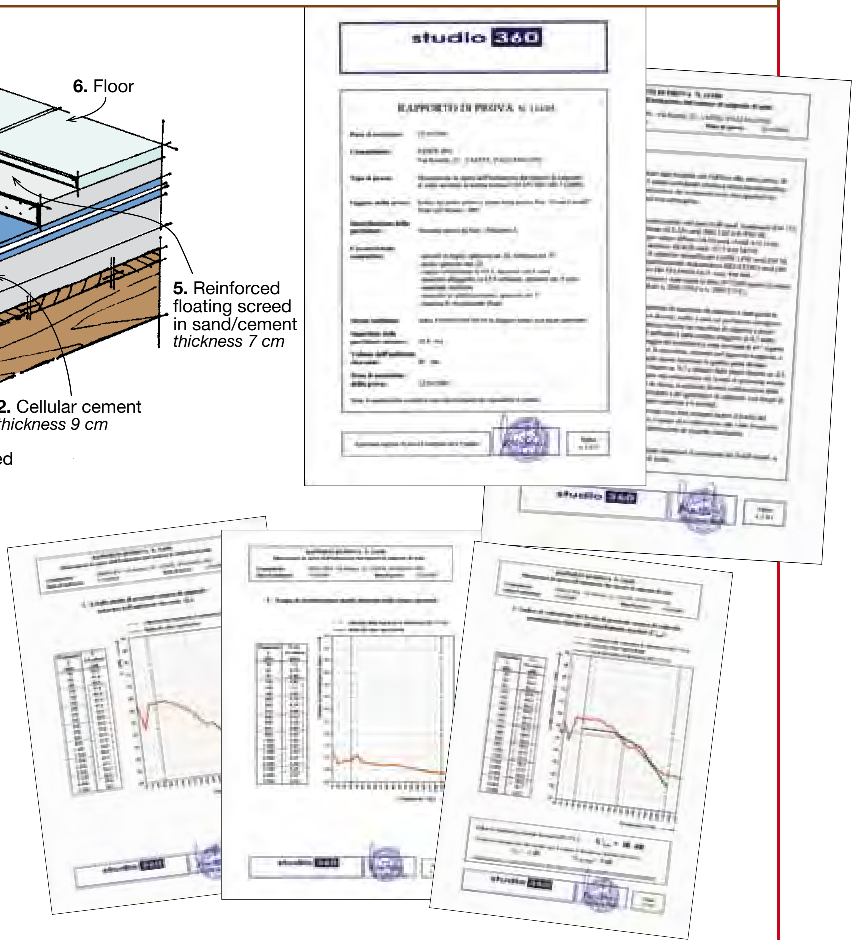
ACOUSTIC INSULATION WITH FLOATING FLOOR TECHNIQUE



NEW BUILDINGS OR FULL REFURBISHMENTS

ACOUSTIC INSULATION WITH FLOATING FLOOR TECHNIQUE ON DOUBLE LAYER OF FONOSTOPDuo



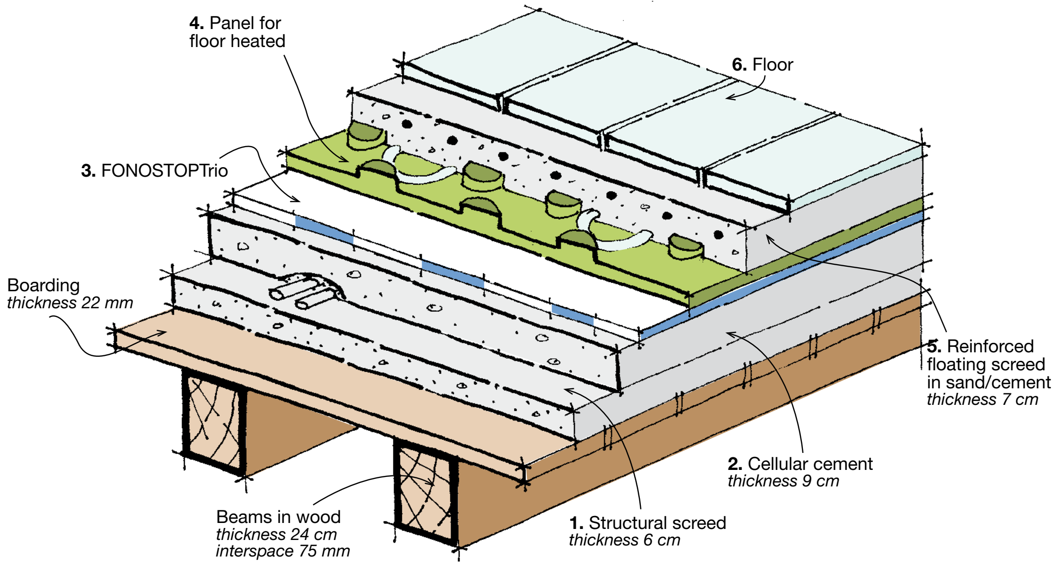


L'nw = 58 dB
(on-site measurement)

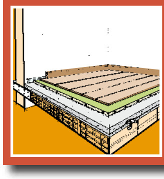
The specifications items are on page 94

NEW BUILDINGS OR FULL REFURBISHMENTS

ACOUSTIC INSULATION WITH FLOATING FLOOR TECHNIQUE FOR HEATED FLOORS



L'nw = 59 dB
(on-site measurement)



ACOUSTIC INSULATION OF FLOATING WOOD FLOORS AGAINST FOOT-TRAFFIC NOISE

A SOLUTION FOR RENOVATION JOBS

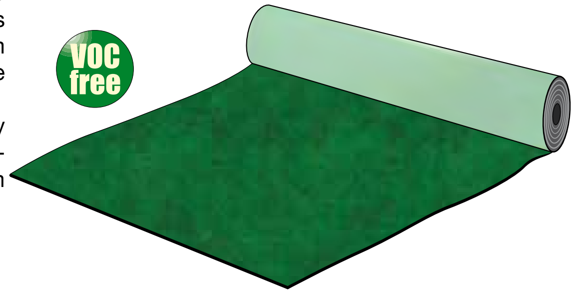
This insulation system is very similar to the one examined previously, with the only difference being that, in this case, there is no floating screed, but the floor itself floats directly on the insulation material.
This system is suitable for use in new builds, but it can also be very convenient in renovation jobs, where it is laid directly on the old floor, thus avoiding demolition. Seeing that is not very thick, it can also be used in desperate cases, when in the case of a new build, there is no space for the screed or, due to design and/or laying errors, the expected result has not been achieved.
FONOSTOPDuo can be used as the insulation material. However, it must be ordered in the version without the overlap wing. Otherwise, we have optimised a specific product - FONOSTOPLegno - suitable for wood tongue-and-groove floors. This product provides slightly inferior acoustic performance, but is not as thick and has a lower compression rating, both to avoid damaging the tongue-and-groove parts of the wooden planks and to avoid that unpleasant sensation of excessive yielding when walking over the floor. FONOSTOPLegno consists of a soundproof foil coupled with a non-woven high-density elastic fabric. The insulation is produced in rolls of 10x1 m.
FONOSTOPLegno has a high friction coefficient referred to cement laying floors, and is sufficiently heavy not to move when laying the wood flooring, thus ensuring insulation continuity and stability. FONOSTOPLegno withstands building site traffic and has a high-density non-woven polypropylene fabric part that is highly resistant to crushing and that guarantees long-term performance. FONOSTOPLegno has a compression resistance 5 times higher than FONOSTOP DUO. FONOSTOPLegno also protects the overlying wood flooring, because the foil of the upper part of the product is waterproof and resistant to water vapour that could rise from the substrate.

The insulation material and the floor are laid completely dry and there are fewer problems compared to laying under a floating cement screed. The FONOSTOPLegno rolls are unrolled on a smooth foundation, which should be clean and dry, without any bumps or dips. FONOSTOPLegno should be laid with the face covered with non-woven fabric facing the floor to be insulated.
FONOSTOPLegno is also used under cement screeds, in special cases where very high compression resistance is required.
When laying over an existent tiled floor, it is preferable to spread a coat of FONOCOLL glue over the latter beforehand to prevent FONOSTOPLegno from moving when laying the overlying flooring.

The joining lines are sealed with the special extra-adhesive SIGILTAPE stuck over the same.
The insulation material should be blocked and trimmed-off at the foot of the walls and of any parts protruding from the surface of the floor.

To avoid acoustic bridges when laying the flooring, the latter must not touch the walls. As a precaution, use a strip of self-adhesive extruded polyethylene, and stick it around the perimeters just at the foot of the walls. This will ensure that the walls are detached from the floor. The strip will be trimmed-off once the flooring has been laid.
Care must also be taken when subsequently laying the skirting board. For the same reason, it must be laid slightly detached from the floor.

FONOSTOPLegno

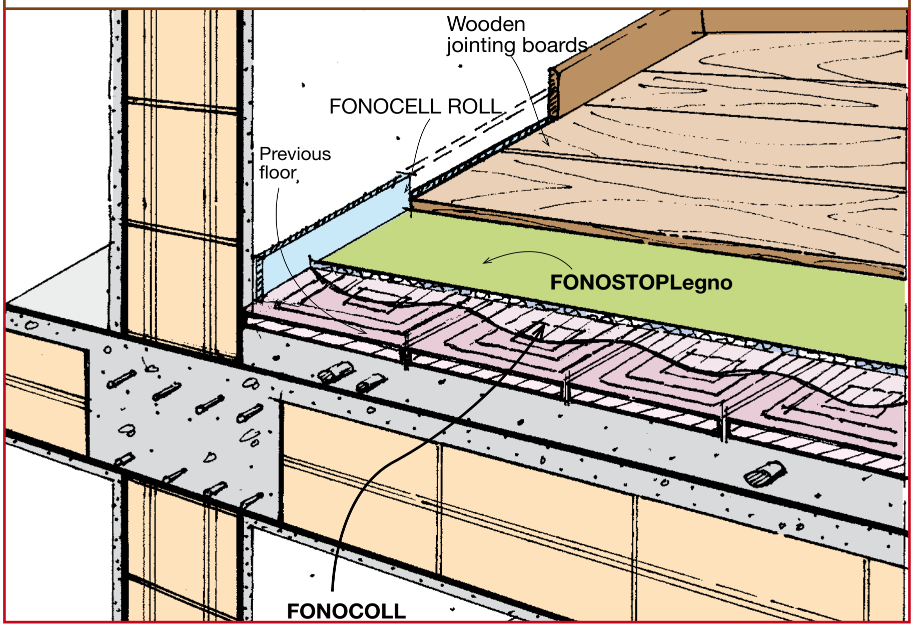


Size
1,00 × 10 m

TECHNICAL INTERVENTION SOLUTION

EXISTENT BUILDINGS

ACOUSTIC INSULATION WITH FLOATING WOOD FLOORS



The specifications items are on page 95

Comparing solution

FONOSTOPLegno's degree of insulation against foot traffic noise was evaluated as a first theoretical analysis by comparing it with the performance of FONOSTOPDuo on a reference floor (by means of the INDEX Internal method), which has a foot-traffic noise level of 71 dB.

ACOUSTIC INSULATION AGAINST FOOT TRAFFIC (*) TEST, BY COMPARISON WITH THE FONOSTOPDuo SYSTEM UNDER A FLOATING SCREED (Index's internal method on 80×40 cm samples)

FONOSTOPDuo	FONOSTOPDuo	**FONOSTOPLegno**
on reference floor (71 dB)	on reference floor (71 dB)	on reference floor (71 dB)
under concrete plate	under multi-layer wood panel	under multi-layer wood panel
thickness 5 cm	thickness 19 mm	thickness 19 mm
ΔLw = 28 dB	Lw = 16 dB	ΔLw = 14 dB
L'nw = 43 dB	L'nw = 55 dB	L'nw = 57 dB

COMPRESSION RESISTANCE TEST, BY COMPARISON WITH FONOSTOPDuo

CRUSHING	1 mm	2 mm
FONOSTOPDuo	0,86 KPa	2,40 KPa
FONOSTOPLegno	5,87 KPa	62,40 KPa

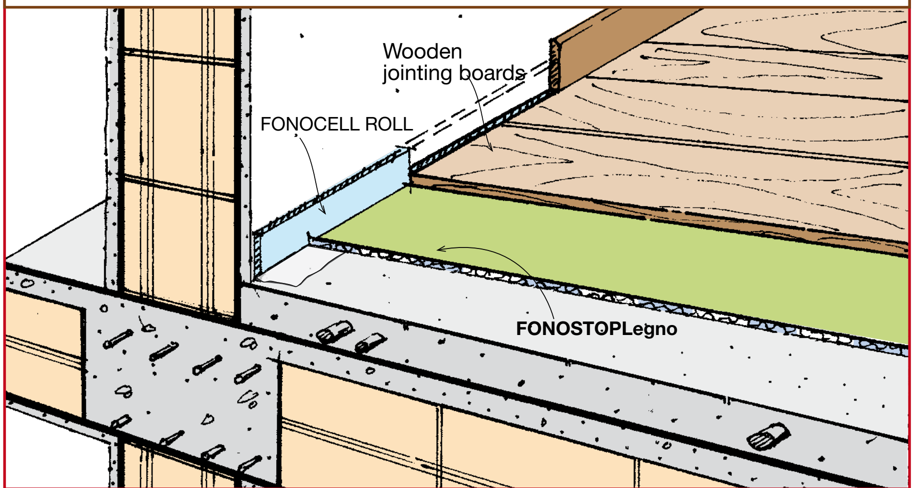
We have studied on-site performance by testing two different solutions with FONOSTOPLegno on the same clay-cement slab and under the same conditions, so that the results can be compared.
The sample floor slab was tested under two different conditions:
- condition A: original floor slab with uninsulated wood flooring;
- condition B: original floor slab with wood flooring insulated with FONOSTOPLegno, not glued.

The stratification of the floor element tested is described below, starting with the intrados.

TECHNICAL INTERVENTION SOLUTION

NEW BUILDINGS OR FULL REFURBISHMENTS

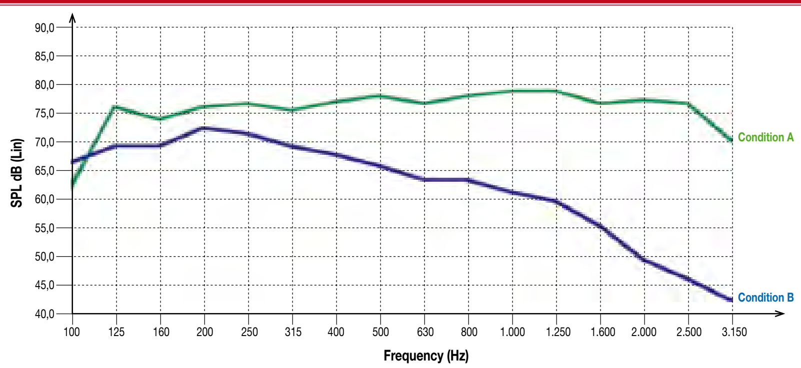
ACOUSTIC INSULATION WITH FLOATING WOOD FLOORS



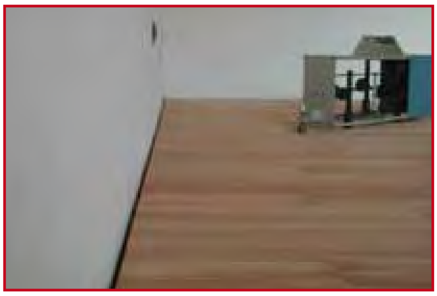
FOOT TRAFFIC NOISE - EVALUATION INDEX $L'_{n,w}$

Description	Thickness (cm)	Experimental value (dB)
Condition A		
Gypsum based plaster	1.5	78,0 dB
Clay-cement slab	20+4	
Light cement for levelling (polystyrene + sand)	5.0	
Sand and cement finishing screed	3.5	
Flooring (wood glued to the screed)	1.5	
Total floor	**about 35,5**	
Condition B		
Gypsum based plaster	1.5	59,0 dB
Clay-cement slab	20+4	
Light cement for levelling (polystyrene + sand)	5.0	
Sand and cement finishing screed	3.5	
FONOSTOPLegno panel not glued to screed	0.5	
Flooring (wood on FONOSTOPLegno)	1,5	
Total floor	**about 36,0**	

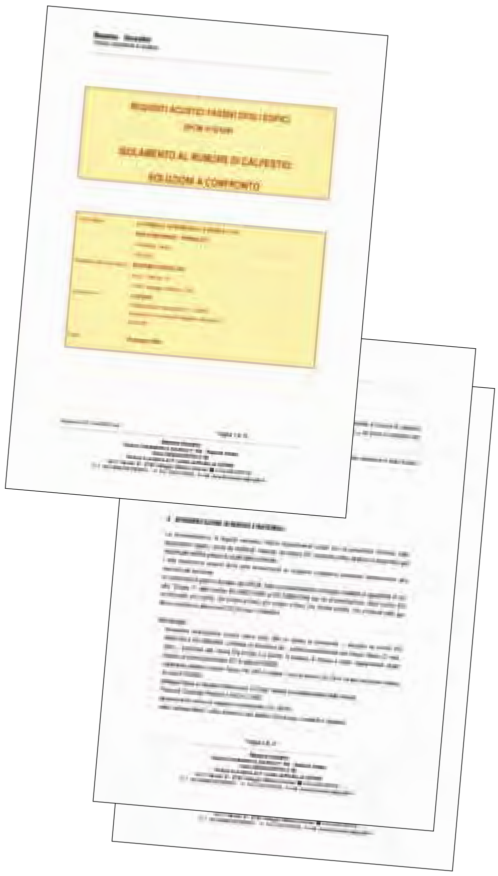
SOUND SPECTRA COMPARATED

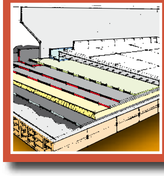


In condition **B**, the FONOSTOPLegno product was not glued to the screed so that the non-woven fabric part that adheres to the screed is in the conditions to better perform the floating action of the floor.
The results of the experimental tests are summarised in the following Table.
Following a frequency analysis of the resulting data, the improvement obtained by adding FONOSTOPLegno can be clearly seen; from the graph - in which the frequency analysis of the sound spectrum is shown in graph form – you can see that the reduction in the sound level of the transmitted noise has changed the trend of the curve, until a curve very similar to the reference curve is obtained.
The installation of FONOSTOPLegno is always recommended without using glue and when the floating wood floorings are laid dry. If FONOSTOPLegno is to be laid with glue, the layer of glue should be kept strictly to just the amount really required, without applying too much so as not to soak and consequently stiffen the textile fibres of the bottom face of the sheet.



On-site tests
Certificate issued by "Studio di Acustica Applicata" - Verona

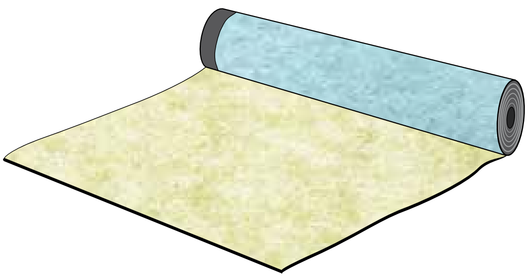




ACOUSTIC INSULATION OF TERRACES AGAINST FOOT-TRAFFIC NOISE

The load-bearing structure of terraces usually consists of floor slabs that are heavy enough to ensure observance of the legal limits specified for acoustic insulation against airborne noise.
The limits for insulation against foot-traffic noise are on the other hand satisfied by appropriate insulating stratifications. They are based on two possible solutions: Solution 1- careful selection of a thermal insulation material, which also has acoustic insulation properties, e.g. panels in expanded Perlite and cellulose fibres, and high density mineral fibre panels. Solution 2: by laying the terrace flooring on a floating screed insulated from the waterproofing coat with FONOSTOPDuo, the same material used for interiors, which, in many cases, can be beneficially replaced by a layer of FONOSTOPStrato, offering waterproofing mechanical protection.
By separating the floor layers, the floating system further increases its soundproofing power $\mathbf{R'_W}$.

FONOSTOPStrato



Size
1,00 × 15 m

FONOSTOPStrato is a multi-purpose ready-to-use separation layer. It is laid to protect the waterproof coat to be floored. It consists of waterproof non-woven thermally sealed polyester foil coupled with a resilient non-woven polyester fabric with “elastic needling”.
The foil that lines the top face prevents the liquid cement-based mortar - when the screed is laid - from encapsulating the fibres of the fabric, as this would annul the insulating properties. FONOSTOPStrato is resistant to perforation and is thick enough to reduce friction between the screed and the waterproof coat, thus preventing the transmission of cracks.
The special “elastic needling”, being an exclusive INDEX project for the non-woven fabric, along with the correct laying of FONOSTOPStrato, in compliance with the “floating screed” principle, also satisfies the other important function of acoustic insulation, thus contributing in observing the passive acoustic requirements of the buildings.
The laying methods of FONOSTOPStrato are the same as those used for laying indoor flooring on FONOSTOPDuo. To ensure the correct acoustic behaviour of the ‘floating screed’, one must plan at the design stage, the most complete separation of the screed from the floor, from the perimeter walls and from any body or pipe that crosses the terrace vertically, completing the details meticulously.
The screed, which will have a minimum thickness of 4 cm and will be reinforced with an electro-welded metal mesh, must be free from any rigid constraint that reduces its ability to oscillate on the insulating mattress, and, therefore, no pipes must be buried inside it.
The FONOSTOPStrato rolls should be unrolled and laid dry on the waterproof coat, overlapping the wing at the edge of the sheet over the nearest sheet. The sheets should not be overlapped at their head ends but just brought carefully up to each other. The sheets should cover the whole flat part of the terrace and will be trimmed-off at the foot of the vertical parts.
Both the longitudinal overlaps and the crosswise joining lines will be accurately sealed with extra-adhesive SIGILTAPE laid over them.
To keep the screed detached from the vertical parts, the latter will be covered with FONOCELL, angular self-adhesive elements in extruded polyethylene, also available in rolls. These elements descend to cover FONOSTOPStrato, already laid over the floor (*see drawing*).
Make sure you lay FONOCELL only after the waterproof coat has been protected with a layer of plaster mortar reinforced with metal mesh. The next step is to lay the screed, taking care not to damage the sheet overlaps. Only after the floor has been laid, trim the projecting part of the vertical cover and, to avoid acoustic bridges, install the skirting board slightly detached from the flooring.
The acoustic performance of FONOSTOPStrato is below that of FONOSTOPDuo, but the former has the benefit of almost always being associated with thermal insulation and if this insulation is suitably selected, it can contribute to the system’s acoustic insulation, and comes at a lower product price.
Below is the forecast calculation of the reduction $\mathbf{\Delta L_w}$ in the level of foot traffic noise.

THEORETICAL ESTIMATE OF THE REDUCTION LEVEL IN FOOT TRAFFIC NOISE

Example of simplified calculation method
TR UNI 11175 - (Guide to the Standards of UNI EN 12354 series for predicting the acoustic performance of buildings) for
SCREEDS WITH SURFACE DENSITY 100 kg/m²
Calculation of the **fo** resonance frequency of the floating screed system, resilient layer:

$$\mathbf{fo} = 160\sqrt{\frac{\mathbf{s'}}{\mathbf{m'}}} = 160\sqrt{\frac{57}{100}} = 120 \text{ Hz}$$

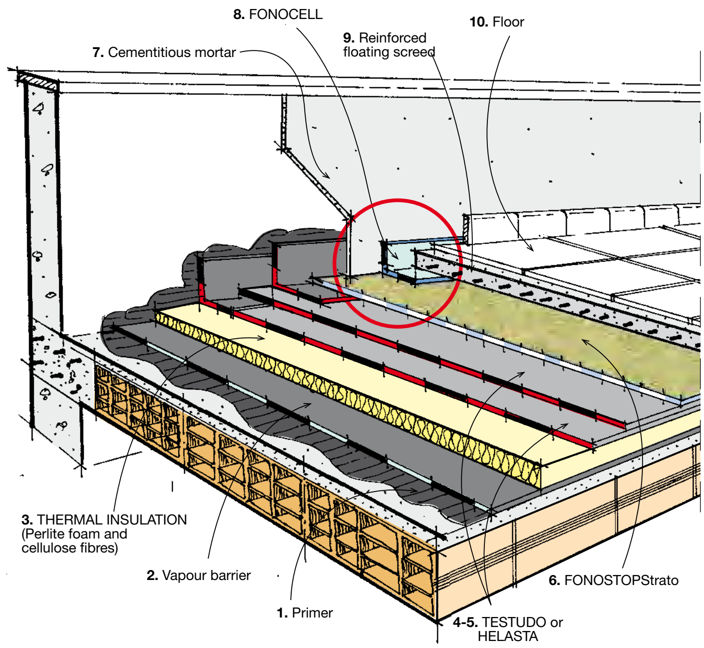
$$\mathbf{\Delta L_w} = 30 \text{ Log}\left(\frac{\mathbf{f}}{\mathbf{fo}}\right) + 3 = \mathbf{21\ dB}$$

where **f** = 500 Hz (of reference)

TECHNICAL INTERVENTION SOLUTION

NEW BUILDINGS OR FULL REFURBISHMENTS

ACOUSTIC INSULATION WITH FLOATING FLOOR TECHNIQUE



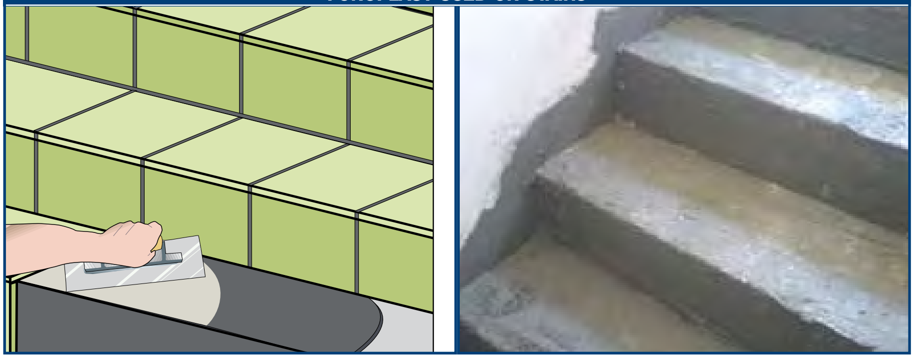
ATTENTION. Lay FONOCELL only after the waterproof coat has been protected with a layer of plaster mortar reinforced with metal mesh.

The specifications items are on page 95

REDUCTION OF THE FOOT TRAFFIC NOISE LEVEL USING FLEXIBLE FONOPLAST MORTAR

FONOPLAST is a flexible cement-based shock-absorbing mortar, with elastomer polymer base, that creates a highly adhesive flexible perimeter seal, superior to standard cement-based mortars. Thanks to its resilience, FONOPLAST can also be used as an aid in laying floating screeds and as a possible solution for limiting the structural noise of reinforced concrete stairways. It reproduces the technique of the floating screed and consequently creates a “resilient container” where the screed and the finishing flooring of the steps will lie (and skirting board if any).

FONOPLAST USED ON STAIRS

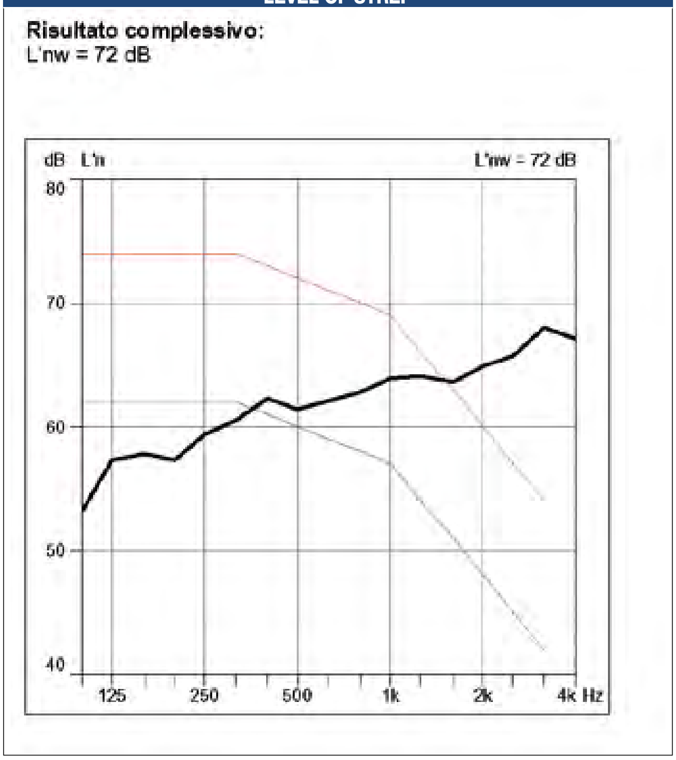


ON-SITE TESTS OF THE REDUCTION IN FOOT TRAFFIC NOISE LEVELS OF THE STEPS OF A STAIRWAY

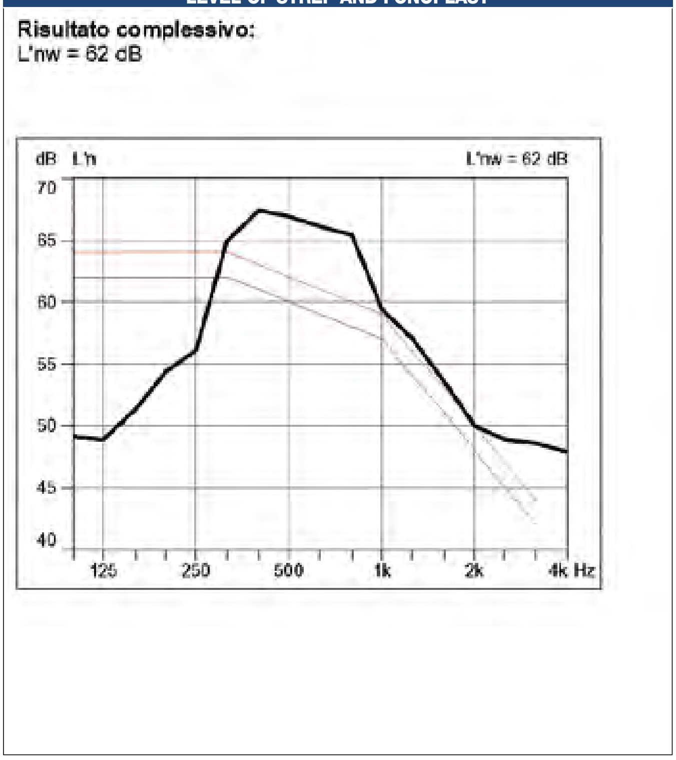
The test was carried out on a stairway secured to the dividing wall of the stairwell of the receiving room.
Originally, the stairway was covered with granite slabs glued to the steps with cement-based mortar.
The volume of the receiving room was 225 m^3.
The test carried out with the tapping machine on the steps involved:

- the step in the centre of the wall with the original granite slab for which an acoustic level of L'_{nw} = **72 dB** was measured in the receiving room;
- the step right below with the same granite slab on which a ceramic tile was glued on a layer of FONOPLAST of 4,5 kg/m^2 for which an acoustic level of L'_{nw} = **62 dB** was measured in the receiving room.

LEVEL OF STREP



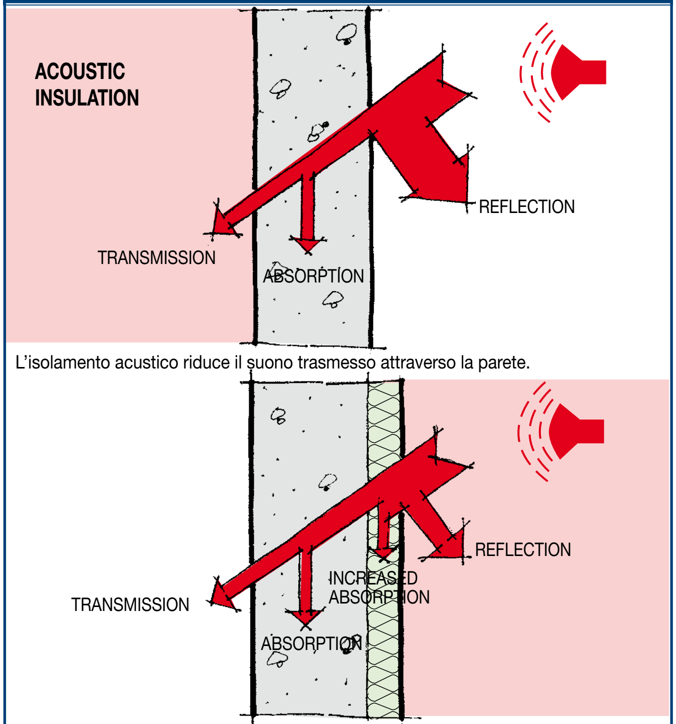
LEVEL OF STREP AND FONOPLAST



THERMAL AND ACOUSTIC INSULATION OF WALLS AGAINST AIRBORNE NOISE

Airborne noise spreading in the air when it encounters an obstacle such as a wall or floor, causes it to vibrate, and part of the noise is transmitted while another part is reflected and absorbed. Acoustic insulation is aimed at reducing the noise transmitted through walls and floors to a different room from that where the sound was produced. Conversely, reflected and absorbed noise concerns the correction of the room where the sound was produced, and is an important aspect of construction acoustics especially in the case of entertainment halls, theatres, etc, but is not dealt with in the following pages.

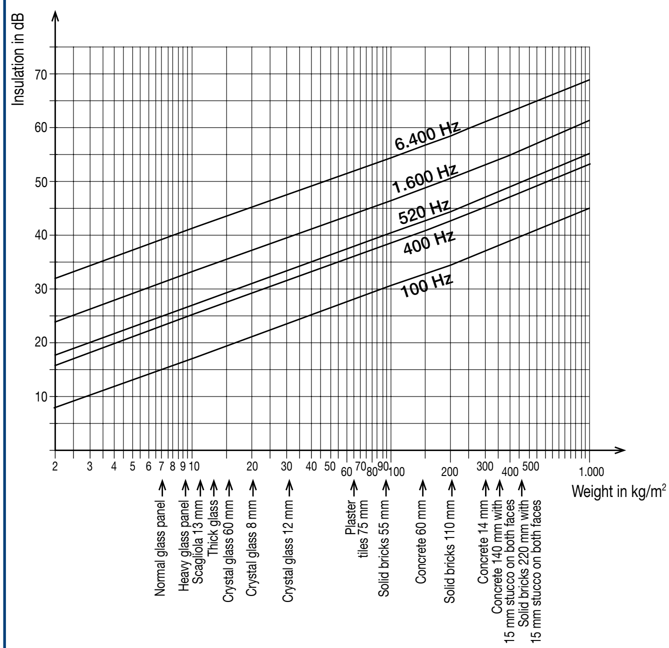
INSULATION AND ABSORPTION



The acoustic correction reduces the noise reflected in the room in which it is produced.

The absorbing materials used for acoustic correction line the walls of the room where the noise is produced.

MASS LAW GRAPH

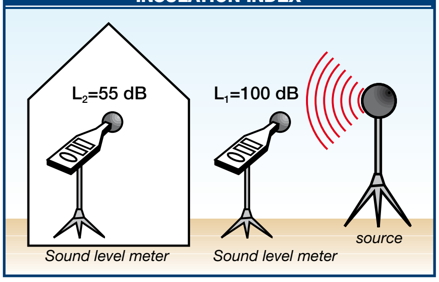


ACOUSTIC INSULATION OF WALLS AGAINST AIRBORNE NOISE

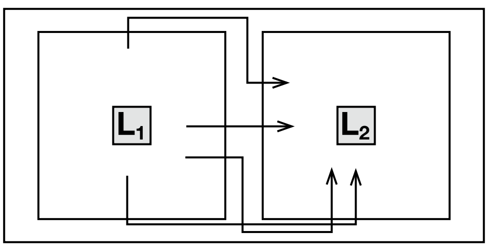
The entity of the reduction in the noise transmitted from one part of the wall to another is called the soundproofing power Rw if measured in a laboratory on a wall that divides two perfectly separated rooms. It represents the difference in the noise level, measured in linear dB's, that the wall is able to determine between the room where the noise is generated and the receiving or disturbed room. It can also be obtained through the compliant calculation of algorithms derived from experience in the laboratory and is used for the forecast calculation of the project of the acoustic insulation against airborne noise.

It is called acoustic insulation R'_w (apparent soundproofing power) if the reduction in noise determined by the wall is measured on site after the wall has been completed, as requested by DPCM 5/12/97, where the transmission of noise not only occurs directly through the separation wall between the two rooms, as in the laboratory, but also indirectly (lateral transmission) through neighbouring walls. Lateral noise transmissions mean that the acoustic insulation of a wall on site is always lower than the soundproofing power of the same wall measured in the laboratory ($R'_w < R_w$). The acoustic insulation against airborne noise of walls is to be distinguished between the insulation of external perimeter walls - whose requirement is indicated in DPCM 5/12/97 by the acoustic insulation of facades $D_{2m,nT,w}$ - and the insulation of interior dividing walls between different dwellings, whose requirement in the DPCM is represented by the apparent soundproofing power R'_w that also concerns the floors between different dwellings.

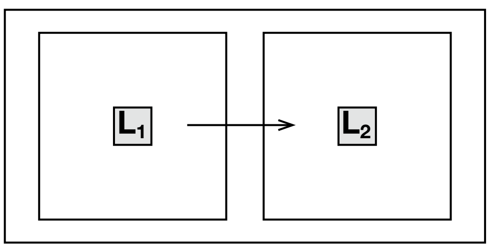
TESTING OF THE EXTERNAL WALL INSULATION INDEX



APPARENT SOUND INSULATING POWERS R'_w (on-site measurements)



APPARENT SOUND INSULATING POWERS R_w (laboratory measurement)



In the first case, the noise coming from outside the building is to be reduced; the performance is measured with a specific test and the soundproofing power of the wall, being the opaque part of the external wall, just partially affects the insulation, which is strongly conditioned by the transparent parts, windows and other elements that will be dealt with in a specific chapter.
In the second case on the other hand, the noise generated inside the building in different dwellings is to be reduced; the insulation against noise is provided exclusively by the wall, both vertical and horizontal, and the performance is measured with a different method to the previous one, which is illustrated hereafter.

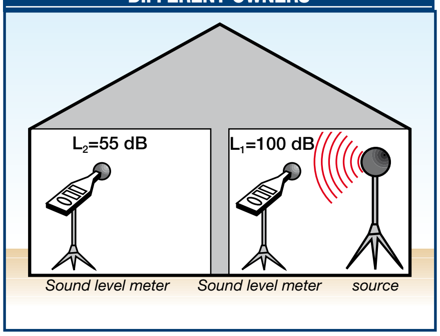
MEASURING AIRBORNE NOISE OF INTERIOR DIVIDING WALLS AND FLOORS

DPCM 05/12/97 establishes both the minimum insulation levels based on what the buildings are to be used for and also the measuring method used on site.
The test consists in measuring the difference in level of the noise $\mathbf{R'_w}$ that the wall or floor being tested are able to determine when the noise generated in a room with a special instrument (dodecahedron) is measured, using a sound level meter, and in the other receiving room, the level of noise transmitted directly and indirectly is measured.

OMNIDIRECTIONAL SOUND SOURCE

To be pointed out is that, compared to the foot traffic test, in this case, a difference in level is measured using two sound level meters, consequently, on the contrary to the afore-mentioned case, higher the insulation of the dividing wall, higher will be the difference in noise between the two rooms and therefore higher will be its soundproofing power.

TESTING OF THE APPARENT SOUNDPROOFING POWER INDEX OF A VERTICAL SEPARATING ELEMENT BETWEEN TWO HOUSING UNIT OF DIFFERENT OWNERS



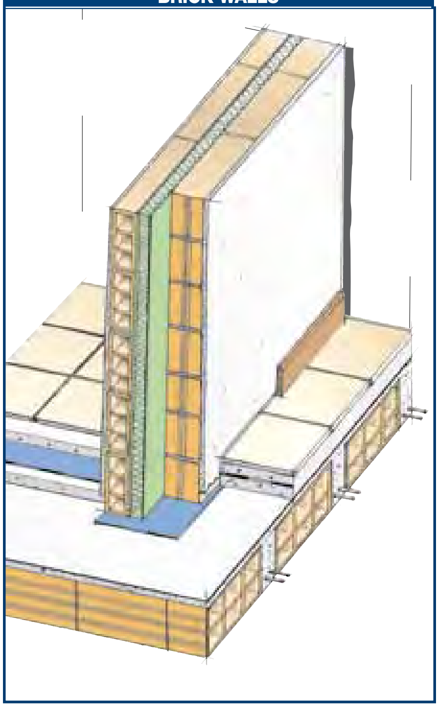
HEAVY WALLS OR LIGHT WALLS?

The acoustic insulation of walls can be created in different ways and the choice depends on a number of factors that often are not related exclusively on this.

Brick walls (the heavy solution)

The insulation of brick walls mainly depends on their weight; heavier the wall, higher will be the insulation level. They are said to follow the law of mass, described in the relative chapter. A tip on how to reduce the weight without altering the suitable level of insulation is that of dividing the weight of the wall in two, by building double walls separated by an air space.

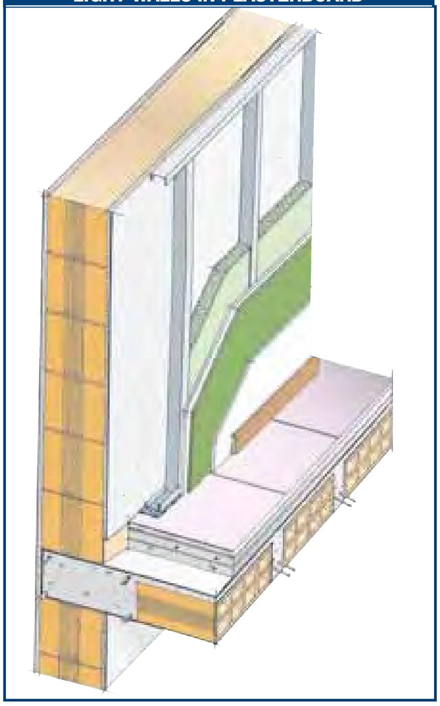
BRICK WALLS



Light walls in plasterboard (the light solution)

The acoustic insulation of plasterboard walls is not based just on the weight but mainly on a "dynamic" type of insulation that depends on resonance effects.
Plasterboard walls are always double and made up of two or more boards separated by an air space filled with fibrous insulation material. The reaction of the system can be represented with a mechanical model where the vibrations of two masses, being the two plasterboard walls, are dampened by a spring (the air in the air space) between them.
As you can see from the laboratory measurements carried out by the IEN G. Ferraris Institute of Turin illustrated further on, these walls are able to provide very high insulation levels with much lower weights and thicknesses compared to traditional brick walls.
They naturally cannot be used for external walls but are used as interior dividers, including separating walls between two different dwellings. This building system is very popular abroad, in North Europe and America, especially in hotels, hospitals, shops and offices.

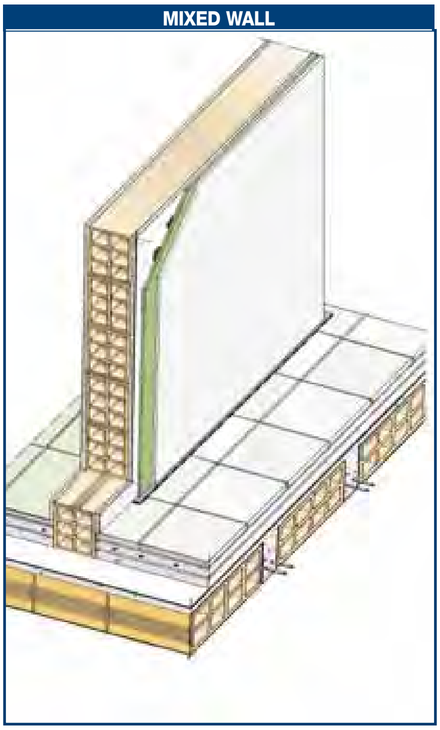
LIGHT WALLS IN PLASTERBOARD



Mixed walls (the mixed solution)

It involves the coupling of a brick wall and a plasterboard wall. This choice is often used to insulate existent walls or to correct an unsuitable wall while still in the building phase when there is not enough space to build another heavy wall.
More and more often these types of walls are built to meet the requirements imposed by laws on new builds and to increase the insulation level of existent walls built before enforcement of DPCM 5/12/97.
The different types will be described in the chapters that follow.

MIXED WALL



BRICK WALLS

SIMPLE BRICK WALLS

The heavier and more solid the wall, the greater its acoustic insulation.

Uniform, rigid walls “observe the law of experimental mass”, whereby a wall weighing 100 Kg/m² at 500 Hz, has a sound insulation power of 40 dB. If its weight is doubled, insulation increased by 4 dB, and is reduced by the same amount if its weight is halved. Uniform, rigid walls are better at insulating high frequency rather than low frequency noise. It is also said that the walls “observe the law of experimental frequency”, i.e. providing the law of mass is adhered to, at 500 Hz, a wall weighing 100 Kg/m² provides insulation of 40 dB. If we measure the insulation at double or halved frequency, the wall’s insulation is higher or lower by 4 dB (the graphs shows the insulation values at different frequencies of various facing materials according to their weight).

However, at a certain frequency, known as “critical frequency”, there is an insulation ‘gap’ in the uniform wall. If this gap occurs in the range of frequencies best heard by the human ear, e.g. conversation, radio, etc, it is very bothering.

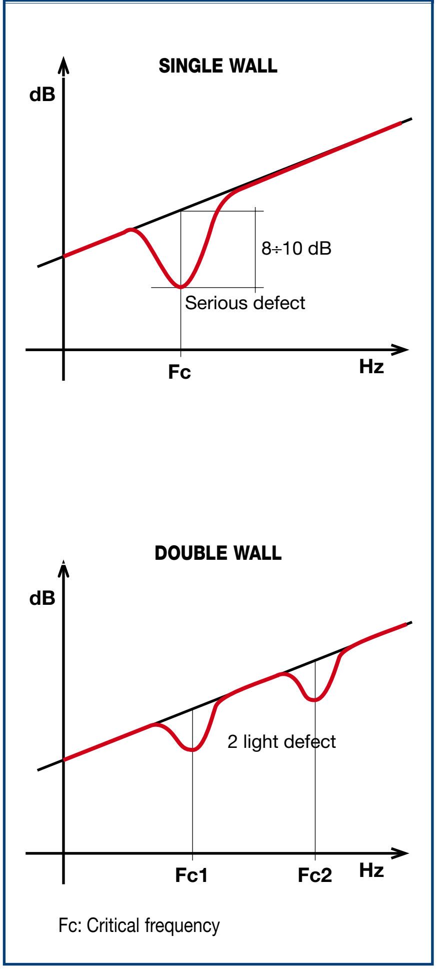
Critical frequency depends on the weight and type of wall (see table). At critical frequencies, traditional construction materials (concrete, bricks etc.) have insulation fall-offs from 6 to 10 dB. Conversely, other materials with a strong internal dissipation capacity, such as lead, rubber or the basic compound of TOPSILENTBitex (a lead polymer), do not have any acoustic gaps in the range of frequencies heard by the human ear, and faithfully follow the law of mass. That is why they are often used to improve the acoustic performance of other materials with which they are combined, as in the case of light multi-layer walls. However, it is pointless to use them for improving the insulation of a heavy brick wall, unless they are aimed at remedying the wall’s “continuity” defects.

In fact, their limited weight cannot significantly influence the end result: it would be like expecting to slow down a running elephant by putting an ant on its back. In practice, to reduce the effect of critical frequency in traditional walls, one has to increase the mass of the single wall, or divide it in two and build a double-wall consisting of two walls of a different mass divided by an interspace to prevent the walls resonating against each other. In this way, the double-wall will have two weak points (critical frequencies), but these points will be at two different frequencies and of lesser value. The double-wall will thus produce a defect smaller than that obtained by a single wall of the same thickness and type and, therefore, acoustic performance will be better.

CRITICAL FREQUENCY VALUES OF SOME COMMON MATERIALS

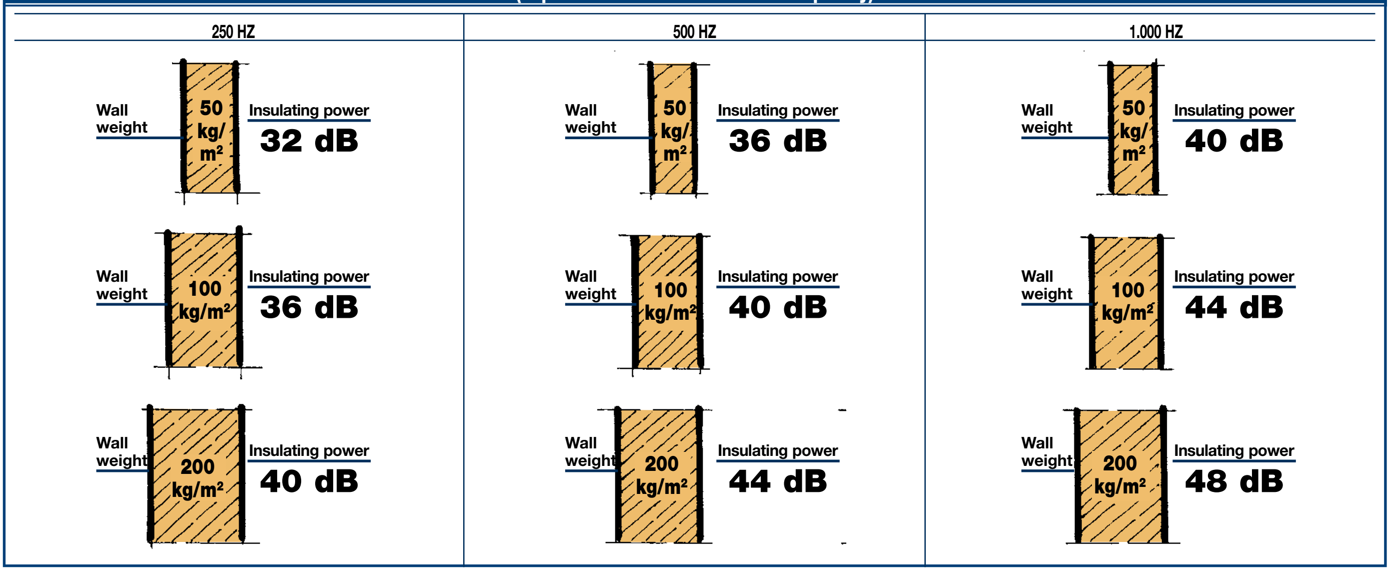
Material	Mass (kg/m³)	Critical frequency for thickness values of 1 cm (Hz)
TOPSILENTBitex	1.250	85.000
Rubber	1.000	80.000
Cork	250	18.000
Expanded polystyrene	14	14.000
Steel	7.800	1.000
Aluminium	2.700	1.300
Lead	10.600	8.000
Glass	2.500	1.200
Solid brick	2.000÷2.500	2.500÷5.000
Concrete	2.300	1.800
Gyp	1.000	4.000
Wood (Spruce)	600	6.000÷18.000

SINGLE WALL AND DOUBLE WALL



The weight required to reach acoustic insulation of $R_w \geq 50$ dB of DPCM 05/12/97 for a single wall is greater than 500 kg/m², whereas, as we shall see further on, a mass of 250-300 Kg/m² is sufficient for a double-wall.

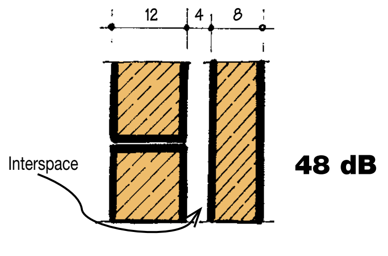
INSULATING POWER OF WALLS (Experimental law of mass and frequency)



DOUBLE BRICK WALLS

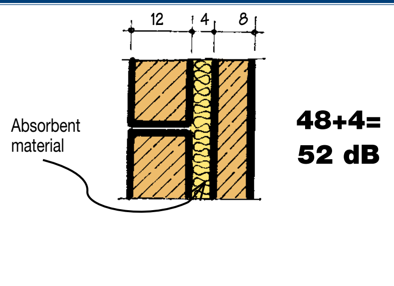
In the previous chapter, we saw how important it is for the two walls in a double-wall to have a different mass.
However, in order to further improve insulation, measures can also be taken as regards the air interspace separating the walls. This space is the spring of the mass-spring-mass system consisting of wall 1 - air space - wall 2.

DOUBLE NO-INSULATED WALL



A double-wall is normally used for the perimeter walls of a dwelling and, for cost saving reasons, the interspace between traditional walls does not exceed 6 cm and is generally in the range from 3 to 5 cm.
If the interspace is filled with absorbing material (fibrous materials are usually employed), acoustic insulation is further improved. This is because the fall-off in insulation at the critical frequencies of the two walls is reduced, thanks to the dissipating effect of the fibrous material which transforms the sound energy passing through the wall into heat. It is calculated that, in the above situation, for every centimetre of interspace filled with fibrous insulation material, insulation improves by 1 dB compared to the same interspace left empty.

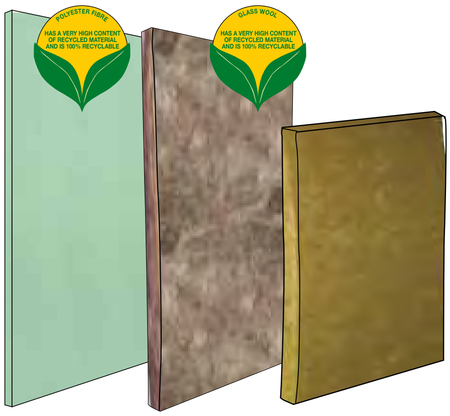
DOUBLE-WALL WITH INSULATED INTERSPACE



INSULATING MATERIALS FOR THE INTERSPACE

The air spaces must be filled with porous material that is permeable to air.
Cellular thermal insulation products with closed cells are of no use and in some cases they may even deteriorate the acoustic performance of the stratified layers.
To ensure the best result, it is better to totally fill the air space with fibrous insulation (see the DETAILS of the fibrous insulation products SILENTEco, SILENTGlass and SILENTRock).
SILENTGlass is a thermal-acoustic insulation product made of glass wool with density of 30 kg/m³. It is supplied in panels measuring 0.60×1.35 m so that it can be used in air spaces of double walls and in light walls and false-walls in plasterboard on metal framework.
SILENTRock is a thermal-acoustic insulation product made of rock wool with density of 40 kg/m³. It is supplied in panels measuring 0.60×1.00 m so that it can be used, likewise for the previous product, for the insulation of brick walls and for light walls in plasterboard on metal framework.
SILENTEco is a thermal-acoustic insulation product made of synthetic polyester non-toxic fibre with density of 20 kg/m³. It is obtained from recovering and recycling mineral water and soft drink bottles in PET (polyethylene terephthalate) through the environment friendly disposal of Solid Urban Waste (SUW). The fibres of SILENTEco are not irritant and the panels can be handled without having to wear gloves and face masks, consequently it is better suited for use in refurbishment work in dwellings that are already inhabited. Likewise for the previous products, SILENTEco is produced in panels measuring 0.60×1.42 m so that they can be used to insulate brick walls and plasterboard walls on metal framework.

SILENTEco | SILENTGlassEco | SILENTRock

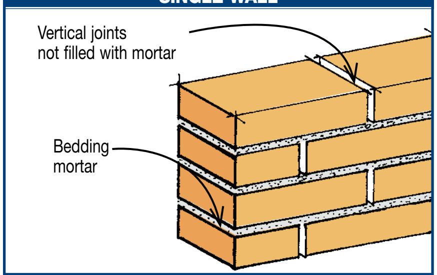


Size 0,60 × 1,42 m | Size 0,60 × 1,35 m | Size 0,60 × 1,00 m

WALL POROSITY

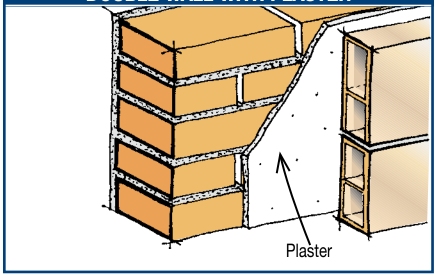
So far we have talked about walls in uniform, perfectly solid materials. In actual fact, brick walls have many variants and gaps.
In general, the mason does not fill the vertical joints of the bricks with mortar, but beds only the rows of the course of horizontal bricks. This is why, often, walls which should provide a sufficient amount of insulation due to their weight, are instead 10 dB or even 30 dB below the expected value!

SINGLE WALL



It's as if we had left an open window after building a perfectly insulated wall!

DOUBLE WALL WITH PLASTER



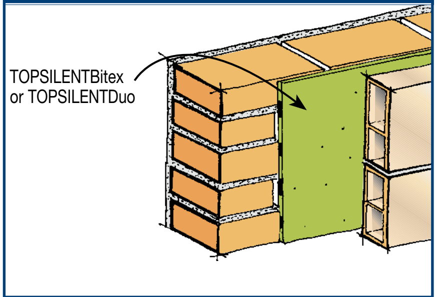
This is why it is important to plaster the wall with waterproofing plaster.
In the case of double walls, the internal face of the air space must also be plastered or the plaster can be advantageously replaced with the soundproofing foil TOPSILENT, which is a much better waterproofer than plaster and makes it possible to create a watertight air space.
<u>TOPSILENT is a foil that offers the acoustic properties of a foil of lead of the same weight, **but it does not actually contain lead**. It insulates the same as lead but is free from the typical toxicological problems of this metal.</u>
There are three version:

- TOPSILENTBitex: with both faces lined with green polypropylene non-woven fabric
- TOPSILENTDuo: with one face lined with green polypropylene non-woven fabric and the other with a thick lining of white polyester non-woven fabric
- TOPSILENTAdhesiv: with one face lined with green polypropylene non-woven fabric and the other with a silicone-coated film that protects a self-adhesive mass spread over the foil face.

When used in air spaces of brick walls, TOPSILENT seals the pores in the wall so that it complies with the theoretic acoustic performance calculated with the law of mass. It does not however add any further insulation to the wall because the addition in weight is insignificant compared to the mass of the wall.
When, on the contrary, TOPSILENT is coupled with light walls in plasterboard or wood, it does indeed increase the acoustic insulation because it dampens the vibrations of light walls and also because the addition in weight is appreciable.

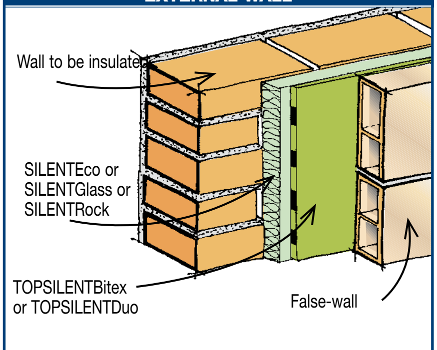
Size 0,60 × 11,5 m - 1,20 × 11,5 m 0,60 × 8,5 m - 1,20 × 8,5 m | Size 1,00 × 8,5 m | Size 0,60 × 8,5 m

DOUBLE WALL LINED WITH TOPSILENT



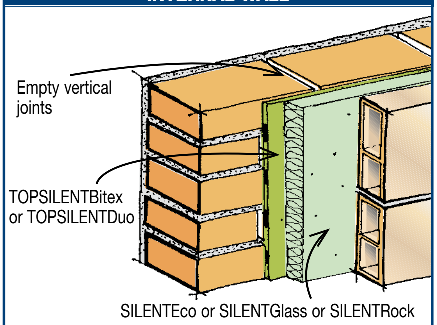
TOPSILENTBitex and TOPSILENTDuo are highly resistant to aqueous vapour and can be used to replace the vapour barrier in metal foil normally employed to protect the thermo-acoustic insulation of outer perimeter walls, when they are applied on the warmer face of the insulation.

EXTERNAL WALL



For internal partition walls, TOPSILENTBitex and TOPSILENTDuo should be applied before the insulating material.

INTERNAL WALL



Alternatively: **TOPSILENTEco** or **TOPSILENTRock**

In this way, one can obtain acoustic insulation close to the theoretical insulation calculated according to weight and geometry. Obviously, for these very reasons, chases for electrical or hydraulic systems, routes, electrical boxes and connector blocks produce the same negative effects which, however, can be considerably reduced in the case of double-walls.

PRE-COUPLED INSULATION PANELS

The pre-coupled panels of TOPSILENTEco and TOPSILENTRock are obtained by joining a polyester fibre insulation product, type SILENTEco, or mineral fibre, type SILENTRock, with a high density soundproofing foil with high resistance to air and water vapour (TOPSILENTBitex) and act as both acoustic and thermal insulation.

With regard to acoustic insulation, the fibre of the composite material dissipates the sound energy that crosses the air space of the double wall, while the airtight foil seals the pores in the wall so that the internal face of the air space does not need to be plastered.

With regard to thermal insulation, the fibre is also an excellent thermal insulator. Its efficiency is maintained over time by the foil, which is always to be turned over towards the inner part of the compartment to be insulated. This foil, in the insulation of external perimeter walls, does indeed act as a vapour barrier and keeps the thermal insulation obtained by the fibres dry and unaltered.

For both types, the coupling of the insulation and the foil, reduces application times and facilitates laying, especially for TOPSILENTEco, which is produced in large sizes.

TOPSILENTEco is a thermal-acoustic insulation product whose fibrous part consists of non-toxic polyester wool obtained from recovering and recycling mineral water and soft drink bottles in PET through the environment friendly disposal of Solid Urban Waste

The fibre thus obtained is to be considered as a dually ecological material because it frees the environment of high volumes of waste and because the product obtained through a glue-free thermal process does not irritate the skin and does not sting. The production cycle of the fibres of TOPSILENTEco, seeing as it is a recycling process, also has very low environmental impact and low consumption of energy compared to that of other insulation materials that derive from raw virgin materials.

The fibres of TOPSILENTEco do not irritate the skin of builders, not even when cutting the panels and this is why, on the contrary to TOPSILENTRock with rock wool base, the panels are not packed in plastic sacks.

For the reasons just mentioned, TOPSILENTEco is better suited for refurbishment work in dwellings that are already inhabited and where the dispersion of irritant fibres is not tolerated, not even when cutting the product.

TOPSILENTEco is suitable for the thermal-acoustic insulation of air spaces in external perimeter walls and internal dividing walls between different dwellings.

The advantages of the coupling of the insulation material and the foil, for TOPSILENTEco, are further enhanced by the special configuration of the panels, combined with the large sizes in which they are produced (100×142cm, 100×285 cm).

Laying is simple and quick; TOPSILENTEco is glued to the wall with the face covered with the foil facing the operator. Simply apply a strip of approximately 15 cm of GIPSOLL glue on the fibrous face on the top end to hold the 100×142 panel in place, whereas another strip will be required in the middle to hold the 100×285 cm or the 100×300 cm panels in place.

It takes just a few minutes; the panel on which the adhesive is applied is put in place and lightly pressed against the wall; it holds straight away and the operator can carry on fitting the next panel. Finally, to ensure greater resistance to air and water vapour, the joining lines of the panels are sealed with the adhesive SIGILTAPE.

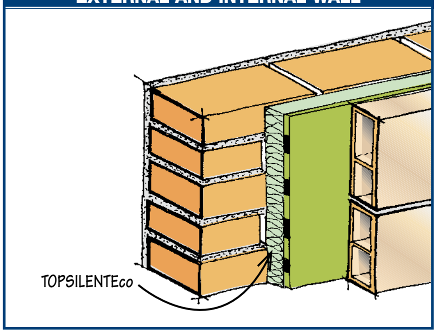
The glue is prepared by mixing the GIPSCOLL powder with water (it takes 600 g per strip), until a thick paste is obtained, which will be applied using a trowel or toothed spatula. Its consistency and adhesiveness should be such to hold the panel on the wall immediately, even when still wet, without having to wait for it to set and without having to use supports.

TOPSILENTEco

Size
1,00 × 2,85 m

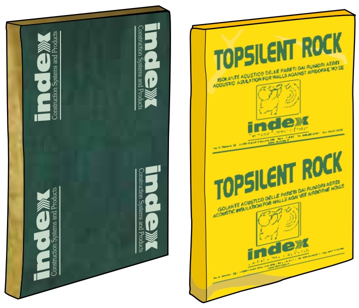
Size
1,00 × 1,42 m

EXTERNAL AND INTERNAL WALL



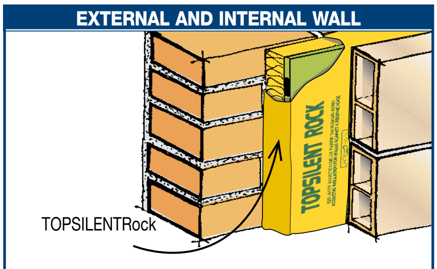
TOPSILENTRock is a thermal-acoustic insulation product consisting of a rigid fireproof panel of high density rock wool treated with thermo-setting resins coupled with the soundproofing foil TOPSILENT. To avoid direct contact with the mineral fibre, it is wrapped in polyethylene, where "Side A-facing the user" indicates the correct position of the product on site, with the foil facing the inner part of the compartment to be insulated.
TOPSILENTRock offers a high level of thermal resistance, which makes it particularly suitable for the thermal-acoustic insulation of air spaces in external perimeter walls. It can also be used very successfully to insulate the air spaces of internal dividing walls between different dwellings. The production dimensions of the panel, 100×60 cm, mean that it is easy to lay, even to insulate the air spaces of light walls and false-walls in plasterboard on metal framework.
TOPSILENTRock is laid in the air spaces of double walls simply by fitting the panel progressively as the second part of the double wall is erected. The panel is held in position by the row of bricks being laid. In the air spaces of plasterboard walls, the panels are fitted and held in the special seats pre-arranged on the metal uprights of the framework.

TOPSILENTRock



Size
0,60 × 1,00 m

EXTERNAL AND INTERNAL WALL



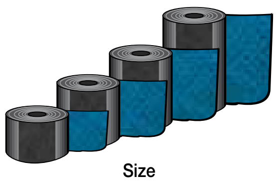
ACOUSTIC BRIDGES IN DOUBLE WALLS

If there are rigid connections (acoustic bridges) between the two walls making up the partition, such as mortar burr or even bricks laid in such a way that they touch both walls, the acoustic benefit of the double wall is annulled and what you will have achieved is a single wall, but with two critical frequencies that are not attenuated, rather than just one. This is how the good habit of filling the air space with fibrous insulation material also serves to avoid these rigid contact points that reduce the insulation possibly achieved in theory.

ACOUSTIC SEPARATION OF WALLS

Walls rigidly connected to the perimeter transmit noise also directly through floors and side walls. If, instead, they are disconnected, the noise is intercepted. It is therefore good practice to separate the wall at least from the floor with a strip of insulating material. The acoustic benefit stands at 2 to 4 dB. Obviously, this procedure must be carefully verified in the case of antiseismic buildings. If the floors of the two rooms separated by the wall are also built with the 'floating floor' system, noise transmission will be further reduced. See the laying details for acoustic separation strips FONOSTRIP and FONOCELL, and the FONOSTOP floating floor system.

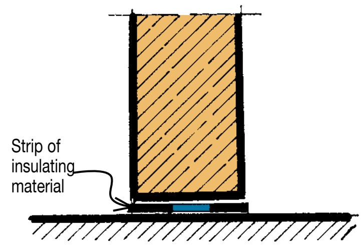
FONOSTRIP



Size
0,14 × 10,0 m
0,20 × 10,0 m
0,25 × 10,0 m
0,33 × 10,0 m

A new innovative cement mortar named FONOPLAST is now available for perimetric separation of the rest of the wall, of the ceiling and of the adjacent walls. It is elastic, dampens vibrations, has two components, is ready for use: the result of Index research. It contains elastomeric polymers, and is in itself a high adhesion perimetric elastic seal, better than the standard cement mortars used on building sites. FONOPLAST has an adhesion force on concrete of ≥1 N/mm², whereas the adhesion of a standard cement mortar is 0.5 N/mm². FONOPLAST mortar was tested as a seal of walls subjected to acoustic insulation tests carried out at the laboratory of ITC-CNR (formerly ICITE) of San Giuliano Milanese (see "Index measurements campaign" and the relevant certification indicated on pages 75-76).

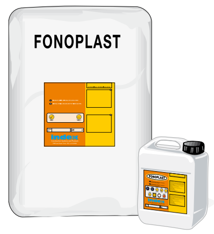
ACOUSTIC SEPARATION OF WALLS



Acoustic benefit
2÷4 dB

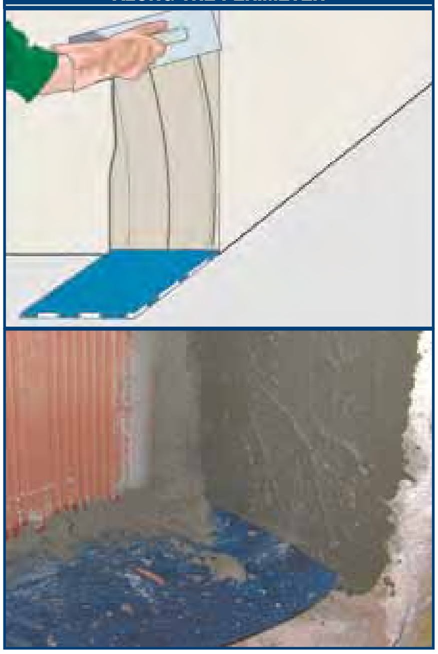
SEPARATION OF PERIMETER WALLS USING ELASTIC MORTAR

The spreading of vibrations induced by direct strains on the structural elements or indirect strains deriving from the exposure to disturbing sound sources such as airborne noise, occurs partly through lateral or bordering transmissions of the walls; such spreading is limited by inserting separation strips (such as FONOSTRIP) under the walls (non-load bearing walls). With this method, the possible ways of transmission through rigid connections are excluded (made with cement mortar) that such walls have with side walls and with ceiling slabs.
Such possible sources of insulation dispersion can be limited or dampened using the new sound-damping mortar FONOPLAST, seeing that is not possible to insert damping strips right along the perimeter of the walls due to their possible structural yielding (without considering possible cracks in the plaster finish due to the different constitution of the materials).



FONOPLAST is a two-component elastic mortar with base of cement-polymer, selected quartz sand and additives that improve elasticity and adhesion.
The combination of the two components produces a mix that is easy to work and that sticks excellently to the support.
Once set, it creates an elastic coating around the perimeter of the walls, which reduces the vibrations of the acoustic pressure waves transmitted to the structure laterally (lateral transmissions).
FONOPLAST is used to skim all normal indoor and outdoor supports in concrete, cement+lime mortar or cement mortar, cement foam, plaster, brickwork etc.
FONOPLAST is used to create elastic perimetric linings with good characteristics of resistance to compression and of adhesion to all types of support, maintaining the elastic properties over time. The level of adhesion provided by FONOPLAST is much superior to that of normal building mortar.

FONOPLAST AND FONOSTRIP KEEP THE WALL SEPARATED RIGHT ALONG THE PERIMETER



FORECAST EVALUATION OF THE ACOUSTIC INSULATION OF SINGLE WALLS

To foresee the acoustic performance of a rigid, single-layer single wall built with traditional materials (concrete, bricks/tiles, cement materials in general), up to a weight of 700 Kg/m², one can use the empirical expression of the law of mass:

R_w = 15,4 **logm** +8,0 which, in the case of walls in lightened mass bricks weighing 100<m≤500 Kg/m², becomes:

R_w = 16,9 **logm** +3,6.

For floors (for evaluation of the acoustically insulating power of airborne noise only, but not of foot-traffic noise), one can instead apply R_w = 22,4 logm -6,5. The above expressions are empirical and were obtained by extrapolating laboratory measurements promoted by ANDIL (Italian acronym of Associazione Nazionale degli Industriali del Laterizio meaning National Association of Brick Industrialists - see table on page 39).

Di seguito si riporta il metodo per una valutazione approssimata conforme il progetto di norma UNI-U20000780 - versione febbraio 2004.

"R_w " is the laboratory's acoustic insulation power and "**m**" is the weight of the wall in Kg/m².

The above law of mass graph can also be used, by reading the data-item on the 500 Hz curve. This is a theoretical laboratory value, and it should be considered that, in practice, the sound insulating power R'_w will be reduced by the effect of lateral transmission, laying faults, electrical systems, etc.

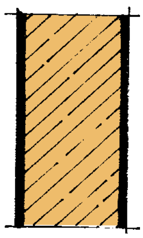
In the figure, you will note the difference between R_w and R'_w . In the laboratory, the wall being tested is completely separated from the receiving room and from its surroundings and, therefore, the noise passes solely directly through the wall, whereas in on-site measurements, the noise also passes sideways through the walls adjoining the wall in question. Consequently:

R'w = Rw – a	where "**a**" is the quantity of lateral transmissions.
a ≥ 5 dB	for strong lateral transmissions, as in the case of a heavy wall with adjoining light walls
2 ≤ **a** ≤ 5 dB	medium local transmissions, as in the case of walls of similar weights
a ≤ 2 dB	weak transmission, as in the case of a light wall adjoining heavy walls or of a wall well separated from lateral walls

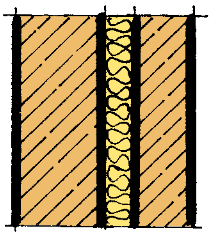
If we apply the formula or read the graph, we will note that a single wall must weigh at least 500 Kg/m² to exceed the 50 dB limit specified in DPCM 5/12/97, as the insulating power R'_w of the walls of buildings in categories A, B, C, E, F, and G.

The results of the experimental campaigns conducted in the laboratory on different types of walls are shown on the table on the last page.

REQUIREMENTS OF WALL TO EXCEED THE 50 dB LIMIT

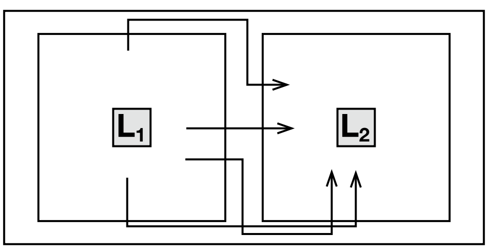


SINGLE
WALL
Must exceed 500 kg/m²

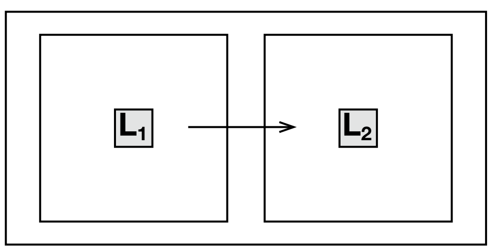


DOUBLE-WALL
WITH MINERAL WOOL
be sufficient
250 kg/m²

APPARENT SOUND INSULATING POWERS R'_w (on site measurement)



APPARENT SOUND INSULATING POWES R_w (laboratory measurement)



APPROXIMATE FORECAST EVALUATION OF THE ACOUSTIC INSULATION OF DOUBLE WALLS

Forecasts are more difficult for double-walls divided by an interspace of low thickness (<3 cm), and there are no standardised calculation methods, but semi-empirical methods only.

One begins by considering that the acoustic insulation of a double-wall is greater than that of a single wall of the same weight. In the frequency range from 100 to 3,200 Hz, a benefit of 4 to 9 dB can be obtained in the case of an interspace with thickness of 5-10 cm completely filled with SILENTEco and SILENTRock fibrous material.

Filling the interspace with fibrous insulating materials, in addition to increasing insulation, also eliminates the resonance of the air chamber.

By using the following expression:

$$\boxed{d < 110\left(\frac{1}{m_1}+\frac{1}{m_2}\right)}$$

where m_1 and m_2 refer to the weight of the walls,

we can calculate the minimum thickness of the interspace so that is not affected by resonance in the field of audible frequencies.

Starting from interspace thickness values of at least 4 cm, filled with SILENTEco and SILENTRock, we can calculate a 1 dB improvement per cm of interspace with respect to the improvement in the law of mass for a single wall (some authors suggest 0.5 dB per cm).

To sum up briefly, an empirical system for estimating the sound insulating power R_w of a double-wall, could be to calculate the acoustic insulation power as indicated in the previous paragraph, as if it were a single wall, using the total weight of the two walls, to which the benefits we indicated previously should then be added. Further below we indicate the general simplified evaluation method conforming to standard UNI TR 11175

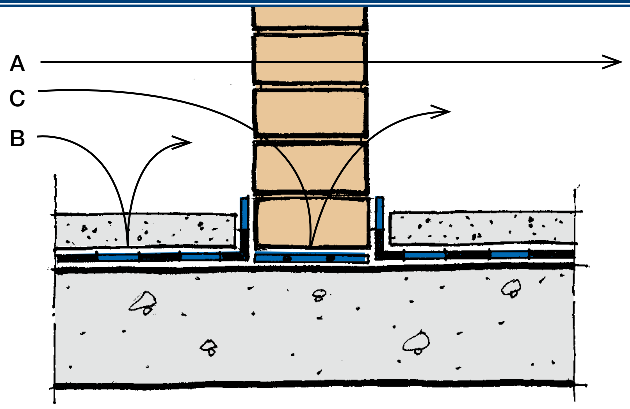
Nota: *To confirm the sufficient approximation of the above mentioned evaluation, see the experimental result obtained at IEN G. Ferraris of Turin, shown at the bottom of this guide. There, a sound insulating power of R_w=52.3 dB was measured for a double wall of 260 kg/m² with a 4 cm interspace insulated with an SILENTEco panel and a TOPSILENTBitex sheet.*

Remember that the sound insulating power of the partition wall in question measured in the laboratory is done by measuring the noise levels between the two rooms, which are completely separated acoustically, in order to cancel out lateral transmissions. Acoustic separation of the walls with FONOSTRIP sound damping elastomer strips laid on the floor, can bring the value of the sound insulation power measured on-site closer to the experimental laboratory value, because lateral transmission tends to be eliminated. The same effect can be obtained if the floors of the rooms divided by the wall are of the type floating on FONOSTOPDuo.

Finally, in the case of new traditional buildings with brick walls, it is important to use the "**3 JOBS RULE**".

1. **Acoustically separate the walls by raising them on the FONOSTRIP soundproofing strips or, better still, by insulating with FONOSTOPDuo, the floating floors of the adjoining rooms divided by the wall.**
2. **Build double-walls with partition walls of differing weight/thickness, considering that the interspace must be larger for light walls.**
3. **Cover one of the faces of the interspace with TOPSILENTBitex or TOPSILENTDuo and fill it completely with SILENTEco or SILENTGlass or SILENTRock or pre-coupled panels TOPSILENTECo or TOPSILENTERock.**

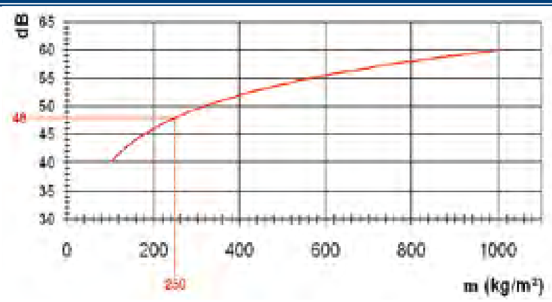
THE FLOATING FLOOR CONTRIBUTES TO THE INSULATION OF THE WALL AGAINST AIRBORNE NOISES



A = Direct passage of noise
B and C = Indirect transmission

GENERAL SIMPLIFIED EVALUATION OF THE SOUNDPROOFING POWER R_w OF TRADITIONAL ITALIAN SINGLE OR DOUBLE MASSIVE WALLS

$Rw = 20\log(m')$, where m' is the Mass per unit area of the single wall or the sum of the Mass per unit areaes of the double walls. This sum can also be obtained graphically from the diagram. (see project under standard UNI-U20000780 - version of February 2004).



We advise you to use a precautionary factor of -2 dB.

Example. (see the values shown in red in the graph)
For a double wall weighing 250 kg/m² with an interspace of about 4 cm, insulated with 4 cm ECOSILENT and TOPSILENT, with one of the partitions insulated with FONOSTRIP, the soundproofing power will be:
$Rw = 20\log 250 = 48$ dB
- the precautionary factor of 2 dB is subtracted
$Rw = 48-2 = 46$ dB
- 1 dB per centimetre of insulated interspace is summed
$Rw = 46+4 = 50$ dB
- 2 dB due to the benefit of the FONOSTRIP basic insulation are summed
$Rw = 50+2 =$ **52 dB**

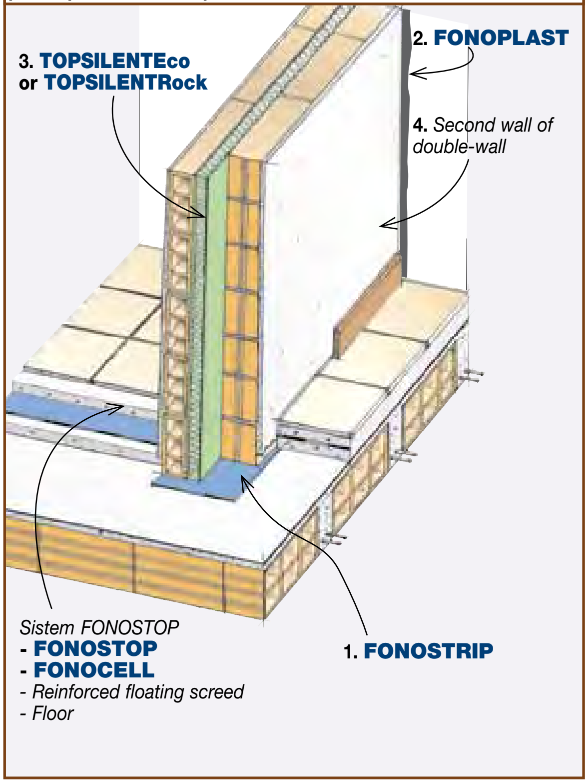
Note. *The above simplifications refer to the traditional Italian construction scenario, based on the erection of double or single brick walls with an area mass varying from 100 to 500 Kg/m², floors in clay/cement mix of 250÷400 Kg/m² and bearing structures with beams and pillars in reinforced concrete. The information in this article must not be used as design document or as a verification of results. Furthermore, the said information does not exempt persons assigned by law to verify and design the acoustic performance of the components of the building. These persons are responsible for the technical solutions based on the use and laying of different materials.*

TECHNICAL INTERVENTION SOLUTIONS IN NEW BUILDINGS

1 2 INTERNAL WALL

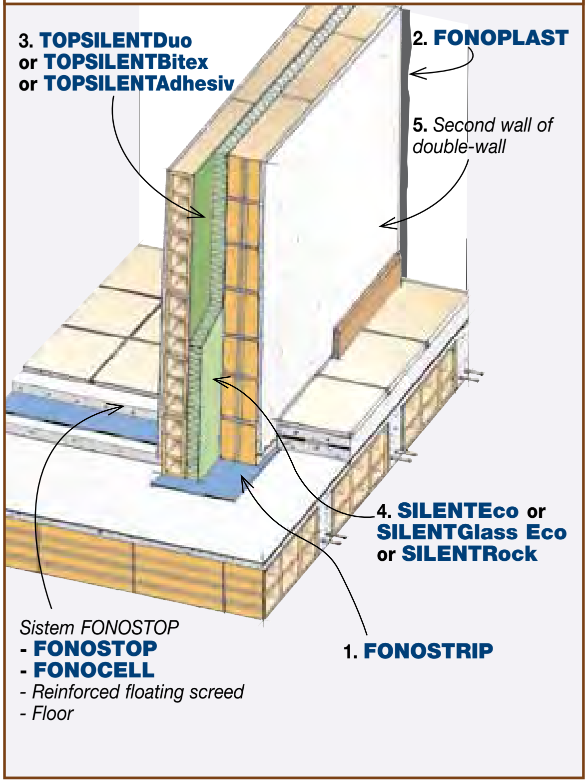
1

Acoustic insulation of interior walls created by means of a double wall with air space in-between, lined and filled with a thermal-acoustic panel pre-coupled with a soundproof sheet.



2

Acoustic insulation of interior walls created by means of a double wall with air space in-between, lined and filled with both soundproofing panel and sheet

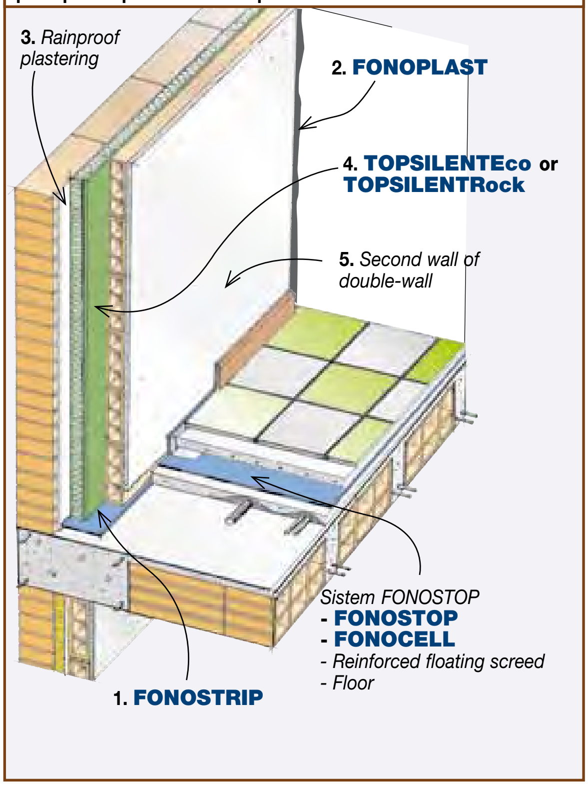


The specifications items are on page 96

3 4 EXTERNAL WALL

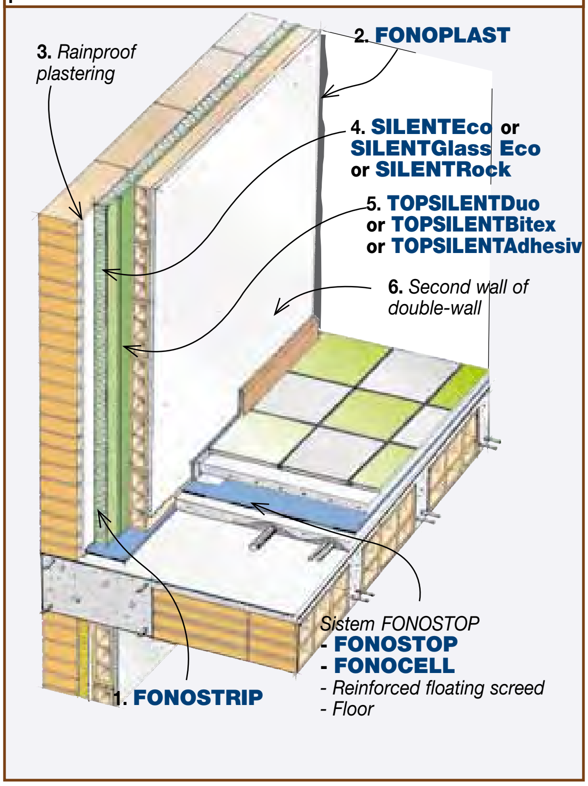
3

Thermal-acoustic insulation of exterior walls created by means of a double wall with air space in-between, filled with a thermal-acoustic panel pre-coupled with a soundproof sheet.



4

Thermal-acoustic insulation of exterior walls created by means of a double wall with plastered air space in-between, filled with a soundproofing panel.



The specifications items are on page 97

METHOD OF USE AND DETAILS

Brick walls that are conventionally used for the forecast calculation of the acoustic insulation are considered to be homogeneous, but in actual fact they are not, especially by the vertical joins between hollow bricks that are not sealed with mortar. Consequently, in many points the double wall just consists of two layers of plaster and quite differs from the acoustic performance foreseen with the law of mass. Hence the importance of restoring the continuity of the walls with suitable layers that are highly airtight, which together with filling the air space with a fibrous insulation, are able to bring the walls back within the foreseen level of acoustic insulation.
The pre-coupled panels of TOPSILENTEco and TOPSILENTRock without doubt offer the advantage that both perform the functions requested, in terms of air tightness and acoustic absorption; the first is delegated to the soundproofing foil coupled on one face of the panel, the second is performed by the polyester or rock wool fibres of which the two afore-mentioned materials are made of.
Pre-coupling of the insulation material subsequently translates on site into the reduction of laying procedures and consequently into an economic benefit, which in the case of TOPSILENTEco is further increased by the dimensions in which the panel is produced; when supplied in size 1.00×2.85 m, it means that the whole height of a conventional wall can be lined with just one panel, of which the laying procedures are illustrated hereafter.
The TOPSILENTEco panel is glued with a simple procedure, using water, plaster glue in powder GIPSCOLL and a toothed spatula or trowel to spread the mix thus obtained. There is no need to use drills or nail guns and the panel set next to the wall using a painter's roller holds itself in place straight away without having to wait for the glue to set.
Another advantage: it can be laid by just one builder independently from the building of the false-wall, which on the other hand, is necessary in the case of TOPSILENTRock that is not glued to the wall but is inserted in the air space as the false-wall is being erected.

LAYING TOPSILENTEco

LAYING TOPSILENTEco

1. Mix the powder glue GIPSCOLL with water.

2. Spread with a spatula on the wool of TOPSILENTEco.

3. Apply two strips per panel (GIPSCOLL consumption: approx. 600 g per strip).

4. Place the panel on the wall.

5. Press the panel using a painter's roller.

6. Laying is complete.

METHOD OF USE AND DETAILS

LAYING TOPSILENTRock

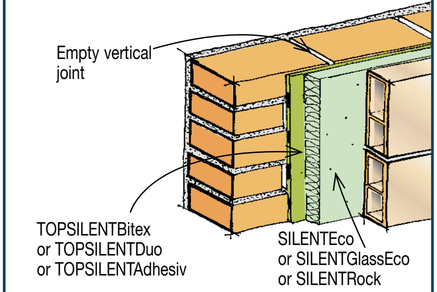
Laying the panels (unpacked version)

Sealing the panels (unpacked version)

Erecting the 2nd brick wall

LAYING TOPSILENTBitex and TOPSILENTDuo

When building walls, the builder does not usually fill the vertical joints and just spreads the bedding mortar horizontally.
This is why it is crucial to position TOPSILENTBitex or TOPSILENTDuo on one of the faces of the air space.
The soundproofing foil of TOPSILENTBitex is secured using Teflon dowels on the high part of the wall (after drilling the holes) and on the side overlaps (minimum recommended: 5 cm), trimming the sheet at the base of the wall (alternatively, if you know the height of the wall, you can also cut the sheets to size).



Alternatively: **TOPSILENTEco or TOPSILENTRock**

LAYING TOPSILENTBitex and TOPSILENTDuo

1. Fill and possibly seal the last row of bricks and possible gaps (broken bricks or traces) in the wall facing.

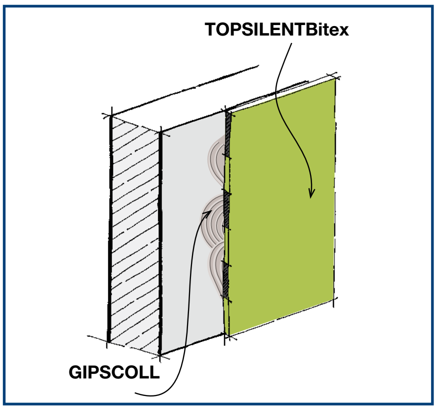
2. Secure the sheets of TOPSILENTBitex on the head of the wall, after drilling and inserting the Teflon dowels (those used for laying the thermal insulation “covers”)

3. The wall is now completely lined and ready for laying the fibrous material type SILENTRock, SILENTGlass or SILENTEco.

4. Secure the panels mechanically with the same method.

Alternatively, the soundproofing foil of TOPSILENTBitex can be glued to the wall with GIPSCOLL adhesive, spread with a toothed spatula.

Alternatively, the soundproofing foil of TOPSILENTBitex can be glued to the wall with GIPSCOLL glue, spread with a toothed spatula. The sheets of TOPSILENT will be overlapped by a few centimetres or set next to each other carefully and sealed with adhesive tape. For the TOPSILENTDuo foil, you are recommended to glue it in place. The second facing is then built, filling the air space progressively with the fibrous panels. The fibrous insulation material can also be secured in advance to the foils of the TOPSILENT range before building the second wall, with polyurethane sealing strips in cartridges type SUPERFLEX PUR or hot extruded glue using an electric gun.

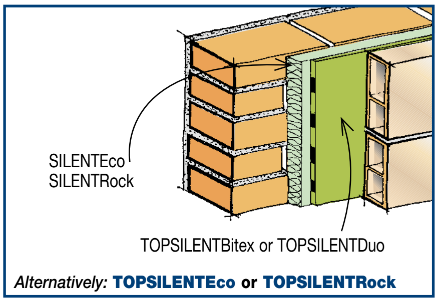


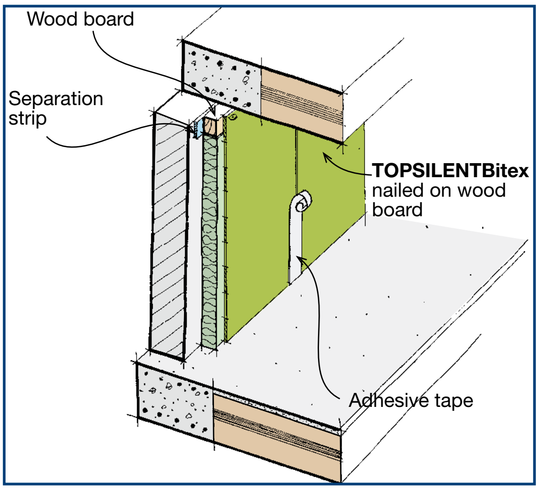
METHOD OF USE AND DETAILS

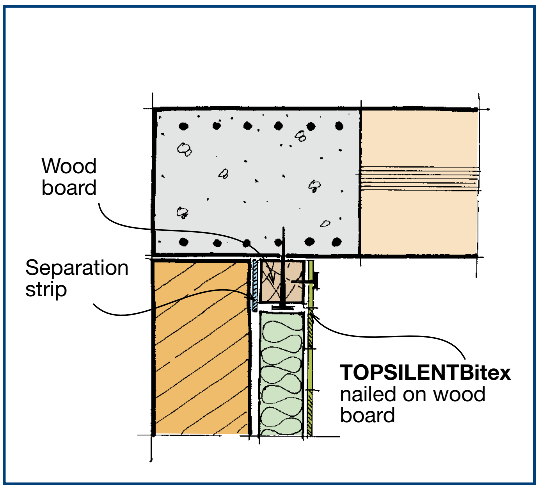
EXTERNAL WALL

For external walls, first glue the fibrous insulation to the first part of the double wall, with strips of SUPERFLEX PUR sealant or hot extruded glue or it can be simply nailed in place.

Then place the **TOPSILENTBitex** or **TOPSILENTDuo** foils on top, which are to be nailed to a wood batten with base of the same thickness as the fibrous insulation and high enough so that the nails hold firmly (2÷3 cm), previously fixed to the ceiling of the air space of the double wall.



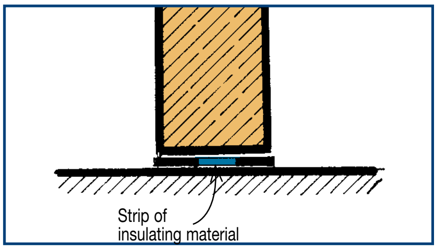




3 JOB RULES

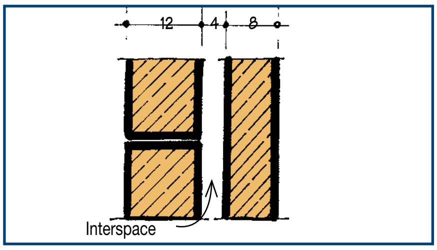
1

ALWAYS ACOUSTICALLY SEPARATE THE WALLS
Acoustically separate the walls by raising them on FONOSTRIP soundproofing strips and then insulate, with FONOSTOPDuo, the floating floors of the adjoining rooms divided by the wall.



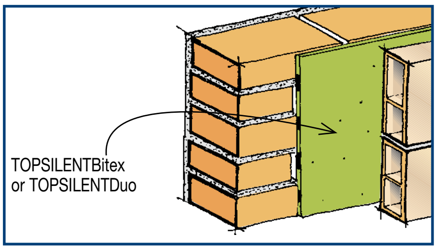
2

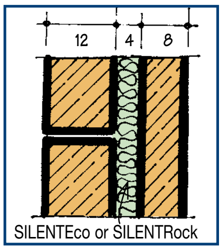
ALWAYS BUILD DOUBLE-WALLS
Build double-walls with partitions of different weight/thickness, bearing in mind that interspace must be larger for light walls.



3

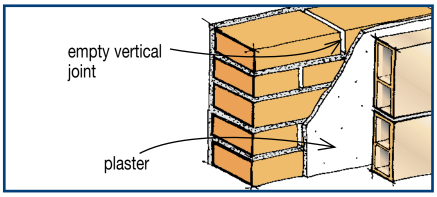
ALWAYS LINE ONE FACE OF THE INTERSPACE AND FILL IT COMPLETELY
Line one of the two faces with TOPSILENTBitex or TOPSILENTDuo and fill it completely with SILENTEco or SILENTGlass or SILENTRock.
Alternatively, as a single solution, apply the pre-coupled TOPSILENTEco or TOPSILENTRock panel.





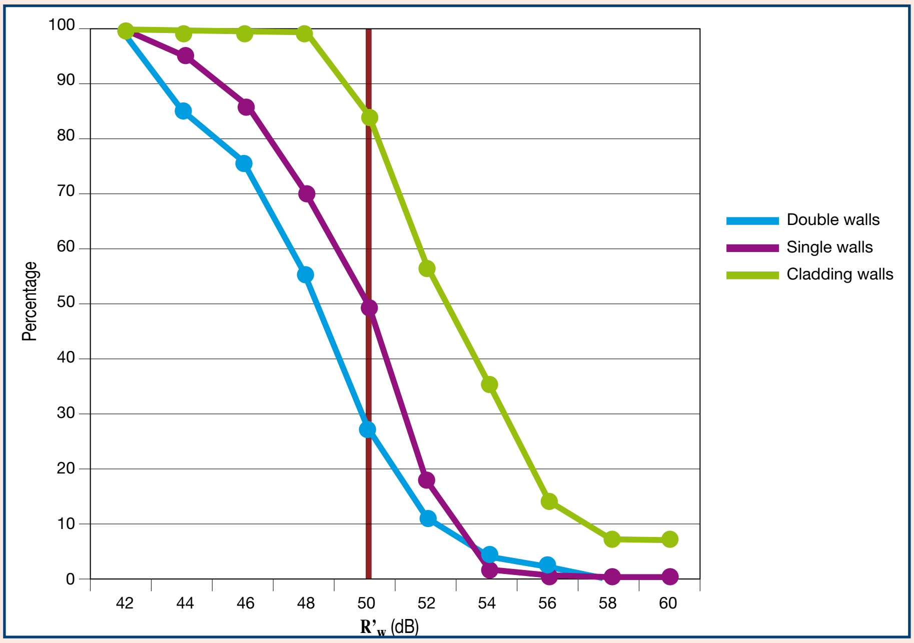
INTERNAL AND EXTERNAL WALL

If it is decided not to use TOPSILENTBitex or TOPSILENTDuo, one of the interspace faces must be plastered before the SILENTEco, or SILENTGlass or SILENTRock insulating panels are installed.



SUGGESTIONS ON HOW TO AVOID DETERIORATIONS IN THE SOUNDPROOFING POWER OF BRICK DIVIDING WALLS BETWEEN DWELLINGS DUE TO LAYING ERRORS

Ten years on from the enforcement of the Decree concerning passive acoustic requirements (DPCM 5/12/97), despite the particularly high offer of technical solutions available on the national market, tests carried out on site by our technicians, together with the technical literature now available, show rather worrying values of the soundproofing power index **R'w** in relation to the requirements imposed.
We are providing a survey of the University of Florence (TAD) published in the deeds of the 35th National Convention of the Italian Acoustics Association (AIA) in June 2008; this survey presents the results of the testing campaign carried out by the technicians of the TAD of Florence related to dividing walls between neighbouring dwellings of different types: out of 150 cases tested, 48% were single brick walls, 40% were double brick walls and the remaining 12% were plasterboard claddings.



If one looks at the red line representing the minimum admitted value to satisfy the requirements of DPCM 5/12/97, the current situation is quite clear: <u>only 28% of double brick walls and 50% of single brick walls satisfied the requirements</u>; much better were the mixed solutions in brick and plasterboard cladding. The possible, yet not easily identifiable reasons related to the low percentage of walls that satisfied the legal requirements could be many. Some years ago, one could imagine that awareness towards acoustic problems in the building trade was certainly not high and therefore most of the cases tested around the year 2000 probably failed to meet the requirements related to dividing walls between neighbouring dwellings due to the incorrect or negligent choice of the technical solutions (focused more on building habits rather than a real assessment of the solution required for the problem of noise) combined with the "not absolutely perfect level" of the building work.
The considerable expansion concerning building acoustics recorded over the last few years, on the contrary to what was prospected, unfortunately has not given rise to obvious effects (the graph above does indeed prove this). It is consequently crucial to wonder what the reason or reasons could be that still today prevent operators of this market from standardising the performance of dividing walls between dwellings in order to guarantee the correct level of comfort of the occupants and satisfaction of the passive acoustic requirements. From what we have learnt through endless instrumental tests carried out on site and in the laboratory, we believe that the cause for the "failures" of many technical solutions, subject to the following problems that transversally embrace the skills in the design and building sphere are:

- **Overestimation of the solutions certified in the laboratory.**
- **Projects that are not sufficiently accurate.**
- **Building errors.**

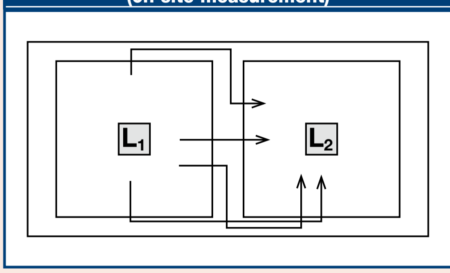
BEWARE OF LABORATORY CERTIFICATES

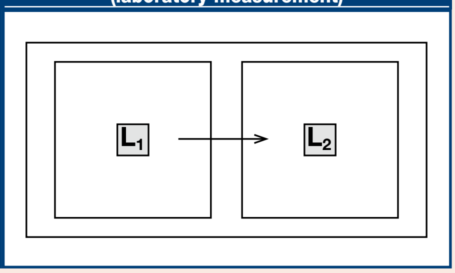
Lab tests of solutions for insulating dividing walls between dwellings are to be considered just indicative and certainly not exhaustive, with regard to the identification of the solution that satisfies legal requirements.
The differences between what can be tested in the laboratory and what can be tested on site can be split-up into three categories related to the test environment, the test times and the actual building of the wall.
The test environment of the laboratory is designed to be able to guarantee the possibility to establish the acoustic performance of an element that separates two rooms (receiving and emitting); to accomplish this, the wall tested must be perfectly separated from the other walls and floors slabs; this is the only way to measure the value R_w referred to the wall examined (contact with other elements would amplify the so-called lateral losses and would invalidate the value measured, thus nullifying the subsequent certificate).

<u>The value of the soundproofing power index R_w supplied by laboratory tests, must be penalised to take into consideration some definite dispersions due to the imperative restraints to which the walls built on site are subjected.</u>
<u>This is indeed the core matter or rather the problem: by how much must we penalise such values?</u>

Together with what we have just evaluated, we should also consider another problem related to the building work. Walls built inside the test rooms of laboratories, in most cases, do not have pipes passing through them or any other discontinuities that could penalise the wall's performance. They are built with all the solutions required, they are prototypes that are quite different to what is actually encountered on building sites, where building times are tighter and the affect of the systems built into the walls are to be seriously taken into consideration.
So, going back to the question still not answered, due to the extreme variability in the building of the walls, unfortunately it is quite difficult to provide a constant value that considers the negative impact of lateral transmissions and incorrect building work; if we should give a rough value, we could risk saying approximately <u>3÷5 dB, which could be sufficiently precautionary if the lateral transmissions are contained and estimated and the building work is carried out accurately; it would be definitely insufficient on the other hand, if the building work is not carried out to perfection or if there are lots of systems built into the walls.</u>

APPARENT SOUND INSULATING POWERS R'_w (on site measurement)	APPARENT SOUND INSULATING POWES R_w (laboratory measurement)

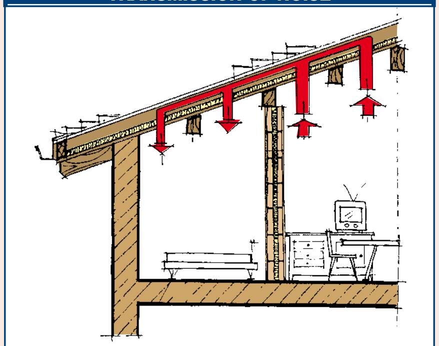




BEWARE OF LATERAL TRANSMISSIONS

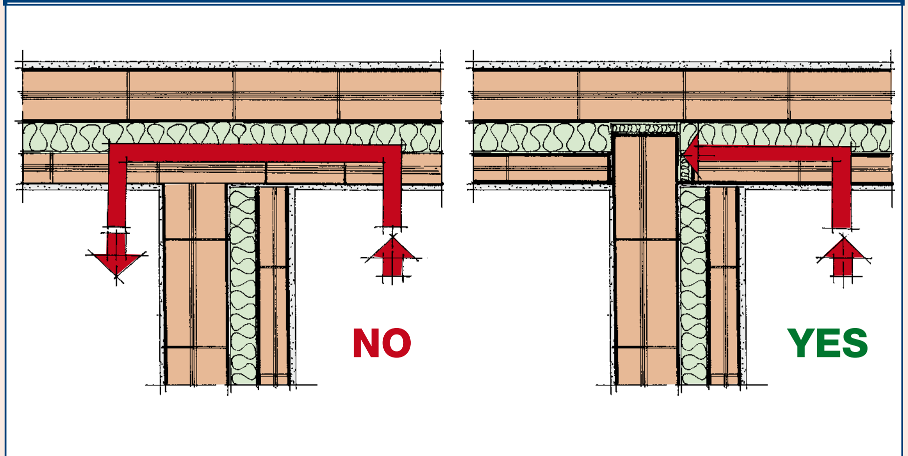
From a sound source the noises spread through the air and act on the molecules of which the air is actually made up; this variation in pressure causes effects in different measures based on the obstacles that it comes across along its path. It is therefore obvious that the correct planning of a dividing element between dwellings of different homes or factories shall imperatively consider the negative impact of lateral transmissions due to the connection of the dividing wall to other partitions that will delimit the rooms; it shall also assess the response to strain, not only of the wall evaluated but also of all the other elements making up the room. In the attempt to exemplify the problem even clearer, it would not be very advantageous to plan a dividing wall with exceptional performance (with soundproofing power index higher than 60 dB) in the loft of a building with rooms next to each other and arranged under the same layer of a ventilated wooden roof; the ventilation system in this case would be extremely harmful in terms of soundproofing and would definitely complicate observance of the requirements.
It would also be hopeful to identify a solution that is not overestimated for the dividing wall and to "stop" the noise that transits over the heads of the occupants, for example proceeding as illustrated in the exemplificative drawings that follow.

TRANSMISSION OF NOISE

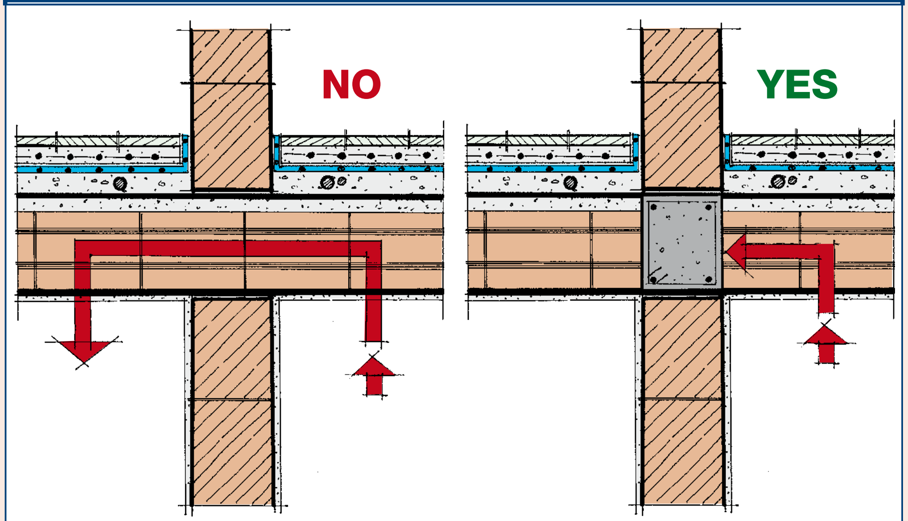


The project must also bear in mind all the possible ways in which noise could spread, considering the problem as a whole and not just limited to identifying the most efficient solution on paper; the integration of the dividing walls in the perimeter walls, the direction of the floor slabs in cement and brick, the presence of discontinuities (pillars or sections in reinforced concrete) could all be critical situations if they are not evaluated and dealt with in advance. As for possible deteriorations due to the presence of pillars or sections in reinforced concrete within the dividing walls, it is advisable to face such problem by splitting it in two.

HORIZONTAL SECTION OF VERTICAL WALL

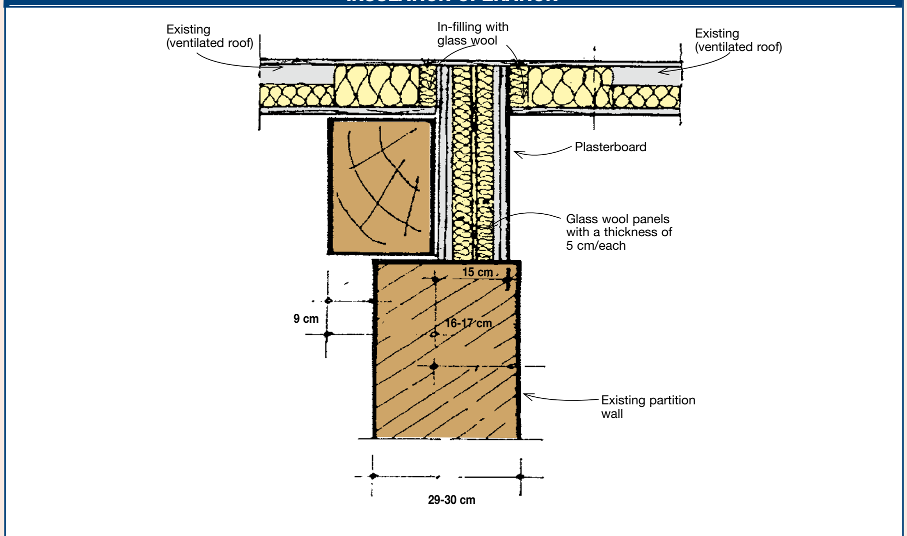


BRANCH POINT OF DIVIDING WALL AND UPPER FLOOR SLAB



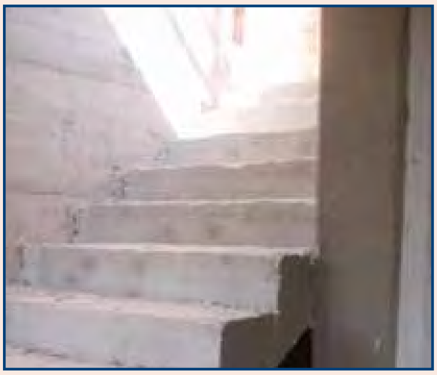
Preferential paths for noise may also form in the case of dividing walls under floor slabs with hollow bricks with beams at right angles compared to the soundproofing wall (floor slab passing through two rooms). The holes of the hollow bricks are aligned and, if they are not interrupted, they form a preferential path for noise.
The path must be interrupted with a concrete seam, for example.

INSULATION OPERATION



From a point of view of insulation against impact noise and therefore noise deriving from the direct percussion of a structural element, the presence of a pillar in reinforced concrete could become an acoustic bridge between two different rooms and could create living discomforts, penalising the wall's level of insulation.

A typical example of reinforced concrete elements that create problems related to undesired noises is that of a stairwell in reinforced concrete with steps in concrete directly in contact with the walls of the surrounding dwellings or identically a lift well in reinforced concrete where the steel guide on which the carriage of the lift booth runs has not been correctly separated; such cases are often encountered and are due to the high spreading speed of the vibrations within the rigid elements (the speed of sound in reinforced concrete is around 4, 5 Km/s).
A valid solution available to limit the spreading of vibrations through rigidly connected structures (i.e. stairs in reinforced concrete or other) is FONOPLAST damping mortar of which we are providing some applications hereafter.

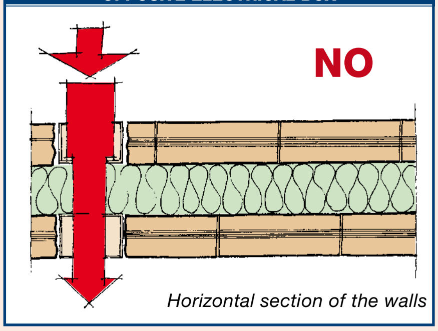


If we should now evaluate the possible deteriorations in performance of a dividing wall due to the presence of a pillar in reinforced concrete, in terms of airborne noise, we should consider that pillars have a considerable mass per unit area and therefore, if we should estimate its performance according to the law of mass, they have a considerable insulation capacity. It consequently seems superfluous to concentrate our efforts on searching for technical solutions capable of stopping noise from spreading through an element with mass per unit area at least double that of the walls built up against it. So basically, we believe that the insulation dispersion, if there is any, due to the presence of pillars or sections in reinforced concrete, is negligible under this aspect, related to the spreading of noise through the air between boundary dwellings on the same floor level. We also believe that a preferential spreading in the longitudinal direction is possible, which could cause transmissions between floors laid over each other; for this purpose, we suggest the separation of the walls from the pillars by building up a fine layer of FONOPLAST mortar (4÷5 mm are suffice), as illustrated in the photograph that follows.

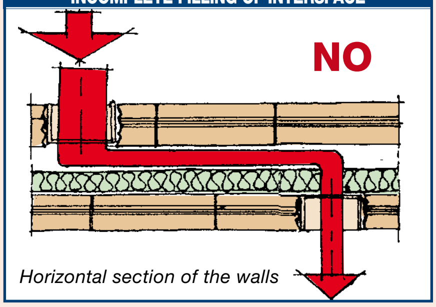
AWAREFUL PLANNING

The planning phase is and always has been considered very important to obtain a quality building; for problems related to building acoustics, the planning phase has a central role, the same as the building phase, in order to reach the correct level of comfort for the occupants.
Awareful acoustic planning prevents all sorts of problems and favours linear and secure laying work; the correct forecasting of the thicknesses required for the specific purposes, for both walls and floor slabs, awareful distribution of the drains, the electrical system and anything else that up-to-date has been traced in the dividing elements between dwellings, the correct direction of the floor slabs in cement and brick, the creation of a separate compartment for noisier and larger pipes, are all project solutions that would resolve many of the “endemic pathologies” suffered by our buildings without involving particularly high additional costs.

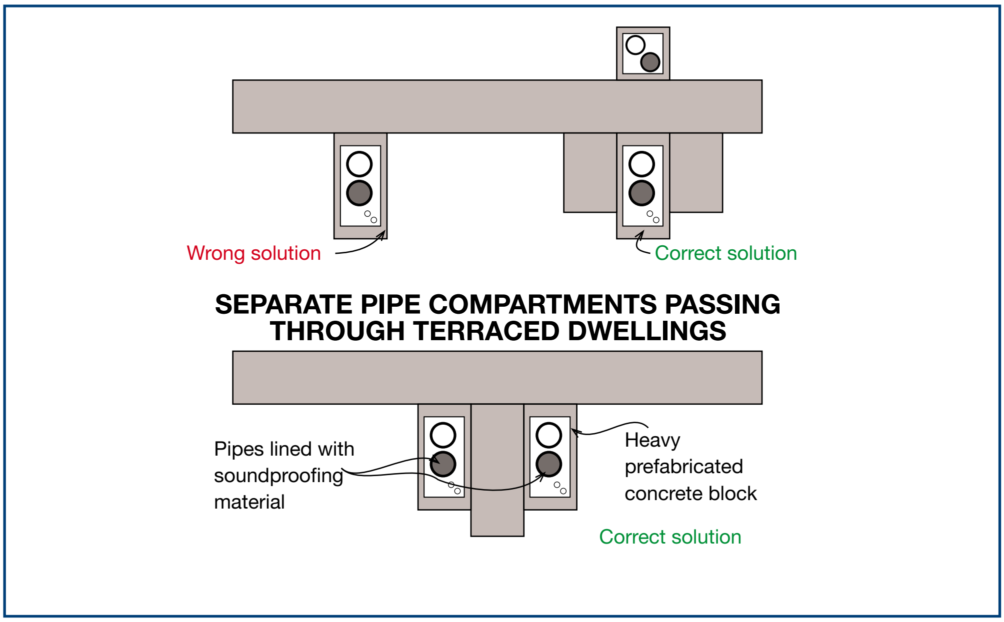
OPPOSITE ELECTRICAL BOX



INCOMPLETE FILLING OF INTERSPACE



DIVIDING WALL BETWEEN APARTMENTS



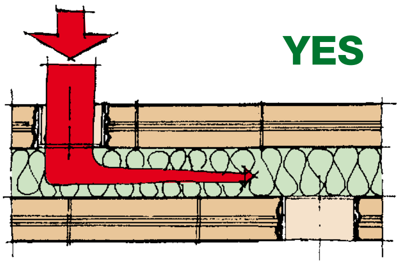
It is definitely preferable to build a separate compartment where the piping will be housed. This separate piping compartment must not be created inside separating walls between different dwellings.

Situations such as those illustrated hereafter cannot guarantee performance in line with expectations, because the dividing walls will not be able to make up for planning errors, which are the basis for failed success.
To conclude, it would be a good rule for the planner to deal with the dividing walls between dwellings with the required caution, which are to be considered separately; very limited quantities of systems shall be built into the walls (just those absolutely necessary) and traces shall be sealed perfectly with mortar; there shall be no main drainage systems, which not only compromise the resistance to noise leakage of the wall itself, but they also amplify the problem of noise of the systems; as an alternative, a special wall shall be created to make up for possible critical situations (if a dividing wall between the bedroom and bathroom is necessary, this wall cannot be considered at the same standard as the others because it is particularly critical).

MAIN BUILDING DEFECTS TO BE AVOIDED

The last problem to be faced is that of the method of building the walls and specifically speaking, brick dividing walls between dwellings.
Bearing in mind what we have said so far and supposing that everything has been completed in the best possible way, we now need to transform theory into practice and consequently build what has been planned.
This step is probably the most important for the success of the objects expressed in the plans; the accuracy or otherwise of the building work will definitely make the difference between a wall that enables the correct level of acoustic comfort and an insufficient wall, despite the fact that the same project is used as the starting point; in extreme synthesis, <u>it is impossible for a wall that has been efficiently planned to respect the forecasts if built without the required accuracy.</u>
The correct building of a dividing wall should consequently not neglect the creation of mortar joints, both vertical and horizontal, should not present any poorly sealed traces or missing portions or brick and it should always provide maximum resistance to the leakage of air; <u>only the perfect integrity of the walls bound to correct and careful preventative evaluation can guarantee the observance of the requirements in terms of comfort and law.</u>

COMPLETE FILLING OF INTERSPACE



Horizontal section of the walls

Situations such as those illustrated in the photograph will considerably penalize the acoustic performance of the wall and will almost definitely bring it below legal requirements.

DIVIDING WALL BETWEEN APARTMENTS WHERE BATHROOMS AND KITCHENS ARE BUILT OPPOSITE EACH OTHER

It is preferable to avoid integrating large systems in the dividing walls between apartments. Alternatively you should plan thicker walls or consider the possibility of building another wall in front of the existent ones (this wall could be considered as a “waste” wall).

Avoid digging out excessively invasive channels in dividing walls, but if they are however necessary, grout the channels abundantly with cement mortar (in some cases, walls that have been efficiently grouted have even proven to be better than equal full walls).

FORECAST CALCULATION OF THE EVALUATION INDEX RELATED TO THE APPARENT SOUNDPROOFING POWER R'_W MEASURED ON SITE

As already explained, the soundproofing power R_w of the wall can be calculated, but better still, there could be a specific laboratory test that certifies the R_w measurement of a whole wall already foreseen with suitable insulation.
The test must naturally be carried out strictly in compliance with the current standard (UNI-EN ISO 140) without any variant whatsoever (see certificates of IEN G. Ferraris – Turin at the end of this guide), describing the type of the materials used, the laying technique, the weight and the dimensions of the dividing wall in the test report.
In such case, the strict observance of the same laying methods and the use of the same materials is the most reliable way to ensure lower error margins compared to the simple forecast calculation.
When subsequently measured on site, then the soundproofing power of the wall will not have the same value because it will be reduced by lateral transmissions that run along adjacent elements, (walls, ceilings and floor slabs).
Consequently, the soundproofing power R_w of the same wall will give rise to different R'_w values (apparent soundproofing power measured on site) based on the different surrounding situations. The entity of the lateral transmissions, too, can be calculated in compliance with the method of standard UNI-EN ISO 12354 - part 1; some computing software programs are also available that include a database on the soundproofing power Rw of different types of building.
The underestimation or overestimation of the evaluation of lateral transmissions by applying simple average corrective coefficients could lead to considerable errors, such as the case represented in the drawings for example, where in a loft split into two dwellings by a wall with soundproofing power of R_w>50 dB, the builders forgot to consider that the ceiling of the two dwellings was made up of a wood roof with ventilated air space insulated with a extruded polystyrene panel through which voices could be heard clearly between the two rooms.
In the specific case, the dividing wall between the two dwellings positioned transversally compared to the direction of the ventilation flow further complicated the problem, because the technician had to face the problem of insulating the air space acoustically by filling it with mineral wool that would have sealed the air space between the two sets of wood boards preventing their ventilation (see work solutions on page 60 - “Acoustic insulation of the roof”). Hence the importance of having the project checked-out by an expert in the field of acoustics.

Warning

Do not confuse R_w with R'_w

R_w: evaluation index of the soundproofing power of the single structure (wall and floor slab) calculated or measured in the laboratory.

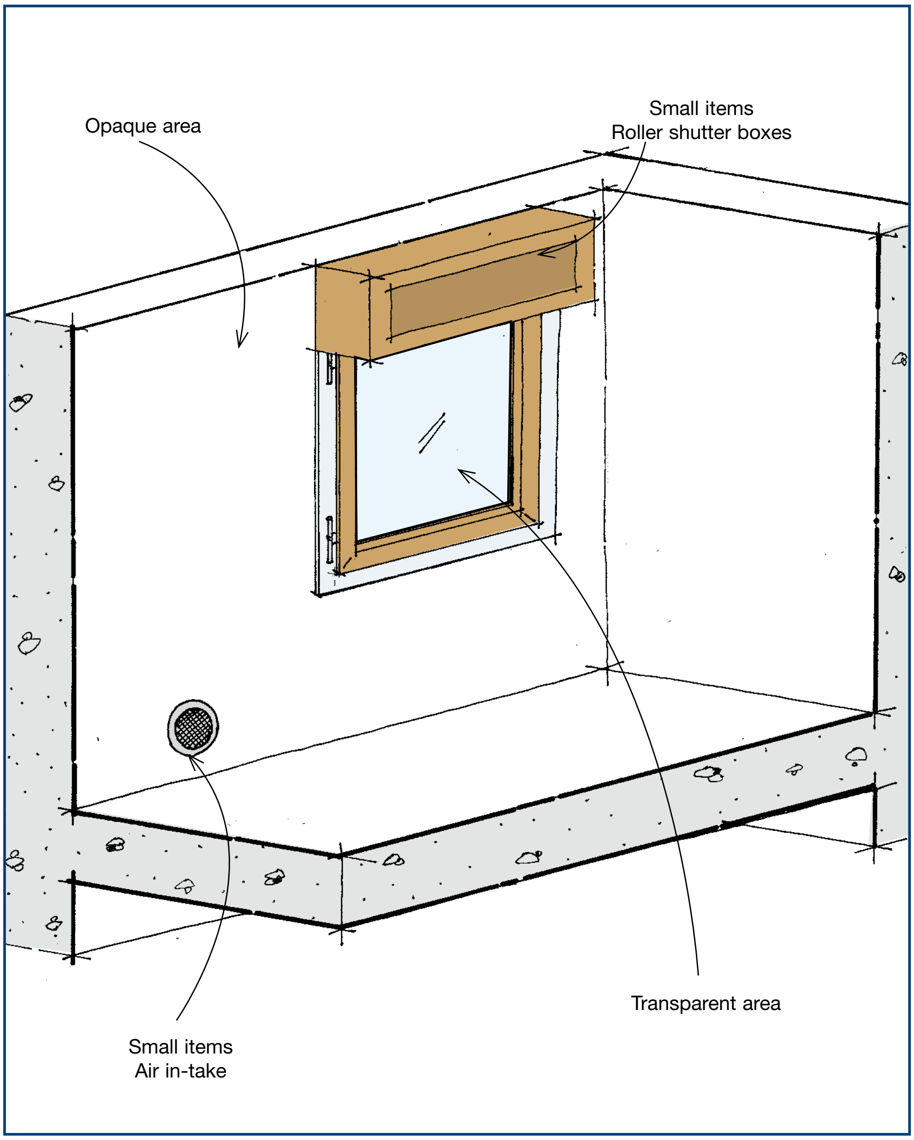
Order of reliability:

- *laboratory certificate (UNI-EN ISO 140-3)*
- *correlation of specifications from laboratory tests on similar elements*
- *general reports from mathematic algorithms based on the mass per unit area and other additional parameters.*

R'_w: the evaluation index of the apparent soundproofing power of an interior dividing wall on site (legal requirement), not only takes the soundproofing power R_w of the dividing element into consideration but also the lateral noise transmissions.

ACOUSTIC INSULATION OF EXTERNAL WALLS

Whereas the soundproofing power of internal dividing walls measured on-site, referred to in DPCM dated 5th December 1997 (Premier's Decree), is identified by the symbol $\mathbf{R'_W}$, for the perimeter external walls, law states that the acoustic insulation is to be identified by parameter $\mathbf{D_{2m,nTW}}$, which is measured with a different index compared to that used for internal walls.
The soundproofing power $\mathbf{R_W}$ (measured in the laboratory or calculated) of the walls, being the "opaque" part of the external wall, only partially affects the insulation $\mathbf{D_{2m,nTW}}$ which is mainly conditioned by the transparent parts, i.e. the windows and by the presence of what are called the "small elements", air openings, roller shutter boxes etc.
It is the mutual opinion of engineers in the field of acoustics that the opaque part, i.e. the wall, with soundproofing power estimated or measured to be $\mathbf{R_W}$>50 dB, is sufficient to guarantee compliance with the limits imposed by law for $\mathbf{D_{2m,nTW}}$ of 40 and 42 dB (buildings in category A, C, B, F and G) and that full attention should be focused on the cautious choice of windows and window frames with high levels of insulation, assuming that the air openings are appropriately insulated etc., which must be fitted with special care to avoid leaving any gaps through which noise could pass.
The evaluation index of the acoustic insulation of the external wall ($\mathbf{D_{2m,nTW}}$) identifies the resistance to the leakage of noise from outside the portion of external wall of each single room. Such requirement also depends on many factors related to the shape and the size of the building.
Thorough analyses of the directions of the sound sources to which the building will be exposed and the consequent evaluation of the dimensional development of the actual building should be the first discriminating element in the choices of planners; even without going into depth on such subject with evaluations of the acoustic impact or studies on the acoustic climate, requested especially in the preventative survey phase for the future building of schools, hospitals or hotels, some simple solutions are considered to be of fundamental importance in order to obtain a good level of comfort, such as distributing the internal rooms according to the "noise logic"; consequently bedrooms will certainly not face the road, kitchen air vents will possibly be positioned in a recess or, at least, will not be exposed to the most persistent source of noise (they could even be confined in a utility kitchen) and anything else that may reduce the level of exposure to the noise of neighbours. As for the planning choices concerning the opaque parts, the document herein does not go into detail concerning the choice of window panes and window frames. The requirements related to passive acoustic specifications shall be harmonised with the new legal requirements on thermal specifications, related to Law Decree no. 311 dated 29th December 2006, which came into force on the 2nd February 2007.



ACOUSTIC INSULATION OF ROLLER SHUTTER BOXES

Nowadays, manufacturers produce an extensive range of roller shutter boxes, to be installed in new buildings, already complete with thermal-acoustic insulation to ensure compliance with the limits imposed by current legislation.
Wooden shutter boxes used in the past in old buildings are on the other hand a major vehicle of noise and source of consistent thermal dispersion.
Bear in mind that an old shutter box of 0.5 m² has an acoustic insulation $\mathbf{D_{n,e,w}}$ lower than 40 dB, which is not enough to guarantee the limit of 40 dB imposed by law for the acoustic insulation of external walls $\mathbf{D_{2m,nT,w}}$ of residential buildings.
Even if the legal limits are applicable to houses built after the enforcement of DPCM 05/12/1997, the thermal-acoustic comfort of residential dwellings can be improved by gluing, on the wooden panels inside the old shutter boxes, the TOPSILENTBitex foil using FONOCOLL adhesive and subsequently lining the shutter box compartment with thermal-acoustic insulation panels SILENTEco, which can be glued using GIPSCOLL adhesive.
SILENTeco is a polyester fibre based insulation product that does not contain mineral fibres, does not irritate skin and does not prick and therefore it can be easily handled, cut and shaped as required.
If the space between the shutter box and the roller shutter is minimal, the compartment can be lined internally using the TOPSILENTDuo foil, with the face lined in non-woven white soundproof polyester fabric facing externally, using FONOCOLL adhesive on the wooden parts and GIPSCOLL adhesive on the bricked parts.

As a further aid to support the planning of "acoustically friendly" buildings, we are enclosing two summary tables of the theoretic experiments published in the deeds of the 31st National Convention of the AIA (Italian Acoustic Association) held in Venice in 2004, in relation to the insulating capacity to be ensured by transparent elements (including glass panes, frames) where certain insulating characteristics of opaque parts are involved (perimeter walls).
The minimum requirements imposed for transparent elements in external walls have been established by imposing a certain number of possible solutions for the opaque parts (different type of perimeter walls) followed by the theoretic calculation of the soundproofing power index **Rw** and evaluating the minimum insulating power of parts with windows according to the shape of the side indicated.

THEORETIC VALUES WITH A WINDOW WITH SURFACE AREA OF 1,5 m²

Wall	R_w opaque part	R_w transparent part
30-cm thick air brick and 2 plaster coats	45,2 dB	36 dB
25-cm thick semi-solid air brick and 2 plaster coats	45,1 dB	37 dB
45-cm thick semi-solid air brick and 2 plaster coats	48,6 dB	35 dB
Double wall constructed with 8 cm hollow bricks and 5 cm air space	47,2 dB	36 dB
Double wall constructed with 8÷12 cm hollow bricks and 5 cm air space	48,2 dB	35 dB
Double wall constructed with 8 cm hollow bricks and double UNI brick of 12 cm and 5 cm air space	49,6 dB	35 dB
Double wall constructed with 8 cm hollow bricks and double UNI brick of 12 cm and 12 cm air space	61,2 dB	34 dB

THEORETIC VALUES WITH TWO WINDOWS WITH TOTAL SURFACE AREA OF 3 m²

Wall	R_w opaque part	R_w transparent part
30-cm thick air brick and 2 plaster coats	45,2 dB	39 dB
25-cm thick semi-solid air brick and 2 plaster coats	45,1 dB	39 dB
45-cm thick semi-solid air brick and 2 plaster coats	48,6 dB	38 dB
Double wall constructed with 8 cm hollow bricks and 5 cm air space	47,2 dB	38 dB
Double wall constructed with 8÷12 cm hollow bricks and 5 cm air space	48,2 dB	38 dB
Double wall constructed with 8 cm hollow bricks and double UNI brick of 12 cm and 5 cm air space	49,6 dB	38 dB
Double wall constructed with 8 cm hollow bricks and double UNI brick of 12 cm and 12 cm air space	61,2 dB	37 dB

ROOM ESTIMATED

Room dimensions: height 2.70 m, width 3.50 m, depth 4.50 m with volume equal to 42.5 m³;
Condition: internal plastered walls, tiled flooring, all the acoustic absorption coefficients have been considered to be lower than 0.3;
Windows size: assessments have been made according to two possibilities: the presence of just one window with surface area of 1.5 m²; the presence of two windows with overall surface area of 3 m².

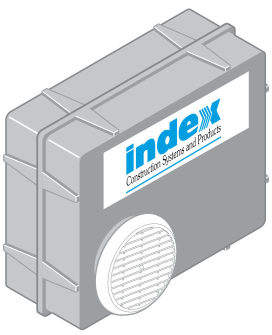
As you can see from the theoretic evaluations expressed in the tables above, the increase in the surface area of the most critical element also involves an increase in the insulating capacity of the element itself; then considering the negative impact due to the presence of boxes of roller shutters, it is usually a good rule to apply the following suggestions:

- For requirements of external walls in category A, B, C, F and G, consider an insulating power of the window frame package equal to what is requested by law and bear in mind any leakage possible through the box of the roller shutter. These windows should be double glazed.
- Consider window frames with a good airtight rating, at least class 3 according to standard UNI EN 12202 (former class A3 according to standard UNI 7979); the windows will be adjusted so that they can be opened and closed with minimum strain.

THE EFFECT OF THE AIR IN-TAKES ON THE ACOUSTIC INSULATION OF EXTERNAL WALLS

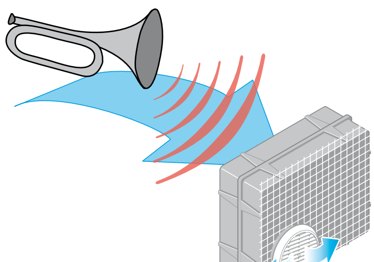
Openings created in external walls may considerably reduce the soundproofing power of the opaque part. Bear in mind that an opening of 100 cm² reduces the insulation of the wall by approximately 10 dB. Safety standard UNI CIG 712/92, to ensure the regular combustion of open flame burning appliances, states that openings must be created with the outside, in kitchens where gas ovens and hobs are installed, which must be proportional with the installed thermal power, having a minimum net cross section of 100 cm². This leads to the need to create silenced air in-takes in order to comply with both standards concerning safety and those concerning acoustic insulation.

FONOPROTEX



FONOPROTEX is the silenced air in-take distributed by INDEX with a net air flow cross section of 100 cm², complete with certified acoustic insulation of $D_{n,e,w}$ = 53.9 dB, which ensures compliance with the limits imposed by DPCM 05/12/1997 for the acoustic insulation of external walls.
FONOPROTEX is compact (35×29×15 cm) and has a modular extension that makes it easy and quick to install in the most commonly used external perimeter walls.
FONOPROTEX takes up a mere volume of 15 dm³ and is made of plastic in order to minimise thermal dispersion and is easily inspectable.
FONOPROTEX is supplied complete with a plastering mesh for the external face, two white draught and dust protection grids and one copper colour, and a modular extension of 125 mm in diameter in four sections of 6 cm each, which once fitted one inside the other, create a total length of 21 cm. The device can be fitted in all positions and a protection pad protects the hole whilst plastering, which will adhere easily to the mesh arranged on the external face of the air in-take.

When installed from the outside, the lodging recess is created in the wall and then the through hole is made, in which the extension will be installed through to the inside of the home; once the pieces of the extension have been put together in the required size, it is blocked in the wall and FONOPROTEX is installed in the recess, inserting the rear inlet in the cup of the extension, then the air in-take is cemented in the recess and the external face is plastered.



$D_{n,e,w}$ = 53,9 dB

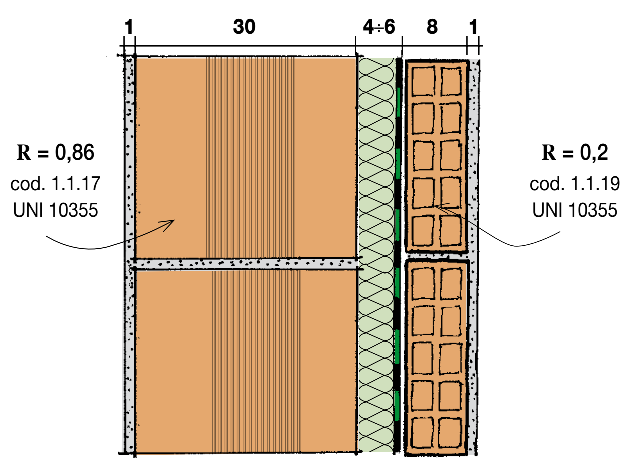
Laboratory certificate "ISTITUTO GIORDANO"

THERMAL ACOUSTIC VERIFICATION OF WALLS

External perimetric walls

Generally speaking, seeing as external walls are built with heavier elements than dividing walls between different dwellings, they can be considered as already pre-arranged to obtain an evaluation index of the soundproofing power higher than 40 dB (which is requested for buildings in category A). The acoustic insulation of the external wall will mainly depend on the choices related to the transparent part and on the planner's attention paid to this aspect: to conclude, situations in which the opaque part has an evaluation index of $\mathbf{R_w}$>50 dB, the observance of the legal limits is to be considered exclusively dependant on the other components making up the external wall. It will consequently be suffice to fill the air space with self-bearing panels type TOPSILENTRock (mineral wool coupled with the soundproofing foil TOPSILENTBitex) or in alternative with TOPSILENTEco (synthetic polyester wool coupled with TOPSILENTBitex) to obtain the above.
The TOPSILENTRock panel is supplied in polyethylene packs bearing the laying instructions of the soundproofing foil TOPSILENTBitex on the "warm face" of the insulation, to avoid problems of condensation in the gaps (the side involved, must face the operator while laying the panels); the TOPSILENTEco panel is not packed and will always be laid with the soundproofing foil TOPSILENTBitex on the warm face (towards the operator).
The solutions assessed and suggested by INDEX to obtain external walls with efficient acoustic and thermal performance, illustrated hereafter, have been calculated for the harshest of weather conditions and take into consideration Legislative Decree 311/06 related to thermal insulation according to the regulations established as of the 1st January 2008 and the 1st January 2010 in more restrictive weather zones, related to zone F; for other building types and in the different weather conditions, professionals shall also evaluate the new values of the transmittance coefficient $\mathbf{U}$ and the forecast evaluation index of the soundproofing power $\mathbf{R_w}$.

DOUBLE PERIMETER WALL IN STANDARD HOLLOW BRICK 30+8 CM

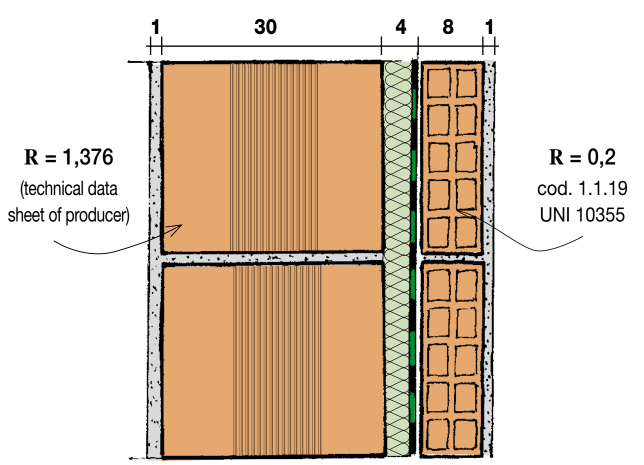


Vertical section of the walls

THERMAL INSULATION			
Transmittance	**DLgs 311/06**	**TOPSILENTEco**	**TOPSILENTRock**
ZONA F from 1/1/2008 **K**	0,3500 W/m²K	thickness 50 mm 0,3452 W/m²K	thickness 50 mm 0,3290 W/m²K
ZONA F from 1/1/2010 (¹) **K**	0,3300 W/m²K	thickness 60 mm 0,3300 W/m²K	thickness 60 mm 0,3146 W/m²K
ACOUSTIC INSULATION			
Soundproofing power	**DPCM 5/12/97**	**TOPSILENTEco**	**TOPSILENTRock**
$D_{2m,nT,w}$	40 dB	thickness 40÷60 mm (²) R_w>50 dB	

Note. When the soundproofing power R_w of the opaque wall of the external wall exceeds 50 dB, the insulation of the external wall depends exclusively on the transparent parts and small elements (windows, shutter boxes, ventilation holes etc.)
Note. The temperature and humidity assessment proved that no condensate formed.
(¹) *For the external plastering, we used THERMOCAP (λ = 0,088) - Index.*
(²) *From the forecast calculation.*

DOUBLE PERIMETER WALL IN AIR BRICK 30+8 CM



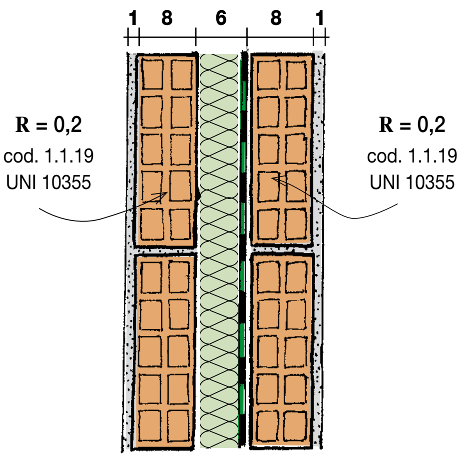
Vertical section of the walls

THERMAL INSULATION			
Transmittance	**DLgs 311/06**	**TOPSILENTEco**	**TOPSILENTRock**
ZONA F from 1/1/2008 **K**	0,3500 W/m²K	thickness 40 mm 0,3482 W/m²K	thickness 40 mm 0,3369 W/m²K
ZONA F from 1/1/2010 (¹) **K**	0,3300 W/m²K	thickness 50 mm 0,3280 W/m²K	thickness 50 mm 0,2968 W/m²K
ACOUSTIC INSULATION			
Soundproofing power	**DPCM 5/12/97**	**TOPSILENTEco**	**TOPSILENTRock**
$D_{2m,nT,w}$	40 dB	thickness 40 mm (²) R_w>50 dB	

Note. When the soundproofing power R_w of the opaque wall of the external wall exceeds 50 dB, the insulation of the external wall depends exclusively on the transparent parts and small elements (windows, shutter boxes, ventilation holes etc.)
Nota. Dalla verifica termoigrometrica non si forma condensa.
(¹) *For the external plastering, we used THERMOCAP (λ = 0,088) - Index.*
(²) *From the forecast calculation.*

Internal partition

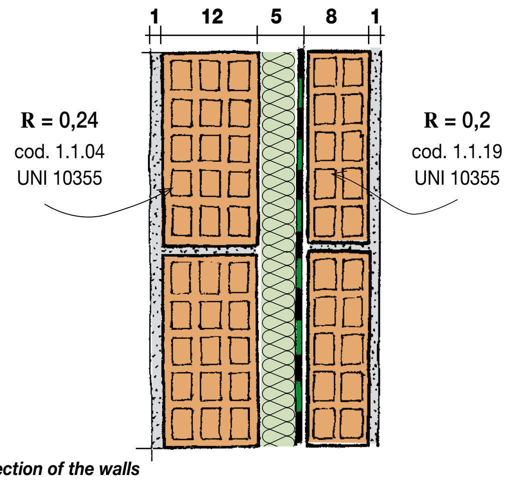
For all categories of buildings, as they are classified based on the purpose for which they are built, according to art. 3 of the Decree of the President of the Republic no. 412 dated 26th August 1993, with the exception of category E.8, to be built in weather zone C, D, E and F, the transmittance value (U) of the separation constructional structures between buildings or boundary building units, bearing in mind the observance of the Decree of the Chairman of the Cabinet dated 5th December 1997 "Establishment of the passive acoustic requirements of buildings", must be lower or equal to 0.8 W/m²K in the case of vertical and horizontal dividing walls. The same limit must be observed for all the opaque, vertical, horizontal and leaning structures that delimit rooms without heating system towards the outdoor environment.



Vertical section of the walls

THERMAL INSULATION			
Transmittance	**DLgs 311/06**	**TOPSILENTEco**	**TOPSILENTRock**
ZONA F from 1/1/2010 **K**	0,8000 W/m²K	thickness 60 mm 0,4285 W/m²K	thickness 60 mm 0,4036 W/m²K
ACOUSTIC INSULATION			
Soundproofing power	**DPCM 5/12/97**	**TOPSILENTEco**	**TOPSILENTRock**
R'_w	50 dB (*)	thickness 60 mm R_w – 56 dB (2)	thickness 60 mm R_w≅55 dB (1)

(1) Value certified at the ITC laboratory (ex ICITE) of San Giuliano Milanese - Milan.
(2) Assumed value, following measurements at the above laboratory of the same wall with a 60 mm air space filled with 50 m of TOPSILENTEco.
(*) Categories A, B, C, E, F, G



Vertical section of the walls

THERMAL INSULATION			
Transmittance	**DLgs 311/06**	**TOPSILENTEco**	**TOPSILENTRock**
ZONA F from 1/1/2010 **K**	0,8000 W/m²K	thickness 50 mm 0,4753 W/m²K	thickness 50 mm 0,4498 W/m²K
ACOUSTIC INSULATION			~
Soundproofing power	**DPCM 5/12/97**	**TOPSILENTEco**	**TOPSILENTRock**
R'_w	50 dB (*)	thickness 50 mm R_w – 57 dB (2)	thickness 50 mm R_w=57 dB (1)

(1) Value certified at the ITC laboratory (ex ICITE) of San Giuliano Milanese - Milan.
(2) Value estimated following the measurement campaign at the same laboratory.
(*) Categories A, B, C, E, F, G

For all cases, the humidity assessment carried out to evaluate the probability of condensate in the surface and gaps in the stratified elements of the insulated walls always resulted in "no condensate", even for the coldest weather zone in view of the high vapour barrier properties of the TOPSILENT foil coupled with the panels (the foil must always face the warm surface of the perimeter wall)

CONCLUSIONS

The TOPSILENTRock and TOPSILENTEco panels in the thicknesses usually employed to acoustically insulate double brick dividing walls between different dwellings of the same building, likewise for the perimeter walls, prove to satisfy the requirements of Legislative Decree 311 on thermal insulation **without the need to integrate the thermal insulation with other insulation panels**

FALSE WALLS IN LINED PLASTERBOARD

It is the most commonly used system to correct acoustic defects in existent walls.
It has the amazing benefit of being a “dry-build” technique and of not requiring soiling materials to install it, such as sand, cement etc. It also offers great insulation results with thinner and lighter walls compared to a traditional false brick wall.
This is why it is the preferred system for restoring the acoustic comfort of rooms that have already been lived in.
The insulating system is not based on the law of weight as is the case with traditional brick walls, which are rigid and heavy and where more weight is equal to more insulation, but rather on the dynamic insulation of extremely light panels, as indeed plasterboard panels are, alternated with one or more air spaces preferably filled with mineral or synthetic wool.

INCREASING THE ACOUSTIC INSULATION OF EXISTENT WALLS

It often occurs that the acoustic insulation of existent dividing walls does not guarantee sufficient protection and consequently the following corrective solutions can be chosen:

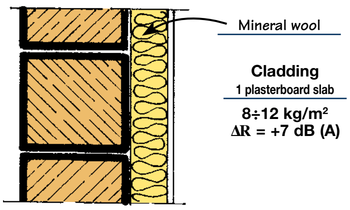
- to build a sufficiently heavy false brick wall separated by an air space filled with mineral or synthetic wool and detached around the edges;
- to install a light false wall against the wall to be insulated in light panels of plasterboard or wood, separated by an air space filled with mineral or synthetic wool.

As already mentioned, the second system is preferred in rooms that have already been lived in, while the first system belongs to the category described previously in the case of traditional double brick walls.
The improvement added by the light false wall with dynamic insulation increases the lighter the wall to be insulated is.
If on the other hand the old wall is heavy, the benefit is lower, even if it is still considerable in terms of absolute value.
Improvements of 15÷20 dB are expected for light walls (80÷100 Kg/m²) and of 7÷12 dB for heavy walls (250÷300 Kg/m²).
The illustration at the side shows how the insulation, with equal air space, increases with the number of plasterboard panels of the false wall.

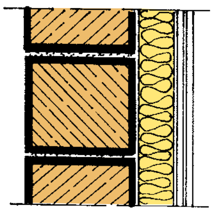
GUIDELINE IMPROVEMENT VALUES OF ACOUSTIC PROTECTION (ΔR) AS WEIGHT OF WALL AND CLADDING VARIES, HAVING INSTALLED A 4 CM THICK FIBROUS PANEL

(From “La realizzazione di murature in laterizio” Norberto Tubi - Ed. Laterconsult

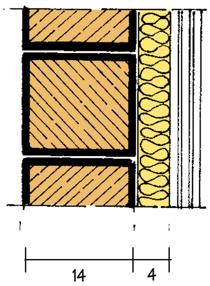
WALL 300 kg/m²



Cladding
1 plasterboard slab
8÷12 kg/m²
ΔR = +7 dB (A)



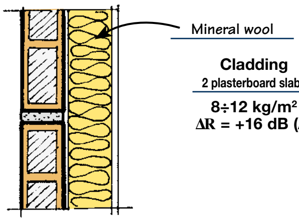
Cladding
2 plasterboard slabs
15÷20 kg/m²
ΔR = +10 dB (A)



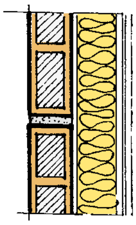
Cladding
3 plasterboard slabs
25÷30 kg/m²
ΔR = +12 dB (A)

dimensions in cm

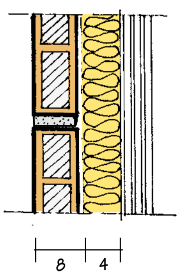
WALL 70 kg/m²



Cladding
2 plasterboard slabs
8÷12 kg/m²
ΔR = +16 dB (A)



Cladding
2 plasterboard slabs
15÷20 kg/m²
ΔR = +19 dB (A)

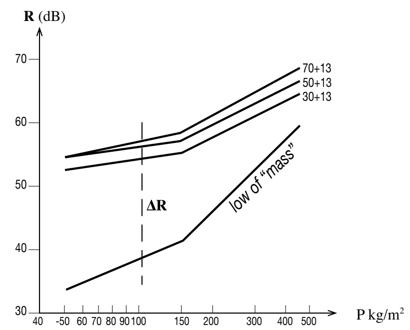


Cladding
3 plasterboard slabs
25÷30 kg/m²
ΔR = +21 dB (A)

dimensions in cm

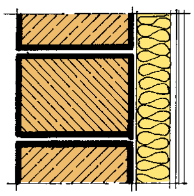
Another improvement can be made by increasing the air space filled with wool. This is even more advisable when a heavy wall needs to be insulated, as can be seen in the graph, where the three curves of the soundproofing power distinguish three different insulated air spaces of 30, 50, 70 mm protected with the same 13 mm plasterboard panel.
In the case of heavy walls, to further increase their insulation, it could be a good idea to insulate both sides of the wall with the light false wall.

INCREASE IN SOUND INSULATION POWER OBTAINED BY A 13 mm PLASTERBOARD WALL, WITH THREE DIFFERENT THICKNESS VALUES OF INSULATED INTERSPACE, ACCORDING TO THE WEIGHT OF THE EXISTING WALL

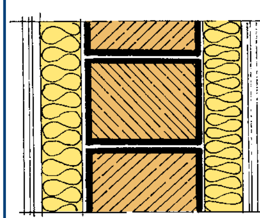


In such case, the total improvement will be represented by the sum of the improvement values of the two false walls.
For example, in the case illustrated previously, where the improvement in the insulation of the heavy wall is 10 dB by lining one side of the wall with 4 cm of mineral wool and two panels of plasterboard, an improvement of 20 dB can be obtained by doubling the insulation on the other side of the same wall.

HEAVY SINGLE WALL



Single cladding
15÷20 kg/m²
ΔR = +10 dB (A)



Double cladding
30÷40 kg/m²
ΔR = +20 dB (A)

FORECAST CALCULATION METHODS OF THE INCREASE IN SOUNDPROOFING POWER R_w OBTAINED WITH FALSE WALLS IN LINED PLASTERBOARD

To foresee the increase in the soundproofing power R_w of a wall that will be lined with a false wall in plasterboard, the resonance frequency (**fo**) of the wall/false wall system must be calculated. For plasterboard panels already coupled with mineral wool, such as SILENTGips, to be glued to the wall, the following formula is used:

$$fo = 160 \sqrt{s'\left(\frac{1}{m_1} + \frac{1}{m_2}\right)}$$

s' = dynamic stiffness of the mineral or synthetic wool (MN/m³)
m'_1 = mass per unit area of the wall to be lined (kg/m²)
m'_2 = mass per unit area of the false wall (kg/m²)

Instead, in the case of a false wall or false ceiling on a metal frame, with the air space filled with mineral or synthetic wool, with air flow resistance of >5 KPas/m², detached from the wall to be treated, we shall use the following formula:

$$fo = 160 \sqrt{\frac{0{,}111}{d}\left(\frac{1}{m_1} + \frac{1}{m_2}\right)}$$

where:
d = depth of the air space (**m**)
m'_1 = mass per unit area of the wall to be lined (kg/m²)
m'_2 = mass per unit area of the false wall (kg/m²)

Next, as we know or have calculated the soundproofing power R_w of the wall to be treated, we obtain the increase in soundproofing power ΔR_w from the following

Resonance frequency fo	ΔR_w
fo≤80	35-R_w/2
80<fo≤125	32-R_w/2
125<fo≤200	28-R_w/2
200<fo≤250	-2
250<fo≤315	-4
315<fo≤400	-6
400<fo≤500	-8
500<fo≤1.600	-10
fo>1.600	-5

table.

FORECAST CALCULATION METHOD OF THE SOUNDPROOFING POWER R_w OF A NON-TRADITIONAL WALL ON A METAL FRAME CONSISTING OF JUST LINED PLASTERBOARD AND MINERAL OR SYNTETHIC WOOL

In the case of walls built with a single metal structure:
R_w = 20log(**m'**)+10log(**d**)+**e**+5

In the case of walls built with a double metal structure:
R_w = 20log(m')+10log(**d**)+**e**+10

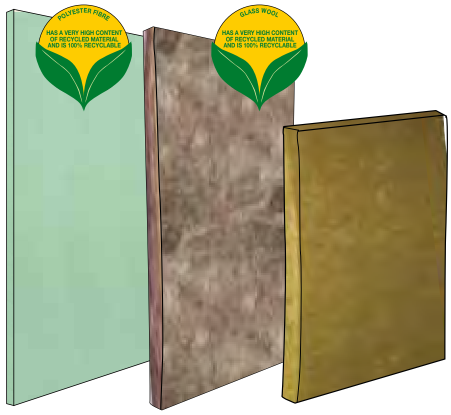
where:
m' = mass per unit area of the wall (kg/m²)
d = depth of the air space (cm)
e = thickness of the fibrous insulation (cm)

INSTALLATION SYSTEMS OF LIGHT FALSE WALLS

The improvement in the insulation indicated in the previous chapters can be achieved in practice the further the light false wall is detached from the wall to be treated and from the side walls along its perimeter. This will avoid acoustic bridges that would totally compromise the intervention. Two types of intervention are possible:

- The prefabricated glued false wall in SILENTGips and TOPSILENTDuogips.
- The false wall assembled on-site on a metal frame where the air space between the plasterboard panel and the existing wall is filled with SILENTGlass glass wool or with SILENTEco polyester wool.

SILENTEco SILENTGlassEco SILENTRock



Size 0,60 × 1,42 m — Size 0,60 × 1,35 m — Size 0,60 × 1,00 m

Alternatively, SILENTRock or the pre-coupled insulation products TOPSILENTRock and TOPSILENTEco can also be used. They are to be inserted in the dedicated seating of the metal uprights, with the face covered with TOPSILENTBitex facing the outer side of the false wall.

The performance of the plasterboard panel can be improved by gluing the TOPSILENTBitex membrane over it using FONOCOLL. These two products correct its critical frequency, raising it towards high frequencies, beyond the audible range.

To reduce installation times, it is convenient to use the lined TOPSILENTGips plasterboard panel pre-coupled with TOPSILENTBitex.

TOPSILENTGips is obtained in our factory by coupling a lined plasterboard panel with TOPSILENTBitex foil. Consequently, the laying jobs previously carried out on-site are eliminated.

TOPSILENTGips is a prefabricated panel that provides higher acoustic insulation performance compared to that of the single plasterboard panel, thanks to the TOPSILENTBitex coupling, which is a high density elastomer foil with soundproofing power equal to a lead foil of the same weight but without the latter's toxic properties.

TOPSILENTGips is indeed lead free.

The acoustic insulation performance of TOPSILENTGips - whether fitted in false walls made on a metal frame next to a brick wall, or in walls made entirely of lined plasterboard on a metal frame – has been certified by the laboratory of I.E.N. Galileo FERRARIS in Turin, using 13 mm plasterboard panels and TOPSILENTBitex weighing 5 Kg/m² pre-coupled on-site with FONOCOLL glue.

The TOPSILENTGips panel is used in the building trade to build walls with high acoustic insulation properties. In view of TOPSILENTBitex's high resistance to vapour migration, it also acts as a barrier against the vapour of the thermal-acoustic insulation material in the perimeter walls bordering the outside.

TOPSILENTGips can be used both for building insulating false walls of existing walls and for building new walls made totally of lined plasterboard panels.

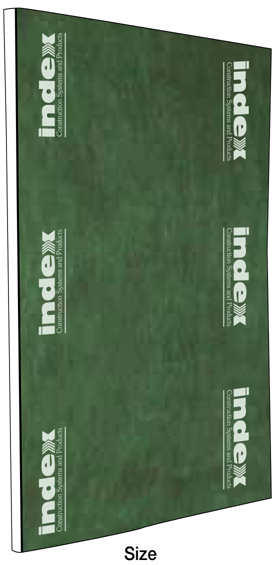
TOPSILENTGips panels are to be screwed onto a metal frame.

They are generally installed as the first layer of walls built with two plasterboard panels, and can be positioned both with the lined face facing the frame or vice versa, with the lined face in-between the two panels.

If a single panel is installed, the face lined with TOPSILENTBitex should face the metal frame.

The joining lines between the panels are then sealed with joint concealing tape.

TOPSILENTGips



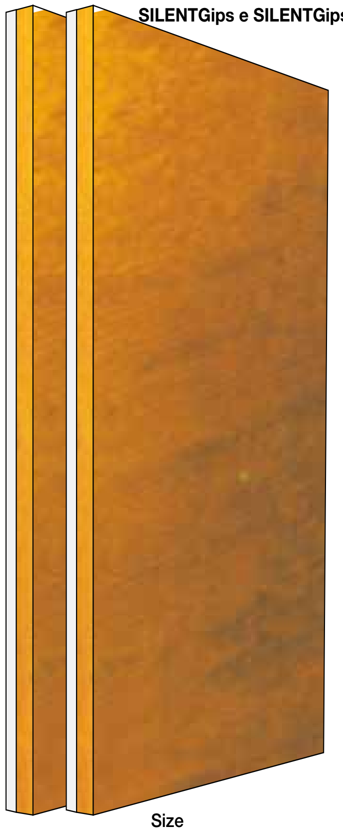
Size
1,20 × 2,00 m

THE LIGHT GLUED FALSE WALL

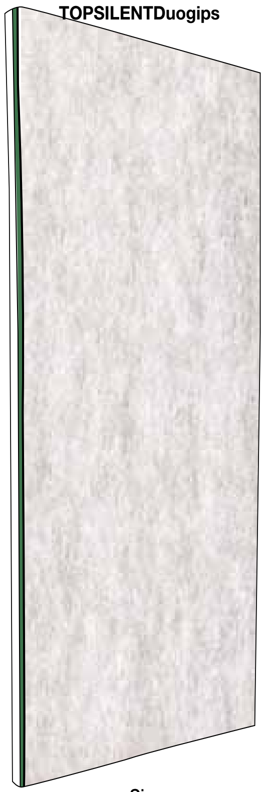
The system is based on the use of plasterboard panels coupled with SILENTGIPS mineral wool. The panels are glued onto the wall to be insulated using adhesives containing hydraulic binders, making sure that the panels do not touch the floor, side walls and ceiling, to avoid generating lateral transmission of noise. SILENTGipsalu, with its metal anti-vapour screen, is used if the perimeter wall facing the outside is to be insulated.

TOPSILENTDuogips can be used on partitions up to minimum mass per unit area of 140 kg/m^2 and is the minimal solution in cases where there is not much space for insulation. As stated in the certificate of IEN G. Ferraris no. 35561/08, the TOPSILENTDuogips panel obtained by gluing the TOPSILENTDuo foil onto a panel of lined plasterboard on-site, then all this glued onto a plastered wall made of perforated bricks 25×25×12 cm has increased the soundproofing power by ΔR_w = 7 dB.

Spread GIPSCOLL glue (dotted or in strips) on the panels to be secured. Next, rest the panel against the wall, while keeping it detached from the floor with small wedges, which will be removed when the glue has set.
Next, fill the gap with an insulating seal in extruded polyethylene and grout the joining line of the panel with the special STUCCOJOINT sealer reinforced with NASTROGIPS tape.

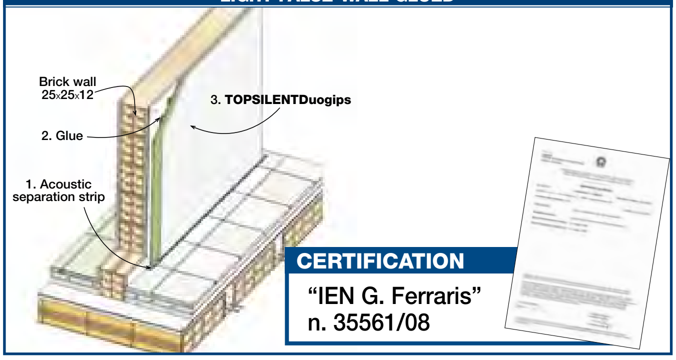


Size
1,20 × 3,00 m

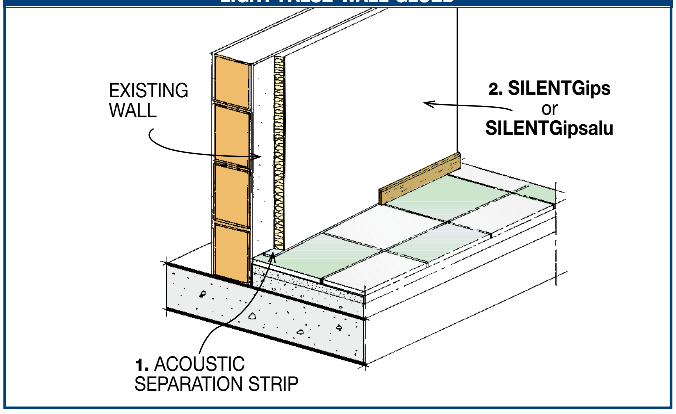


Size
1,20 × 2,80 m

LIGHT FALSE-WALL GLUED



LIGHT FALSE-WALL GLUED

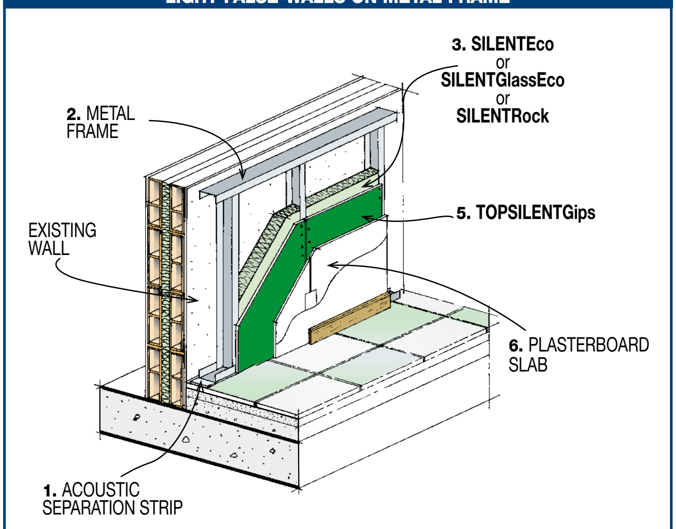


THE LIGHT FALSE WALL ON A METAL FRAME

This offers more planning freedom, because you can vary the distance from the wall and install several layers of panels, alternated with anti-vibration materials, gradually increasing the degree of insulation. Moreover, the mechanical fastening of the panels near the joint between each panel offers a greater guarantee of stability compared to the glued-only solution.
This also facilitates the installation of systems built into the wall. Practically speaking, you use a technique that is similar to the one used for building partition walls made of plasterboard only.
There are various types of metal frames, with a common measurement of the fastening centre line distance of 60 cm, which, in special cases, can be shortened to 40 cm.
The greater degree of freedom is provided by the self-supporting metal frame. It does not need to be fastened to the wall being insulated, but only requires perimeter rails screwed onto the ceiling and floor, suitably insulated with self-adhesive seals, which guarantee separation and reduce lateral transmissions.
The air space between panels and wall is completely or partially filled with SILENTGLASS glass wool or SILENTEco polyester wool or with panels of SILENTRock, TOPSILENTRock and TOPSILENTEco, which are inserted in the dedicated seating of the vertical uprights.
Next, screw-fasten the plasterboard panels in one or more layers.
If you are installing a single layer only, the panel should be coupled beforehand with TOPSILENTBitex soundproofing foil. The latter improves its acoustic properties and acts as a vapour barrier if the external perimeter wall is insulated.
If you are installing a double layer, you may wish to insert the TOPSILENTDuo foil between the panels. The foil integrates the movement action of the panel's resonance frequency.

In both cases, to speed up laying jobs, it may be an advantage to use TOPSILENTGips panels pre-coupled with TOPSILENTBitex.
Lay the panels staggered between each other and the screw seating, and suitably grout the joints.

LIGHT FALSE-WALLS ON METAL FRAME



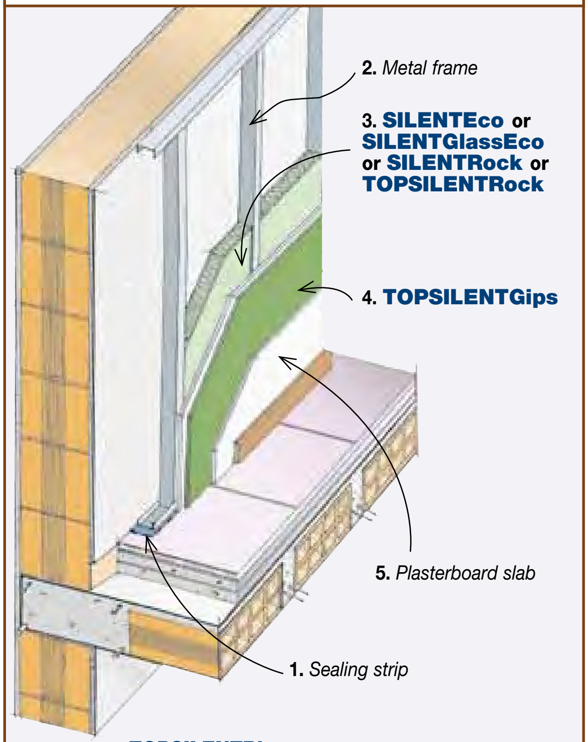
Alternatively **TOPSILENTGips: TOPSILENT** + Plasterboard

TECHNICAL INTERVENTION SOLUTIONS IN EXISTING BUILDINGS

1 2 EXTERNAL WALL

1

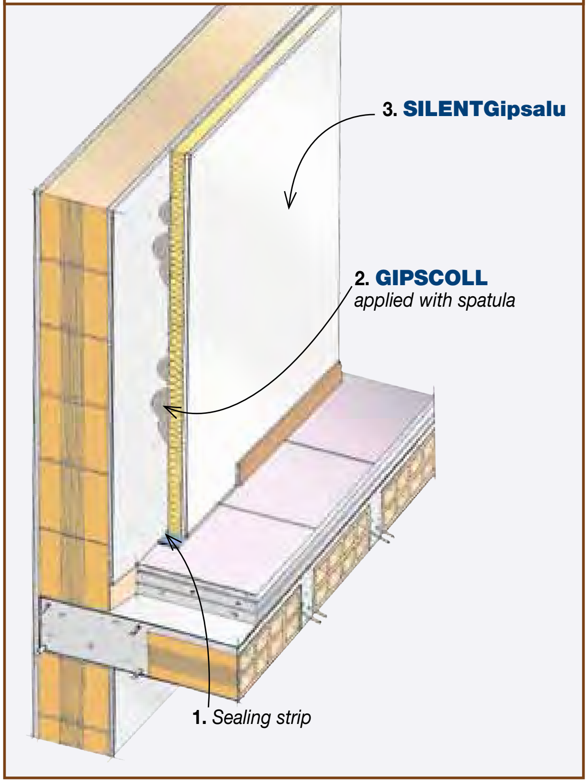
Acoustic insulation by a plasterboard wall fitted on a self-bearing metal frame



Alternatively : **TOPSILENTBitex** *and plasterboard*

2

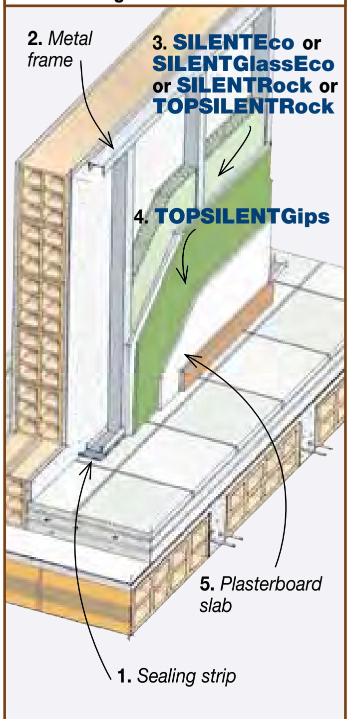
Acoustic insulation obtained by gluing a mineral wool panel coupled to a SILENTGipsalu plaster slab



3 4 5 INTERNAL WALL

3

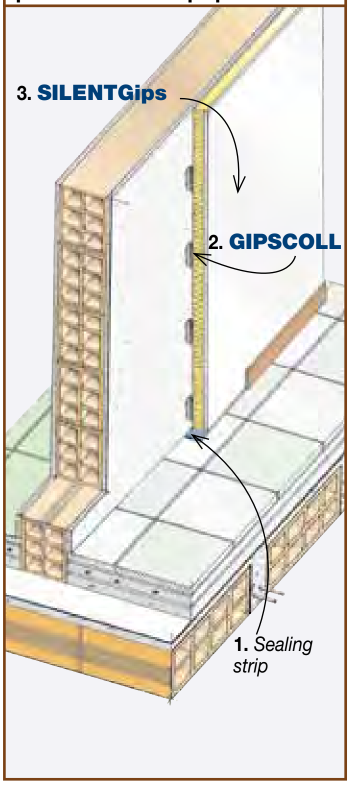
Acoustic insulation by a plasterboard wall fitted on a self-bearing metal frame



Alternatively : **TOPSILENTBitex** *and plasterboard*

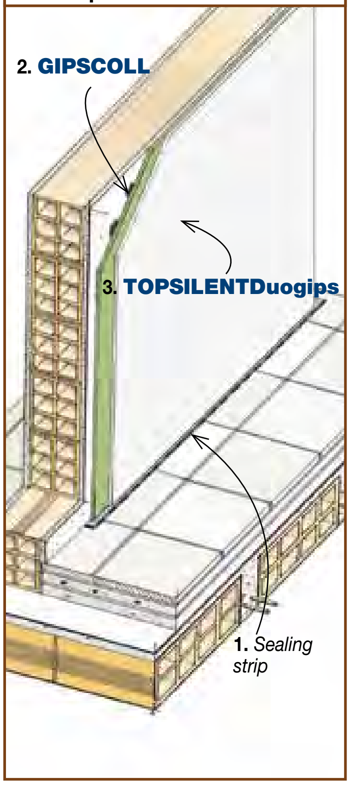
4

Acoustic insulation obtained by gluing a mineral wool panel coupled to a SILENTGips plaster slab



5

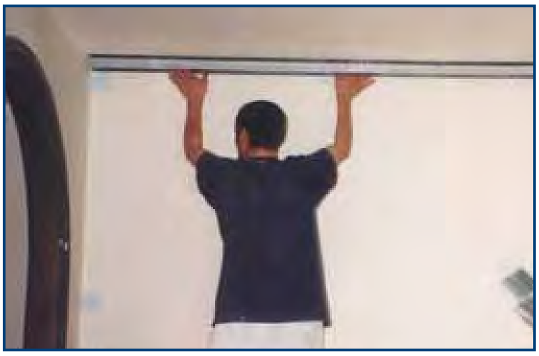
Acoustic insulation in minimal thickness by gluing a plasterboard slab coupled to TOPSILENTDuo



The specifications items are on page 98-99

LAYING METHOD

LAYING TECHNIQUE FOR FALSE-WALLS ON METAL FRAME



1. Install the metal frame

2. Lay SILENTEco

3. First layer of plasterboard

4. Lay TOPSILENTDuo

5. Lay and seal of plasterboard

LAYING TECHNIQUE FOR GLUED FALSE-WALLS

1. Spread GIPSCOLL glue

2. Position the sealing strip

3. Position the SILENTGIPS slab

LAYING METHOD

LAYING TECHNIQUE FOR LIGHT GLUED FALSE-WALLS TYPE TOPSILENTDuogips

1. Spread the GIPSCOLL glue

2. Spread the GIPSCOLL glue on the panel

3. Put the panel of TOPSILENTDuogips in position

4. Put another panel of TOPSILENTDuogips in position

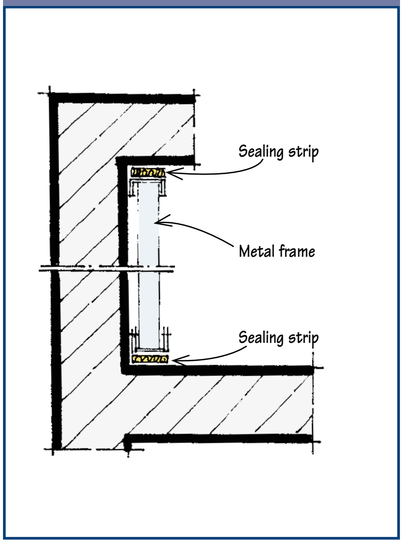
5. Seal the joins between the TOPSILENTDuogips panels

DETAILS

DETAILS

FALSE-WALLS ON METAL FRAME

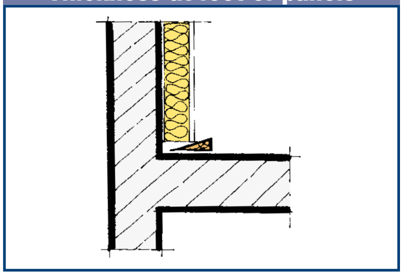
The sealing strip is positioned before the frame is laid



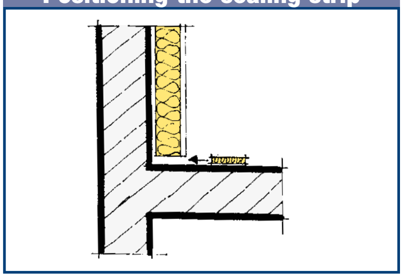
DETAILS

GLUED FALSE-WALLS

Thickness at foot of panels



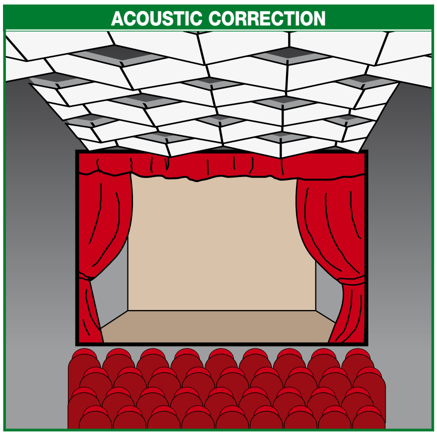
Positioning the sealing strip

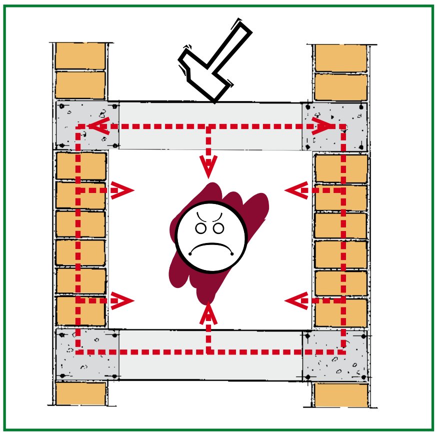


THERMAL AND ACOUSTIC INSULATION OF CEILINGS AGAINST AIRBORNE AND FOOT-TRAFFIC NOISE

It is an insulation system based on the same principle as that of plasterboard walls already used for airborne noise.
Likewise for walls, it insulates against airborne noise but also against percussion noise, even if for the latter it is not quite as effective as the "floating floor" system, unless the volume of the disturbed room is reduced considerably; this would consequently create a very large air space that must also be filled-in with insulation material and that would be very difficult to fulfil.
You must not however mix up material for false ceilings used for the acoustic correction of public halls, offices etc. with those for acoustic insulation.

ACOUSTIC CORRECTION

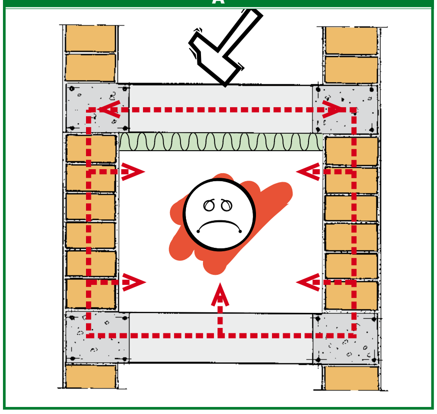




The former are too light and are not airtight, on the contrary they are often perforated, while for an insulating false ceiling, the solution is the same as for walls: you must create a false wall, which in this case is horizontal, completely impermeable to sound waves and of a certain weight. The system based on fixing plasterboard panels to the ceiling already coupled with mineral wool is not so effective as for walls, where the same prefabricated panel is just glued, because the presence of unavoidable fixing screws, in the case of ceilings, establishes a rigid bond that reduces the acoustic benefit to just 3÷4 dB.
Likewise for walls, the best results are obtained with plasterboard panels fitted on metal framework. The framework can be fitted onto the ceiling to minimise reductions in height, or spaced from the ceiling and supported by special metal suspension hooks; the second is the most effective system. Suppliers of plasterboard panels do indeed offer a complete range of hooks and metal framework.

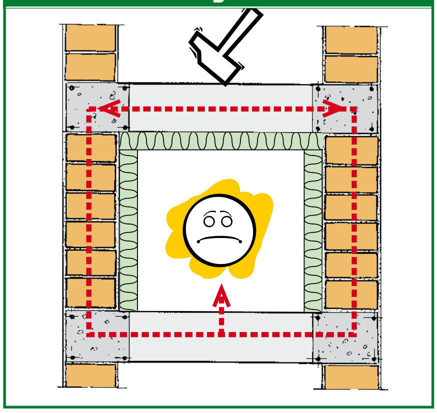
Generally speaking (A) is used for inhabited rooms of an existent building with insufficient insulation.

A

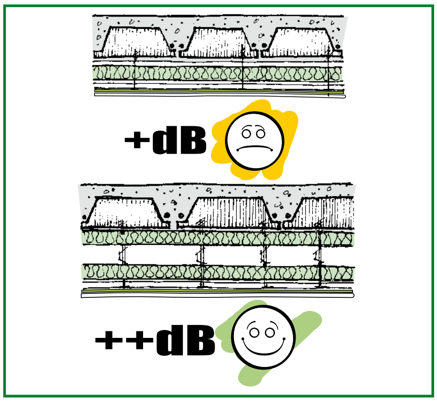


It is often associated with the insulation of the walls (B) lined with the same technique, otherwise flanking transmissions of foot traffic noise would be so high that the insulation of the ceiling alone would be annulled. Considering that it is an invasive action that reduces the living space, it is only used for some rooms of the home, usually bedrooms.

B

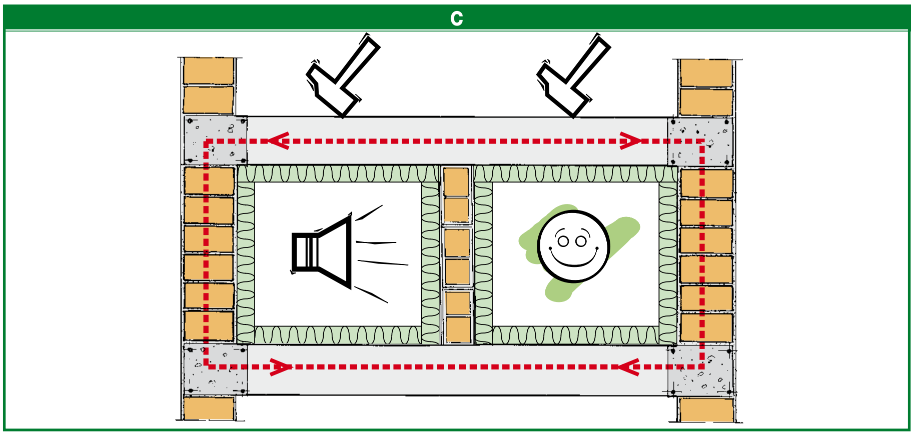


Basically speaking, to ensure effective insulation, you must create "a room within a room" and in more severe cases you must also insulate the floor. Such solution is generally effective also for insulating noise produced within the room and the same technique is indeed used to insulate discos and theatres. (C).
In false ceilings too, the increased weight of the latter adds an acoustic benefit, so it is important to double the plasterboard panels of the false ceiling, just like for walls.



The insertion of TOPSILENTBitex foil between the two panels will further improve acoustic performance, or alternatively, you can use TOPSILENTGips (the panel pre-coupled with TOPSILENTBitex) that cuts down laying jobs, making them consequently simpler on site, which is better appreciated in the case of false ceilings.

C

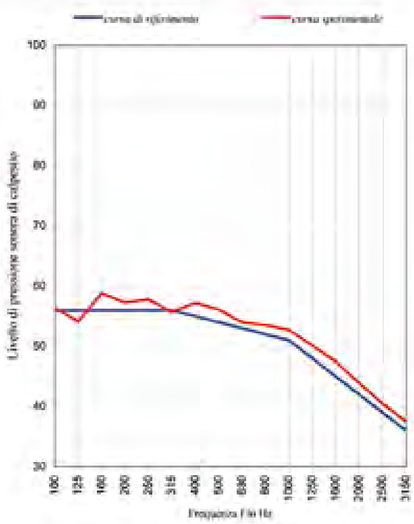


As a precautionary evaluation of the increased soundproofing power index ΔRw obtainable by creating a false ceiling, be it directly on the ceiling or fitted on special suspension hooks, the technical standards currently available enable a theoretic evaluation of the resonance frequency fr of the system made up of the existent floor slab and of the false ceiling; this value is used to obtain the ΔR_w in table format (with the same experimental formulae and tables used to assess the performance of the false wall and written in this document on page 72).
As for the preliminary estimation of the reduction level in foot traffic noise ΔL_n, the technical standards state the following precisely: "If suitable data are not available concerning the reduction in the sound pressure level of foot traffic, and ΔL_d, due to the false ceilings on the receiving side of the dividing floor, the increased soundproofing power of airborne noise ΔR can be used to assess the situation". With the aim to estimate the approximation level, related to the indications written in the standards, we have carried out experiments directly on site, by testing an existent floor slab, with regard to both its soundproofing power index R_w and its foot traffic noise level $L'_{n,w}$ and, using such input data, we calculated a theoretic estimation of the remedy suggested and finally tested the indexes involved.
We are providing an illustration of the survey procedure carried out and the results obtained before and after the remedy was implemented.

INSULATION INDICES MEASURED FOR THE PARTITION CONSIDERED BEFORE THE ACTION

Volume ambiente ricevente: 41,5 m²

Frequenza Hz	L'n Terzo di ottava dB
50	
63	
80	
100	56,4
125	54,1
160	58,8
200	57,3
250	57,8
315	55,7
400	57,2
500	56,1
630	54,0
800	53,5
1000	52,7
1250	50,1
1600	47,5
2000	43,9
2500	40,5
3150	37,5
4000	
5000	

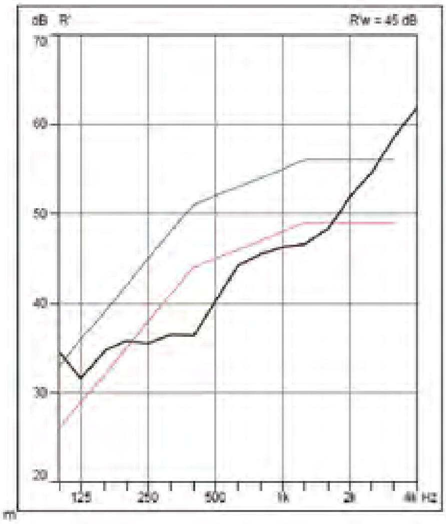


Valutazione secondo la UNI EN ISO 717-2:

$L'_{n,w}$ = 54,0 dB $C_{I,50-2500}$ = -2,3 dB

Freq f Hz	R' (ottava)
[Hz]	R' [dB]
100	34,6
125	31,6
160	34,7
200	35,8
250	35,5
315	36,5
400	36,4
500	40,2
630	44,2
800	45,5
1 k	46,3
1,25 k	46,6
1,6 k	48,3
2 k	51,9
2,5 k	54,6
3,15 k	58,5
4 k	61,9

Area S dell'elemento: 13,5 m²
Volume dell'ambiente emittente: m³
Volume dell'ambiente ricevente: 41,5 m³



Indice di valutazione e termini di adattamento:
R'w = 45 dB

STRATIFIED ELEMENTS OF THE PARTITIONS TAKEN INTO CONSIDERATION

Floor slab type:

- Slabs with joists and hollow flat blocks of 4 cm + 4 cm of concrete cap with total mass per unit area estimated to be approximately 110 Kg/m²;
- 8-cm thick sand/cement screed with surface density estimated to be approximately 128 Kg/m²;
- approximately 1.5-cm thick wood flooring (including glue).

CALCULATING THE INCREASED APPARENT SOUNDPROOFING POWER R_w OF THE FLOOR SLAB

Cement and brick slab: suggested increase in soundproofing power by creating a false ceiling in plasterboard and fibre suspended with springed hooks.
After testing, the effective parameter on which the forecast is to be made will therefore be:

R_w = 45 dB

Below is the theoretic estimation of the benefit created by the false ceiling suspended on elastomer "hooks".

m_1 = 250 Kg/m² (mass per unit area estimated for the existent floor slab)
m_c = 24 Kg/m² (mass per unit area of the false ceiling made up of a plasterboard panel of 12.5 mm and a panel of TOPSILENTGips of 17 mm)
d = 200 mm (air space of false ceiling filled with a double layer of polyester-based fibre material SILENTEco 4 + 4 cm, one directly on the external surface of the floor slab and one resting a suspended metal structure).

f_0 = 160 [0,111/d (1 / m_1 + 1 / m_2)]$^{1/2}$

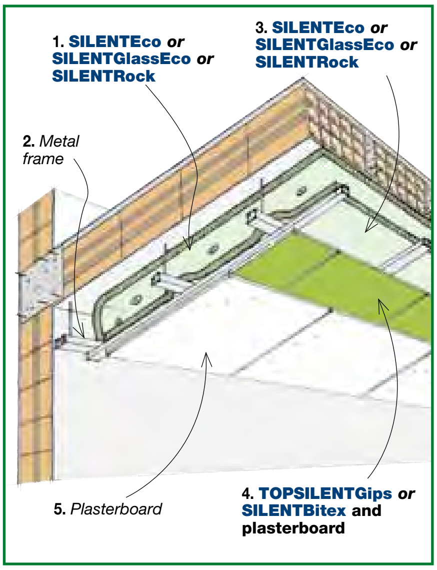
f_0 = 25,5 Hz

Knowing the critical frequency, we can now evaluate the increased soundproofing power index with the following experimental report derived from the tables indicated on page 72:

ΔR_w = 35 – R_w/2 = 12,5 dB

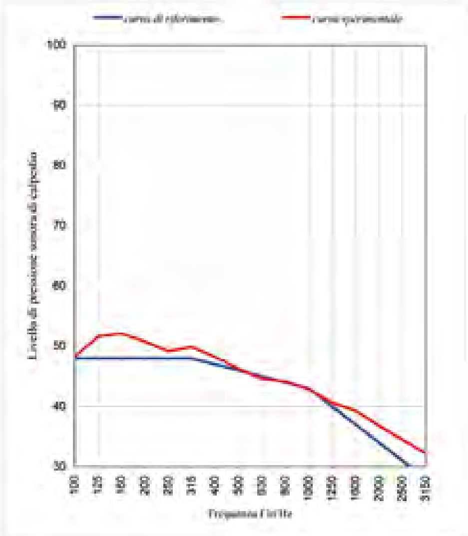
<u>Evaluation index of the overall soundproofing power:</u>

R_w = R_w + ΔR_w = 45 + 12,5 = 57,5 dB



INSULATION INDICES MEASURED FOR THE PARTITION CONSIDERED AFTER THE ACTION

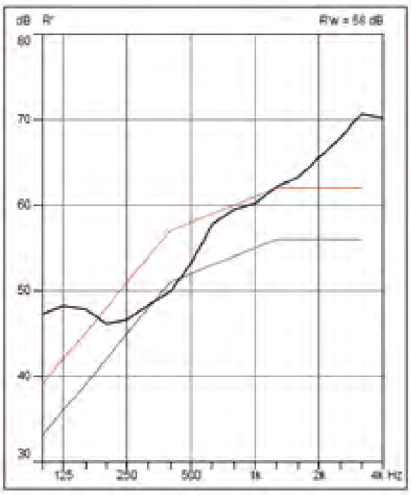
Frequenza Hz	L'n Terzo di ottava dB
50	
63	
80	
100	48,3
125	51,6
160	52,1
200	50,8
250	49,2
315	49,9
400	48,2
500	46,3
630	44,6
800	44,2
1000	42,8
1250	40,7
1600	39,3
2000	36,8
2500	34,5
3150	32,2
4000	
5000	



Valutazione secondo la UNI EN ISO 717-2:

L'n,w = 46,0 dB $C_{I,50-3150}$ = -1,3 dB

Freq f Hz	R' (ottava)
[Hz]	R' [dB]
100	47,2
125	48,2
160	47,8
200	46,1
250	46,6
315	48,3
400	49,9
500	53,2
630	57,8
800	59,5
1 k	60,2
1,25 k	62,1
1,6 k	63,3
2 k	65,6
2,5 k	67,8
3,15 k	70,7
4 k	70,2



Indice di valutazione e termini di adattamento:
R'w = 58 dB

CONSTRUCTIONAL DETAILS

Here are the laying instructions to create the suspended false ceiling.

- Mechanically fix the soundproofed suspension hooks with elastomer spring; the pitch is to be established based on the estimated load together with the plasterboard fitter (probable pitch 80-40 cm);
- Completely line the existent ceiling with 4-cm thick soundproofing panels made up of synthetic polyester fibre SILENTEco; these panels can be fixed using plaster-based adhesive (with setting retardant additive) or they can be fixed mechanically.
- Together with the complete lining of the existent ceiling (you are recommended not to leave any gaps when arranging the panels next to each other), you must also line the bordering walls of the ceiling between the suspended metal framework and the ceiling.
- Lay the primary framework made up of "C" profiles measuring 50×27×0.6, that will be fixed mechanically to the perimeter walls using Teflon dowels and phosphate treated screws, after inserting the correct resilient layer (self-adhesive polyethylene) between the frame and wall; there must be no rigid contact points between the wall and the metal framework.
- Arrange the secondary framework, again made up of "C" profiles measuring 50×27×0.6, laid perpendicular to the primary framework with pitch to be evaluated by the fitter.
- Lay the second layer of 4-cm thick SILENTEco soundproofing panels against the primary framework and bring them together with care;
- Apply the TOLPSILENTGips insulation panel made up of a plasterboard panel coupled with a soundproofing foil TOPSILENTBitex, of 1.7 cm in thickness (the green part will be laid towards the frame) and fix mechanically with phosphate treated screws; seal the perimeter abundantly (using silicon) and grout the joining lines.
- Apply the second 1.25-cm thick plasterboard panel and fix it mechanically; seal again and grout the joining lines.

FINAL COMMENTS

The results obtained from instrumental tests carried out before and after creating the false ceiling highlight an increase in the soundproofing power index of 13 dB and an increase in the foot traffic insulation index of 8 dB.

ΔR_w = 13 dB
ΔL_n = 8 dB

Finally, if we wish to draw some conclusions from our experience, we could say that, with regard to the increased soundproofing power index, the values tested have practically confirmed what we forecasted in the theoretical estimation, whereas with regard to the reduced foot traffic noise, the values obtained are probably better than what we expected.

This condition was probably due to the presence of definitely sturdy brick perimeter walls, made of stone and brick and being very thick (roughly 50 cm), which strongly limited possible flanking transmissions of vibrations imposed by mechanical strain on the slab.

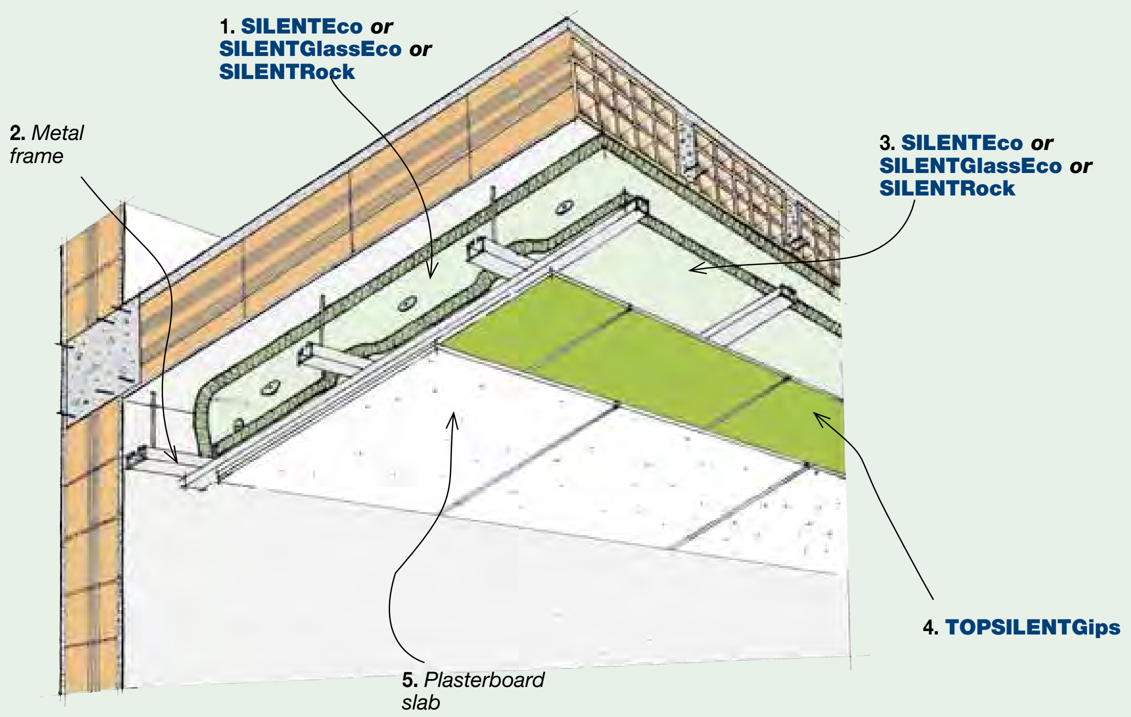
If we should give an indication on the possible benefit of a false ceiling fitted on suspended "hooks" and with an air space of 20 cm and without false walls, in relation to the insulation index against foot traffic noise, considering also the extreme variability of possible walls touching the floor slab, we could consider the foreseeable increased insulation in 4÷8 dB; the combined presence of false walls (glued or on metal structure) would further improve the result.

TECHNICAL INTERVENTION SOLUTIONS

FALSE-CEILINGS ON A SUSPENDED METAL FRAME

EXISTENT BUILDINGS

ACOUSTIC INSULATION WITH LOWERED FALSE CEILING ON METAL FRAMEWORK

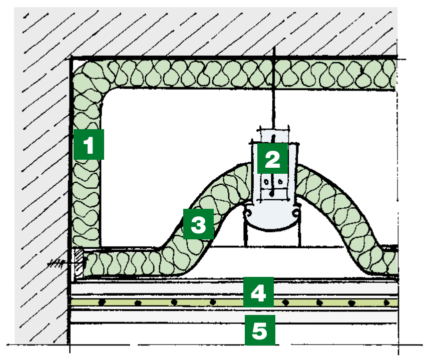


The specifications items are on page 100

METHOD OF USE AND DETAILS

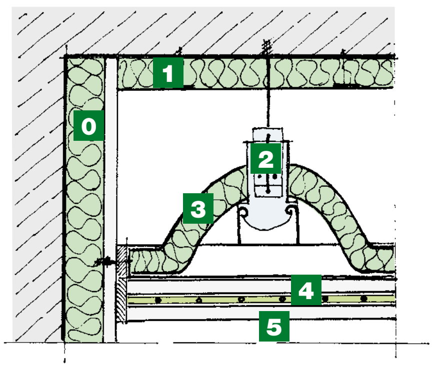
Wall joint without false-walls

1. SILENTEco or SILENTGlassEco or SILENTRock
2. Metal frame
3. SILENTEco or SILENTGlassEco or SILENTRock
4. TOPSILENTGips
5. Plasterboard slab



Wall joint with false-walls

0. Wall insulation
1. SILENTEco or SILENTGlassEco or SILENTRock
2. Metal frame
3. SILENTEco or SILENTGlassEco or SILENTRock
4. TOPSILENTGips
5. Plasterboard slab

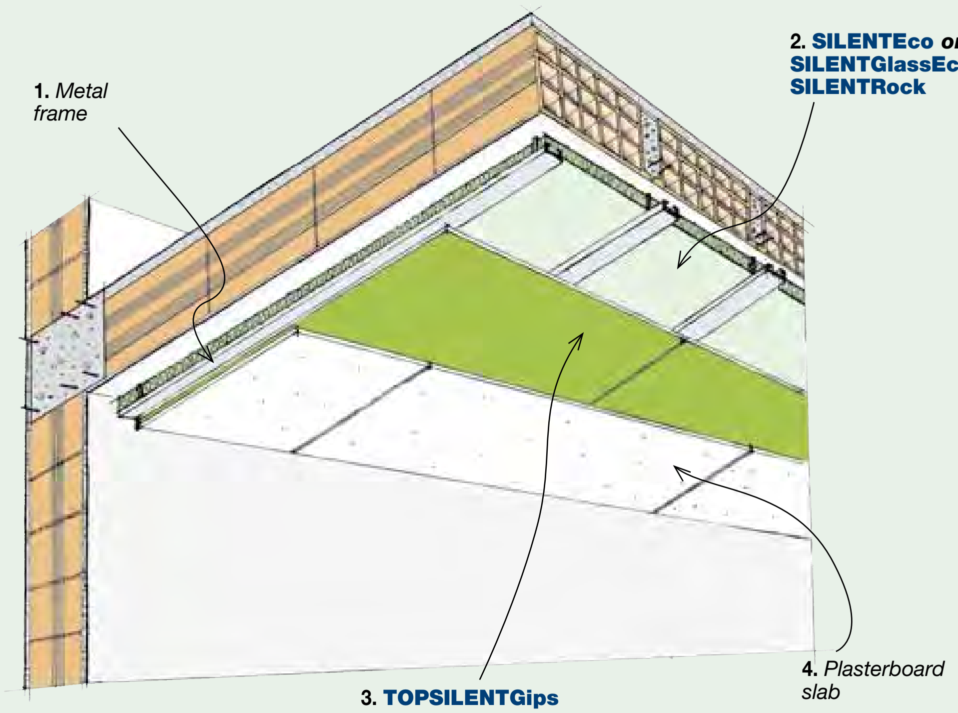


TECHNICAL INTERVENTION SOLUTIONS

FALSE-CEILINGS ON AN ADHERING METAL FRAME

EXISTENT BUILDINGS

ACOUSTIC INSULATION WITH FALSE CEILING ON METAL FRAMEWORK INSTALLED ON EXISTENT CEILING



The specifications items are on page 101

METHOD OF USE AND DETAILS

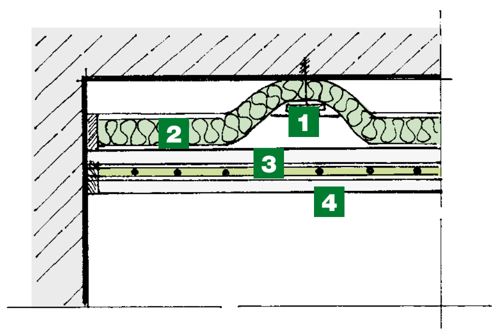
Wall joint without false-walls

1 Metal frame

2 SILENTEco or SILENTGlassEco or SILENTRock

3 TOPSILENTGips

4 Plasterboard slab



Wall joint with false-walls

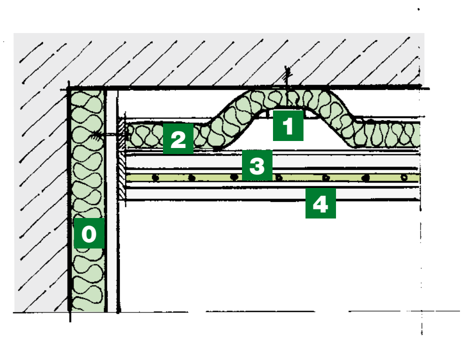
0 Wall insulation

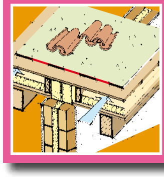
1 Metal frame

2 SILENTEco or SILENTGlassEco or SILENTRock

3 TOPSILENTGips

4 Plasterboard slab





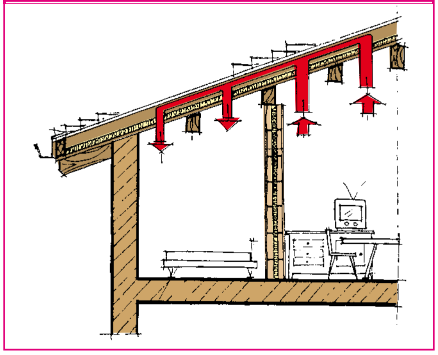
THERMAL AND ACOUSTIC INSULATION OF ROOFS AGAINST AIRBORNE NOISE

The recent standard concerning the passive acoustic requirements of buildings does not impose any limits on noise from outside entering the building through the roof, but only through the external wall.
If we can take it for granted that a traditional stratified roof in concrete or clay-cement is almost always heavy enough to guarantee levels of $D_{w2m,nTw}$ higher than 45 dB and, in the case of terraces - since they are heavier - even of 55 dB, this is not as obvious when the roof is lighter, as in the case of roofs made of wood or of wood by-products, such as OSB panels, etc.
The ever increasing use of lofts as dwellings and the wide use of ventilated wooden roofs for renovation projects, combined with forgetful laws, could lead to the absurd situation whereby lofts that may be comfortable and thermally compliant to legal regulations are however lacking in proper acoustic insulation.
There are essentially two acoustic problems that can affect wooden roofs. They derive from the architect's choices and from the nature of the material. Furthermore, the contribution of the acoustics technician is essential during the design stage.
First of all, we should consider that if, on one hand, the lightness, low cost, flexible destinations of use and the aesthetic advantages of wood, make it a material particularly appreciated by planners and end users, on the other hand, these excellent generic requirements unfortunately do not match what is imposed by current laws on acoustic insulation.
The excessive lightness of the material that clashes with the need for sufficient weight for acoustic insulation, combined with the countless irregularities in the roof surfaces, being the joining lines of the boards and panels, make wooden roofs potentially inadequate to guarantee a good level of acoustic comfort.
Planning will therefore aim at:

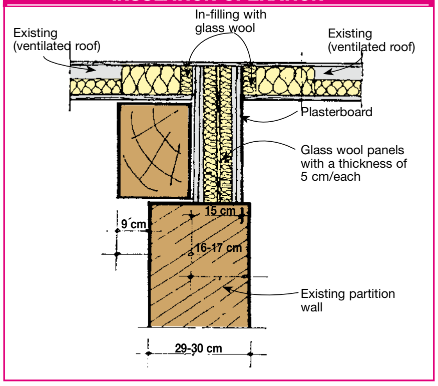
- making the stratified roof as heavy as possible;
- sealing the irregularities of the boards and panels;
- using insulating materials that are suitable for both thermal and acoustic requirements.

The solution of making the first boarding that borders the dwelling heavier or doubling it, tends to satisfy the first requirement and the use of an additional layer of TOPSILENTBitex nailed to the boarding with Canadian tile nails, before the vapour barrier is laid, contributes to sealing the joins.
In the case of double ventilated boarding, nailing is not necessary.
To the same end, in the case of double ventilated boarding, laying a slate coated membrane on the second boarding, which supports the tile coat, also helps to seal the joins.
The choice of thermal-acoustic insulation material to satisfy both requirements must necessarily concern fibrous insulation materials, (the closed cell insulation materials normally used, in practice only provide thermal performance), of sufficient thickness to satisfy the thermal requirements and, in any event, no less than 60 mm, and with a density of no less than 70 kg/m³, i.e. the SILENTRock mineral wool panel.
The second problem in the case of a ventilated wooden roof concerns lateral transmissions of airborne noise, which are particularly serious especially if an unsuitable insulation panel is used.
The presence of a ventilation chamber, required for thermal reasons, creates a communication 'corridor' between dwellings under the same roof.
Moreover, when the ventilation direction of the roof runs perpendicularly compared to the partition walls between adjoining rooms of different owners, remedying the acoustic problem afterwards is particularly complicated and intrusive, because the acoustic in-filling obtained by completely filling the air space with mineral or synthetic wool prevents it from being ventilated.

TRANSMISSION OF NOISE



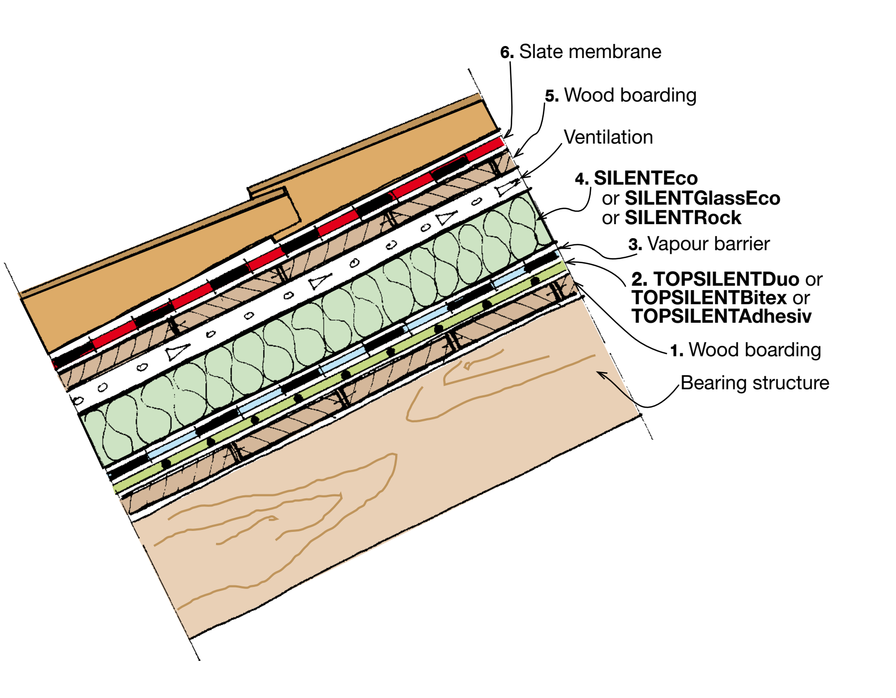
INSULATION OPERATION



TECHNICAL INTERVENTION SOLUTIONS

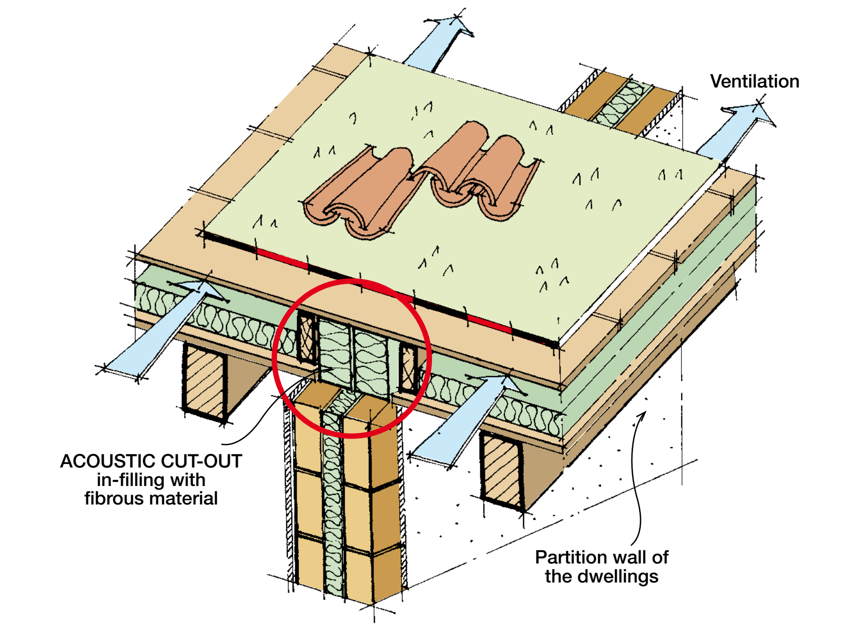
NEW BUILDINGS OR FULL REFURBISHMENTS

THERMAL-ACOUSTIC INSULATION OF ROOFS



The use of fibrous insulating materials combined with preventive planning of roofs with ventilation direction parallel to the direction of the separating walls makes it possible to intercept most of the lateral transmission of airborne noise.
In this case, the **acoustic cut-out** obtained by completely filling the ventilation air space with fibrous insulation along the direction of the dividing wall underneath, already preventively arranged parallel compared to the ventilation direction, will not interfere with its efficient performance.
If any skylights in the roof, or external walls, are not evaluated properly, the system's overall acoustic insulation will be compromised; in these cases too, transparent elements (window frame + glass pane) with a sufficient soundproofing index value should be preferred.

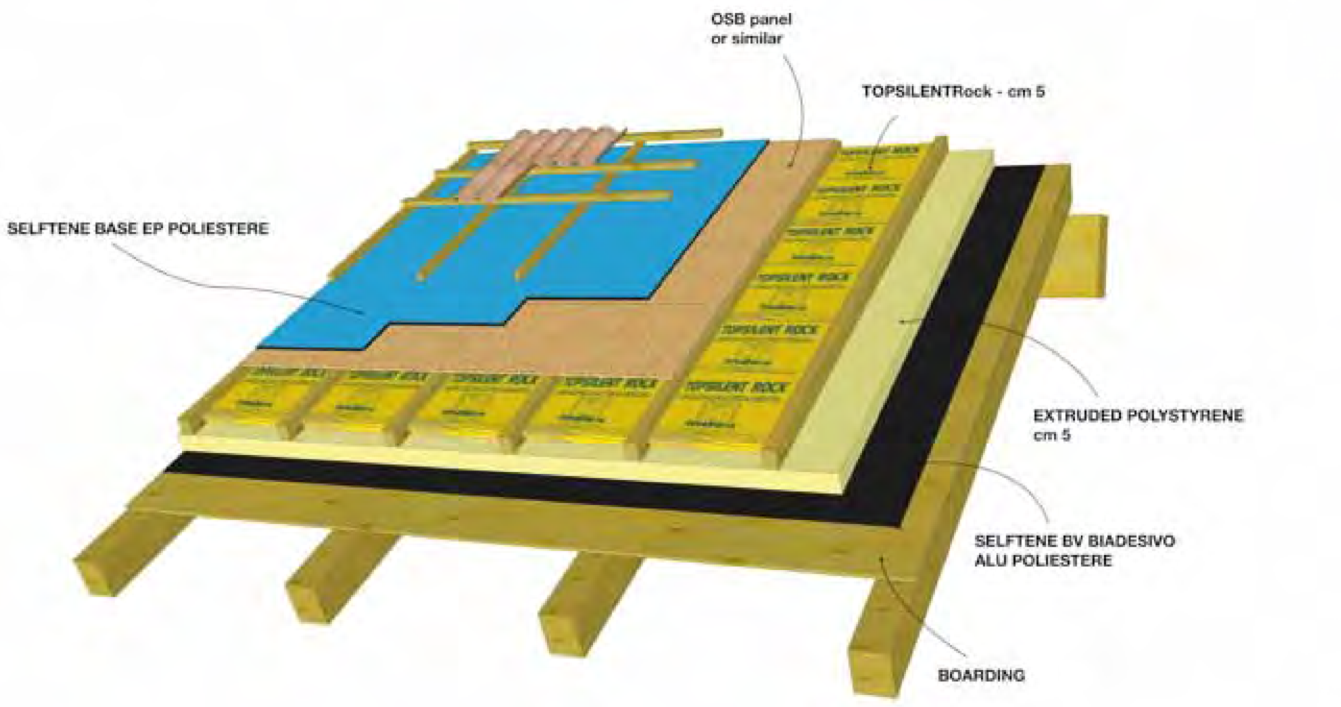
ACOUSTIC CUT-OUT



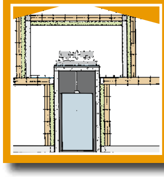
TECHNICAL INTERVENTION SOLUTIONS

NEW BUILDINGS OR FULL REFURBISHMENTS

THERMAL-ACOUSTIC INSULATION OF ROOFS



The insulation of the roof in the technical solution illustrated above foresees the use of two layers of thermal insulation products of different nature; the first consists of panels in extruded polystyrene that act mainly as thermal insulation, but that have the required resistance to compression, so that they can be used to secure the battens that support the boarding on top, thus avoiding thermal bridges caused through direct contact of the battens on the boarding underneath; the second layer acts also as acoustic insulation, seeing as it is made of a layer of mineral fibre panels type TOPSILENTRock.
To reduce lateral transmissions of noise by boundary lines between different dwellings, the acoustic method just described should be exploited.



ACOUSTIC INSULATION OF SYSTEMS

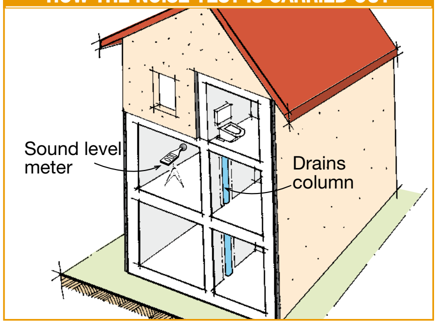
DPCM dated 5th December 1997 (Premier's Decree), table B of Appendix A, states the maximum levels of noise generated by systems installed in the building for the various categories of buildings classified in table A of the same appendix and splits them up into:

- Noise generated by discontinuously operating systems
- Noise generated by continuously operating systems

CATEGORIE		[illegible]	[illegible]
A	Edifici adibiti a Residenza o assimilabili	35	35
B	Edifici adibiti a Uffici e assimilabili	35	35
C	Edifici adibiti ad Alberghi, pensioni ed assimilabili	35	35
D	Edif. adibiti ad Ospedali, cliniche, case di cura e ass.	35	25
E	Edif. adibiti ad Attività scolastiche a tutti i livelli e ass.	35	25
F	Edif. adibiti ad attività ricreative o di culto o ass.	35	35
G	Edifici adibiti ad attività commerciali o assimilabili	35	35

The noise is measured with the sound level meter equipped with filter and is expressed in dB(A) because what is measured is a "disturbance" and not a "performance", as in the case for measuring the insulation of walls and floors, which are on the other hand expressed in linear dB. The measurement is made in the room which is mostly disturbed by the noise of the system taken into consideration in compliance with standard UNI EN ISO 16032:2005, but in a different room to that in which the noise is generated whatever the case.

HOW THE NOISE TEST IS CARRIED OUT



You will also notice that, in the same Appendix A under the item entitled "Noise produced by technological systems", the decree states that the noise level produced by the technological systems (despite the purpose for which the building in which they are installed is used) must not exceed the following limits:
a) 35 dB(A)$\mathbf{L_{Amax}}$ with slow time constant for discontinuously operating systems.
b) 25 dB(A)$\mathbf{L_{Aeq}}$ for continuously operating systems.
HCA continuously operating systems are the following:

- Heating systems
- Air Conditioning systems
- Aeration systems

Discontinuously operating systems are the following:

- Lifts
- Bathrooms
- Drains
- Taps
- Sanitary fixtures

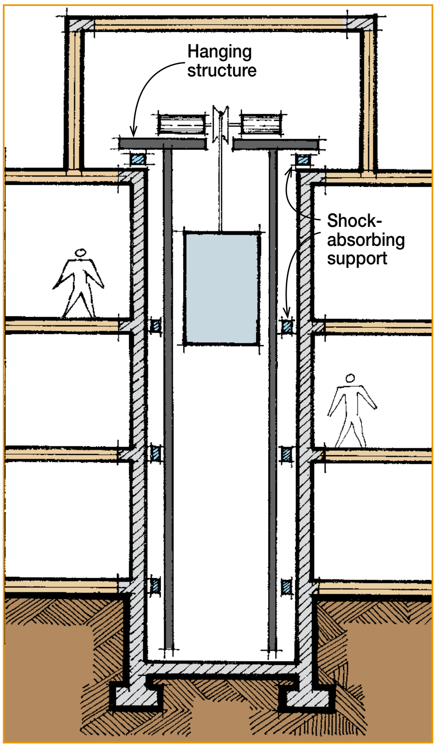
■ NOISE OF DISCONTINUOUSLY OPERATING SYSTEMS

LIFTS

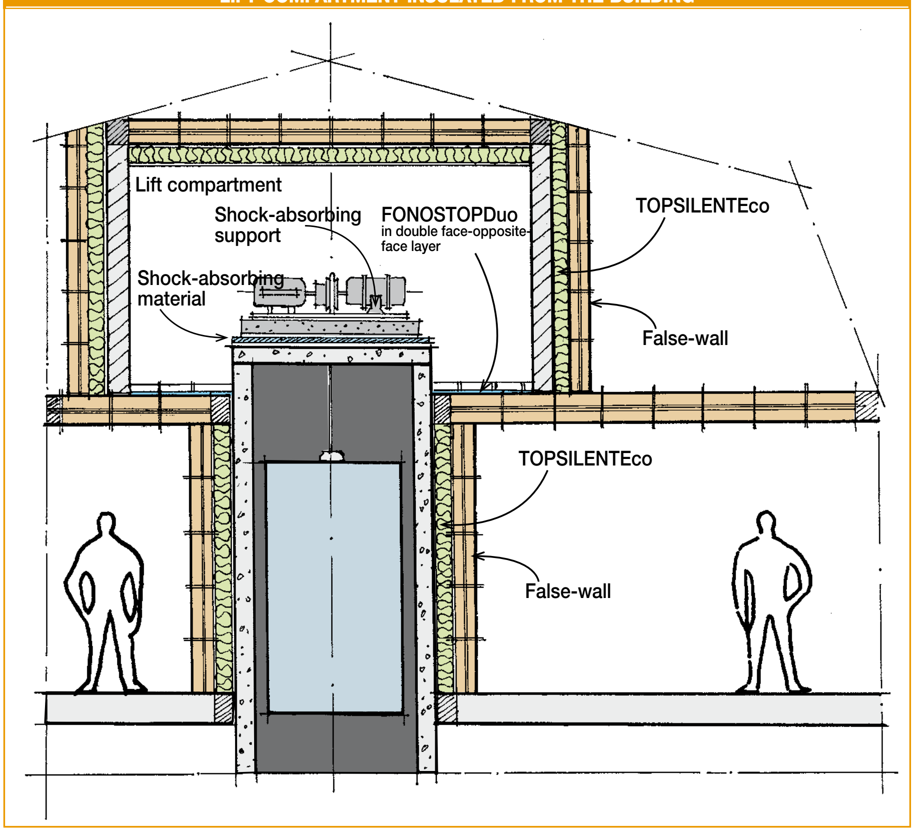
There are two types:

- Hydraulic piston operated lifts
- Electric cable lifts

The first type is the quietest and the hydraulic compressor that operates it is installed in a special insulated compartment on shock-absorbing supports. It is more expensive than the other type and its travel is shorter, which limits its use in taller buildings.
Cable lifts are driven by an electric motor that is installed above the lift compartment and whose vibrations are insulated with shock-absorbing supports.
The whole flooring of the compartment will be on a floating screed on 2 layers of FONOSTOPDuo laid face-opposite-face. The walls and ceiling of the technical compartment in which the machine is installed will also be insulated with the techniques illustrated for the heating plants described further on.
The wall of the compartment in which the lift travels shall be heavier, at least 250 kg/m2 next to which a false wall will be built, within the bordering apartments, made of brick of at least 8 cm with an air space of 6 cm insulated with at least 5 cm of TOPSILENTEco.
Alternatively the false wall may be made up of a light plasterboard wall on a metal frame of 4.9 cm with air space insulated with SILENTEco 5 cm.
A first slab of TOPSILENTGips will be screwed to the frame and covered with a second layer of 13 mm plasterboard.
To further limit the transmission of lateral noise during the planning phase, it is advisable for the technical compartment in which the lift travels and on which the motor stands to be appropriately insulated from the rest of the building, as per illustration diagram.



LIFT COMPARTMENT INSULATED FROM THE BUILDING



THE WATER SYSTEM

The noise of the water-bathroom system comes from the pipes, the taps and toilets making it up during the following phases:

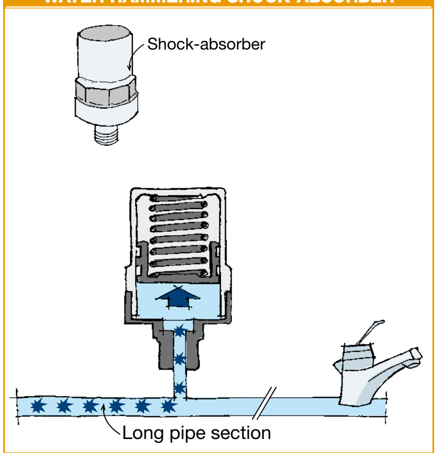
- when water is supplied to the taps and the toilets;
- when the taps and toilets are actually used;
- when water is drained and the toilet flushed.

The piping network, secured to the brick walls, is connected to the taps and to the toilets and is subject to the vibrations generated by the pumps and by the variations in the water pressure that are transmitted to the building partitions, creating noise in all the rooms of the building that they cross.

Taps

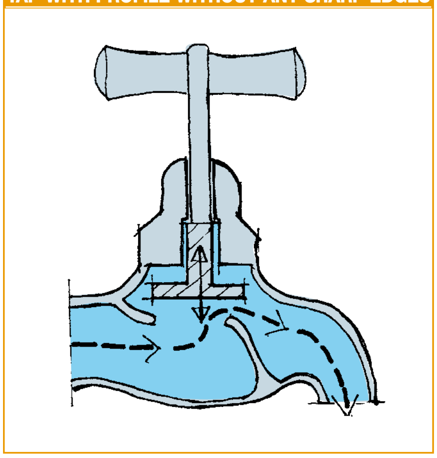
The noise of taps when they are opened increases as the speed and the pressure of the water increases, therefore a pressure regulator should be installed on the inlet of each apartment. The sudden closure of taps could also generate noisy "water hammering" problems that can be reduced by installing special shock-absorbers on the longer sections of the piping.

WATER HAMMERING SHOCK-ABSORBER



The addition of a flexible sleeve between the piping and the tap associated with an aerator nozzle installed on the tap, just like the special design of the tap cross section, without sharp edges, combined with progressive closing, which is more effective than shock-absorbers, helps to reduce both problems.

TAP WITH PROFILE WITHOUT ANY SHARP EDGES



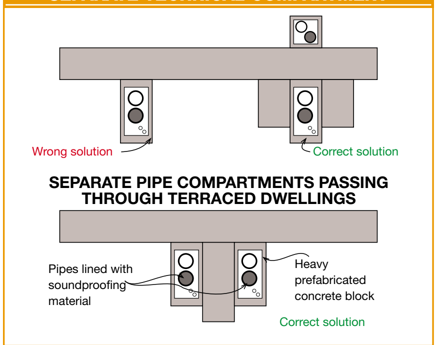
Piping

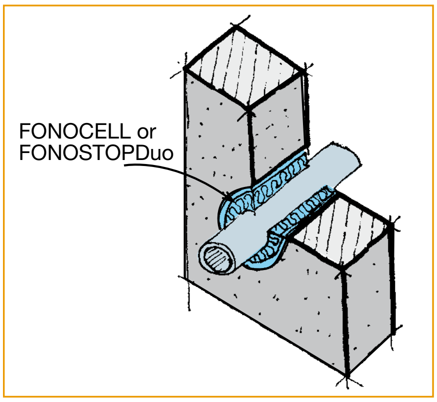
Piping quickly and remotely transmits the vibrations generated by taps and pumps, which are reduced as follows:

- by adjusting the piping morphology;
- by adjusting the connections and crossing points in the brick walls;
- by adjusting the nature of the piping.

The breaking-down of the length of metal piping with flexible sleeves every 6 meters reduces the vibratory energy that crosses it. Such periodic interruptions damp the vibration of the metal pipe that the vibration of the water column regenerates every 6 meters. Basically speaking, it is advisable to arrange a flexible sleeve on the riser column on each floor of the building on the entrance to each single apartment. It is also advisable to create a dedicated separate compartment in which pipes that are not bricked into the dividing walls will run.

DIVIDING WALL BETWEEN APARTMENTS WITH SEPARATE TECHNICAL COMPARTMENT





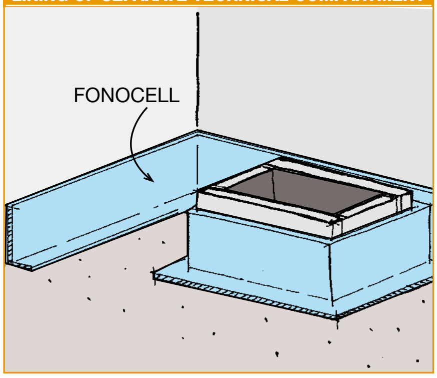
To avoid whistling and humming noises in the pipes and the valves, the speed of the water must be limited as indicated in the table below.

MAXIMUM FLOW RATES ADVISABLE FOR THE WATER IN THE PIPING

Diameter in pipe (mm)								
25	50	80	100	125	150	200	250	≥300
0,9	1,2	1,5	1,8	2,1	2,4	2,7	2,9	3,0
Maximum flow rate (m/s)								

Elbow joints may also generate turbulence in the water and therefore noise, hence they must have a suitable radius. The collars of the metal anchoring systems to the walls that are tightened around the pipes must be covered with flexible material. Lacking previously arranged devices, it may be necessary to wrap the piping with FONOCELL or FONOSTOPDuo by the securing collar or where it crosses the wall, where needed. Holes in walls or in floors where the piping passes will then be carefully sealed to prevent the noise from spreading through the gap.

LINING OF SEPARATE TECHNICAL COMPARTMENT



LINING OF SYSTEMS WHERE THEY PASS THROUGH FLOOR SLABS

Based on the type of constructional materials used, the piping may emit noises of various intensity.

Roughly, for uninsulated piping with a water speed of 3.4 m/s:

- copper emits a noise level of 46 dB(A)
- plastic emits a noise level of 41 dB(A)
- lead emits a noise level of 39 dB(A)
- steel emits a noise level of 38 dB(A)
- copper lined with plastic emits a noise level of 29 dB(A).

EXECUTIVE DETAILS IN THE ACOUSTIC INSULATION OF A PIPE

ACOUSTIC INSULATION OF A DRAIN PIPE USING TOPSILENTBitex

ACOUSTIC INSULATION OF A DRAIN PIPE USING TOPSILENTAdhesiv

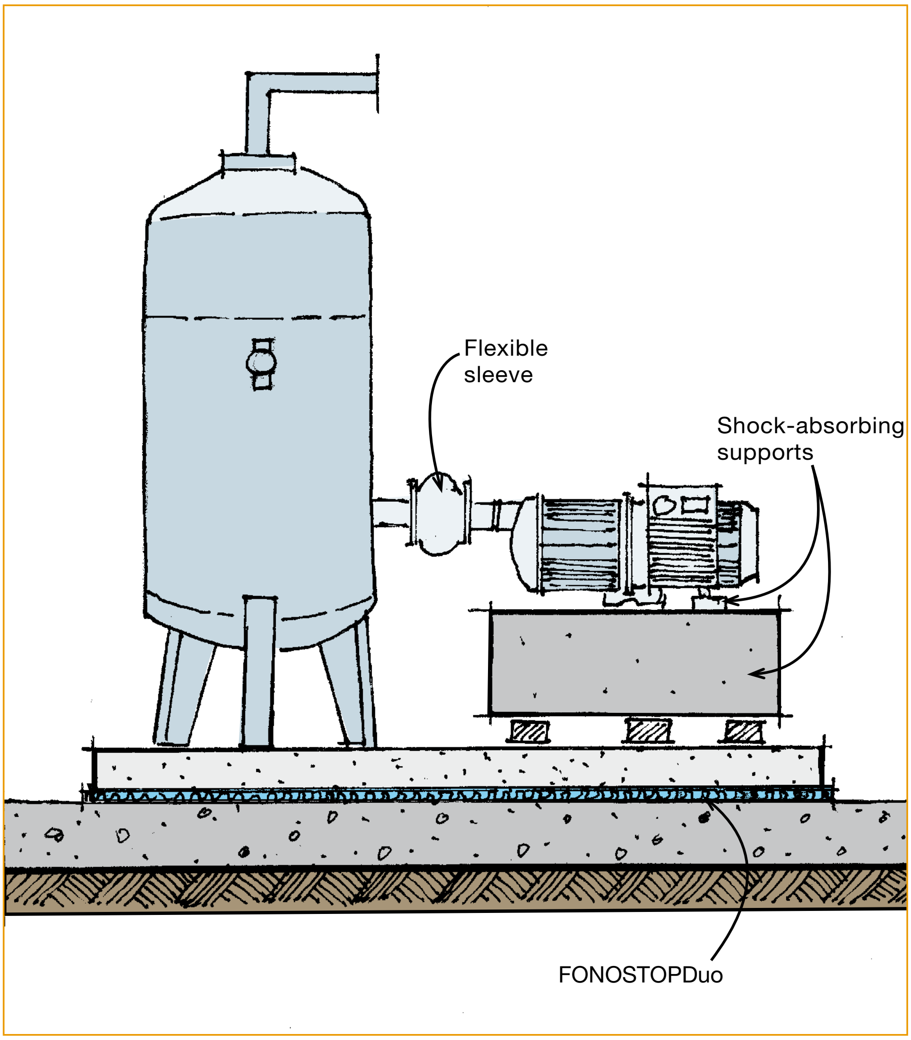
PHASES FOR THE ACOUSTIC INSULATION OF A DRAIN PIPE BEND USING TOPSILENTDuo

LAYING METHODS AND DETAILS FOR THE ACOUSTIC INSULATION OF A PIPE

Pumps and pressure tanks

Again, for these machines that generate vibrations which cause noise, the precautions described further on for heating and conditioning systems apply. Pumps must be equipped with shock-absorbing supports and connected to the piping with rubber union sleeves.

Both the pump and the pressure tank will be installed on a concrete bed laid over resilient material. Up to a load-bearing capacity of 1.000 kg/m^2, you can use a double layer of FONOSTOPDuo laid face-opposite-face, otherwise you can use special shock-absorbing material. The machinery will be arranged in dedicated and appropriately insulated compartments, as indicated for the compartment where the heating plant will be installed.

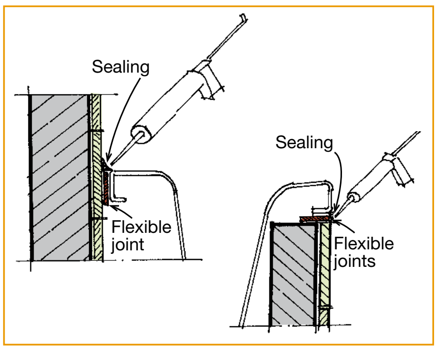


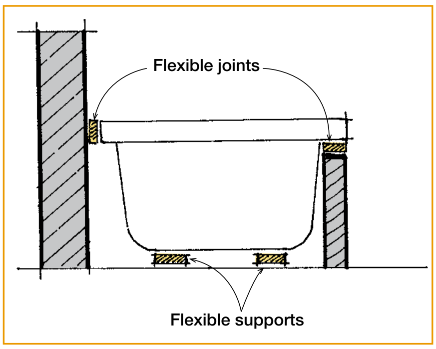
Sanitary fixtures

They create noise in the filling-up, flushing and draining phase to which any noise caused by the impact of objects against them is added. This is why taps must be insulated from the piping, as indicated previously and why the fixtures must be insulated from the walls to which they are anchored by means of rubber gaskets.

Bath tubs are also to be insulated from the walls by resting them on flexible supports or on a screed insulated from the floor and from the surrounding walls with two layers of FONOSTOPDuo laid face-opposite-face, which in turn will be detached from the perimeter walls by means of FONOCELL strips.

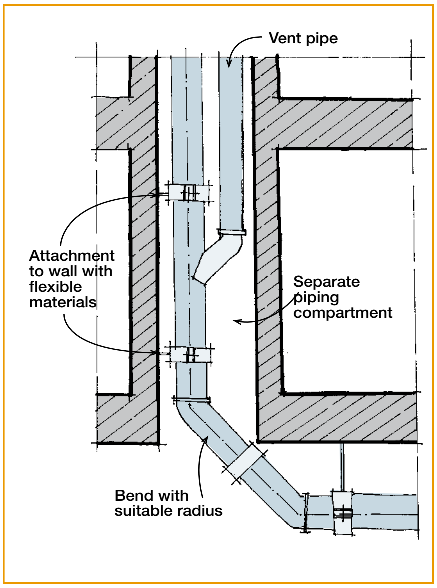
The upper rim of the bath tub must not be rigidly attached to the wall but insulated with watertight lining or sealing devices that prevent water leakage.





Used water drains

Noise from steel kitchen sinks is reduced with noise-deadening panels glued to the back of them. For this purpose you can use TOPSILENTAdhesiv in pieces shaped for each application. Flush cisterns of toilets built into the wall are strong sources of annoying noise and they should be replaced with external flush cisterns that are quieter, using commercial soundproofing equipment. The flush cistern will be inserted in a separate compartment with heavy walls, using wall brackets insulated with rubber collars or strips of TOPSILENTDuo, without positioning them on boundary walls of bedrooms or living rooms.

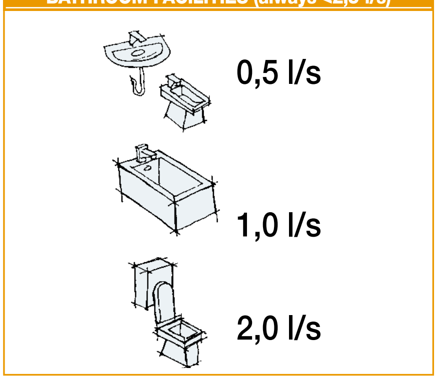


Vent pipes and bends must be of suitable radius. The piping will be insulated and made of multi-layer and sufficiently heavy material.

To improve the insulation of uninsulated piping, you can wrap them with TOPSILENTAdhesiv, TOPSILENTBitex or better still TOPSILENTDuo with the face covered with the white non-woven fabric part facing the pipe, which will be secured with adhesive SIGILTAPE.

When the water flow rate is below the limits indicated in the illustration, the flush system will not be noisy.

DRAIN FLOW RATES ADVISABLE FOR BATHROOM FACILITIES (always <2,5 l/s)



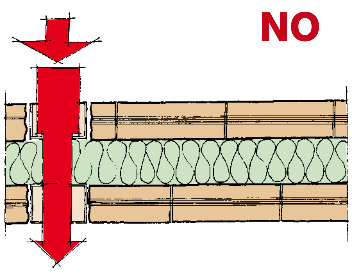
THE ELECTRICAL SYSTEMS

The electrical systems of residential buildings generally do not produce significant noise to have to impose special insulation precautions. Generally all you need, as already mentioned in the pages related to the acoustic bridges of walls, is to avoid arranging the electric boxes and electric switches opposite each other in the same wall so as not to hear the “clicking” noise when they switch on and off.
As for the fixed installation of special equipment that is susceptible to transferring vibrations, observe the principles illustrated in the previous pages and mount them on flexible supports.

DIGGING OUT CHANNELS FOR SYSTEMS AND ELECTRICAL BOXES

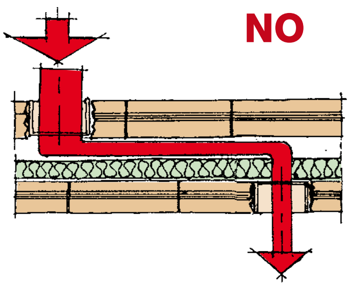
Avoid digging out channels for systems and electrical boxes opposite each other, which would create acoustic bridges of considerable entity. Such problems could be partially eliminated by completely filling-in the air space.

ELECTRICAL BOXES OPPOSITE EACH OTHER



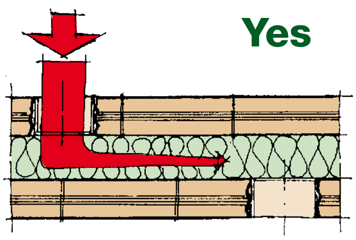
Horizontal section of the walls

COMPLETE FILLING OF THE AIR SPACES



Horizontal section of the walls

INCOMPLETE FILLING OF THE AIR SPACES

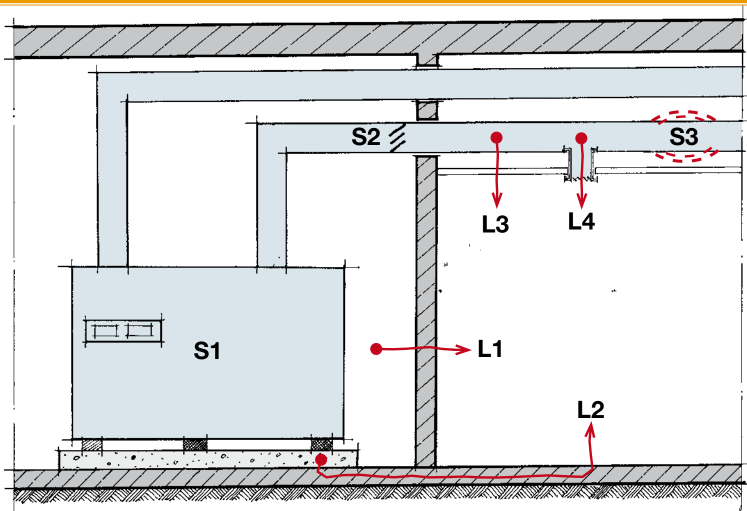


Horizontal section of the walls

■ NOISE OF CONTINUOUSLY OPERATING SYSTEMS

The noise level of Heating, Air Conditioning and Aeration systems (HCA), with the development of growing requirements to control the heating-humidity of ever-increasing watertight building coverings, is an ever important problem that is controlled at the origin in the planning phase by carefully choosing the machines and materials with certificated acoustic characteristics, then by defining, based on what the building is to be used for, the location of the machines, the lay-out of the system and relative operating conditions, combined with a scrupulous description of the methods of installation and connection to the walls. Such specifications shall then be carefully inspected in the execution phase.
The forecasting calculation procedure to which the planner may refer is that given in the standard project prEN 12354-5 (August 2006) that considers the main sources of noise of the system that may transmit it both through the air and through the actual components of the system: channels, shunts/flues and piping by the same way through the partitions of the building: walls and floors, both through the structures and through the actual partitions.
This task is to be entrusted to the planner and specialised installation companies otherwise retrofitting work on existent buildings is more difficult, more expensive and does not always resolve the problem.
The ways of transmission of noise in these types of systems are both by air and through solids, through the vibrations that the systems transmit directly to the building partitions on which they rest or to which they are connected and to the vibrations transmitted to the piping network.
As an example, the drawing of a conditioning system given below, shows the sources of the noise S1 and S2, which are respectively: the fan, the individual points of the air distribution system, such as louvers, bends, shutters, variations in cross section etc. to which the vibration S3 that the flow of air causes in ducts of a certain length is to be added.

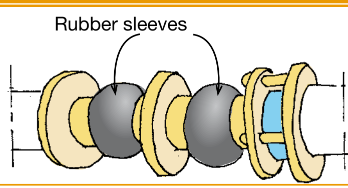
DIAGRAM OF A CONDITIONING SYSTEM



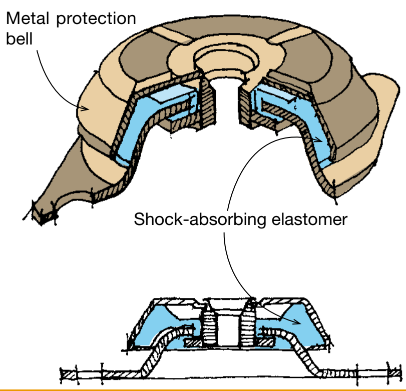
Paths L1, L2, L3 and L4 through which the noise spreads are the following respectively:
- L1 – by air through walls and floors of the room where the machine is installed.
- L2 – through solids, where the vibrations of the machinery are transmitted through the floor on which it is installed and the vibrations of all the components of the system that are connected to the walls.
- L3 – by air due to the vibrations generated by the turbulence in the air in the ducts.
- L4 – spreading of the noise of the sources by air along the air ducts. This noise is emitted directly in the various rooms conditioned through the various openings of the ducts.

Similar are the ways of transmission of the noise of heating systems where the sources are the burner, the boiler, the pump and the connections to the wall structures of the distribution system where vibrations are generated that are transmitted directly to the walls and the floors, while the noise caused by the burner when it triggers up and while it is running and the noise of the rotating parts of the pump are transmitted through the air.
The vibrations of the boiler and of the pump are transmitted quickly and remotely, even along the piping of the system that branches off throughout the whole building, therefore they must rest on special shock-absorbing supports. The pumps and the flues will be connected to the piping and to the shunts with special flexible sleeves and the shunt will be housed in a special separate compartment.

DETAIL OF THE JOINTS ON THE CONNECTION PIPE TO THE EXPANSION VESSEL



SHOCK-ABSORBING SUPPORT



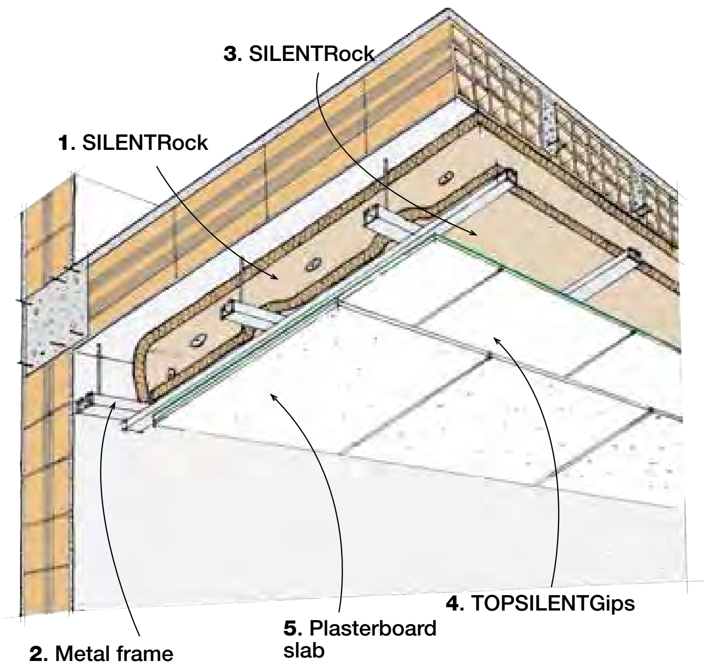
■ ACOUSTIC INSULATION OF THE HEATING, AIR CONDITIONING AND AERATION SYSTEM COMPARTMENT (HCA)

The compartment in which the boiler or conditioning equipment is installed must be delimited by walls and floors with high resistance to airborne noise. An $\mathbf{R_w}$ insulation higher than 60 dB is recommended and the it is also better to line the walls and the ceiling internally with fireproof and soundproof material such as wood-magnesite panels.

Type of burner	Town gas	Fuel Oil	Condensation
Power	520 kW (450.000 kcal/h)	230 kW (200.000 kcal/h)	350 kW (300.000 kcal/h)
Year of manufacture	1983	1996	2002
Sound level at 1 m (db)	99.5	88.6	74.0

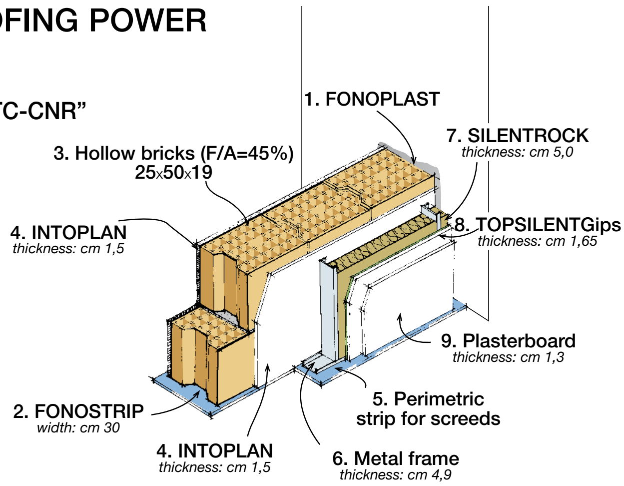
The table above indicates the sound level measured in the heating plant at 1m from burners of various powers and years of manufacture fuelled in different ways. In the building phase, it is advisable to plan walls heavier than 250 kg/m^2 arranged on strips of FONOSTRIP. Whether or not the building is being built or it already exists, to obtain the value of the $\mathbf{R_w}$ soundproofing power indicated above with limited weight and thicknesses, the compartment should be lined from the inside with false walls and false ceilings in plasterboard insulated with SILENTRock fitted on metal framework, as per example illustrated.
To complete the insulation, the flooring of the compartment will rest on a floating screed on a double layer of FONOSTOPDuo laid face-opposite-face.

ACOUSTIC INSULATION FROM THE INSIDE WITH FALSE-CEILING AND FALSE-WALLS

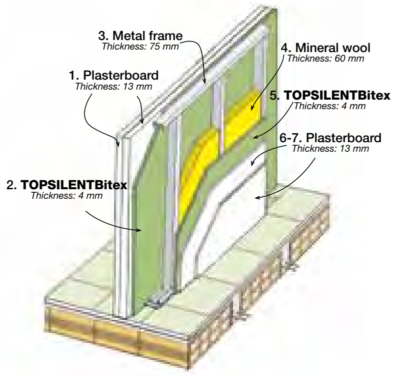


SOUNDPROOFING POWER $\mathbf{R_w}$ = 69,0 dB

CERTIFICATION "ITC-CNR"
n. 4213/RP/06



In alternative, the structure indicated below made up mainly of plasterboard has been classified as REI 120 with certificate dated 22nd June 2007.

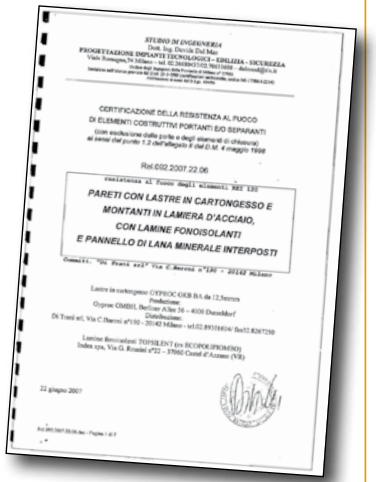


SOUNDPROOFING POWER $\mathbf{R_w}$ = 59,2 dB

Alternatively:
TOPSILENTBitex+Plasterboard = **TOPSILENTGips**

CERTIFICATION "IEN G. Ferraris"
n. 35561/03

CERTIFICATION "REI120"


STUDIO DI INGEGNERIA
PROGETTAZIONE IMPIANTI TECNOLOGICI – EDILIZIA – SICUREZZA

CERTIFICAZIONE DELLA RESISTENZA AL FUOCO
DI ELEMENTI COSTRUTTIVI PORTANTI E/O SEPARANTI
(con esclusione delle porte e degli elementi di chiusura)
ai sensi del punto 1.2 dell'allegato II del D.M. 4 maggio 1998

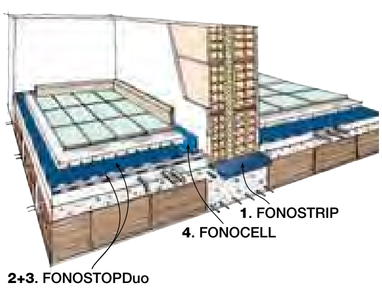
Rel.092.2007.22.06

PARETI CON LASTRE IN CARTONGESSO E
MONTANTI IN LAMIERA D'ACCIAIO,
CON LAMINE FONOISOLANTI
E PANNELLO DI LANA MINERALE INTERPOSTI

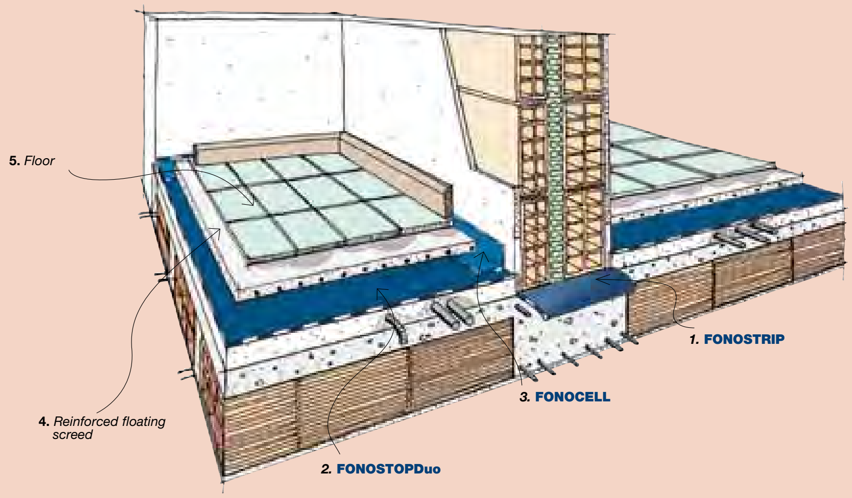
22 giugno 2007

To reinforce the insulation of the false ceiling of the compartment where the boiler is installed, it is also advisable for the flooring of the apartment above to be the type on "floating screed" on a double layer of FONOSTOPDuo laid face-opposite-face, which further increases the $\mathbf{R_w}$ soundproofing power of the floor.

ACOUSTIC INSULATION OF FLOORS



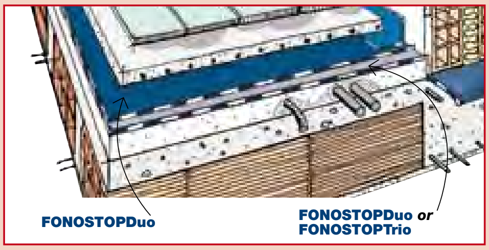
ACOUSTIC INSULATION OF FLOORS AGAINST FOOT-TRAFFIC NOISE



Insulation under the floating screed

FONOSTOPDuo single layer (method A)

The acoustic insulation of floors against foot-traffic noise will be performed with the "floating floor" technique on acoustic insulation against foot-traffic noise, made up of sound resilient foil coupled with non-woven polyester fabric, type **FONOSTOPDuo** with dynamic stiffness of **s'**=21 MN/m^3 measured in compliance with standard UNI-EN 29052 part 1ª and approved by ITC-CNR (ex ICITE). The insulating material will be supplied in 105 cm width rolls with a 5 cm overlap wing. The insulating sheets will be laid on a smooth laying surface with a 5 cm overlap between the sheets and the overlapped parts will then be sealed with special adhesive SIGILTAPE. The head ends of the insulating sheets will not be overlapped but brought up to each other and sealed with the same adhesive tape. The reinforced floating screed will be separated from the projecting walls by use of a self-adhesive strip in extruded polyethylene called **FONOCELL**. A screed will then be cast over the insulation that must be reinforced with electrically welded mesh and on which the foreseen flooring will be laid. The excess insulating material around the perimeter will be trimmed-off and the skirting board will be laid, which must be detached from the floor in order to prevent "acoustic bridges". The partition walls will be insulated from the floor using strips of sound dampening elastomer material with dynamic stiffness under a load of 200 kg/m^2 **s'**=449 MN/m^3 and under a load of 400 kg/m^2 **s'**=937 MN/m^3, type **FONOSTRIP** with thickness of 4 mm and at least 4 cm wider than the thickness of the walls, which will be laid between the floor and the wall.



For a superior degree of insulation:

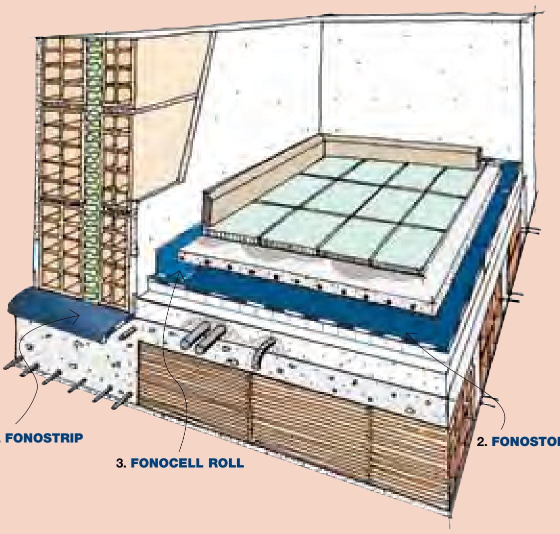
FONOSTOPDuo double layer (method B)

The acoustic insulation of floors against foot-traffic noise will be performed with the "floating floor" technique on acoustic insulation against foot-traffic noise with dynamic stiffness of s'=11 MN/m^3 measured in compliance with standard UNI-EN 29052 part 1ª and approved by ITC-CNR (ex ICITE), made up of sound resilient foil coupled with non-woven polyester fabric, type **FONOSTOPDuo** laid in double layer face-opposite-face. The insulating material will be supplied in 105 cm width rolls with a 5 cm overlap wing. The insulating sheets of the first layer will be laid on the smooth laying surface, overlapping them by 5 cm with the face covered with polyester fibre facing the top while the second layer will be laid parallel to the first and over the joining lines of the first layer with the face covered with polyester fibre facing downwards and the 5 cm overlaps sealed with the special adhesive SIGILTAPE. The head ends of the insulating sheets will be not be overlapped but brought up to each other and sealed with the same adhesive tape. The reinforced floating screed will be separated from the projecting walls by use of a self-adhesive strip in extruded polyethylene called **FONOCELL**. A screed will then be cast over the insulation that must be reinforced with electrically welded mesh and on which the foreseen flooring will be laid. The excess insulating material around the perimeter will be trimmed-off and the skirting board will be laid, which must be detached from the floor in order to prevent "acoustic bridges". The partition walls will be insulated from the floor using strips of sound dampening elastomer material with dynamic stiffness under a load of 200 kg/m^2 s'=449 MN/m^3 and under a load of 400 kg/m^2 s'=937 MN/m^3, type **FONOSTRIP** with thickness of 4 mm and at least 4 cm wider than the thickness of the walls, which will be laid between the floor and the wall.

FONOSTOPDuo + FONOSTOPTrio (method C)

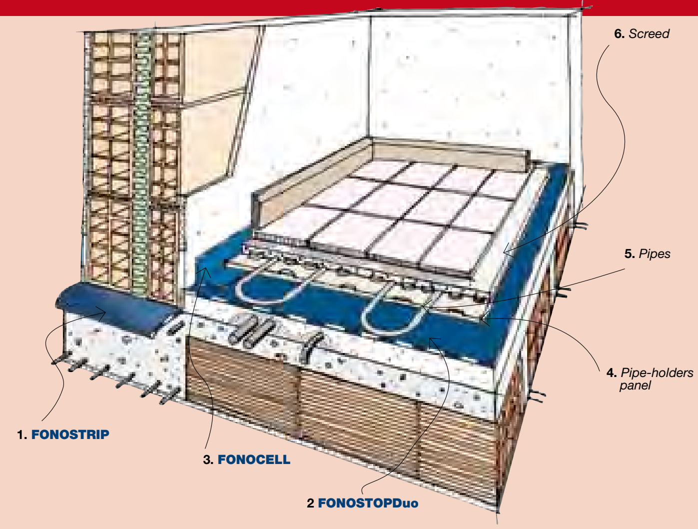
The acoustic insulation of floors against foot-traffic noise will be performed with the "floating floor" technique on acoustic insulation against foot-traffic noise with double layer and dynamic stiffness of s'=9 MN/m^3 measured in compliance with standard UNI-EN 29052 part 1ª and approved by ITC-CNR (ex ICITE), made up of sound resilient foil coupled on both faces with non-woven polyester fabric, type **FONOSTOPTrio** and additional sound resilient foil coupled with non-woven polyester fibre type **FONOSTOPDuo**. The first layer of **FONOSTOPTrio** will be laid on the smooth and perfectly clean laying surface by overlapping the sheets by 5 cm along the two opposed selvedges arranged on the sheet while the head ends of the sheets will not be overlapped but just brought up to each other. The second layer of **FONOSTOPDuo** will then be laid parallel to the first layer and over the overlaps of the same. The sheets will be overlapped by 5 cm along the special overlap wing arranged on the sheet while the head ends will just be carefully brought up to each other. Finally, both the longitudinal overlaps and the transversal joining lines will be sealed with the special adhesive SIGILTAPE. The reinforced floating screed will be separated from the projecting walls by use of a self-adhesive strip in extruded polyethylene called **FONOCELL**. A screed will then be cast over the insulation that must be reinforced with electrically welded mesh and on which the foreseen flooring will be laid. The excess insulating material around the perimeter will be trimmed-off and the skirting board will be laid, which must be detached from the floor in order to prevent "acoustic bridges". The partition walls will be insulated from the floor using strips of sound dampening elastomer material with dynamic stiffness under a load of 200 kg/m^2 s'=449 MN/m^3 and under a load of 400 kg/m^2 s'=937 MN/m^3, type **FONOSTRIP** with thickness of 4 mm and at least 4 cm wider than the thickness of the walls, which will be laid between the floor and the wall.

ACOUSTIC INSULATION AGAINST FOOT TRAFFIC NOISE FOR FLOORS AND THERMAL INSULATION OF FLOOR SLABS



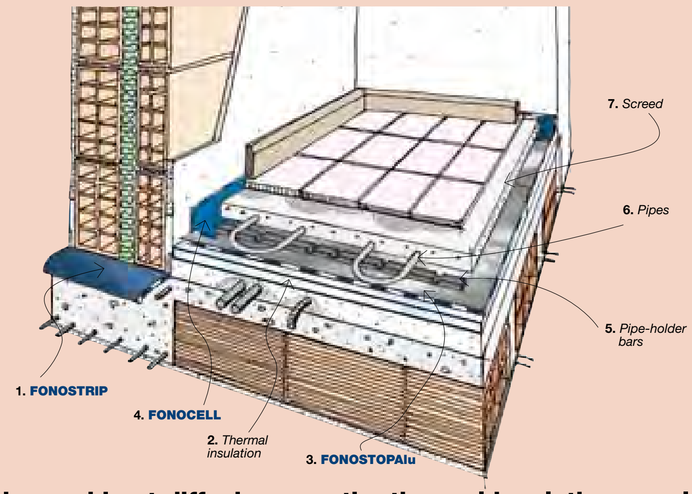
The acoustic insulation against foot traffic noise and the thermal insulation of floor slabs will be performed with the “floating floor” technique on a thermal-acoustic insulation product, type **FONOSTOPThermo**. It consists of insulation against foot traffic noise with dynamic stiffness s’=21 MN/m^3, obtained by coupling a soundproof foil and a non-woven sound-resilient fabric, glued to the sintered expanded polystyrene panel EPS 120. The EPS 120 material is a stable waterproof product with conductivity coefficient λ=0.035 W/mK, cut in 50 mm strips.
The product is supplied in 100 cm wide rolls, complete with 5 cm overlap wing made up of the soundproof foil to enable side overlapping.
The rolls are to be unrolled in their natural unrolling direction and are to be overlapped at the sides by arranging the overlap wing on the adjacent sheet and carefully matching-up the polystyrene strips of the faces underneath. On the short side, the sheets are carefully brought together end-to-end. They will cover the whole floor slab and are to be blocked and trimmed-off at the foot of the perimeter walls of the room to be insulated.
All the longitudinal overlap lines and the transversal joining lines of the sheets are then to be carefully sealed with the special adhesive SIGILTAPE, stuck over the same.
The reinforced floating screed will be detached from the protruding walls with a self-adhesive strip of expanded polyethylene called **FONOCELL**.
The insulating panels and the floor heating pipes will then be laid over **FONOSTOPThermo**, and they will be covered with a screed in compliance with the instructions of the supplier of the heating system and on which the foreseen flooring will then be laid.
The excess insulating material that protrudes from the perimeter will be trimmed-off and the skirting board will be laid, which must be detached from the floor in order to prevent “acoustic bridges”.
The dividing walls will be insulated from the floor slab using strips of sound-damping elastomer material with dynamic stiffness under a load of 200 kg/m^2 s’=449 MN/m^3 and under a load of 400 kg/m^2 s’=937 MN/m^3, type **FONOSTRIP** with thickness of 4 mm and at least 4 cm wider than the thickness of the walls, which will be laid between the floor slab and the wall.

ACOUSTIC INSULATION AGAINST FOOT TRAFFIC NOISE OF FLOOR SLABS WITH UNDERFLOOR HEATING



Acoustic insulation under the thermal insulation panel with shaped face

The acoustic insulation of floors against foot-traffic noise will be performed with the "floating floor" technique on acoustic insulation against foot-traffic noise, made up of sound resilient foil coupled with non-woven polyester fabric, type **FONOSTOPDuo** with dynamic stiffness of **s'**=21 MN/m^3 measured in compliance with standard UNI-EN 29052 part 1ª and approved by ITC-CNR (ex ICITE). The insulating material will be supplied in 105 cm width rolls with a 5 cm overlap wing. The insulating sheets will be laid on the smooth laying surface with a 5 cm overlap between the sheets and the overlapped parts will then be sealed with special adhesive SIGILTAPE. The head ends of the insulating sheets will be not be overlapped but brought up to each other and sealed with the same adhesive tape. The reinforced floating screed will be separated from the projecting walls by use of a self-adhesive strip in extruded polyethylene called **FONOCELL**. The insulating panels and the floor heating pipes will then be laid over **FONOSTOPDuo**, which will be covered with a screed in compliance with the instructions of the supplier of the heating system and on which the foreseen flooring will then be laid. The excess insulating material around the perimeter will be trimmed-off and the skirting board will be laid, which must be detached from the floor in order to prevent "acoustic bridges". The partition walls will be insulated from the floor using strips of sound dampening elastomer material with dynamic stiffness under a load of 200 kg/m^2 **s'**=449 MN/m^3 and under a load of 400 kg/m^2 **s'**=937 MN/m^3 type FONOSTRIP with thickness of 4 mm and at least 4 cm wider than the thickness of the walls, which will be laid between the floor and the wall.

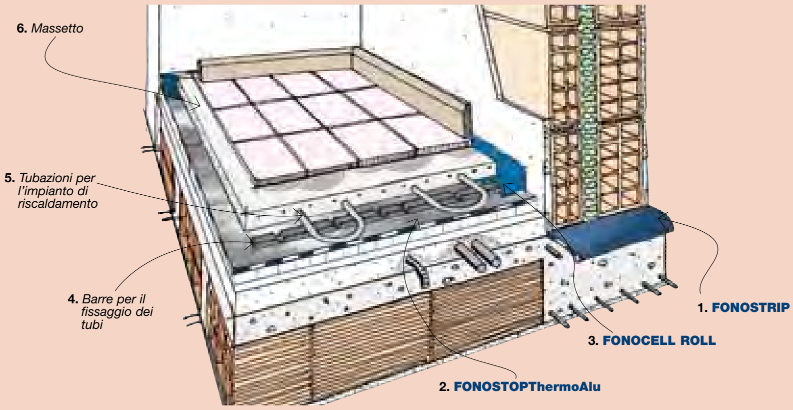


Acoustic insulation and heat diffusion over the thermal insulation panel with smooth face

The acoustic insulation against foot traffic noise will be performed with the "floating floor" technique on an acoustic insulation product, type **FONOSTOPAlu** with dynamic stiffness **s'** = 21 MN/m^3, obtained by coupling a soundproof foil and a non-woven sound-resilient fabric, which will be laid over the smooth thermal insulation panel of the heating system in compliance with the instructions of the supplier of the same system.

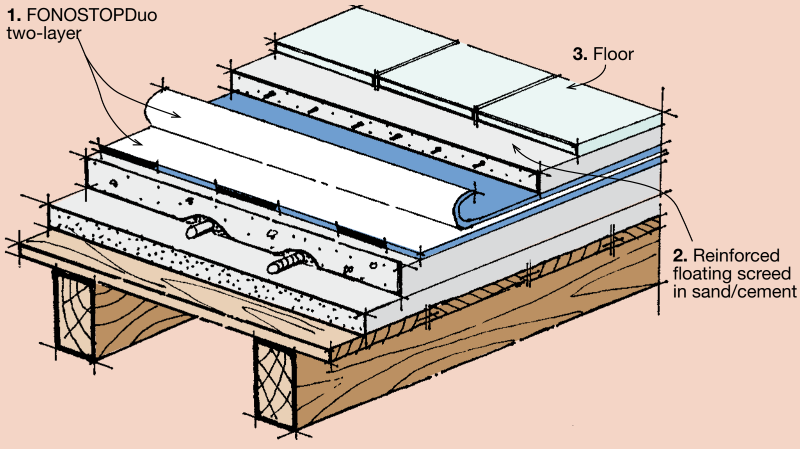
The top face of the acoustic insulation layer will be coated with an aluminium foil with thicknes s = 0,012 mm and diffusivity α = 8,2 · 10-5 m^2/s in order to distribute the heat evenly. The acoustic insulation is produced in rolls of 15x1.05 meters and the top aluminium coated face has a textile overlap wing of 5 cm. The sheets are to be unrolled in their natural unrolling direction on the thermal insulation panels and are to be overlapped at the sides by arranging the overlap wing on the adjacent sheet whereas, on the short side, the sheets are carefully brought together end-to-end. They will cover the whole floor slab surface and are to be blocked and trimmed-off at the foot of the perimeter walls of the room to be insulated. All the longitudinal overlap lines and the transversal joining lines of the sheets are then to be carefully sealed with the special adhesive SIGILTAPE, stuck over the same. The floating screed will be detached from the perimeter walls with a self-adhesive strip of expanded polyethylene called FONOCELL. In the case of unreinforced screeds, the plastic profiles will be subsequently laid over the acoustic insulation layer, which are complete with pipe seats, in which the heating pipes will be fitted and which will be glued to the aluminium coated face with hot extruded adhesive, using the special electric glue gun, or in the case of screeds reinforced with metal mesh, the pipes will be secured to the reinforcement. The pipes will then be covered with a screed in compliance with the instructions of the supplier of the heating system and on which the foreseen flooring will then be laid. The excess insulating material that protrudes from the perimeter will be trimmed-off and the skirting board will be laid, which must be detached from the floor in order to prevent "acoustic bridges". The dividing walls will be insulated from the floor slab using strips of sound-damping elastomer material with dynamic stiffness under a load of 200 kg/m^2 s'=449 MN/m^3 and under a load of 400 kg/m^2 s'=937 MN/m^3, type **FONOSTRIP** with thickness of 4 mm and at least 4 cm wider than the thickness of the walls, which will be laid between the floor slab and the wall.

ACOUSTIC INSULATION AGAINST FOOT TRAFFIC NOISE AND THERMAL INSULATION OF FLOOR SLABS WITH UNDERFLOOR HEATING



The acoustic insulation against foot traffic noise and the thermal insulation of the floor slabs on which the heating system will be laid, is to be performed with the "floating floor" technique on a thermal-acoustic insulation product, type **FONOSTOPThermoAlu**, the top face of which will be coated with an aluminium foil with thickness s = 0.012 mm and diffusivity α = 8,2 · 10-5 m²/s in order to distribute the heat evenly. is an insulation product against foot traffic noise with dynamic stiffness s'=21 MN/m³, obtained by coupling a soundproof foil and non-woven sound-resilient fabric, glued to the sintered expanded polystyrene panel EPS 120. The EPS 120 material is a stable waterproof product with conductivity coefficient λ=0.035 W/mK, cut in 50 mm strips. The product is supplied in 100 cm wide rolls, complete with 5 cm textile overlap wing to enable side overlapping. The rolls are to be unrolled in their natural unrolling direction and are to be overlapped at the sides by arranging the overlap wing on the adjacent sheet and carefully matching-up the polystyrene strips of the faces underneath. On the short side, the sheets are carefully brought together end-to-end. They will cover the whole floor slab and are to be blocked and trimmed-off at the foot of the perimeter walls of the room to be insulated. All the longitudinal overlap lines and the transversal joining lines of the sheets are then to be carefully sealed with the special adhesive SIGILTAPE, stuck over the same. The floating screed will be detached from the perimeter walls with a self-adhesive strip of expanded polyethylene called FONOCELL. In the case of unreinforced screeds, the plastic profiles will be subsequently laid over the top face of the insulation layer, which are complete with pipe seats, in which the heating pipes will be fitted and which will be glued to the aluminium coated face with hot extruded adhesive, using the special electric glue gun, or in the case of screeds reinforced with metal mesh, the pipes will be secured to the reinforcement. The pipes will then be covered with a screed in compliance with the instructions of the supplier of the heating system and on which the foreseen flooring will then be laid. The excess insulating material that protrudes from the perimeter will be trimmed-off and the skirting board will be laid, which must be detached from the floor in order to prevent "acoustic bridges". The dividing walls will be insulated from the floor slab using strips of sound-damping elastomer material with dynamic stiffness under a load of 200 kg/m² s'=449 MN/m³ and under a load of 400 kg/m² s'=937 MN/m³, type **FONOSTRIP** with thickness of 4 mm and at least 4 cm wider than the thickness of the walls, which will be laid between the floor slab and the wall.

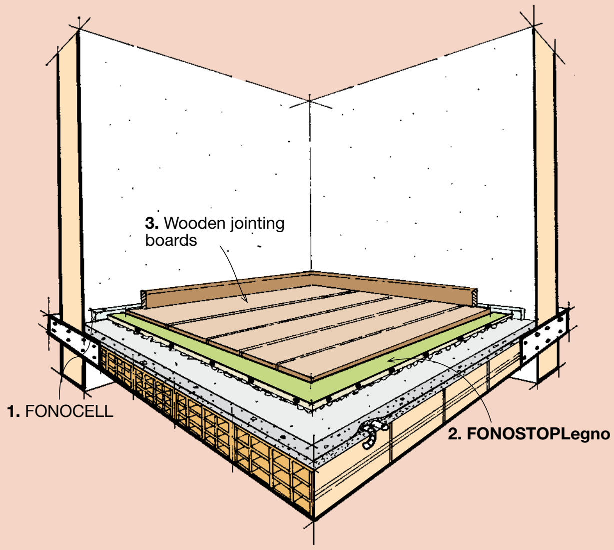
ACOUSTIC INSULATION OF WOODEN FLOORS AGAINST FOOT-TRAFFIC NOISE



Insulation of wooden floors

The acoustic insulation of floors against foot-traffic noise will be performed with the "floating floor" technique on acoustic insulation against foot-traffic noise with dynamic stiffness of s'=11 MN/m³ measured in compliance with standard UNI-EN 29052 part 1ª and approved by ITC-CNR (ex ICITE), made up of sound resilient foil coupled with non-woven polyester fabric, type **FONOSTOPDuo** laid in a double face-opposite-face layer. The insulating material will be supplied in 105 cm width rolls with a 5 cm overlap wing. The insulating sheets of the first layer will be laid on the smooth laying surface, overlapping them by 5 cm with the face covered with polyester fibre facing the top while the second layer will be laid parallel to the first and over the joining lines of the first layer with the face covered with polyester fibre facing downwards and the 5 cm overlaps sealed with the special adhesive SIGILTAPE. The head ends of the insulating sheets will not be overlapped but brought up to each other and sealed with the same adhesive tape. The reinforced floating screed will be separated from the projecting walls by use of a self-adhesive strip in extruded polyethylene called **FONOCELL**. A screed will then be cast over the insulation that must be reinforced with electrically welded mesh and on which the foreseen flooring will be laid. The excess insulating material around the perimeter will be trimmed-off and the skirting board will be laid, which must be detached from the floor in order to prevent "acoustic bridges". The partition walls will be insulated from the floor using strips of sound dampening elastomer material with dynamic stiffness under a load of 200 kg/m² s'=449 MN/m³ and under a load of 400 kg/m² s'=937 MN/m³, type **FONOSTRIP** with thickness of 4 mm and at least 4 cm wider than the thickness of the walls, which will be laid between the floor and the wall.

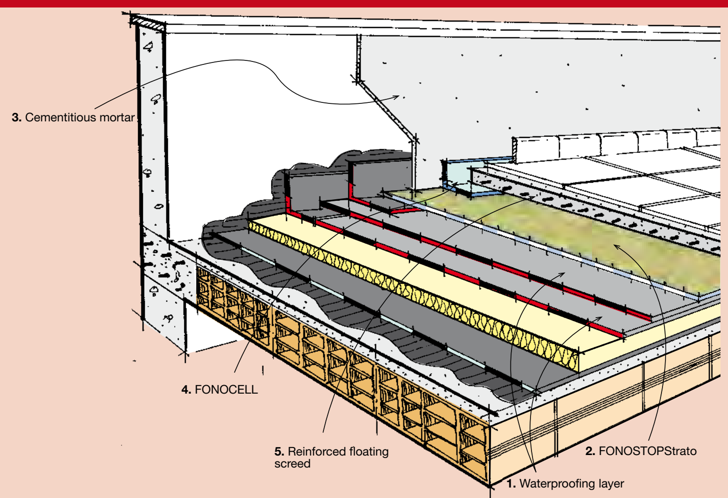
ACOUSTIC INSULATION OF FLOATING WOODEN FLOORS AGAINST FOOT-TRAFFIC NOISE



Insulation under floating wooden floors

The acoustic insulation of floating tongue-and-groove floors will be performed using acoustic insulation against foot-traffic noise type **FONOSTOPLegno**, made up of sound resilient foil coupled with high density non-woven fabric that is highly resistant to crushing under a constant load of 2 KPa for 122 days in compliance with EN 1606 lower than 0.2 mm.
The insulation sheets will be unrolled dry over the smooth and dry foundations with the face covered with the non-woven fabric facing the floor, joining the sheets carefully together but without overlapping them.
The insulation sheets will be blocked and trimmed-off at the foot of the walls and anything protruding from the surface of the floor and the joining lines will be sealed with the special adhesive tape.
The overlying wooden flooring will then be laid dry on the acoustic insulation making sure to keep it slightly detached from the walls.
The same precaution must be applied also when laying the skirting board, which must not touch the floor.

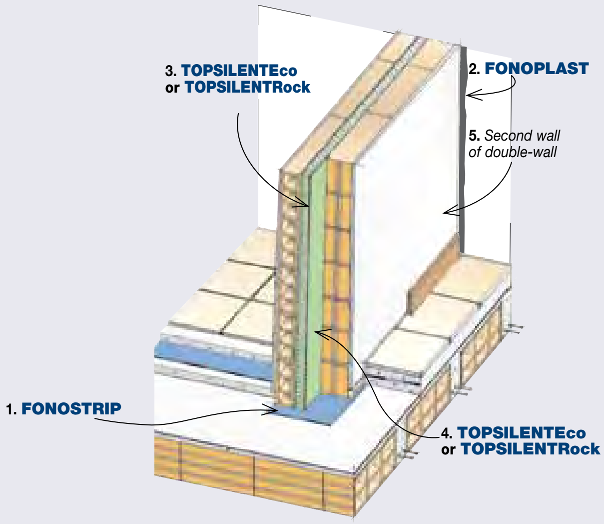
ACOUSTIC INSULATION OF TERRACES AGAINST FOOT-TRAFFIC NOISE



Insulation of terraces under floating screed

The acoustic insulation of terraces against foot-traffic noise will be performed with the “floating floor” technique on an acoustic insulation type **FONOSTOPStrato** made up of heat-sealed non-woven fabric coupled with non-woven polyester fabric with “elastic needling”, with ultimate tensile stress L/T=550/350 N/50 mm and ultimate elongation L/T=100/200% supplied in 100 cm width rolls with 5 cm overlap wing.
The sheets will be laid on the weatherproof layer, overlapping them by 5 cm longitudinally along the special overlap wing, while the head ends will just be carefully brought together. The sheets will be blocked and trimmed-off at the foot of the perimeter walls and around all the elements protruding from the surface of the floor. All the overlaps and joining lines will be sealed with the special adhesive SIGILTAPE.
Once the vertical parts of the waterproof layer have been protected, the insulated strip in extruded polyethylene **FONOCELL** will be glued on to them, which will descend to cover the sheets of **FONOSTOPStrato** laid previously on the flat part. The concrete screed reinforced with electrically welded mesh with thickness of more than 4 cm will then be cast on the insulation layer. Once the floor has been laid, the excess part of the strip of **FONOCELL** will be trimmed-off and the skirting board will be laid, which must be detached from the floor.

ACOUSTIC INSULATION OF WALLS IN NEWLY CONSTRUCTED BUILDINGS



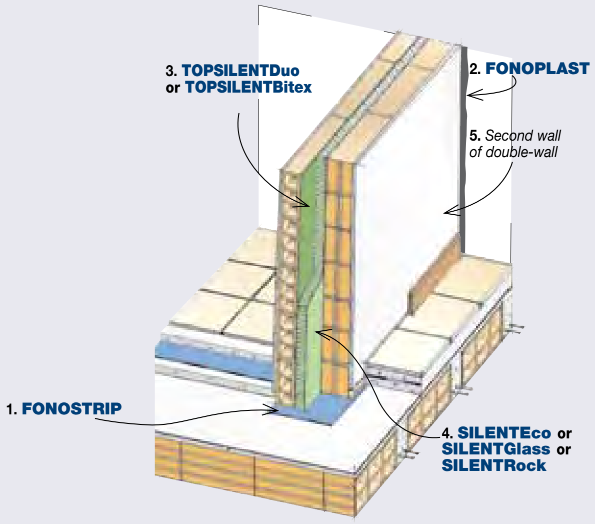
New internal double-walls in masonry

The internal perimeter double-walls will be acoustically separated from the floor by building them over a sound-dampening elastomer strip with thickness of s=4 mm, with dynamic stiffness under a load of 400 kg/M^2 = 937 MN/m^3, and with a width at least 4 cm greater than the double-wall. Acoustic insulation of the internal double-walls dividing different residential units, separated by an interspace with thickness of not less than 4 cm will be obtained by applying plaster, resistant to the sound waves, on the internal face of the space between the two walls:

- in self-bearing panels made of polyester fibre with density of 30 kg/m^3, non-toxic, heat-sealed and free from glues, airtightness r=3.90 KPa/sm^2 and thermal conductivity λ=0.037 W/mK, coupled with a high density, air and vapour tight soundproof foil, type **TOPSILENTEco**, with thickness s=… cm.

Or alternatively:

- in self-bearing panels in polyethylene packaging, made of rock wool with density of 40 kg/m^3, airtightness r=14.9 KPa/sm^2, thermal conductivity λ=0.035 W/mK and thickness s=… cm, coupled with a high density, air and vapour tight soundproof foil, to be turned over inwards, type **TOPSILENTRock**, with thickness s=… cm.



New internal double-walls in masonry

The internal perimeter double-walls will be acoustically separated from the floor by building them over a sound-dampening elastomer strip with thickness of s=4 mm, with dynamic stiffness under a load of 400 kg/M^2 = 937 MN/m^3, and with a width at least 4 cm greater than the double-wall. Acoustic insulation of the internal double-walls dividing different residential units, separated by an interspace with thickness of not less than 4 cm will be obtained by applying plaster, resistant to the sound waves, on the internal face of the space between the two walls:

- with a high-density phono-resistant foil with area mass of 4 Kg/m^2 based on a compound with critical frequency of over 85,000 Hz type **TOPSILENTBitex**.

Or alternatively:

- with a high-density phono-resistant foil based on a compound with critical frequency of over 85,000 Hz with dynamic stiffness (UNI EN 29052/1) s'=21 MN/m^3 and total area mass of 5 Kg/m^2 based on a compound with critical frequency of over 85,000 Hz type **TOPSILENTDuo**, laid with the face covered with the non-woven fabric directed to the wall.

The space between the two walls to be subsequently filled with a thermal-acoustic insulation material:

- in panels with polyester fibre base, density of 20 kg/m^3, non-toxic, heat-sealed and free from glues, airtightness r=2.26 KPa/sm^2 and thermal conductivity λ=0.040 W/mK, type **SILENTEco**, with thickness s=… cm.

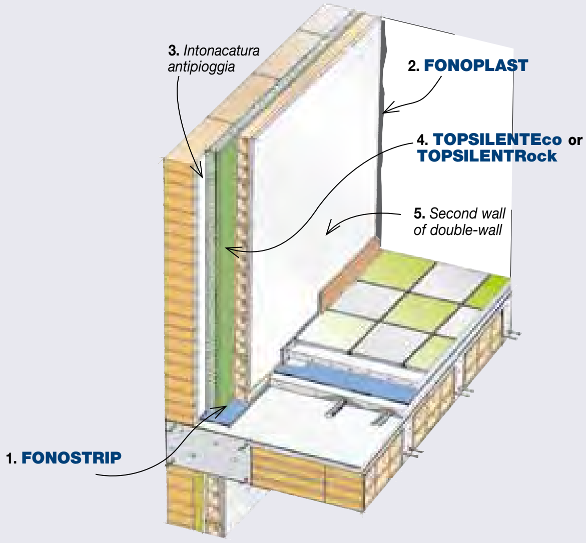
Or alternatively:

- in self-bearing panels of rock wool with density of 40 kg/m^3, airtightness r=14.9 KPa/sm^2 and thermal conductivity λ=0.035 W/mK, type **SILENTRock**, with thickness s=… cm.

Or alternatively:

- in panels with fibreglass base with density of 30 kg/m^3, airtightness r≥5 KPa/sm^2 and thermal conductivity λ=0.032 W/mK, type **SILENTGlassEco**, with thickness s=... cm.

ACOUSTIC INSULATION OF WALLS IN NEWLY CONSTRUCTED BUILDINGS



New external double-walls in masonry

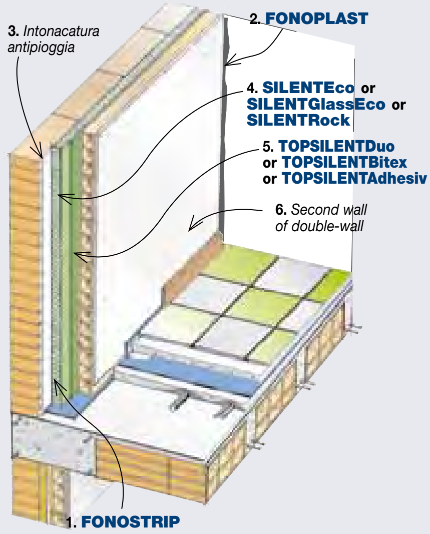
The thermal-acoustic insulation of double external perimeter walls, separated by an air space (of which the internal face of the first wall is previously plastered to protect against rain and damp) will be accomplished by lining the space between the two walls with the insulation product:

- in self-bearing panels made of polyester fibre with density of 30 kg/m^3, non-toxic, heat-sealed and free from glues, airtightness r=3.90 KPa/sm^2 and thermal conductivity λ=0.037 W/mK, coupled with a high density, air and vapour tight soundproof foil, type **TOPSILENTEco**, with thickness s=… cm.

Or alternatively:

- in self-bearing panels in polyethylene packaging, made of rock wool with density of 40 kg/m^3, airtightness r=14.9 KPa/sm^2, thermal conductivity λ=0.035 W/mK and thickness s=… cm, coupled with a high density, air and vapour tight soundproof foil, to be turned over inwards, type **TOPSILENTRock**, with thickness s=… cm.

The internal wall will be built on an elastomeric sound-damping strip with thickness s=4 mm and width at least more than 4 cm compared to the wall being erected, and dynamic stiffness under a load of 400 Kg/m^2 = 937 MN/m^3.



New external double-walls in masonry

The thermal-acoustic insulation of double external perimeter walls, separated by an air space (of which the internal face of the first wall is previously plastered to protect against rain and damp) will be accomplished by lining the space between the two walls with the insulation product:

- in panels with polyester fibre base, density of 20 kg/m^3, non-toxic, heat-sealed and free from glues, airtightness r=2.26 KPa/sm^2 and thermal conductivity λ=0.040 W/mK, type **SILENTEco**, with thickness s=… cm.

Or alternatively:

- in self-bearing panels of rock wool with density of 40 kg/m^3, airtightness r=14.9 KPa/sm^2 and thermal conductivity λ=0.035 W/mK, type **SILENTRock**, with thickness s=… cm.

Or alternatively:

- in panels with fibreglass base with density of 30 kg/m^3, airtightness r≥5 KPa/sm^2 and thermal conductivity λ=0.032 W/mK, type **SILENTGlassEco**, with thickness s=... cm.

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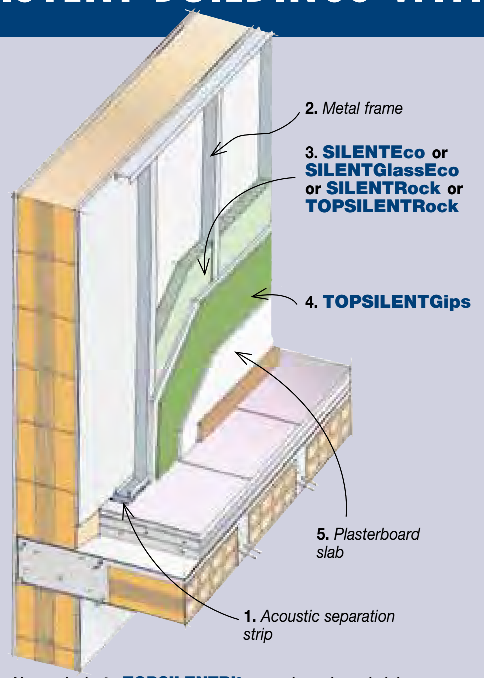
that will be lined with plaster resistant to sound waves and water vapour, as follows:

- with a high-density phono-resistant foil with area mass of 4 Kg/m^2 based on a compound with critical frequency of over 85,000 Hz type **TOPSILENTBitex**.

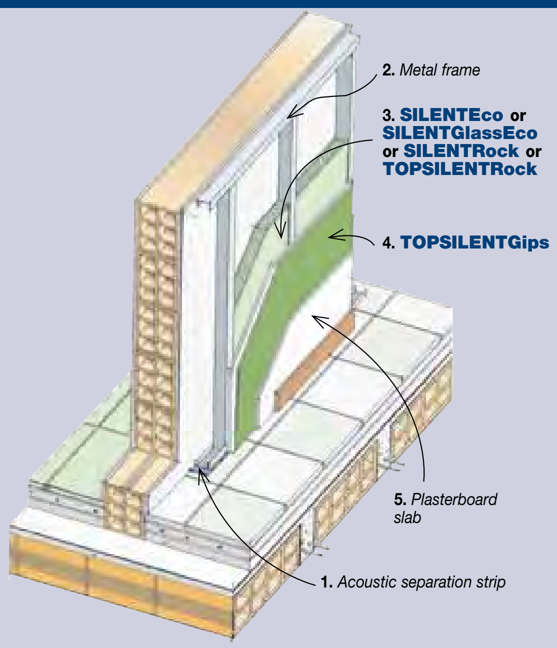
Or alternatively:

- with a high-density phono-resistant foil based on a compound with critical frequency of over 85,000 Hz with dynamic stiffness (UNI EN 29052/1) s'=21 MN/m^3 and total area mass of 5 Kg/m^2 based on a compound with critical frequency of over 85,000 Hz type **TOPSILENTDuo**, laid with the face covered with the non-woven fabric directed to the wall.

ACOUSTIC INSULATION OF WALLS AGAINST AIRBORNE NOISE IN EXISTENT BUILDINGS WITH FALSE-WALL ON METAL FRAMEWORK



Alternatively **4** *:* **TOPSILENTBitex** *+ plasterboard slab*



Alternatively **4** *:* **TOPSILENTBitex** *+ plasterboard slab*

Existing walls with false-wall on metal frame

The existing perimeter walls of the residential unit, will be acoustically insulated with a false-wall in covered plaster with thickness of s=… cm fitted on a self-bearing metal frame which delimits an interspace filled as follows:

- in panels with polyester fibre base, density of 20 kg/m³, non-toxic, heat-sealed and free from glues, airtightness r=2.26 KPa/sm² and thermal conductivity λ=0.040 W/mK, type **SILENTEco**, with thickness s=… cm.

Or alternatively:

- in panels with fibreglass base with density of 30 kg/m³, airtightness r≥5 KPa/sm² and thermal conductivity λ=0.032 W/mK, type **SILENTGlassEco**, with thickness s=... cm.

Or alternatively:

- in self-bearing panels of rock wool with density of 40 kg/m³, airtightness r=14.9 KPa/sm² and thermal conductivity λ=0.035 W/mK, type **SILENTRock**, with thickness s=… cm.

The wall will be cladded as follows:

- with a first plasterboard panel pre-coupled with a high density, very high critical frequency soundproof foil, thickness s=16.5 mm and mass per unit area of 15 kg/m², type **TOPSILENTGips**, followed by laying a second plasterboard panel, thickness >12mm, both screwed to the vertical metal uprights spaced 60 cm apart.

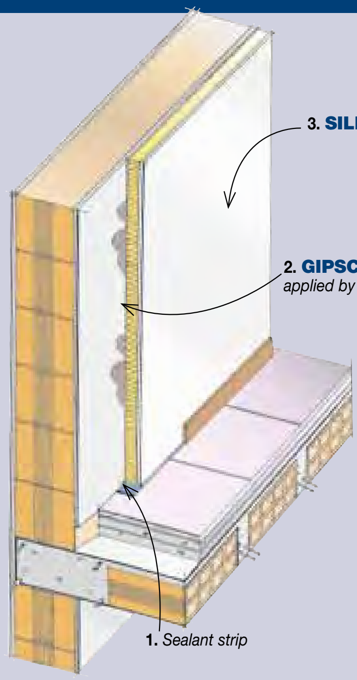
Or alternatively:

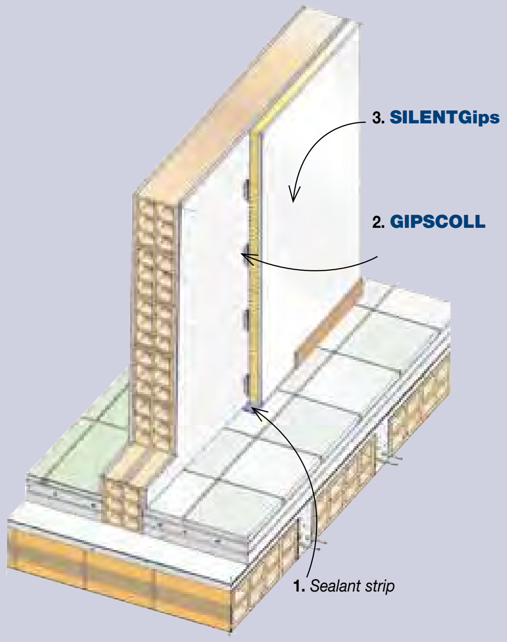
The false-wall will be enclosed by a double layer of slabs in covered plaster screwed on vertical metal uprights at distances of 60 cm, with an inserted dampening layer consisting of:

- ua high density soundproof foil with mass per unit area of 4 Kg/m², based on a compound having a critical frequency higher than 85.000 Hz, type **TOPSILENTBitex**, which will be glued to the plasterboard using FONOCOLL.

A **NASTROGIPS** joint-covering mesh will be laid across the slab joining lines for the purpose of reinforcing the joint seals, to be effected with **STUCCOJOINT** stucco.

ACOUSTIC INSULATION OF WALLS AGAINST AIRBORNE NOISE IN EXISTENT BUILDINGS FIXED BY GLUING





Existing external perimeter walls with glued insulation

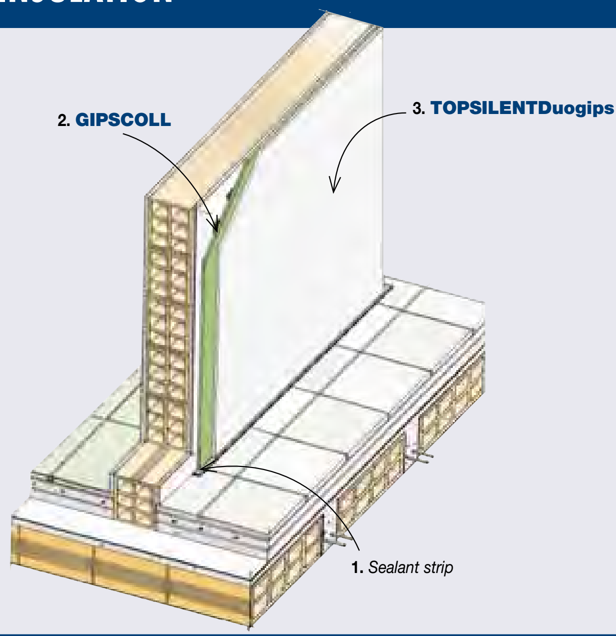
The existing external perimeter walls will be acoustically insulated by cladding them with prefabricated slabs with a thickness of s=… cm, consisting of a plasterboard with thickness of s=9.5 mm and vapour permeability of μ 8.4, coupled to fibreglass with density of 85 Kg/m^3 and aqueous vapour permeability of μ 1.3 and dinamic stiffness s'=2,2 MN/m^3, protected by a built-in vapour barrier consisting of aluminium foil with thickness of s=15 mm and aqueous vapour permeability of μ=600,000, type **SILENTGipsalu**. The slabs will be secured to the wall to be covered, with lumps of adhesive plaster type **GIPSCOLL**, and a **NASTROGIPS** joint-covering mesh will be laid across the element joining lines for the purpose of reinforcing the joint seals, to be effected with **STUCCOJOINT** stucco.

Existing internal walls with glued insulation

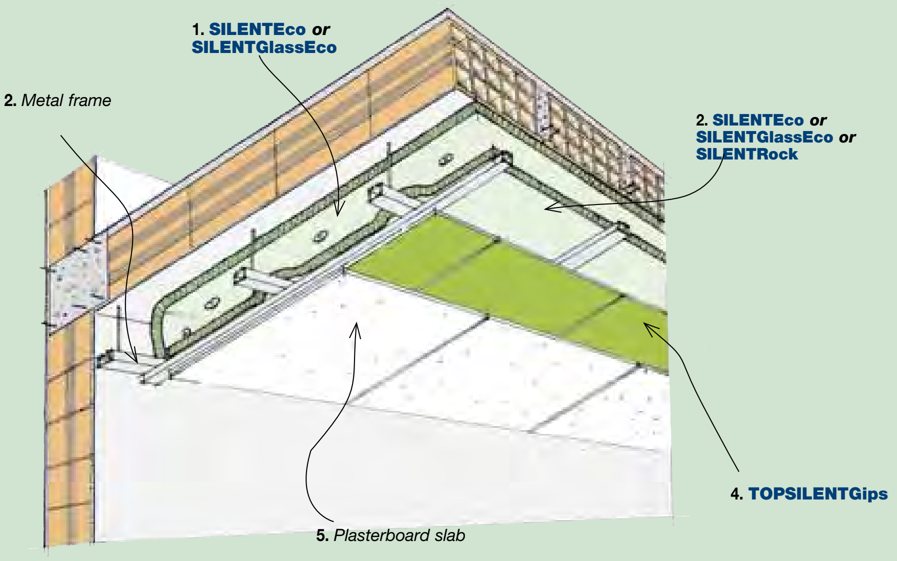
The internal perimeter walls dividing different residential units, will be acoustically insulated by cladding them with prefabricated slabs with thickness of s=9.5 mm and vapour permeability of μ 8.4, coupled to fibreglass with density of 85 Kg/m^3 and aqueous vapour permeability of μ 1.3 and dinamic stiffness s'=2,2 MN/m^3 type **SILENTGips**. The slabs will be secured to the wall to be covered, with lumps of adhesive plaster type **GIPSCOLL**, and a **NASTROGIPS** joint-covering mesh will be laid across the element joining lines for the purpose of reinforcing the joint seals, to be effected with **STUCCOJOINT** stucco.

THIN ACOUSTIC INSULATION

The thin acoustic insulation of walls (mass per unit area ≥140 kg/m^2) will be accomplished by cladding them with prefabricated panels with thickness s=21 mm and mass per unit area of 15 kg/m^2, made up of a plasterboard panel with thickness s=12.5 mm and vapour permeability μ=8.4, coupled with a soundproof foil with water vapour permeability μ=100.000 lined with non-woven polyester fabric with dynamic stiffness of s'=21 MN/m^3, type **TOPSILENTDUOgips**. The panels are secured to the wall to be lined using spots of plaster adhesive, type **GIPSCOLL**. Joint-covering mesh tape, type **NASTROGIPS**, will be laid over the joining lines of the elements to reinforce the seal of the joints made with **STUCCOJOINT** sealing filler.



ACOUSTIC INSULATION OF CEILINGS AGAINST AIRBORNE AND FOOT TRAFFIC NOISE ON HANGING METAL FRAMEWORK



Existing floor with false-ceilings on a suspended metal frame

The acoustic insulation against foot traffic noise of the existing floors above dwelling, will be obtained by a lowered false-ceiling measuring ….cm, in lined plaster, which delimits an interspace with double insulation, consisting of:

- in panels with polyester fibre base, density of 20 kg/m³, non-toxic, heat-sealed and free from glues, airtightness r=2.26 KPa/sm² and thermal conductivity λ=0.040 W/mK, type **SILENTEco**, with thickness s=… cm.

Or alternatively:

- in panels with fibreglass base with density of 30 kg/m³, airtightness r≥5 KPa/sm² and thermal conductivity λ=0.032 W/mK, type **SILENTGlassEco**, with thickness s=... cm.

Or alternatively:

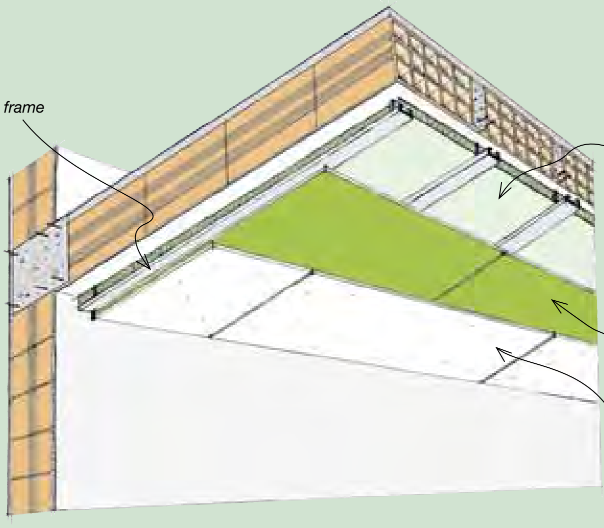
- in self-bearing panels of rock wool with density of 40 kg/m³, airtightness r=14.9 KPa/sm² and thermal conductivity λ=0.035 W/mK, type **SILENTRock**, with thickness s=… cm.

The first layer of …cm in thickness will be glued or secured mechanically to the ceiling while the second layer of …cm in thickness will be laid on the cladding plasterboard panels of the false-ceiling. This will be done with a double layer of plasterboard panels with damping layer in-between screwed onto the metal profiles of a frame hanging on special hooks for the acoustic insulation.

- The cladding will be made up of a first plasterboard panel pre-coupled with a high density and very high critical frequency soundproof foil, with thickness s=16.5 mm and mass per unit area of 15 kg/m², type **TOPSILENTGips**, followed by laying a second plasterboard panel, thickness >12mm.

Joint-covering mesh tape, type **NASTROGIPS**, will be laid over the joining lines of the panels to reinforce the seal of the joints made with **STUCCOJOINT** sealing filler.

ACOUSTIC INSULATION OF CEILINGS AGAINST AIRBORNE AND FOOT TRAFFIC NOISE ON FIXED METAL FRAMEWORK



Existing floor with false-ceilings on adhering metal frame

The acoustic insulation against foot-traffic noise of the existing floors above dwelling will be obtained by a … cm thick false-ceiling, in lined plaster, which delimits an interspace filled as follows:

- in panels with polyester fibre base, density of 20 kg/m³, non-toxic, heat-sealed and free from glues, airtightness r=2.26 KPa/sm² and thermal conductivity λ=0.040 W/mK, type **SILENTEco**, with thickness s=… cm.

Or alternatively:

- in panels with fibreglass base with density of 30 kg/m³, airtightness r≥5 KPa/sm² and thermal conductivity λ=0.032 W/mK, type **SILENTGlassEco**, with thickness s=... cm.

Or alternatively:

- in self-bearing panels of rock wool with density of 40 kg/m³, airtightness r=14.9 KPa/sm² and thermal conductivity λ=0.035 W/mK, type **SILENTRock**, with thickness s=… cm.

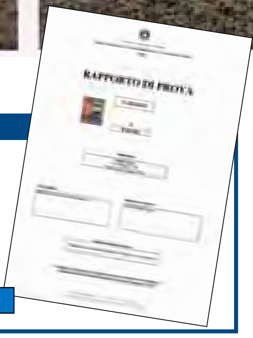
The ceiling will be cladded with a double layer of plasterboard panels with damping layer in-between screwed onto metal profiles of a frame next to the ceiling but insulated from the same with an adhesive extruded polymer gasket.

- The cladding will be made up of a first plasterboard panel pre-coupled with a high density and very high critical frequency soundproof foil, with thickness s=16.5 mm and mass per unit area of 15 kg/m², type **TOPSILENTGips**, followed by laying a second plasterboard panel, thickness >12mm.

Joint-covering mesh tape, type **NASTROGIPS**, will be laid over the joining lines of the panels to reinforce the seal of the joints made with **STUCCOJOINT** sealing filler.

DYNAMIC STIFFNESS FOR THE FORECAST CALCULATION OF ACOUSTIC INSULATION OF FLOOR SLABS – "ITC-CNR"

SYSTEM A
FONOSTOPDuo



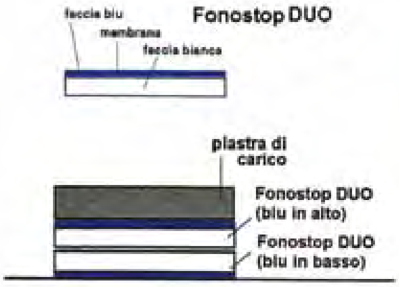
CERTIFICATION

ITC

"ITC-CNR"
n. 3402/RP/01

s' = 21 MN/m³

SYSTEM B
FONOSTOPDuo+FONOSTOPDuo



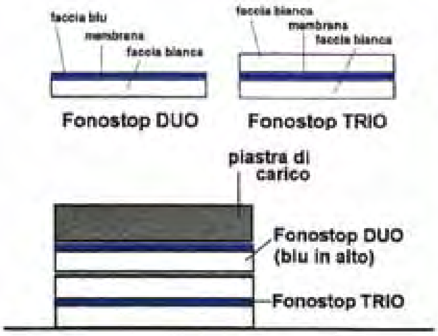
CERTIFICATION

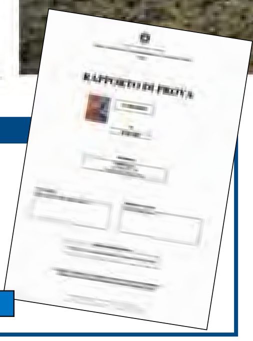
ITC

"ITC-CNR"
n. 3403/RP/01

s' = 11 MN/m³

SYSTEM C
FONOSTOPTrio+FONOSTOPDuo





CERTIFICATION

ITC

"ITC-CNR"
n. 3404/RP/01

s' = 9 MN/m³

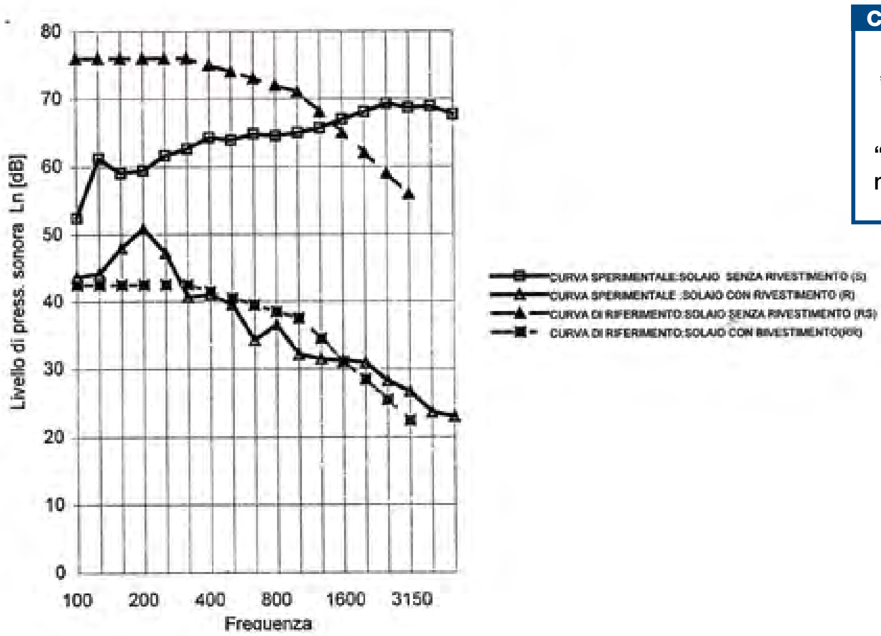
MEASUREMENT OF THE STANDARD INSULATION AGAINST FOOT TRAFFIC (Ln) - "CSI"

MISURA DELL 'ISOLAMENTO AL CALPESTIO NORMALIZZATO (Ln)

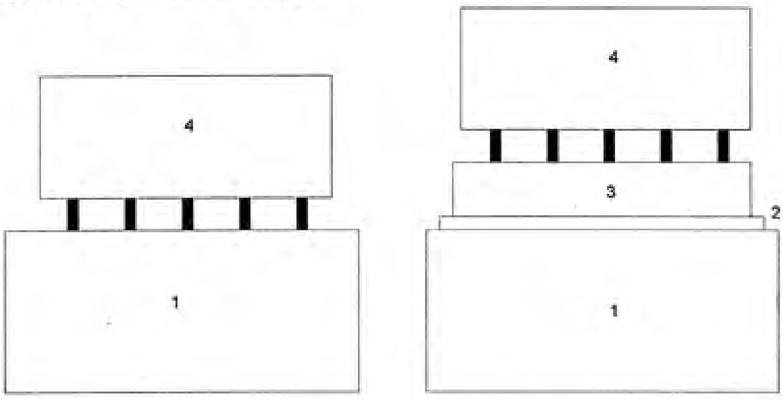
CAMPIONE IN PROVA : **PANNELLO DENOMINATO "FONOSTOP DUO"** isolante acustico dei rumori di calpestio, costituito da: una membrana bitume-polimero da 1,5 mm di spessore con additivi fonoresilienti accoppiata ad un tessuto non tessuto di poliestere di spessore di 6,5 mm per uno spessore complessivo di 8 mm ed una massa di 1,850 kg/m^2 (vedere disegno allegato).

Curva solaio senza rivestimento in prova (S) con $I_0 = 74,0$ dB ,dove I_0 è l'indice di valutazione ISO a 500 Hz , del solaio senza massetto e senza rivestimento in prova.
Curva solaio con rivestimento in prova (R) con $I_1 = 40,5$ dB ,dove I_1 è l'indice di valutazione ISO a 500 Hz , del solaio con massetto e con rivestimento in prova.

(*)Miglioramento dell' isolamento al calpestio per la presenza del rivestimento in prova : $I_r = I_0 - I_1 = 33,5$ dB.



DESCRIZIONE AMBIENTE DI PROVA :



1) - Soletta in calcestruzzo armato di spessore 240 mm.

2) - Elemento in prova avente dimensioni m 1 x 1 .

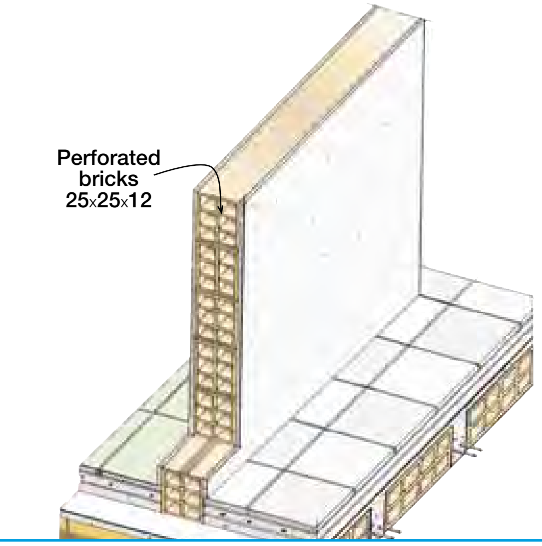
3) - Massetto in granito da 107 Kg/m^2 con dimensioni m 1 x 1.

4) - Macchina per calpestio normalizzata ISO.

(*) *Note. The improvement in insulation against foot traffic noise resulting from the afore-mentioned test report is merely indicative to be able to compare tests carried out with the same method but **it cannot be used for an acoustic forecast nor for forecast calculations of the acoustic insulation against foot traffic noise of a floor slab on site.***

LABORATORY MEASUREMENTS
ACOUSTIC INSULATION OF WALLS CERTIFIED BY "IEN G. FERRARIS"

SINGLE WALL OF 12 cm



CHARACTERISTICS OF THE WALL
- Total thickness 15 cm
- Weight 153 kg/m²

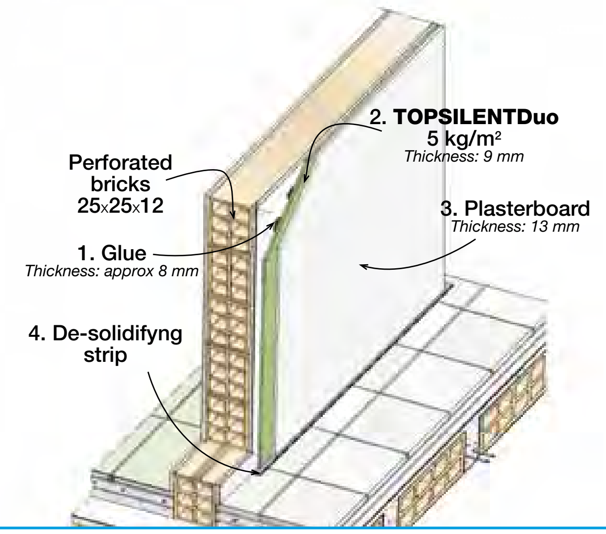
SOUNDPROOFING POWER
R_w = 44,9 dB

TRANSMITTANCE
U = 1,9126 W/m²K (*)

CERTIFICATION

"IEN G. Ferraris"
n. 35561/04

THIN GLUED PLASTERBOARD FALSE-WALL



CHARACTERISTICS OF THE WALL
- Total thickness 18 cm
- Weight 167 kg/m²

SOUNDPROOFING POWER
R_w = 51,9 d B

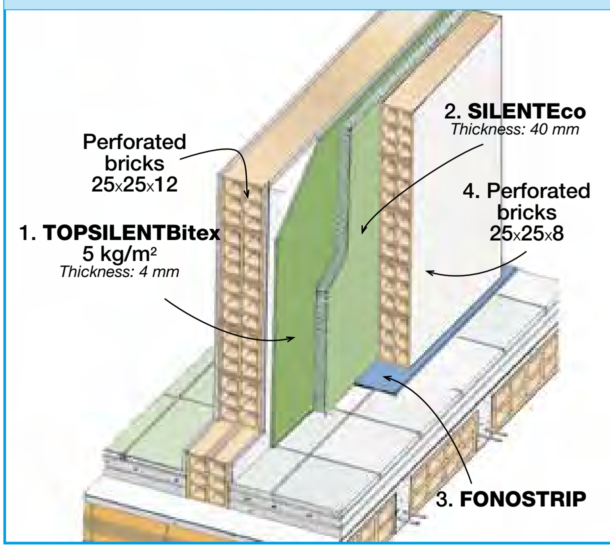
TRANSMITTANCE
U = 1,3425 W/m²K (*)

Alternatively:
TOPSILENTDuo+Plasterboard = **TOPSILENTDuogips**

CERTIFICATION

"IEN G. Ferraris"
n. 35561/08

DOUBLE INSULATED WALL 12÷8 cm



CHARACTERISTICS OF THE WALL
- Total thickness 29 cm
- Weight 260 kg/m²

SOUNDPROOFING POWER
R_w = 52,3 dB

TRANSMITTANCE
U = 0,5365 W/m²K (*)

Alternatively:
SILENTECo+TOPSILENTBitex = TOPSILENTECo

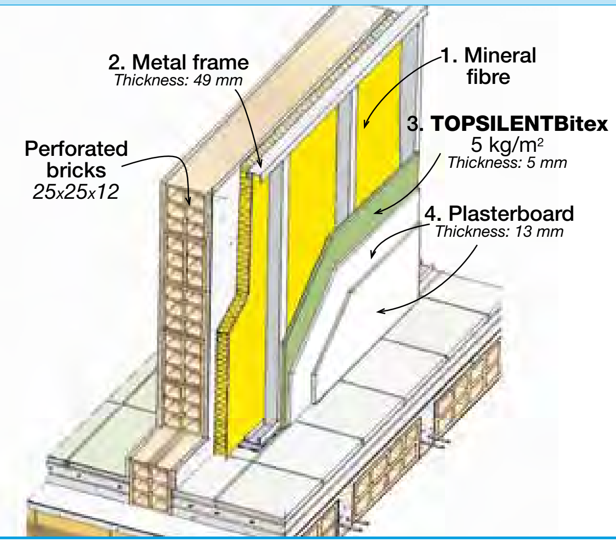
CERTIFICATION

"IEN G. Ferraris"
n. 35561/09

(*) Calculated values of just the wall alone

LABORATORY MEASUREMENTS
ACOUSTIC INSULATION OF WALLS CERTIFIED BY "IEN G. FERRARIS"

DETACHED PLASTERBOARD FALSE-WALL ON METAL FRAMEWORK



CHARACTERISTICS OF THE WALL
- Total thickness 26 cm
- Peso 180 kg/m²

SOUNDPROOFING POWER
R_w = 61,1 dB

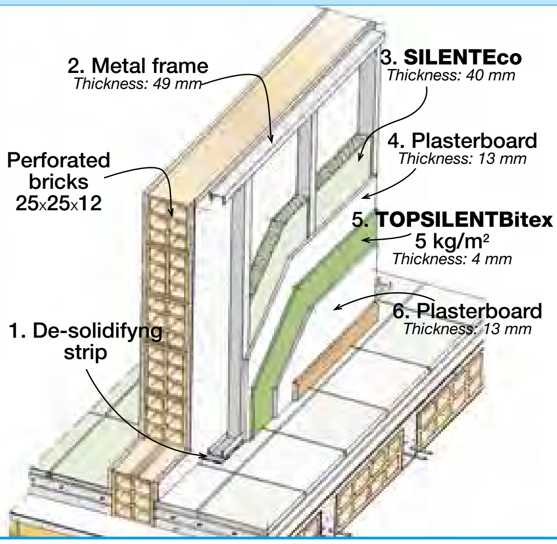
TRANSMITTANCE
U = 0,4958 W/m²K (*)

Alternatively:
TOPSILENTBitex+Plasterboard = **TOPSILENTGips**

CERTIFICATION

"IEN G. Ferraris"
n. 35561/05

BACK-TO-BACK FALSE-WALL IN PLASTERBOARD ON METAL FRAMEWORK



CHARACTERISTICS OF THE WALL
- Total thickness 23 cm
- Weight 178 kg/m²

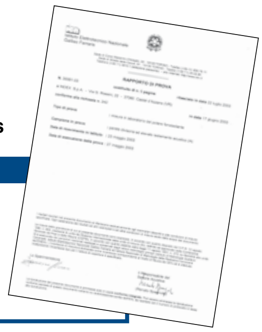
SOUNDPROOFING POWER
R_w = 61,3 dB

TRANSMITTANCE
U = 0,5033 W/m²K (*)

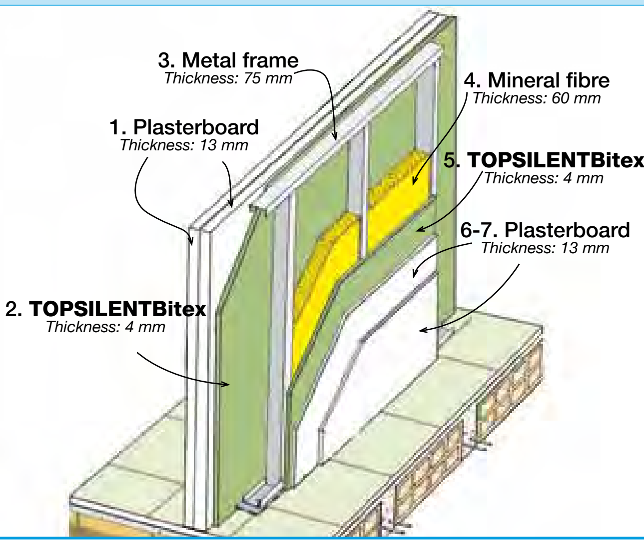
Alternatively:
TOPSILENTBitex+Plasterboard = **TOPSILENTGips**

CERTIFICATION

"IEN G. Ferraris"
n. 35561/07



PLASTERBOARD WALL ON METAL FRAMEWORK



CHARACTERISTICS OF THE WALL
- Total thickness 13,5 cm
- Weight 54 kg/m²

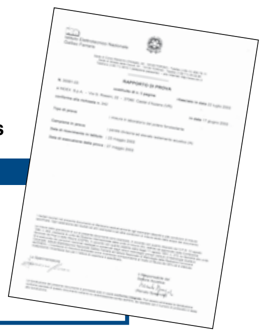
SOUNDPROOFING POWER
R_w = 59,2 dB

TRANSMITTANCE
U = 0,4202 W/m²K (*)

Alternatively:
TOPSILENTBitex+Plasterboard = **TOPSILENTGips**

CERTIFICATION

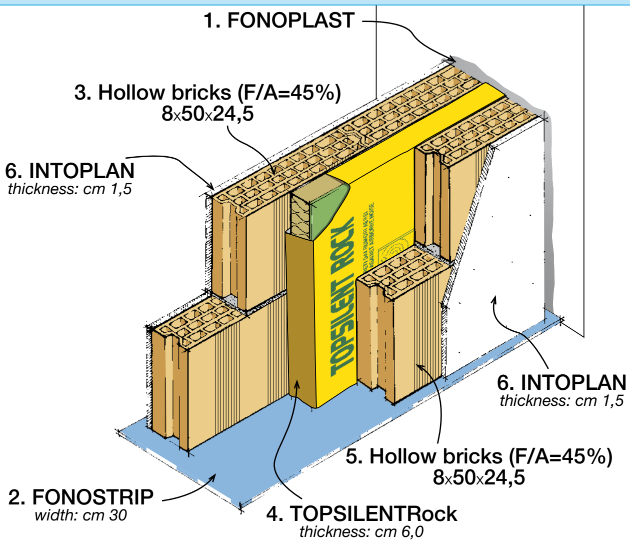
"IEN G. Ferraris"
n. 35561/03



(*) Calculated values of just the wall alone

LABORATORY MEASUREMENTS
ACOUSTIC INSULATION OF WALLS CERTIFIED BY "ITC-CNR"

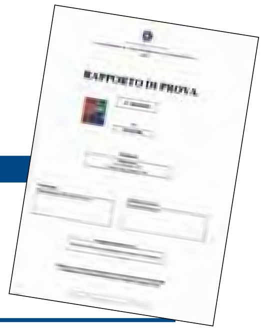
DOUBLE WALL OF 8 cm



CHARACTERISTICS OF THE WALL
- Total thickness 25 cm
- Weight 245 kg/m²

SOUNDPROOFING POWER
R_w = 55,0 dB

TRANSMITTANCE
U = 0,3016 W/m²K (*)

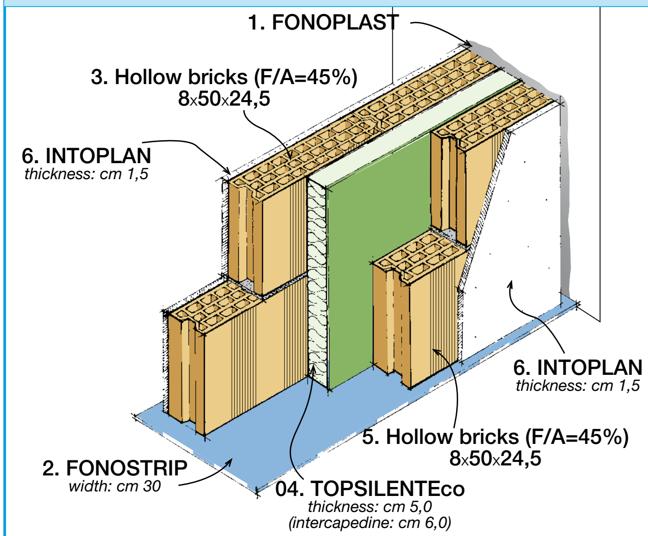


CERTIFICATION

ITC

n. 4165/RP/06

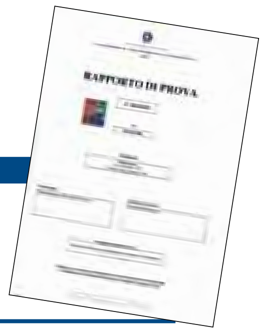
DOUBLE WALL OF 8 cm



CHARACTERISTICS OF THE WALL
- Total thickness 25 cm
- Weight 243 kg/m²

SOUNDPROOFING POWER
R_w = 56,0 dB

TRANSMITTANCE
U = 0,3249 W/m²K (*)

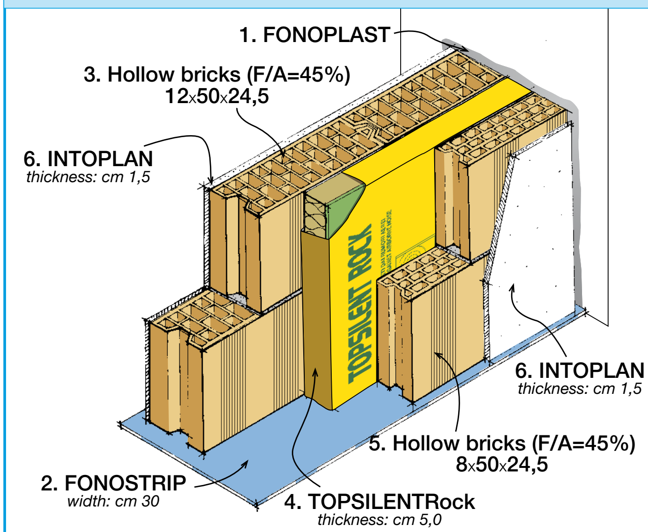


CERTIFICAZIONE

ITC

n. 4166/RP/06

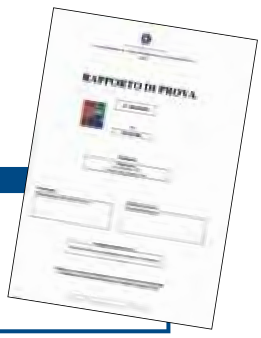
DOUBLE WALL 12÷8 cm



CHARACTERISTICS OF THE WALL
- Total thickness 28 cm
- Weight 288 kg/m²

SOUNDPROOFING POWER
R_w = 57,0 dB

TRANSMITTANCE
U = 0,3204 W/m²K (*)



CERTIFICATION

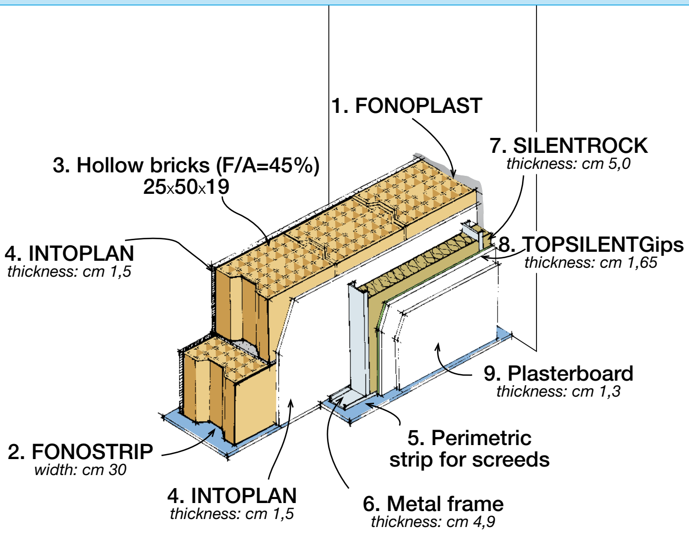
ITC

n. 4167/RP/06

(*) Calculated values of just the wall alone

LABORATORY MEASUREMENTS
ACOUSTIC INSULATION OF WALLS CERTIFIED BY "ITC-CNR"

DETACHED PLASTERBOARD FALSE-WALL ON METAL FRAMEWORK ON BLOCK OF 25 cm



CHARACTERISTICS OF THE WALL
- Total thickness 37 cm
- Weight 228 kg/m²

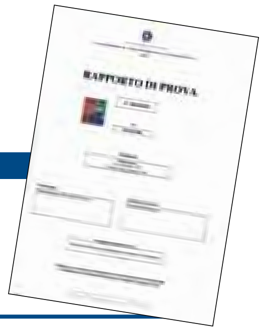
SOUNDPROOFING POWER
R_w = 69,0 dB

TRANSMITTANCE
U = 0,3656 W/m²K (*)

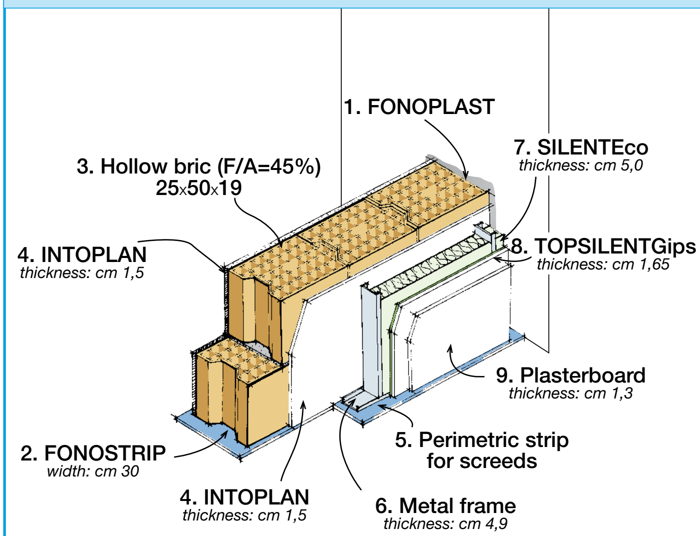
CERTIFICATION

ITC

n. 4213/RP/06



DETACHED PLASTERBOARD FALSE-WALL ON METAL FRAMEWORK ON BLOCK OF 25 cm



CHARACTERISTICS OF THE WALL
- Total thickness 37 cm
- Weight 228 kg/m²

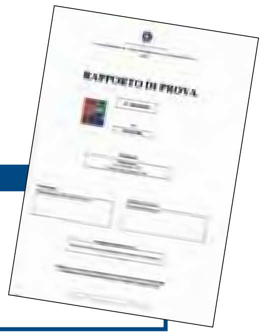
SOUNDPROOFING POWER
R_w = 68,0 dB

TRANSMITTANCE
U = 0,3784 W/m²K (*)

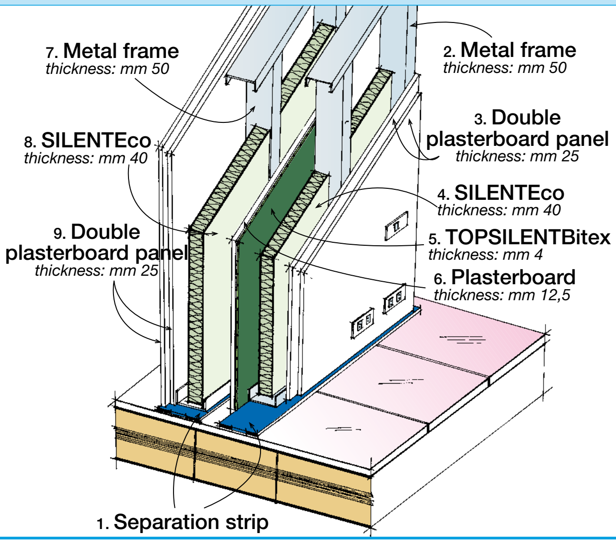
CERTIFICATION

ITC

n. 4214/RP/06



PLASTERBOARD WALL ON DOUBLE METAL FRAMEWORK



CHARACTERISTICS OF THE WALL
- Total thickness 20 cm
- Weight 67 kg/m²

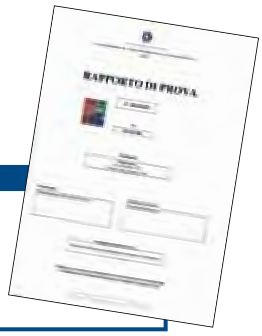
SOUNDPROOFING POWER
R_w = 62,0 dB

TRANSMITTANCE
U = 0,3059 W/m²K (*)

CERTIFICATION

ITC

n. 4946/RP/09



(*) Calculated values of just the wall alone

ON-SITE TESTING OF THE PASSIVE REQUIREMENTS OF BUILDINGS

The following information is provided as a guide to the themes requested by DPCM dated 5th December 1997 (Premier's Decree), hence we do not claim that the contents of this chapter are comprehensive, but just indicative for informative purposes. For further information concerning the measurement methods of passive requirements, the reader is encouraged to read the contents of the associated technical standards, listed hereafter, or to contact a competent technician in the environmental acoustics field (a professional working with these types of measurements, registered on a regional list, referring to the regional environmental agencies in Italy). For reasons associated with the products, the legal requirements concerning the noise levels produced by continuously or discontinuously operating systems have not been considered.

■ ACOUSTIC PARAMETERS RELATED TO THE BUILDINGS

The acoustic parameters requested by DPCM dated 5th December 1997, relating to the structural elements of the building, are as follows:

- apparent soundproofing power index of separating elements between rooms (R'_w)
- standardised acoustic insulation index of external walls ($D_{2m,nT,w}$)
- standardised foot-traffic noise level index of floors ($L'_{n,w}$)

■ ASSOCIATED REFERENCE STANDARDS

- UNI 10708-1 "*Measurement of the acoustic insulation in buildings and elements of buildings - On-site measurements of the acoustic insulation through the air between rooms*", now replaced by standard UNI EN ISO 140- 4 December 2000.
- UNI 10708-2 "*Measurement of the acoustic insulation in buildings and elements of buildings - On-site measurements of the acoustic insulation through the air of the external wall elements and the external walls*", now replaced by standard UNI EN ISO 140-5 December 2000.
- UNI 10708-3 "*Measurement of the acoustic insulation in buildings and elements of buildings – On-site measurements of foot-traffic noise on floors*", now replaced by standard UNI EN ISO 140-7 December 2000.
- The measurement of the reflection time is defined according to standard ISO 3382 1975, updated in 1997, with reference to UNI EN 20354.

■ INSTRUMENTS

The instruments required to carry out sound level surveys are the following:

- omnidirectional sound source (dodecahedron).
- sound level meter.
- Machine for creating foot traffic noise (tapping machine)
- Spreadsheet calculation system for processing the parameters.
- Any other accessories such as stands or earphones.

A short description of the elements listed follows:

Tapping machine

With regard to measuring the standardised foot-traffic level index, sound emission through the dodecahedron is no longer necessary (hence source of airborne noise), but mechanical strain must be induced on the floor in order to test its attenuation level of the noises caused by direct blows to the structures that travel through solids.
This strain is created using a tapping machine (of various shapes but with pre-set characteristics according to Standards in force) equipped with five steel cylinders weighing 500 g ±12 that fall in a perpendicular direction onto the surface by gravity (through the rotation of a camshaft) from a height of 4 cm with a tolerance of ±5%, causing the floor package to vibrate.

Sound level meter

The instrument used for measuring the sound pressure level consists of a measuring chain that includes a microphone, a filter and a level indicator.
The presence of the weighting filter (there are various types of filters - for the building field, type A is used and for other situations, such as in industrial fields or other, there are filters type B or C) is required to transform the level measured into dB, according to a scale related to the way our hearing system perceives sounds (the human ear perceives the same sound pressure levels differently according to the frequency of the sound emission).

Omnidirectional Sound Source

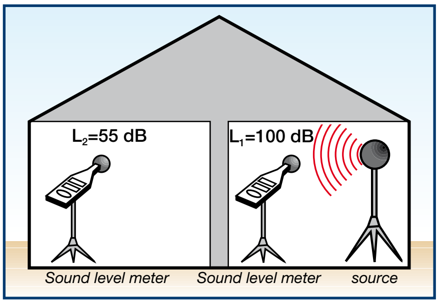
The sound source is used for on-site measurements relating to all the requirements of DPCM dated 5th December 1997, whilst measuring the reflection time T30 (time measured in seconds [s] related to a reduction in the sound pressure level of 30 dB, then transformed into T60 whilst processing the data), which is essential for corrections related to the sound absorption of the receiving rooms (the sound absorption level of the receiving rooms is a variable that may distort the values during the data processing phase if it is not evaluated correctly). It is then used as a noise source (pink noise) for measuring the apparent soundproofing power index of internal separating elements R'_w (floors and partition walls between apartments of different owners) and the external wall insulation index $D_{2m,nT,w}$.
In such circumstances the source arranged in the emitting room gives off a sufficient sound pressure level to guarantee a sound pressure level in the receiving room, which can easily be detected using the sound level meter (such tools have difficulty in detecting sound pressures close to or less than 20 dB). This level is normally somewhere between 90 dB and 105 dB (depending on the walls in the testing location and on the type of measurement, indoors or outdoors).

Spreadsheet calculation system

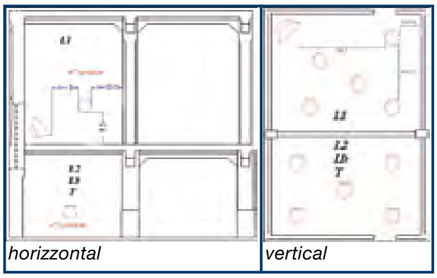
Once the measurements have been made on-site, the data saved by the sound level meter must be entered and processed using a spreadsheet calculation system that is able to implement the levels measured to provide an evaluation index (representing the performance of an element in a certain context, but not comprehensive of the effective quality or otherwise of the soundproofing power).

HOW THE TESTS ARE CARRIED OUT ON-SITE

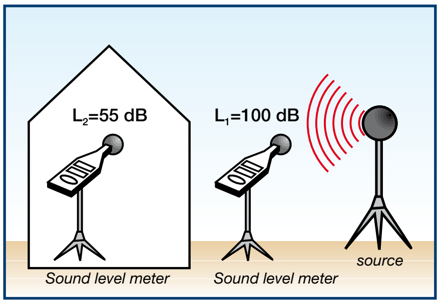
R'_w - Testing of the apparent soundproofing power index of a vertical separating element between two housing units of different owners.



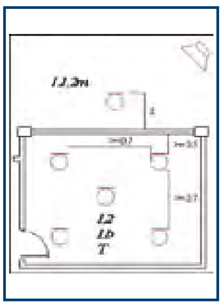
Once the wall used for testing has been identified, the sound source is arranged in one of the two rooms (belonging to different housing units) separated by the wall. This noise source will give off a sound pressure level (around 100 dB as previously mentioned) and a sound level meter in the same emitting room will detect this value. At the same time, if the technicians avail of two sound level meters, or straight afterwards if they only have one sound level meter (the source will obviously be left operating), the sound pressure level in the receiving room will be detected in various measurement positions. As well as measuring the insulation of the partition, the reflection times must be measured (the sound source will be operated again, to be able to measure the decay time of the sound pressure level through pulse sound emissions) as well as the background noise (measurement of the noise effectively present on-site with the sound source switched off). Once these required measurements have been obtained, the data will be processed in order to obtain the apparent soundproofing power index **R'**$_w$ related to the wall used for testing (obviously including the surrounding conditions related to the anchoring systems of the wall to all the other walls) for the difference in levels between the disturbed room and the disturbing room (providing the "performance" of the element). The same test method can be carried out by inverting the emitting and receiving rooms. Upon completion, the volumes of the receiving rooms are measured in order to calculate the level of acoustic absorption.



$D_{2m,nT,w}$ - Testing of the external wall insulation index

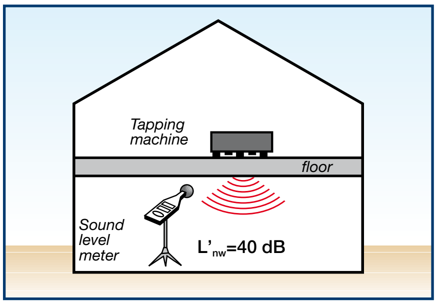


Likewise for the previous case, a measurement will be made also for the outer walls that will determine an index relating to the "performance" of an element, being the external wall of the building. Should the whole building be assessed, such instrumental surveys should be carried out on all the external walls and if necessary, floor by floor, apartment by apartment, room by room (which results in considerable investment costs). The measurement procedures faithfully reflect what has already been analysed for the internal walls, with the only variations relating to the fact that the source will be arranged outdoors (about 5-6 m from the external wall being tested) and hence the sound level meter that will measure the noise

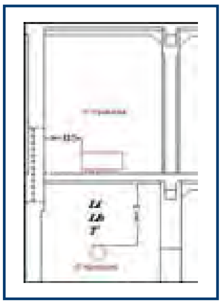


source level (the sound level meter is to be placed 2 m from the external wall). Once the surveys have been carried out outdoors, the sound source will be moved into the receiving rooms in order to measure the reflection times and the background noise with the source switched off. Upon completion, the volumes of the receiving rooms will be measured to calculate the level of acoustic absorption.

$L'_{n,w}$ - Testing of the standardised foot-traffic level index of floors



In this case, the "performance" of a separating element is no longer measured, but rather the maximum disturbance level of the receiving room. The tapping machine is arranged on the floor in the measurement location and is operated to put mechanical strain on the partition in at least 4 different positions that must be 50 cm from the walls, taking care to place the machine at 45° compared to the framework of the floors. In the receiving room (underneath the machine in most cases, but also alongside or even above it; the Law does not specify any of the three possibilities) the sound pressure level is measured using just one sound level meter, moving around the 4 measuring positions in order to guarantee a minimum measurement of 16 values. Then the reflection times and background noise are measured, again in order to characterise the measurement condition and hence to make the corrections stated by the legal requirements in order to express a comprehensive evaluation index of the implications of acoustic absorption in the receiving room or the reflection times. Upon completion, the volumes of the receiving rooms will be measured to calculate the level of acoustic absorption.



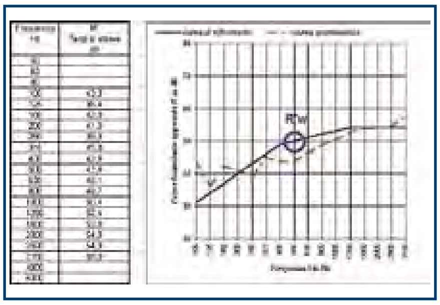
DATA PROCESSING

Once the data measured on-site using the sound level meter have been downloaded, the results can be processed using a spreadsheet calculation system. The frequency interval requested by Standards in force ranges from 100 Hz to 3150 Hz (splitting up the interval according to bands of a third of an octave). After considering the incidence of the background noise (corrections) and the reflection times T, according to the formulae given in the UNI standards, the frequency values measured will be collected in a table and shown on a graph similar to those presented as follows, in order to draw experiment curves. Once the curves have been drawn, in order to obtain an evaluation index at 500 Hz, the known ISO curve (indicated in blue) must be moved (up and down) in order to guarantee a maximum negative deviation of 32 dB (the difference between the ISO curve and the experiment curve is carried out frequency by frequency until a maximum deviation of 32 dB at the most is obtained), then the ISO curve is then blocked and the dB value corresponding to the frequency of 500 Hz is intercepted with 2 straight lines. The evaluation index of the three parameters being analysed is obtained (in the three different cases) from the dB value relative to 500 Hz. As illustrated hereafter, each requirement corresponds to an ISO curve that will be the same used to evaluate the apparent soundproofing power indices and external wall insulation indices but different for the standardised foot-traffic index.

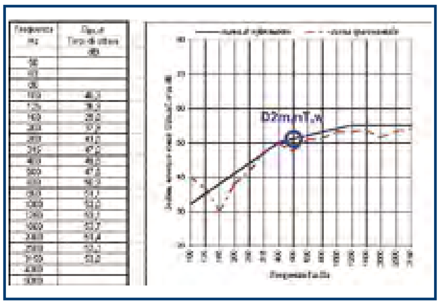
These curves reproduce the correct trend of the elements towards the acoustic insulation according to standards in force and consequently mark out the "right track" that each correctly insulated partition should follow:

- for walls, there should always be an increase in the insulation level, increasing along the frequency axis;
- for floors, on the other hand, there should be a decrease in the levels as the frequencies increase.

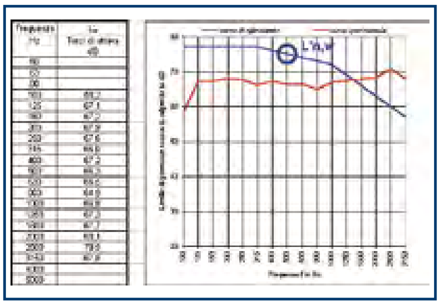
R'$_w$ - Calculation of the apparent soundproofing power index of a vertical separating element between two housing units of different owners.



$D_{2m,nT,w}$ - Calculation of the external wall insulation index



$L_{n,w}$ - Calculation of the foot-traffic noise index of floors



MEASUREMENTS ON SITE
ACOUSTIC INSULATION AGAINST FOOT TRAFFIC NOISE FOR FLOORS

LIST OF TESTS ON SITE CARRIED OUT BY STUDIOS AND LABORATORIES SPECIALISED IN ACOUSTICS

	$L'_{n,w}$	SCREED THICKNESS (cm)	LAYERS AND MATERIAL	FINISH
CEMENT AND BRICK 16 + 4 cm (BEAMS AND HOLLOW BRICKS)	54	5	FONOSTOPDuo+FONOSTOPDuo	Ceramic
	54	5	FONOSTOPDuo+FONOSTOPDuo	Ceramic
	53	5	FONOSTOPDuo+FONOSTOPDuo	Ceramic

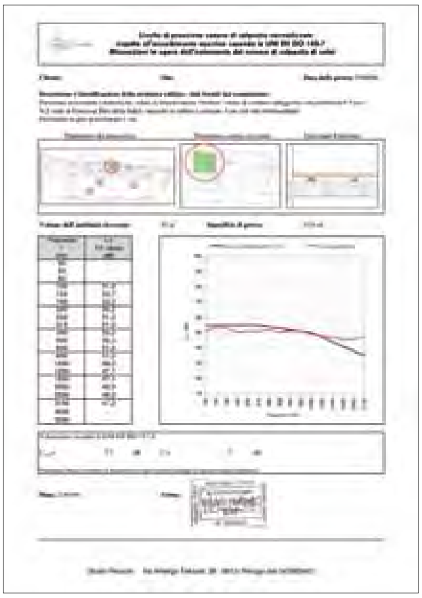
	$L'_{n,w}$	SCREED THICKNESS (cm)	LAYERS AND MATERIAL	FINISH
CEMENT AND BRICK 20 + 4 cm (BEAMS AND HOLLOW BRICKS)	49	5	FONOSTOPDuo	Ceramic
	53	5	FONOSTOPDuo	Ceramic
	55	6	FONOSTOPDuo	Ceramic
	56	5	FONOSTOPDuo	Wood
	56	4	FONOSTOPDuo	Ceramic
	55	4	FONOSTOPDuo	Ceramic
	57	4	FONOSTOPDuo	Ceramic
	58	4	FONOSTOPDuo	Ceramic
	53	5	FONOSTOPDuo	Ceramic
	52	5	FONOSTOPDuo	Ceramic
	40	6	FONOSTOPDuo+FONOSTOPDuo	Wood
	52	4	FONOSTOPDuo	Wood
	54	4	FONOSTOPDuo	Wood
	56	5	FONOSTOPDuo	none
	52	5	FONOSTOPDuo+FONOSTOPDuo	none
	55	5	FONOSTOPDuo	Ceramic
	58	5	FONOSTOPDuo	Ceramic
	55	5	FONOSTOPDuo	Ceramic
	55	5	FONOSTOPDuo	Ceramic
	57	5	FONOSTOPDuo	Ceramic
	56	5	FONOSTOPDuo	Wood
	58	5	FONOSTOPDuo	Wood
	58	5	FONOSTOPDuo	Ceramic
	51	4	FONOSTOPDuo+FONOSTOPDuo	Wood
	55	5	FONOSTOPDuo	Ceramic
	55	5	FONOSTOPDuo	Wood
	42	5	FONOSTOPDuo+FONOSTOPDuo	Wood
	54	5	FONOSTOPDuo	None
	50	5	FONOSTOPBar	Ceramic
	52	5	FONOSTOPBar	Ceramic
	58	5	FONOSTOPBar	Ceramic
	58	5	FONOSTOPBar	Ceramic
	56	5	FONOSTOPBar	Ceramic
	58	5	FONOSTOPBar	Ceramic
	54	5	FONOSTOPDuo	Ceramic
	50	4	FONOSTOPDuo	Wood
	54	4	FONOSTOPDuo	Wood
	57	4	FONOSTOPDuo	None
	56	5	FONOSTOPDuo	Ceramic
	53	5	FONOSTOPDuo	Wood
	54	5	FONOSTOPDuo	Ceramic
	52	6	FONOSTOPDuo	Ceramic
	51	6	FONOSTOPDuo	Ceramic

	$L'_{n,w}$	SCREED THICKNESS (cm)	LAYERS AND MATERIAL	FINISH
CEMENT AND BRICK 24 + 4 cm (BEAMS AND HOLLOW BRICKS)	55	5	FONOSTOPDuo	Ceramic
	58	4	FONOSTOPDuo	Ceramic
	59	5	FONOSTOPBar	Ceramic
	60	5	FONOSTOPBar	None

	$L'_{n,w}$	SCREED THICKNESS (cm)	LAYERS AND MATERIAL	FINISH
WOOD 2 cm + REINFORCEMENT COMPOSITE CONCRETE SLAB 6 cm	58	7	FONOSTOPDuo+FONOSTOPDuo	Ceramic
	55	5	FONOSTOPDuo+FONOSTOPTrio	Ceramic
	58	6	FONOSTOPDuo+FONOSTOPDuo	Wood
	59	6	FONOSTOPTrio	Ceramic

	$L'_{n,w}$	SCREED THICKNESS (cm)	LAYERS AND MATERIAL	FINISH
PREFABRICATED PANELS WITH PSE (type "Predalle")	56	5	FONOSTOPDuo	Ceramic
	58	5	FONOSTOPDuo	Ceramic
	54	5	FONOSTOPDuo	none
	52	5	FONOSTOPDuo	none

Cement and brick 16 + 4 cm (Beams and hollow bricks)

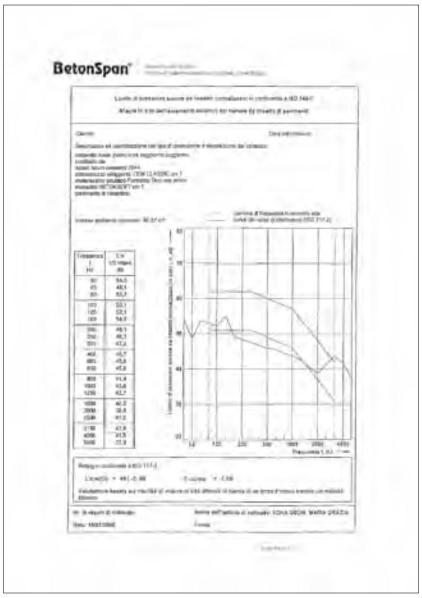


Stratified elements

- Floor in porcelain stoneware	1 cm
- Reinforced sand/cement screed	5 cm
- **FONOSTOPDuo**	0,8 cm
- **FONOSTOPDuo**	0,8 cm
- Lightened cement	6-7 cm
- Floor slab in cement and brick	20 cm
- Civil plastering	1,5 cm

L'$_{nw}$ = 53 dB

Cement and brick 20 + 4 cm (Beams and hollow bricks)

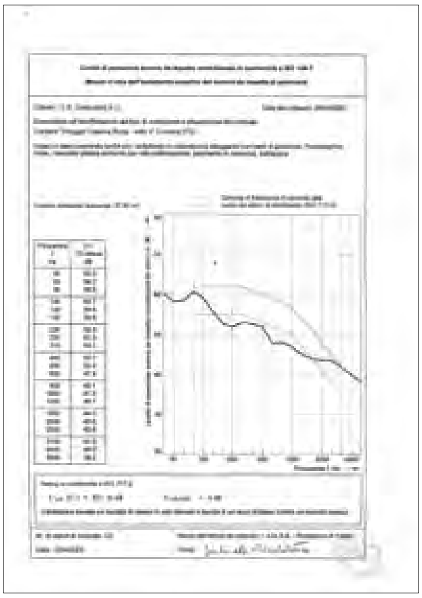

BetonSpan

Stratified elements

- Ceramic floor	1 cm
- Reinforced sand/cement screed	5 cm
- **FONOSTOPDuo**	0,8 cm
- Lightened concrete	7 cm
- Floor slab in cement and brick	24 cm
- Civil plastering	1,5 cm

L'$_{nw}$ = 49 dB

Cement and brick 20 + 4 cm (Beams and hollow bricks)



Stratified elements

- Ceramic floor	1 cm
- Reinforced sand/cement screed	5 cm
- **FONOSTOPDuo**	0,8 cm
- Lightened concrete	6÷8 cm
- Floor slab in cement and brick	24 cm
- Civil plastering	1,5 cm

L'$_{nw}$ = 53 dB

Cement and brick 20 + 4 cm (Beams and hollow bricks)

Stratified elements

- Wood floor	2 cm
- Screed	5 cm
- **FONOSTOPDuo**	0,8 cm
- Lightened screed	8 cm
- Floor slab in cement and brick	24 cm
- Civil plastering	1,5 cm

L'_{nw} = 53 dB

Cement and brick 20 + 4 cm (Beams and hollow bricks)

Stratified elements

- Ceramic floor	1 cm
- Screed	5 cm
- **FONOSTOPDuo**	0,8 cm
- Lightened screed	8 cm
- Floor slab in cement and brick	24 cm
- Civil plastering	1,5 cm

L'_{nw} = 54 dB

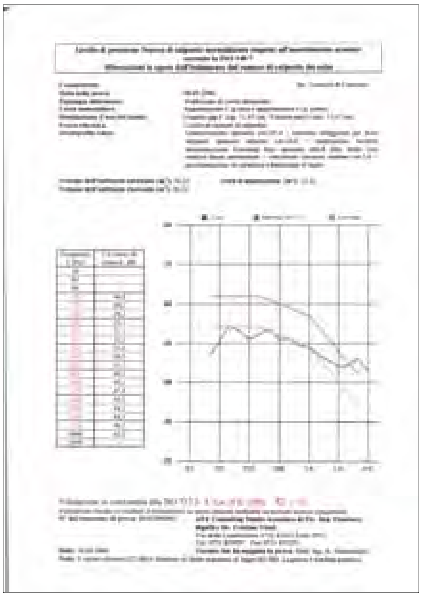
Cement and brick 20 + 4 cm (Beams and hollow bricks)

Stratified elements

- Floor	1 cm
- Screed	5 cm
- **FONOSTOPDuo**	0,8 cm
- Lightened screed	10 cm
- Floor slab in cement and brick	24 cm
- Civil plastering	1,5 cm

L'_{nw} = 53 dB

Cement and brick 20 + 4 cm (Beams and hollow bricks)

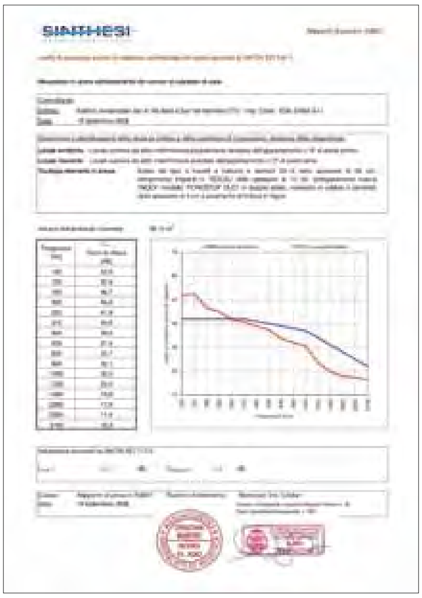


Stratified elements

- Floor	1 cm
- Screed	5 cm
- **FONOSTOPDuo**	0,8 cm
- Lightened screed	10 cm
- Floor slab in cement and brick	24 cm
- Civil plastering	1,5 cm

L'_{nw} = 52 dB

Cement and brick 20 + 4 cm (Beams and hollow bricks)

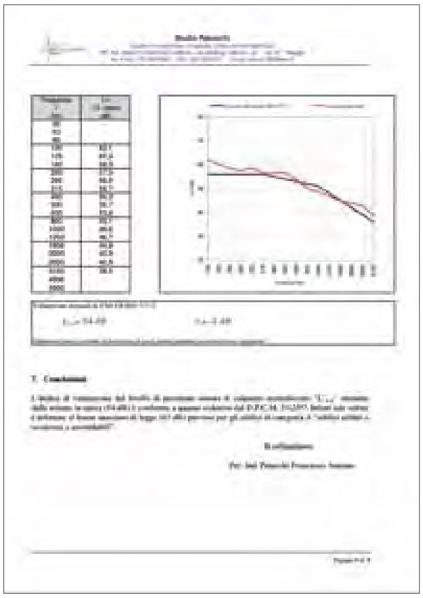


Stratified elements

- Wood floor	2 cm
- Reinforced sand/cement screed	4 cm
- **FONOSTOPDuo**	0,8 cm
- **FONOSTOPDuo**	0,8 cm
- Filling	10 cm
- Floor slab in cement and brick	25 cm
- Civil plastering	1,5 cm

L'$_{nw}$ = 40 dB

Cement and brick 20 + 4 cm (Beams and hollow bricks)

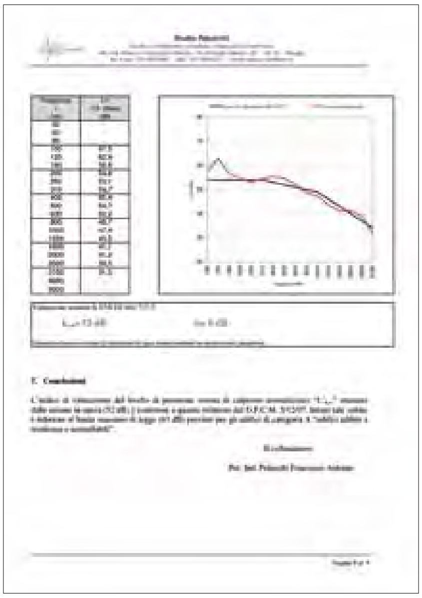


Stratified elements

- Wood floor	1 cm
- Reinforced sand/cement screed	4 cm
- **FONOSTOPDuo**	0,8 cm
- Lightened screed	6 cm
- Floor slab in cement and brick	24 cm
- Civil plastering	1,5 cm

L'$_{nw}$ = 54 dB

Cement and brick 20 + 4 cm (Beams and hollow bricks)



Stratified elements

- Parquet wood floor	1 cm
- Reinforced sand/cement screed	4 cm
- **FONOSTOPDuo**	0,8 cm
- Lightened screed	6 cm
- Floor slab in cement and brick	24 cm
- Civil plastering	1,5 cm

L'$_{nw}$ = 52 dB

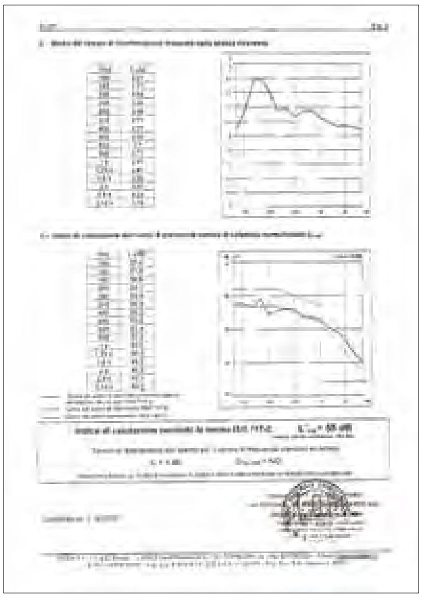
Cement and brick 20 + 4 cm (Beams and hollow bricks)

Stratified elements

- Ceramic floor	1 cm
- Reinforced sand/cement screed	5 cm
- **FONOSTOPDuo**	0,8 cm
- Lightened screed	8 cm
- Floor slab in cement and brick (UNISOL KS type)	24 cm
- Civil plastering	1,5 cm

L'$_{nw}$ = 56 dB

Cement and brick 20 + 4 cm (Beams and hollow bricks)

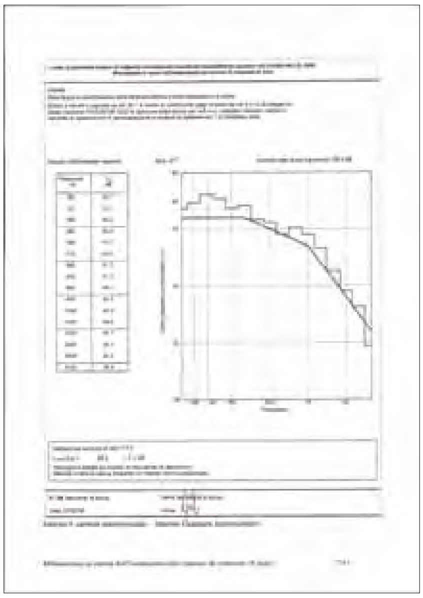


Stratified elements

- Parquet wood floor	1,5 cm
- Reinforced sand/cement screed	5 cm
- **FONOSTOPDuo**	0,8 cm
- Lightened screed	6 cm
- Floor slab in cement and brick	24 cm
- Civil plastering	1,5 cm

L'$_{nw}$ = 55 dB

Cement and brick 20 + 4 cm (Beams and hollow bricks)



Stratified elements

- Wood floor	1,5 cm
- Reinforced sand/cement screed	4 cm
- **FONOSTOPDuo**	0,8 cm
- Lightened screed	6 cm
- Floor slab in cement and brick	24 cm
- Civil plastering	1,5 cm

L'$_{nw}$ = 50 dB

Cement and brick 20 + 4 cm (Beams and hollow bricks)

Stratified elements

- Ceramic floor	1 cm
- Reinforced sand/cement screed	6 cm
- **FONOSTOPDuo**	0,8 cm
- Lightened screed	10 cm
- Floor slab in cement and brick	24 cm
- Civil plastering	1,5 cm

L'$_{nw}$ = 52 dB

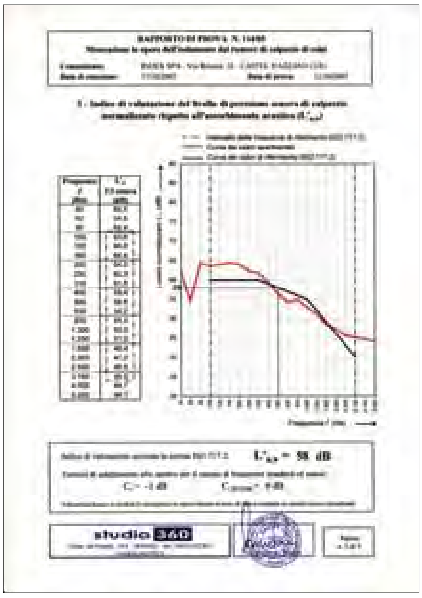
Cement and brick 20 + 4 cm (Beams and hollow bricks)

Stratified elements

- Ceramic floor	1 cm
- Reinforced sand/cement screed	6 cm
- **FONOSTOPDuo**	0,8 cm
- Lightened screed	10 cm
- Floor slab in cement and brick	24 cm
- Civil plastering	1,5 cm

L'$_{nw}$ = 51 dB

Wood 2 cm + Reinforcement composite concrete slab cm 6



Stratified elements

- Ceramic floor	1 cm
- Reinforced sand/cement screed	7 cm
- **FONOSTOPDuo**	0,8 cm
- **FONOSTOPDuo**	0,8 cm
- Lightened screed in cellular concrete	9 cm
- Reinforcement composite slab	5 cm
- Planking	2,2 cm
- Wood joists	24x16 cm

L'_{nw} = 58 dB

Prefabricated panels with ESP

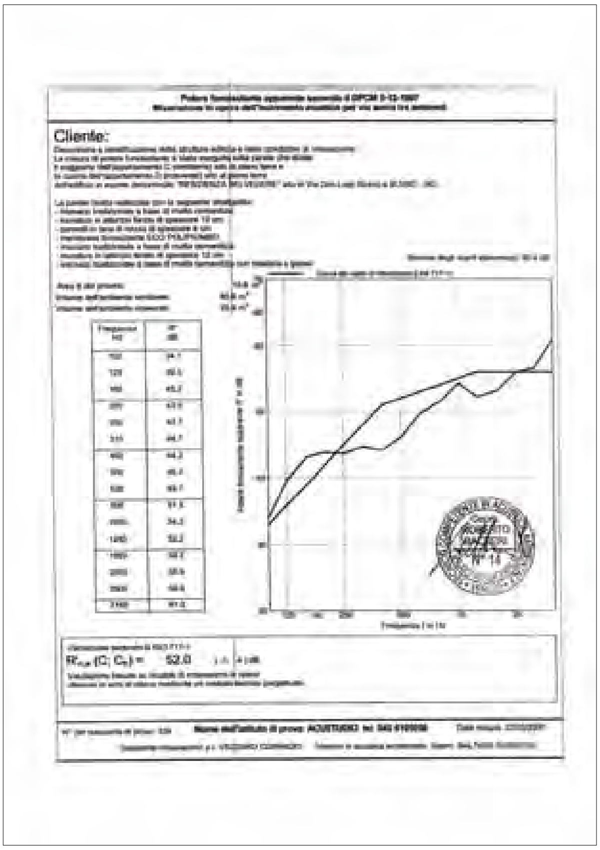
Stratified elements

- Reinforced sand/cement screed	5 cm
- **FONOSTOPDuo**	0,8 cm
- Lightened screed	8 cm
- Lightened floor slab (type “Unisol”)	32 cm
- Civil plastering	1,5 cm

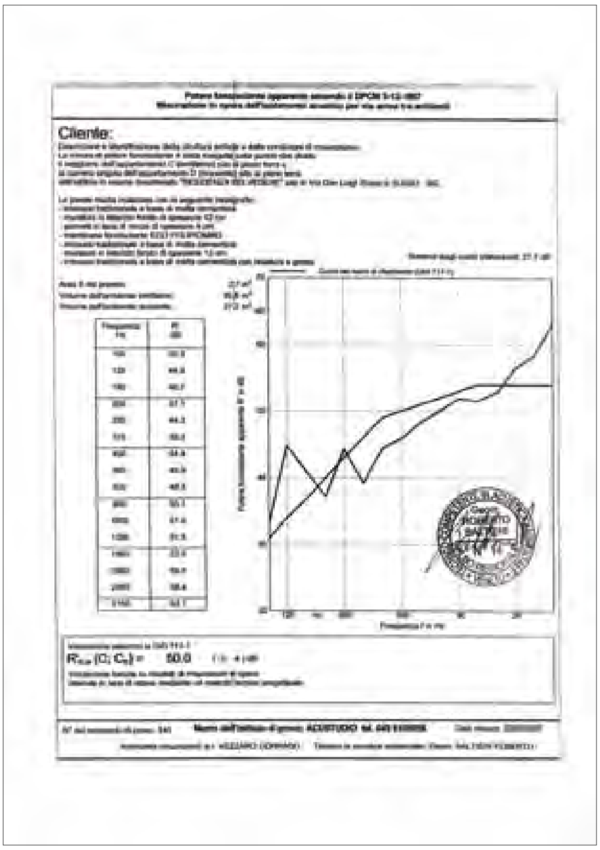
L'_{nw} = 52 dB

Double-wall 12+8 cm

Double wall 12+8 cm
and **TOPSILENTRock**


Cliente:

R_w = 52 dB


Cliente:

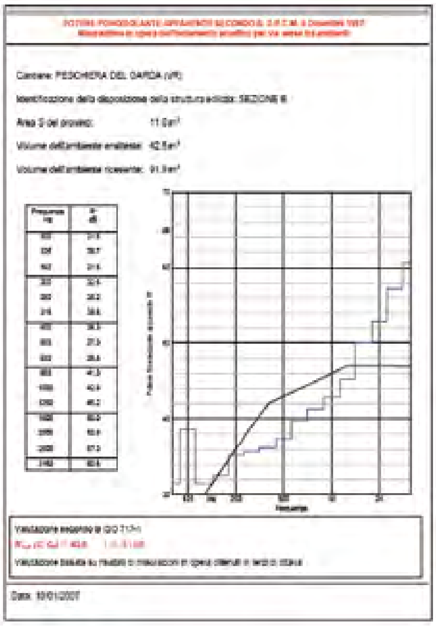
R_w = 50 dB

Acoustic upgrading: increase in the soundproofing power of dividing walls between dwellings in brickwork with plasterboard false-walls

Here's a summary of the site experiments carried out by INDEX s.p.a., assisted by "STUDIO ECOSERVICE", related to the testing on site of a false-wall solution aimed at increasing the soundproofing power of two different types of dividing walls between adjacent dwellings, which did not comply perfectly with the passive acoustic requirements following instrumental testing carried out by Studio Ecoservice.
At the time of testing, the two dividing walls had an apparent soundproofing power index as follows:

WALL 1

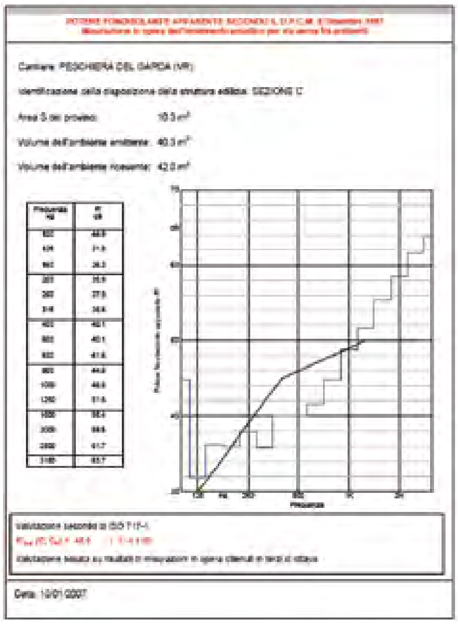
Double hollow brick 8-cm thick wall, with 6 cm of glass wool in-between and two layers of plaster.



R'$_w$ = 43 dB

WALL 2

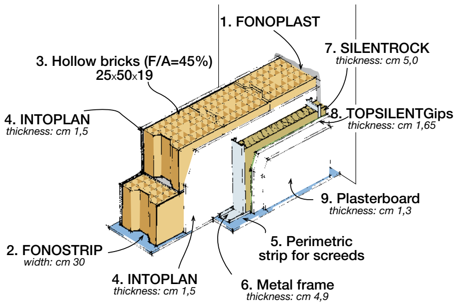
25-cm thick brick block and two layers of plaster.



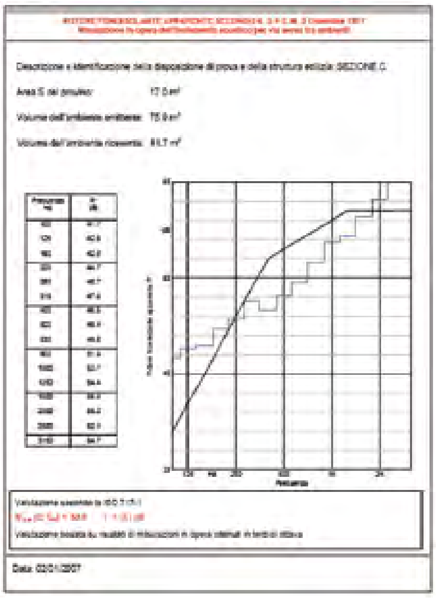
R'$_w$ = 46 dB

Considering the situation resulting from the tests illustrated above, the upgrading solution of the soundproofing power referred to the creation of a false-wall on metal structure measuring 75 mm in thickness, partially filled with **SILENTRock** (thickness: 6 cm).
The structure was then lined with a first layer of plasterboard panels and a second layer (with offset joints) of panels type **TOPSILENTGips**.
As an example, we are providing the drawing of the afore-mentioned false-wall indicated for the brick block of 25 cm.

This solution, which was tested in the laboratory (see page 75 Test report no. 4213 RP06) and planned according to the calculation methods written in the TR UNI 11175 and indicated in page 38, resulted in the following soundproofing power index after further instrumental testing:

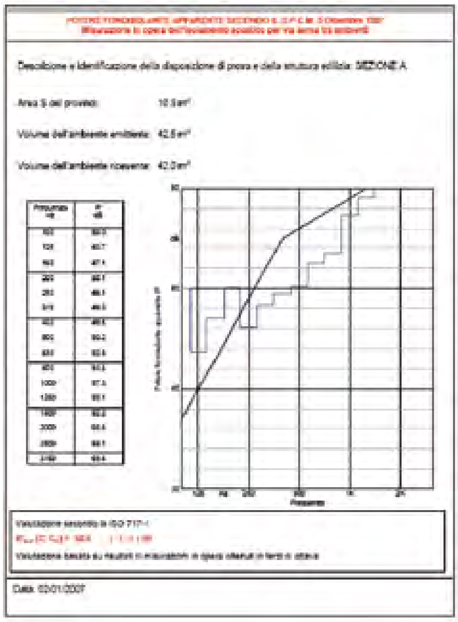


WALL 1



R'$_w$ = 53 dB

WALL 2



R'$_w$ = 56 dB

LABORATORY MEASUREMENTS
ANDIL

ANDIL ASSOLATERIZI is the Italianassociation of producers of brick and tile elements intended for use mainly by residential housing building industry. The following are the results of a laboratory measurement campaign of the phono-insulation power R_w of single walls, double-walls and brick/tile floors conducted by ANDIL, referred to the types most widespread in Italy.

Wall type	Certif. n.	SINGLE WALLS Description of materials used	Thickness (cm)	Surface density (kg/m²)	R_w (dB) evaluation index
1	4	Partition 8x25x25, 10 holes, F/A=60% horizontal holes, with plaster, finished 12 days ago.	11 1,5+8+1,5	136 (nom. 105)	42,5
2	8	Semi-solid hollow-core block 25x30x19, F/A=45% vertical holes, very recently plastered	28 1,5+25+1,5	285	51,5
3	10	Solid brick UNI 12x25x5.5, F/A=15% montata di punta (2 heads)	28 1,5+25+1,5	477	51,0
4	11	Solid brick UNI 12x25x5.5, F/A=15% installed with 3 heads + plaster	41 1,5+38+1,5	682	52,5
5	12	Semi-solid brick 12x25x5.5, F/A=32% vertical holes, montato di punta (with 2 heads), with plaster	28 1,5+25+1,5	440	51,0
6	13	Semi-solid hollow-core block 25x30x19, F/A=45% vertical holes, montato di testa, with plaster	33 1,5+30+1,5	330	46,5
7	15	Normal perforated clay 12x25x25, 15 holes, F/A=60% horizontal holes, plaster	15 1,5+12+1,5	149	42,5
8	18	Semi-solid hollow-core brick 45x30x19, F/A=45% vertical holes, montato di testa, with plaster	15 1,5+12+1,5	176 (nom. 203)	40,0
9	22	Semi-solid hollow-core block 45x30x19, F/A=45% vertical holes, montato di testa, with plaster	48 1,5+45+1,5	428	49,0
10	23	Perforated hollow-core block 30x25x19, F/A=55% montato di testa, vertical holes, with plaster	33 1,5+30+1,5	285	44,5
11	24	Perforated block in normal clay 30x25x16, 10 holes, F/A=50% vertical holes, with plaster	33 1,5+30+1,5	301	45,0
12	26	Perforated wall in normal clay 8x12x24, 4 holes, F/A=60% horizontal holes, with plaster	11 1,5+8+1,5	96	37,0
13	27	Hollow-core partition 8x45x22.5, F/A=45% vertical holes, with plaster	11 1,5+8+1,5	112	38,5
14	28	Hollow-core partition 12x45x22.5, F/A=45% vertical holes, with plaster	15 1,5+12+1,5	164	41,5
15	29	Hollow-core perforated block 30x19x22.5, F/A=50% horizontal holes, with plaster	33 1,5+30+1,5	268	43,0
16	42	Perforated block in normal clay, 8x24x12,6 holes, F/A=60% horizontal holes, plaster	11 1,5+8+1,5	118	42,5
17	43	Perforated block in normal clay, 12x25x25, 10 holes, F/A=60% horizontal holes, plaster	15 1,5+12+1,5	125	42,0
18	44	Perforated block in normal clay, 12x25x25, 10 holes, F/A=60% horizontal hoes, with plaster + scagliola finish	15 1,5+12+1,5	129	42,5
19	15/92	perforated block in normal clay, 8x30x15, 6 holes, F/A=60% horizontal holes, plaster	11 1,5+8+1,5	124	42,0

Wall type	Certif. n.	DOUBLE WALLS Description of materials used	Spessore (cm)	Surface density (kg/m²)	R_w (dB) evaluation index
1	14	Perforated block 12x25x25, 15 horizontal holes, F/A=60% plaster on both sides 4 cm air interspace, partition 8x25x25, 10 horizontal holes F/A=60%, external plaster	28,5 1,5+12+1,5+4+8+1,5	287 (nom. 205)	47,5
2	17	Perforated block 12x25x25, 15 horizontal holes, F/A=60% plaster on both sides 2 cm air interspace, Perforated blcok128x25x25, 15 horizontal holes, F/A=60%, external plaster	30,5 1,5+12+1,5+2+12+1,5	268 (nom. 225)	47,5
3	19	Double UNI 12x25x12, F/A=40% vertical holes, plaster on both sides, 4 cm air interspace , with 100 kg/cu.m fibreglass. Partition 8x25x25, 10 horizontal holes, F/A=60%, external plaster	27,0 1,5+12+1,5+4+8+1,5	241 (nom. 285)	48,5
4	20	Double UNI 12¥25¥12, F/A=40% vertical holes, plaster on both sides, 4 cm air interspace , Partition 8x25x25, 10 horizontal holes, F/A=60%, external plaster	27,0 1,5+12+1,5+4+8+1,5	257 (nom. 281)	48,0
5	21	Semi-solid, hollow-core 25x30x19, F/A=45%, vertical holes, plaster on both sides, 4 cm air interspace , with 100kg/cu.m fibreglass. Partition 8x25x25, 10 horizontal holes, F/A=60%, external plaster	41,5 1,5+25+1,5+4+8+1,5	302	49,0
6	25	Swiss block 25x18x13, F/A=55%, vertical holes, plaster on both sides, 4 cm air interspace , with 100kg/cu.m fibreglass. Partition 8x25x25, 10 horizontal holes, F/A=60%, external plaster	41,5 1,5+25+1,5+4+8+1,5	360	52,0
7	10/92	Partition 8x25x25, 10 horizontal holes, F/A=60%, plaster on both sides, 5 cm air interspace, Partition 8x25x25, 10 horizontal holes, F/A=60%, external plaster	25,5 1,5+8+1,5+5+8+1,5	198	47,0
8	11/92	Partition 8x25x25, 10 horizontal holes, F/A=60%, plaster on both sides, 5 cm air interspace with expanded melted clay, Partition 8x25x25, 10 horizontal holes, F/A=60%, external plaster	25,5 1,5+8+1,5+5+8+1,5	222	49,5
9	12/92	Partition 12x25x25, 15 horizontal holes, F/A=60%, plaster on both sides, 4 cm air interspace, Partition 8x25x25, 10 horizontal holes, F/A=60%, external plaster	28,5 1,5+12+1,5+4+8+1,5	241	47,5
10	13/92	Perforated block 12x25x25, 15 horizontal holes, F/A=60%, plaster on both sides, 4 cm air interspace with expanded melted clay, Partition 8x25x25, 10 horizontal holes, F/A=60%, external plaster	28,5 1,5+12+1,5+4+8+1,5	260	50,0
11	16/92	Partition 12x25x25, 15 horizontal holes, F/A=60%, plaster on both sides, 4 cm air interspace, M type vermiculite, Partition 8x25x25, 10 horizontal holes,	28,5 1,5+12+1,5+4+8+1,5	244	48,0
12	14/92	Partition 12x25x25, 15 horizontal holes, F/A=60%, plaster on both sides, 4 cm air interspace, Partition 8x25x25, 10 horizontal holes, F/A=60%, separated with Sylomer, external plaster	28,5 1,5+12+1,5+4+8+1,5	241	51,5

ANDIL

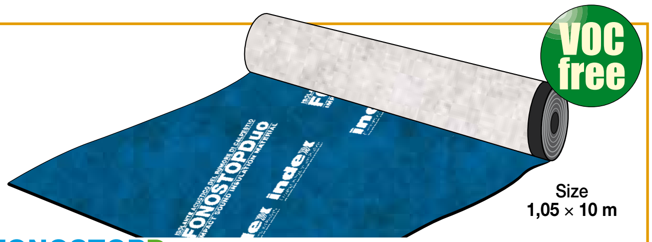
Wall type	Certif. n.	**SOLAI** Description of materials used	Thickness (cm)	Surface density (kg/m²)	R_w (dB) evaluation index
1	30	Lattice joists, between-axes 50, clay type A 16+4, with plaster on soffit	21,5 1,5+16+4,0	270	49,0
2	31	Lattice joists, between-axes 50, clay type A 20+4, with plaster on soffit	25,5 1,5+20+4,0	340	50,0
3	32	Lattice joists in pre-compressed concrete, between-axes 50, clay type A 16+4, with plaster on soffit	21,5 1,5+16+4,0	269	48,5
4	33	Lattice joists in pre-compressed concrete, between-axes 50, clay type A 20+4, with plaster on soffit	25,5 1,5+20+4,0	284	47,5
5	34	Lattice joists in pre-compressed concrete, between-axes 50, clay type B 16.5+4, with plaster on soffit	22,0 1,5+16,5+4,0	273	47,5
6	35	Lattice joists in pre-compressed concrete, between-axes 50, clay type B 20+4, with plaster on soffit	25,5 1,5+20+4,0	362	50,0
7	36	Floors with loose reinforcing panels, clay type B 16.5+4, with plaster on soffit	22,0 1,5+16,5+4,0	321	48,5
8	37	Floors with loose reinforcing panels, clay type B 20+4, with plaster on soffit	25,5 1,5+20+4,0	369	52,5
9	40	Slabs in pre-compressed concrete, between-axis 120, clay type B	24,0 4,0+4,0+12+4,0	419	51,5
10	41	Slabs in pre-compressed concrete, between-axis 120, clay type B	28,5 4,0+4,0+16,5+4,0	458	53,5
11	38	Slabs in pre-compressed concrete, between-axis 120, and polystyrene	24,0 4,0+16+4,0	261	50,5
12	39	Slabs in pre-compressed concrete, between-axis 120, and polystyrene	28,5 4,0+20,5+4,0	296	53,5

Wall code	**SINGLE-LAYER WALLS** Description of materials used	Thickness (cm) Sup. weight (kg/m²)	R_w (dB) evaluation index
A03 Single-layer	Wall built with jointed blocks, paste lightened, with 3 vertical holes (18×50×20cm), with holes filled with mortar, plaster on both sides (plaster thickness 1.5 cm)	21,0 360	R_w = 54 C = -1 Ctr = -4
A04 Single-layer	Wall built with "H" blocks, paste lightened, (25×30×19cm), plaster on both sides (plaster thickness 1.5 cm)	28,0 300	R_w = 52 C = -1 Ctr = -3
A05 Single-layer	Wall built with "H" blocks, paste lightened, with mortar-filled holes (25×30×19cm), plaster on both sides (plaster thickness 1.5 cm)	28,0 340	R_w = 53 C = -1 Ctr = -4
A06 Single-layer	Wall built with "H" blocks, paste lightened, with mortar-filled holes (30×25×17cm), plaster on both sides (plaster thickness 1.5 cm)	33,0 390	R_w = 56 C = 0 Ctr = -3
A07 Single-layer	Wall built with jointed semi-solid blocks, paste lightened, (35×25×24.5cm), plaster on both sides (plaster thickness 1.5 cm)	38,0 380	R_w = 48 C = -1 Ctr = -2
A08 Single-layer	Wall built with jointed semi-solid blocks, paste lightened, (38×25×24.5cm), plaster on both sides (plaster thickness 1.5 cm)	41,0 420	R_w = 49 C = -1 Ctr = -2
A09 Single-layer	Wall built with jointed blocks, paste lightened, (42×25×24.5cm), plaster on both sides (plaster thickness 1.5 cm)	45,0 470	R_w = 50 C = -1 Ctr = -2

Wall code	**MULTI-LAYER AND EXPERIMENTAL WALLS** Description of materials used	Thickness (cm) Sup. weight (kg/m²)	R_w (dB) evaluation index
B01 Multi-layer	Wall built with boarding of normal partitions with 10 holes 8×25×25 cm and plaster (1.5 cm) on external side; 10 cm interspace filled with 5 cm rock wool (50 kg/m³) laid on the boarding; boarding of normal partitions with 10 holes (8×25×25 cm) and plaster on external side	29,0 190	R_w = 50 C = -1 Ctr = -4
B02 Multi-layer	Wall built with boarding of normal partitions with 15 holes 12×25×25 cm and plaster (1.5 cm) on external side; 6 cm interspace filled with 5 cm rock wool (50 kg/m³); boarding of half-flat jointed paste-lightened partitions (8×50×24.5 cm) and plaster (1.5 cm) on external side	29,0 300	R_w = 53 C = 0 Ctr = -3
B03 Multi-layer	Wall built with boarding of normal partitions with 10 holes 8×25×25 cm and plaster (1.5 cm) on external side; 12 cm interspace; boarding of half-flat jointed paste-lightened partitions (8×50×24.5 cm) and plaster (1.5 cm) on external side	31,0 260	R_w = 53 C = 0 Ctr = -4
B04 Multi-layer	Wall built with boarding of normal partitions with 15 holes 12×25×25 cm and plaster (1.5 cm) on external side; 6cm interspace filled with 5 cm rock wool (50 kg/m³); boarding of normal partitions (12×25×25 cm) and plaster (1.5 cm) on external side	33,0 250	R_w = 49 C = -1 Ctr = -5
C02 Experimental	Wall built with boarding of normal partitions with 10 holes 8×50×25 cm and plaster (1.5 cm) on external side; 2 cm interspace filled with compressed polyester fibre (original thickness 2.5 cm, weight 0.2 kg/m²); boarding in 4-hole hollow tiles (6×80×25 cm) and plaster on external side.	19,0 160	R_w = 46 C = -1 Ctr = -5
C03 Experimental	Wall built with "T" blocks 17×33×24.5 cm, paste-lightened, with vertical cuts, installed staggered, plastered (1.5 cm) on external side; 3 cm interspace; boarding in simple jointed paste-lightened partitions (8×50×24.5 cm) and plaster on external side.	31,0 320	R_w = 52 C = -1 Ctr = -4
C04 Experimental	Wall built with "T" blocks 17×33×24.5 cm, paste-lightened, installed staggered, plastered (1.5 cm) on external side; 3 cm interspace; boarding in semi-solid jointed paste-lightened partitions (8×50×24.5 cm) and plaster on external side.	31,0 320	R_w = 54 C = -1 Ctr = -4

THE PRODUCT RANGE

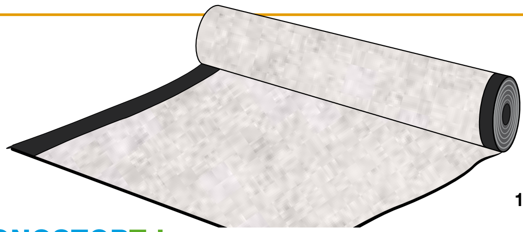
ACOUSTIC INSULATION PRODUCTS AGAINST FOOT TRAFFIC NOISE FOR FLOORS



Size
1,05 × 10 m

FONOSTOPDuo

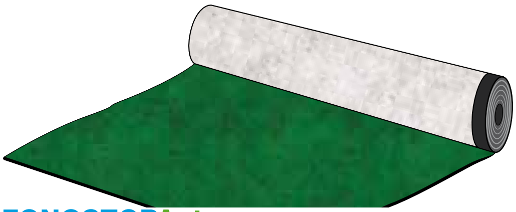
Double-layer, highly efficient acoustic insulation against foot traffic noise, made up of a waterproofing and airtight phono-resistant foil, lined with a film of polypropylene fibres, coupled to a non-woven fabric in phono-resilient polyester with “Velcro effect” for the acoustic insulation of indoor and outdoor floors with floating flooring.



Size
1,05 × 8 m

FONOSTOPTrio

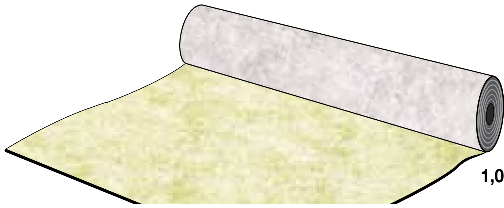
Triple-layer acoustic insulation against foot traffic noise made of a phono-resistant foil, combined on both faces with a non woven fabric in phono-resilient polyester for higher acoustic insulation of floating floors.



Size
1,05 × 10 m

FONOSTOPAct

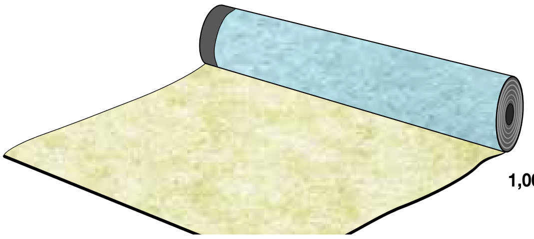
Double-layer, “strong grip” acoustic insulation against foot traffic noise with high resilience, made up of a waterproofing and airtight phono-resistant foil, coupled to a non-woven polyester fabric with elastic needling for the acoustic insulation of indoor and outdoor floors with floating flooring.



Size
1,00 × 15 m

FONOSTOPBar

Multi-functional and waterproofing double-layer acoustic insulation against foot traffic noise with high resilience and strong resistance to punching, made up of non-woven polyester fabric with elastic needling, coupled to a non-woven thermally sealed fabric resistant to site traffic noise, for the acoustic insulation of indoor and outdoor floors with floating flooring. It also protects and separates the waterproof coat of terraces



Size
1,00 × 15 m

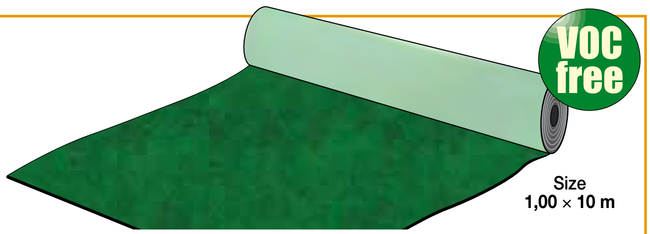
FONOSTOPStrato

Multi-functional and waterproofing double-layer acoustic insulation against foot traffic noise with strong resistance to punching, made up of non-woven polyester fabric, with elastic needling, coupled to a non-woven thermally sealed fabric resistant to site traffic noise, for the acoustic insulation of indoor and outdoor floors with floating flooring. It also protects and separates the waterproof coat of terraces.

Size
1,50 × 100 m

FONOSTOPCell

Acoustic insulation against foot traffic noise for the acoustic insulation of indoor and outdoor floors with floating flooring, made up of an extruded foam polyethylene foil, with closed cells, waterproofing and water-resistant.



Size
1,00 × 10 m

FONOSTOPLegno

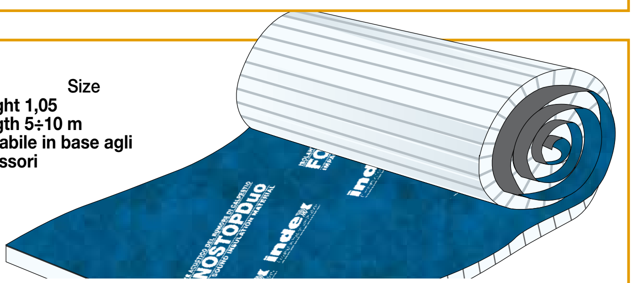
Double-layer acoustic insulation against foot traffic noise, waterproofing and vapour-tight, made up of a phono-resistant foil, coupled to a phono-resilient high density non-woven fabric in polyester, resistant to compression, for the acoustic insulation of jointed wooden floating floors.

Size
1,05 × 10 m

FONOSTOPAlu

Double-layer highly resilient acoustic insulation against foot traffic noise, lined with aluminium foil, for insulating slabs with underfloor heating.

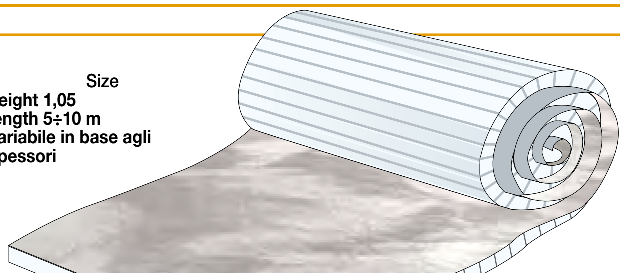
Size
height 1,05
length 5÷10 m
variabile in base agli spessori



FONOSTOPThermo

Thermal insulation coupled with highly resilient acoustic insulation against foot traffic noise, supplied in rolls for insulating intermediary floor slabs.

Size
height 1,05
length 5÷10 m
variabile in base agli spessori



FONOSTOPThermoAlu

Thermal insulation coupled with highly resilient acoustic insulation against foot traffic noise, lined with aluminium foil, supplied in rolls, for insulating slabs with underfloor heating.

The images of the products illustrated in the Guide are to scale.

THE PRODUCT RANGE

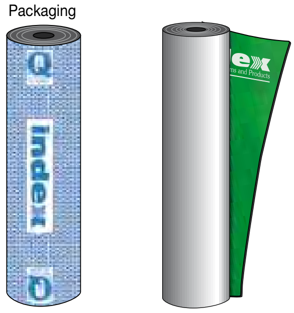
ACOUSTIC INSULATION PRODUCTS AGAINST AIRBORNE NOISE

Size
0,60 × 11,5 m - 0,60 × 8,5 m
1,20 × 11,5 m - 1,20 × 8,5 m

TOPSILENTBitex

Acoustic insulation made up of a high density soundproof foil with very high critical frequency for the acoustic airtight plastering of air spaces in brick walls and for the acoustic improvement of plasterboard walls, with both faces lined with a polypropylene textile finish

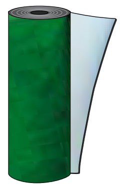
Packaging



Size
1,00 × 8,5 m

TOPSILENTAdhesiv

Acoustic insulation made up of a high density, self-adhesive, soundproof foil with very high critical frequency for the acoustic airtight plastering of air spaces in brick walls, for the acoustic improvement of plasterboard walls and the anti-vibration lining of metal sheets. The self-adhesive face is protected by a silicone-coated polyethylene film and the other is lined with a polypropylene textile finish.



Size
0,60 × 8,5 m

TOPSILENTDuo

Acoustic insulation made up of a high density, soundproof foil with very high critical frequency for the acoustic airtight plastering of air spaces in brick walls, for the acoustic improvement of plasterboard walls and the insulation of roller shutter boxes. One face is coupled with thick non-woven polyester insulating felt and the other is lined with a polypropylene textile finish.

Size
1,00 × 2,85 m

Size
1,00 × 1,42 m

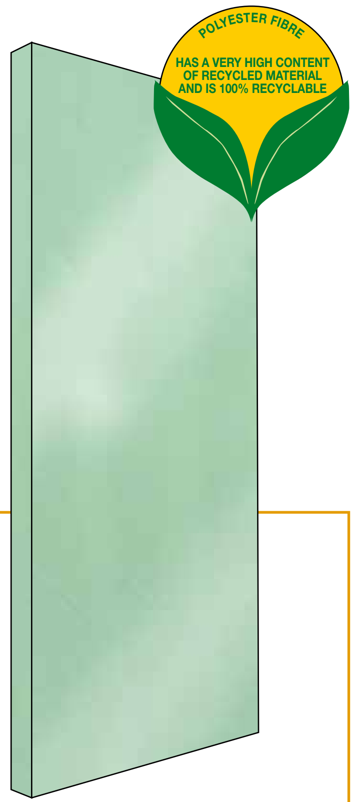
TOPSILENTEco

Self-bearing thermal-acoustic insulation panels with polyester fibre base, non-toxic, heat-sealed, free from glues, pre-coupled with a high density soundproof foil, air and vapour tight, for insulating traditional double walls

Size
0,60 × 1,00 m

TOPSILENTRock

Self-bearing thermal-acoustic insulation panels with rock wool base, pre-coupled with a high density soundproof foil, air and vapour tight, for insulating air spaces in traditional double walls and walls and false-walls in plasterboard on metal framework.
The product can be supplied with or without polyethylene packaging



Size
1,00 × 2,85 m

SILENTEcoEster

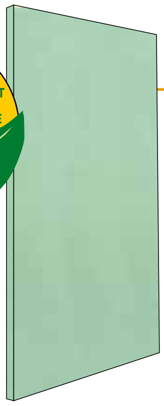
Self-bearing thermal-acoustic insulation panels with polyester fibre base, non-toxic, heat-sealed, free from adhesives, pre-coupled with a high density soundproofing foil, airtight and resistant to vapour, for insulating double brick walls.

The images of the products illustrated in the Guide are to scale.

THE PRODUCT RANGE

ACOUSTIC INSULATION PRODUCTS AGAINST AIRBORNE NOISE

POLYESTER FIBRE
HAS A VERY HIGH CONTENT OF RECYCLED MATERIAL AND IS 100% RECYCLABLE



Size
0,60 × 1,42 m

SILENTEco
Self-bearing thermal-acoustic insulation panels with polyester fibre base, non-toxic, heat-sealed and free from glues. Used to fill-in and reduce resonance in the air space of double brick walls or of false-walls and false-ceilings in plasterboard on metal framework

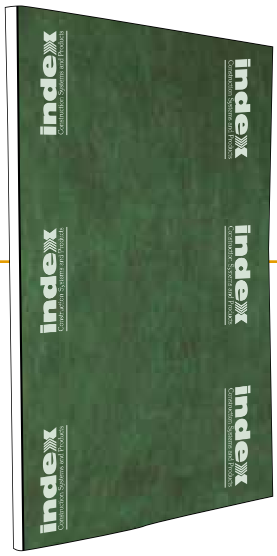
Size
0,60 × 1,00 m

SILENTRock
Self-bearing thermal-acoustic rock wool insulation panels for insulating air spaces in traditional double walls and walls and false-walls in plasterboard on metal framework

GLASS WOOL
HAS A VERY HIGH CONTENT OF RECYCLED MATERIAL AND IS 100% RECYCLABLE

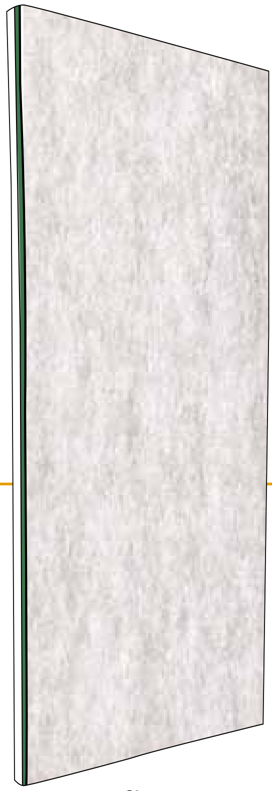
Size
0,60 × 1,35 m

SILENTGlassEco
Semi-rigid thermal-acoustic insulation panels with glass wool base produced with an innovative resinous binder of vegetable origin, odourless, free from phenols, formaldehydes and colorants, for thermally insulating and reducing the resonance in the air spaces of double brick walls and of false-walls and false-ceilings in plasterboard.



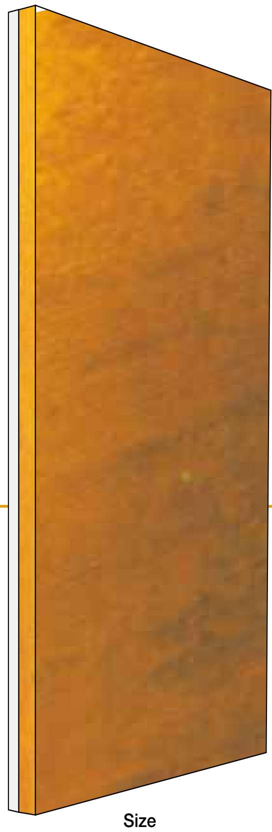
Size
1,20 × 2,00 m

TOPSILENTGips
Thermal-acoustic insulation made up of plasterboard panels for higher grade soundproofing walls and false-ceilings, pre-coupled with the TOPSILENTBitex foil with high density and very high critical frequency



Size
1,20 × 2,80 m

TOPSILENTDuogips
Thermal-acoustic insulation made up of plasterboard panels for higher grade soundproofing walls and false-ceilings, pre-coupled with the TOPSILENTDuo foil with high density and very high critical frequency



Size
1,20 × 3,00 m

SILENTGips
Thermal-acoustic insulation made up of plasterboard panels, pre-coupled with glass wool, for the insulation false-walls of internal diving walls

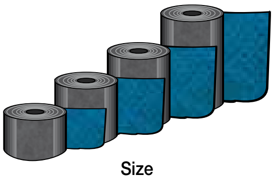
Size
1,20 × 3,00 m

SILENTGipsalu
Thermal-acoustic insulation made up of plasterboard panels, pre-coupled with glass wool with vapour barrier in aluminium foil for the insulation false-walls of external perimeter walls

The images of the products illustrated in the Guide are to scale.

THE PRODUCT RANGE

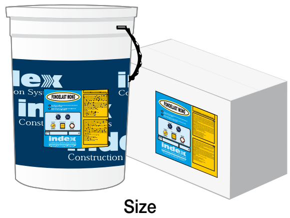
COMPLIMENTARY PRODUCTS AND ACCESSORIES



Size
0,14 × 10,0 m
0,20 × 10,0 m
0,25 × 10,0 m
0,33 × 10,0 m

FONOSTRIP

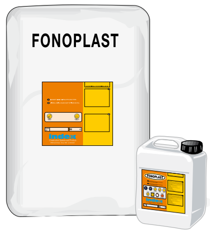
Elastomeric sound-damping strip lined on both sides with a film of 4-mm thick polypropylene fibres which, laid under the dividing walls, prevents the transmission of impact and vibration on the floor slab



Size
Pail 20 kg
Bag 1 kg (20 bag in a box)

FONOELAST MONO

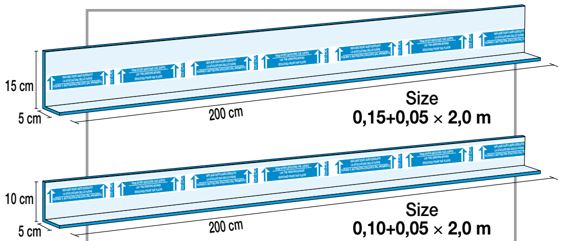
Ready-to-use one-component elastomeric vibration damping sealing paste



Size
Sack 20 kg + Can 6,5 kg

FONOPLAST

Elastic, two-component, vibration-damping, highly adhesive cement mortar used to separate walls

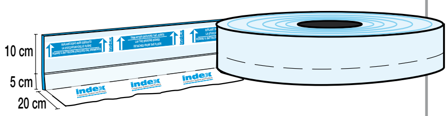


Size
0,15+0,05 × 2,0 m

Size
0,10+0,05 × 2,0 m

FONOCELL

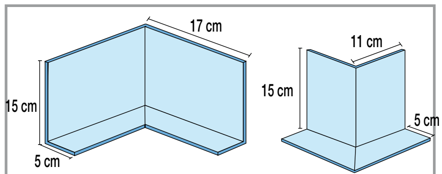
Pre-shaped angular separation strip in self-adhesive expanded polyethylene for connection to the insulation material against horizontal foot traffic, to provide perimetric insulation of the floating screed, from walls, from the parts emerging from the floor, thus avoiding any possible acoustic bridges due to screed contact points.



Size
0,15 × 50,0 m

FONOCELL ROLL

Pre-cut separation strip in self-adhesive expanded polyethylene coupled with strip in polyethylene joining with the horizontal insulation against foot traffic to insulate the perimeter of the floating screed, also for heated floors, from walls and parts rising up from the floor to prevent acoustic bridges due to screed contact points



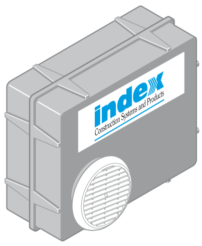
Size
height 15 cm

FONOCELL ANGLE

Pre-cut and pre-welded internal and external angle made of self-adhesive expanded polyethylene joining with the horizontal insulation against foot traffic to insulate the perimeter of the floating screed, from walls and parts rising up from the floor to prevent acoustic bridges due to screed contact points.
Internal version and external angle.

FONOPROTEX CYLINDER

Compact silenced air in-take for ventilation holes of kitchens with high acoustic insulation index.



FONOPROTEX

Silenced air in-take for ventilation holes of kitchens with high acoustic insulation index.

Size
20 kg

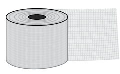
GIPSCOLL

Gypsum based glue for counter-cladding walls with SILENTGips, SILENTGipsalu and TOPSILENTDuogips.
Application of fibre insulation panels in interspaces of masonry double-walls: TOPSILENTEco or SILENTEco, SILENTGlass e SILENTRock.

Size
5 kg - 20 kg

FONOCOLL

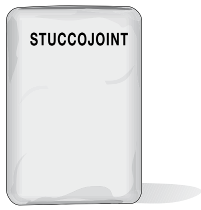
Water-based adhesive for binding TOPSILENTBitex and TOPSILENTDuo on wood or plasterboard panels.



Size
0,05 × 90,0 m

NASTROGIPS

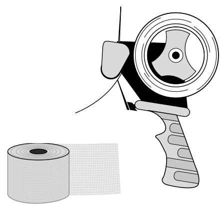
Tape for sealing SILENTGips, SILENTGipsalu, TOPSILENTDuogips and TOPSILENTGips sheets. The tape is 5 cm high.



Size
20 kg

STUCCOJOINT

Putty for finishing the joint between SILENTGips, SILENTGipsalu, TOPSILENTDuogips and TOPSILENTGips sheets.



Size
0,05 × 25,0 m

SIGILTAPE and DISPENSER

Super-adhesive fabric-lined tape for sealing overlaps and approach lines of FONOSTOPDuo, FONOSTOPAct, FONOSTOPBar, FONOSTROPStrato, FONOSTOPCell, FONOSTOPLegno and FONOCELL.

ACOUSTIC INSULATION AGAINST FOOT-TRAFFIC NOISE

PRODUCTS	FIELDS OF USE: Floating screed	FIELDS OF USE: Wooden deck	FIELDS OF USE: Floating pavements	TECHNICAL CHARACTERISTICS: Thickness	Apparent dynamic rigidity s' (UNI 29052-1)	Dynamic rigidity s' [*] (UNI 29052-1)	Aeric mass	Thickness reduction under load (200 kg/m²) (EN 1606)	Compression class (UNI EN 12431)	Reduction of foot traffic noise level (100 kg/m² screed) [**] (EN ISO 12354-2)	Fire reaction class	Thermal conductivity coefficient λ	Aqueous vapour diffusion coeff. μ
FONOSTOPDuo	x		provided a distribution of loadings	7,5 mm ca.	4 MN/m³	21,0 MN/m³	1,6 kg/m²	≤1 mm	CP2	28 dB	1	Foil 0,17 W/mK Polyester 0,045 W/mK	μ 100.000
FONOSTOPDuo+FONOSTOPDuo	x	x		15 mm ca.	2 MN/m³	11,0 MN/m³	3,2 kg/m²	≤1 mm	CP3	32 dB	1		
FONOSTOPTrio	x	x		11 mm ca.		14,0 MN/m³	2,2 kg/m²			30 dB		Foil 0,17 W/mK Polyester 0,045 W/mK	μ 100.000
FONOSTOPTrio+FONOSTOPDuo	x	x		18,5 mm ca.	2 MN/m³	9,0 MN/m³	3,8 kg/m²	≤1 mm		33,5 dB			
FONOSTOPAct	x		provided a distribution of loadings	7,5 mm ca.	7 MN/m³	27,0 MN/m³	1,5 kg/m²	≤1 mm	CP2	26 dB		Foil 0,17 W/mK Polyester 0,045 W/mK	μ 50.000
FONOSTOPAct+FONOSTOPAct	x	x		15 mm ca.	4 MN/m³	14,5 MN/m³	3,0 kg/m²	≤1 mm	CP3	30 dB			
FONOSTOPBar	x		provided a distribution of loadings	4,5 mm ca.	9 MN/m³	29,0 MN/m³	1,0 kg/m²	≤1 mm	CP2	26 dB		Foil 0,17 W/mK Polyester 0,045 W/mK	μ 8.000
FONOSTOPBar+FONOSTOPBar	x	x		13 mm ca.	5 MN/m³	18,0 MN/m³	2,0 kg/m²	≤1 mm	CP3	29 dB			
FONOSTOPStrato	x		x	4 mm ca.	20 MN/m³	44,0 MN/m³	1,0 kg/m²			21 dB		Foil 0,17 W/mK Polyester 0,045 W/mK	μ 8.000
FONOSTOPCell	x		x	5 mm ca.	32 MN/m³	32,0 MN/m³	0,15 kg/m²			25,5 dB		0,044 W/mK	μ 2.000
FONOSTOPThermo	x	x		26 mm ca. 36 mm ca. 46 mm ca. 56 mm ca.	4 MN/m³	21,0 MN/m³		≤1 mm	CP2	28 dB		Foil 0,17 W/mK Polyester 0,045 W/mK EPS polystyrene 0,035 W/mK	μ 100.000
FONOSTOPAlu	x	x		6,5 mm ca.	4 MN/m³	21,0 MN/m³	1,1 kg/m²	≤1 mm	CP2	28 dB		Polyester 0,045 W/mK Aluminium foil 236 W/mK	μ 1.500.000
FONOSTOPThermoAlu	x	x		26 mm ca. 36 mm ca. 46 mm ca. 56 mm ca.	4 MN/m³	21,0 MN/m³		≤1 mm	CP2	28 dB		Polyester 0,045 W/mK Aluminium foil 236 W/mK EPS polystyrene 0,035 W/mK	μ 1.500.000
FONOSTOPLegno	x		x	5 mm ca.	43 MN/m³	72,0 MN/m³	1,8 kg/m²	0,2 mm			1 C_{fl}-s1 [***]	Foil 0,17 W/mK Polyester 0,045 W/mK	μ 100.000

Certificate: ISTITUTO GIORDANO. *Certificate:* LAPI. *Certificate:* ITC-CNR.
[*] *Useful values for calculation.* [**] *Calculated values.* [***] *Euroclass.*

ACOUSTIC INSULATION AGAINST AIRBORNE NOISE

PRODUCTS	FIELDS OF USE: Interspace of brick walls	Plasterboard false-wall Plasterboard false-ceilings: Bonded	Plasterboard false-wall Plasterboard false-ceilings: On metal frame	Plasterboard walls	TECHNICAL CHARACTERISTICS: Thickness	Dynamic rigidity s' [*] (UNI 29052-1)	Aeric mass	Thermal conductivity λ	Resistivity to air flow r	Aqueous vapour diffusion coefficient μ	Fire reaction class	Sound insulation power (ab. calculation) R_w	Specific heat
TOPSILENTBitex	x		x	x	3 mm 4 mm		4 kg/m² 5 kg/m²	0,17 W/mK		100.000 μ	1	27 dB 24 dB	1,7 KJ/kgK
TOPSILENTAdhesiv			x	x	4 mm		5 kg/m²	0,17 W/mK		100.000 μ		27 dB	1,7 KJ/kgK
TOPSILENTDuo	x		x	x	4 mm		5 kg/m²	0,17 W/mK		100.000 μ	1	27 dB	1,7 KJ/kgK
TOPSILENTEco	x	x	x	x	40 mm 50 mm 60 mm	30	3,3 kg/m² 3,5 kg/m² 3,7 kg/m²	0,17 0,037 W/mK 0,17 0,037 W/mK 0,17 0,037 W/mK		100.000 μ		[**]	1,7 1,2 KJ/kgK 1,7 1,2 KJ/kgK 1,7 1,2 KJ/kgK
TOPSILENTRock	x	x	x	x	40 mm 50 mm 60 mm		4,1 kg/m² 4,5 kg/m² 4,9 kg/m²	0,17 0,035 W/mK 0,17 0,035 W/mK 0,17 0,035 W/mK		100.000 μ	B-s1, d0 [*]	[**]	1,7 1,03 KJ/kgK 1,7 1,03 KJ/kgK 1,7 1,03 KJ/kgK
SILENTEco	x		x	x	40 mm 50 mm 60 mm	30	0,8 kg/m² 1,0 kg/m² 1,2 kg/m²	0,040 W/mK			1		1,2 KJ/kgK
SILENTRock	x		x	x	40 mm 50 mm 60 mm		1,6 kg/m² 2,0 kg/m² 2,4 kg/m²	0,035 W/mK	14,0		A1 [*]		1,03 KJ/kgK
SILENTGlass	x		x	x	40 mm 50 mm 60 mm		1,2 kg/m² 1,5 kg/m² 1,8 kg/m²	0,032 W/mK	10,1	1 μ	A1 [*]		0,85 KJ/kgK
TOPSILENTGips	x		x	x	16,5 mm		15 kg/m²	0,17 0,21 W/mK		100.000 μ		27 dB	1,7 0,837 KJ/kgK
TOPSILENTDuogips	x	x	x		21,5 mm	21	15 kg/m²	0,17 0,21 W/mK		100.000 μ		27 dB	1,7 0,837 KJ/kgK
SILENTGips	x	x	x		29,5 mm 39,5 mm 49,5 mm	2,2	11,4 kg/m² 12,2 kg/m² 13,0 kg/m²	0,364 0,21 W/mK 0,364 0,21 W/mK 0,364 0,21 W/mK		13 μ 8,4 μ 13 μ 8,4 μ 13 μ 8,4 μ			0,85 0,837 KJ/kgK 0,85 0,837 KJ/kgK 0,85 0,837 KJ/kgK
SILENTGipsalu	x (perimetral)	x (perimetral)	x (perimetral)		29,5 mm 39,5 mm	2,2	11,6 kg/m² 12,4 kg/m²	0,364 0,21 W/mK 0,364 0,21 W/mK		600.000 μ			0,85 0,837 KJ/kgK 0,85 0,837 KJ/kgK

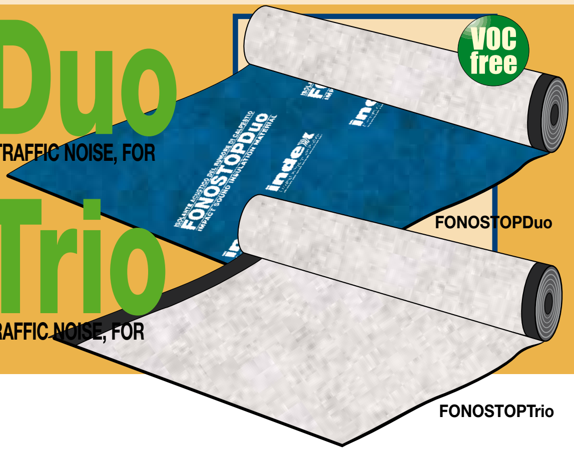
Certificate: ISTITUTO GIORDANO. *Certificate:* LAPI.
[*] Euroclass. [**] *To be calculated in accordance to the type of wall TR UNI 11175*

FONOSTOPDuo

DOUBLE LAYER HIGHLY RESILIENT ACOUSTIC INSULATION AGAINST FOOT TRAFFIC NOISE, FOR INDOOR AND OUTDOOR FLOOR SLABS WITH FLOATING FLOOR

FONOSTOPTrio

TRIPLE LAYER HIGHLY RESILIENT ACOUSTIC INSULATION AGAINST FOOT TRAFFIC NOISE, FOR INDOOR AND OUTDOOR FLOOR SLABS WITH FLOATING FLOOR



CHARACTERISTICS		IMPACT ON THE ENVIRONMENT		
ACOUSTIC INSULATION	FIRE REACTION	ECO GREEN	RECYCLABLE	NON-DANGEROUS WASTE

PROBLEM

The installation of resilient material between the floating screed, on which any type of flooring can be laid, and the load-bearing floor slab, reduces the spreading of impact noise or foot traffic noise (ΔL_w) and increases insulation against airborne noise (ΔR_w). It also represents the most flexible and effective insulation technique available.
DPCM dated 5th December 1997 (Premier's Decree) imposes different levels of insulation based on what the building is to be used for, hence the need to avail of modular insulating materials that enable the assembly of systems proportioned with the different levels of insulation imposed by the decree and also of superior insulation systems for absolute comfort. The levels of insulation against foot traffic noise determine the need to avail of insulating materials of maximum efficiency but that are thin enough to be compatible with the parameters usually foreseen in the plans of the building. Furthermore, seeing as the acoustic specifications are measured on site, such insulation materials must also be compatible with the real situation of the building site; they consequently must be resistant to the noise of men and equipment and they must not move while the floorings are laid.

SOLUTION

To resolve the above-mentioned problems, INDEX has created **FONOSTOPDuo** and **FONOSTOPTrio**, which alone or combined together, are able to satisfy any insulation requirements against foot traffic noise. **FONOSTOPDuo** and **FONOSTOPTrio** are designed for the building trade and are not made from recycled products nor do they derive from different fields of application.
FONOSTOPDuo is a thin yet highly effective acoustic insulation product against foot traffic noise, and represents the most efficient insulation method against foot traffic noise of the product range of INDEX. It is made up of a sound-resistant foil, coupled with a sound-resilient non-woven polyester fabric obtained with a special "elastic needling" procedure, being an exclusive INDEX project.

The sound-resistant foil is a seamless waterproof and airtight element, which optimises acoustic performance by filling-in pores that may occur in the building work, through which airborne noise would spread, consequently re-establishing continuity, being an appreciated feature especially in discontinuously laid floors.
The foil also stops the fresh cement grout, spread over the insulation material when creating the screed, from encapsulating the fibres of the non-woven fabric, which would consequently eliminate its elastic properties.
The non-woven fabric is an elastic separation layer between rigid elements, screed and floor slab, which reduces the transmission of vibrations caused by foot traffic on the paved floating screed and also vibrations of the screed induced by airborne noise deriving from various sound sources such as voices, radios, televisions, etc.
The fibrous nature of the non-woven fabric, even if very thin, represents another element that favours the insulating capacities of the material also against airborne noise that closed cell insulating materials do not offer. The fibres are not irritant, they are flexible and do not crumble when compressed or folded.
The special texture of the non-woven fabric determines the natural dry adherence of the fibres to the laying surfaces in cement of slightly rough surfaces on which they generally lie, similar to a "Velcro effect", which prevents the sheet from moving when subsequently laying the flooring. Even though **FONOSTOPDuo** is a relatively light product, once it is laid, it "sticks" to the foundations and does not move.
FONOSTOPDuo, is also resistant to static and dynamic punching, therefore it is resistant to both building site traffic during laying and to the perforating action of rough parts of irregular foundations under the load of the floating screed in the work phase.
The sound-resilient non-woven fabric acts as a spring in the physical "spring-mass" system model, in which a mass, being the floating screed, is loaded on a spring, being the sound-resilient fabric, resting on a rigid support, being the load-bearing floor slab.

The relatively low unit load of the floating screed (0.008÷0.012 kg/cm^2) means that materials commonly defined to be elastic, such as rubber sheeting, in the specific case, have excessive dynamic stiffness, making them inadequate to absorb vibrations generated by foot traffic on the screeds whereas, within specifically defined limits of non-excessive compressibility, softer materials such as **FONOSTOPDuo** have the just dynamic stiffness which, proportioned with the low unit load of the screed, determine excellent insulation.
FONOSTOPDuo has the best level of dynamic stiffness of the series of acoustic insulation against foot traffic noise produced by INDEX. **FONOSTOPDuo** is produced in rolls of 1,05×10 meters.
The sound-resistant foil of the top face, which is lined with a light-blue non-woven polypropylene textile finish, is 5 cm longer than the white non-woven sound-resilient fabric of the bottom face; this is done to create an overlap wing, which protects the side joining line of the sheets against the intrusion of cement mortar of the screed, which would otherwise create an acoustic bridge once it sets hard.
FONOSTOPTrio is a triple layer insulation product made up of the same elements as **FONOSTOPDuo** but in this case, the sound-resistant foil is also lined on the top face with the same non-woven fabric that lines the bottom face.
FONOSTOPTrio completes the performance of the insulation product from which it derives because when it is combined with **FONOSTOPDuo**, it obtains an even higher dynamic stiffness of the system to be able to satisfy the insulation requirements of light floor slabs or for particular requirements that are higher than legal limits.
FONOSTOPTrio is produced in rolls of 1,05×8 meters. To obtain the seamless effect of the non-woven fabric after laying, it has two 5 cm overlap wings set opposite each other on both faces of the sheet.
INDEX has designed and certificated three insulation systems based on the combined use of **FONOSTOPDuo** and **FONOSTOPTrio**, which resolve insulation problems of the most common types of floor slabs.

2ª DIVISIONE 2ª LINEA   5ª DIVISIONE 2ª LINEA

index Construction Systems and Products

MODULAR ACOUSTIC INSULATION AGAINST FOOT TRAFFIC NOISE

The table that follows indicates the foot traffic noise levels L'_{nw} and the increase in soundproofing power ΔR_w for a floor slab of 20+4 in clay-cement mix of 237 kg/m², with 7 cm of lightened foundation with a density of 800 kg/m³ that starts from a level of foot traffic noise of $L_{nw,eq}$=77,66 dB and soundproofing power of R_w=48,74 dB (screed included) insulated with floating screed of 5 cm (d:2000Kg/m³) on the three afore-mentioned systems, which can be calculated with the simplified calculation method foreseen in standard EN 12354-2.

	System	Laboratory characteristics		Performances according to EN 12354-2		
		Certificate I.T.C. n.	Dynamic stiffness	ΔL_w	$L_{n,w}$ insulated floor (K=3 dB)	ΔR_w
A	FONOSTOPDuo	3402/RP/01	21 MN/m³	28 dB	53 dB	7,63 dB
B	FONOSTOPDuo+FONOSTOPDuo	3403/RP/01	11 MN/m³	32 dB	48 dB	10,63 dB
C	FONOSTOPTrio+FONOSTOPDuo	3404/RP/01	9 MN/m³	33,5 dB	47 dB	10,63 dB

METHOD OF USE AND PRECAUTIONS

SYSTEM A. The rolls of **FONOSTOPDuo** are to be unrolled in their natural unrolling direction with the top light-blue face facing upwards and are to be overlapped at the sides by arranging the overlap wing on the adjacent sheet and carefully matching-up the non-woven fabric of the faces underneath.
On the short side, the sheets are not overlapped but carefully brought together end-to-end. The sheets will cover the whole floor slab and are to be blocked and trimmed-off at the foot of the perimeter walls of the room to be insulated. All the longitudinal overlapping lines and the transversal joining lines of the sheets are then to be carefully sealed with the special adhesive SIGILTAPE, stuck over the same.
To insulate the floating screed from perimeter walls, the latter are to be lined with 10 cm of the extruded polyethylene separation self-adhesive **FONOCELL** strip, to limit the thickness of the screed, which will be turned over by 5 cm and glued on the insulation material laid on the floor slab where it will be further secured with adhesive SIGILTAPE.
Note. Make sure you lay FONOCELL on terraces only after the waterproof coat has been protected by a layer of plaster mortar reinforced with a metal net and make sure to seal the gap between the flooring and the skirting board with a flexible sealant.

SYSTEM B. If you are installing **FONOSTOPDuo** in a double layer, the first layer will be laid on site in the opposite direction to the natural unrolling direction of the roll, with the top light-blue face facing the floor slab and the white face facing upwards. Overlap the sheets lengthwise along the overlap strip and bring the ends of the sheets together without overlapping them; the sheets of the first layer will cover the whole floor slab and are to be blocked and trimmed-off at the foot of the perimeter walls of the room to be insulated but not sealed.
The second layer will then be unrolled parallel with the first layer, in its natural unrolling direction, with the top light-blue face facing upwards, making sure to offset it to lay it over the joining lines of the first layer
The laying and sealing methods of the second sheet will be those already explained for system A laid in a single layer.

SYSTEM C. In the system made up of **FONOSTOPTrio + FONOSTOPDuo**, the first layer to be laid will be the **TRIO** type. The rolls will be unrolled on the laying surface, overlapping them lengthwise along the dedicated overlap strips while the ends of the sheets will be brought together without overlapping them.
The sheets of the first layer will cover the whole floor slab and are to be blocked and trimmed-off at the foot of the perimeter walls of the room to be insulated but not sealed.
The second layer, made up of the **DUO** type, will be unrolled parallel with the first layer, in its natural unrolling direction, with the top light-blue face facing upwards, making sure to offset it to lay it over the joining lines of the first layer
The laying and sealing methods of the second sheet will be those already explained for system A laid in a single layer.

SYSTEM A
FONOSTOPDuo

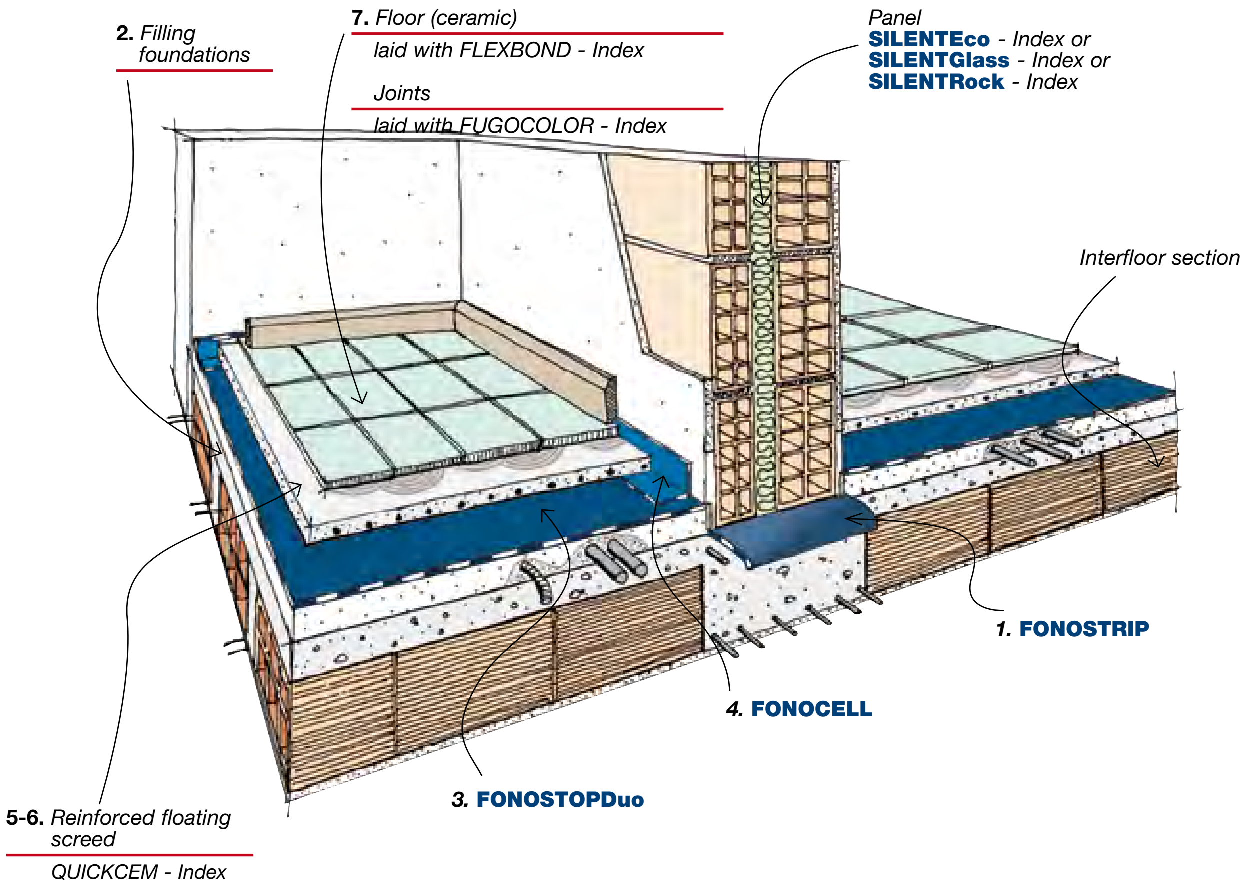
SYSTEM B
FONOSTOPDuo+FONOSTOPDuo

SYSTEM C
FONOSTOPTrio+FONOSTOPDuo

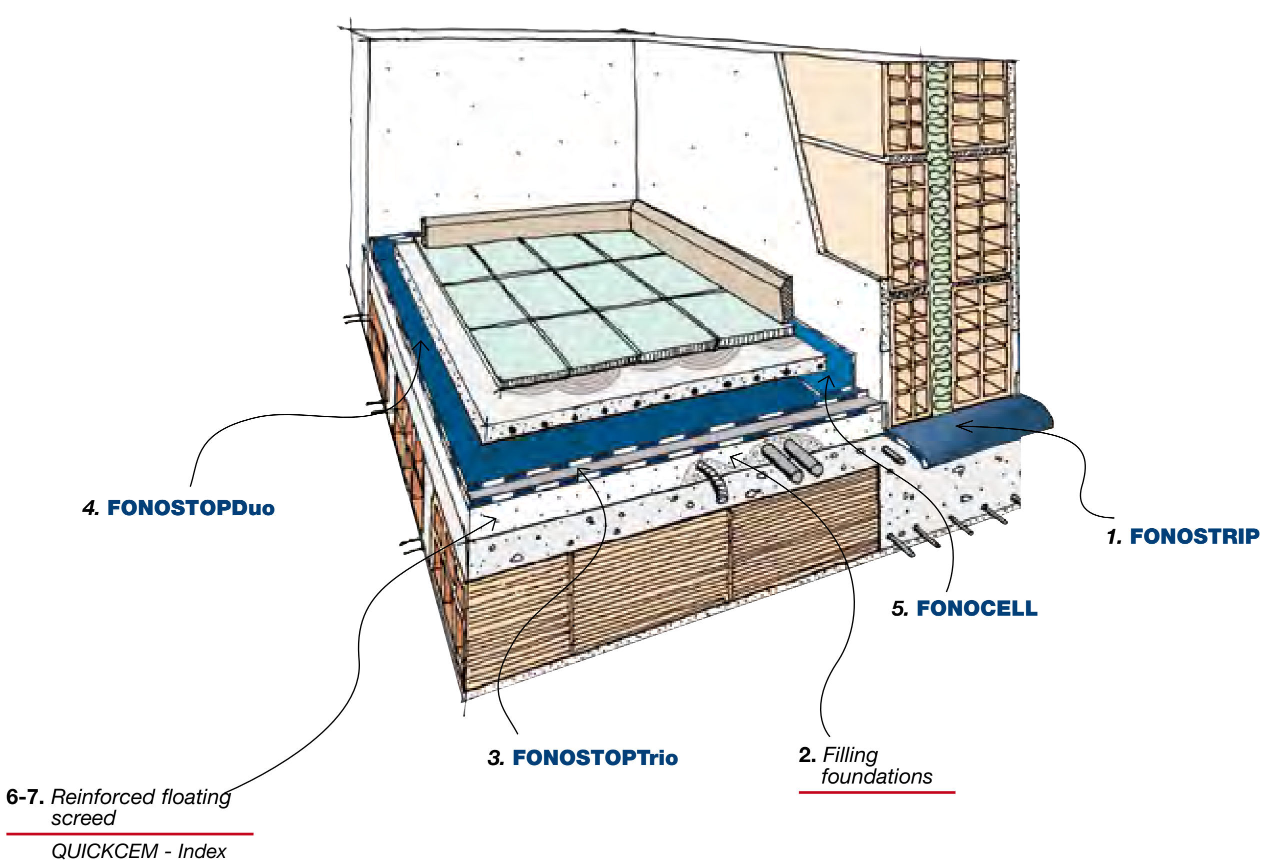
INDEX has customised the top surface finish of FONOSTOPDuo, by printing some important laying instructions on it in order to help the builder when preparing the floating screed to insulate against foot traffic noise.

TECHNICAL INTERVENTION SOLUTIONS

ACOUSTIC INSULATION FOR FLOORS AGAINST FOOT-TRAFFIC NOISE



HIGH PERFORMANCE ACOUSTIC INSULATION FOR FLOORS AGAINST FOOT-TRAFFIC NOISE FONOSTOPTrio + FONOSTOPDuo



	FONOSTOPDuo	FONOSTOPTrio
Thickness	7,5 mm approx	11 mm approx
Roll size	1,05×10,0 m	1,05×8,0 m
Width • phonoresilient foil • Non-woven fabric • edge	 1,05 m 1,00 m 0,05 m	 1,05 m 1,00 m 0,05 m (double)
Mass per unit area	1,6 kg/m²	3,0 kg/m²
Impermeability	Waterproof	–
Aqueous vapour diffusion coefficient (phonoresilient foil)	μ 100.000	μ 100.000
Thermal conductivity λ	0,039 W/mK (8)	0,039 W/mK (8)
Heat capacity per unit area (7)	1,620 KJ/m²K	2,840 KJ/m²K
Thermal resistance **R**	0,135 m² K/W (8)	0,230 m² K/W (8)
Acoustic insln.against foot-traffic noise (ISO717/82, UNI8270/7)		
ISO evaluation index at 500 Hz • bare floor (thickness: 240 mm) • floor with "floating flooring" Improvement as a difference between the two indices (6)	 I_i:74.0 dB I_i:40.5 dB ΔI_i:33.5 dB	 – – –
Dynamic stiffness (ITC certificate conforming to UNIEN29052 p. 1st) load 200 kg/m² • FONOSTOPDuo single layer • FONOSTOPDuo double layer (4) • FONOSTOPTrio single layer • FONOSTOPTrio+FONOSTOPDuo	Apparent dynamic stiffness: s'_t = 4 MN/m³; s'_t = 2 MN/m³ Dynamic stiffness: s' = 21 MN/m³ (1); s' = 11 MN/m³ (2)	Apparent dynamic stiffness: s'_t = 2 MN/m³ (FONOSTOPTrio+FONOSTOPDuo) Dynamic stiffness: s' = 14 MN/m³ (FONOSTOPTrio single layer); s' = 9 MN/m³ (3) (FONOSTOPTrio+FONOSTOPDuo)
Compression tests under constant load of 200 kg/m² (EN 1606) • FONOSTOPDuo single layer • FONOSTOPDuo double layer (4) • FONOSTOPTrio+FONOSTOPDuo	Reduction of thickness ≤1 mm ≤1 mm –	Reduction of thickness ≤1 mm
Compression capability (EN 12431:2000 - Determination of thickness) • FONOSTOPDuo single layer • FONOSTOPDuo double layer (4)	 ≤2 mm ≤3 mm	 – –
Volatile Organic Compound (VOC) emissions (EN ISO 16000-9) • after 48 hours • after 28 days	 << minimal value required by prEN 12052 (9) << minimal value required by prEN 12052 (9)	 – –
Fire reaction class	**Class 1** (5)	–
Certifications	ITC, CSI, Istituto Giordano, CATAS	ITC

(1) Certificate ITC-CNR n. 3402/RP/01. (2) Certificate ITC-CNR n. 3403/RP/01. (3) Certificate ITC-CNR n. 3404/RP/01. (4) FONOSTOPDuo laid in double layer with opposing white faces.
(5) Approval of the Ministry of Interior No. VR2172B41C100002. - (6) Certificate CSI n. ME06/060/98. (7) Apparent value obtained by calculating values of every component expressed per unit area of whole product (m²)
(8) Value established on the material subjected to a load of 1 KPa (100 kg/m²).- (9) Certificate "CATAS" - Research and development centre and test laboratory for the wood-furnishing industry n. 109570/1.
WARNING: only the dynamic stiffness values **s'**, ringed in red, are values useful for an estimate calculation conforming to standard EN 12354-2.

THEORETICAL ESTIMATE OF THE REDUCTION LEVEL IN FOOT TRAFFIC NOISE

Example of simplified calculation method
TR UNI 11175 - (Guide to the Standards of UNI EN 12354 series for predicting the acoustic performance of buildings) for
FLOOR SLAB of 20+4 IN CLAY-CEMENT MIX OF 300 kg/m²
LIGHTENED FOUNDATION WITH DENSITY OF 300 kg/m³
thickness 10 cm
Total mass per unit area **m'**=330 kg/m²
$L_{n,w,eq}$ = 164 - 35 log m = 76 dB
SCREEDS WITH SURFACE DENSITY **m'**=100 kg/m²
Calculation of the **fo** resonance frequency of the floating screed system, resilient layer:

FONOSTOPDuo single-layer

$$fo = 160 \sqrt{\frac{s'}{m'}} = 73 \text{ Hz}$$

$$\Delta L_w = 30 \text{ Log } \left(\frac{f}{fo}\right) + 3 = \mathbf{28\ dB}$$

where **f** = 500 Hz (of reference)

$$L_{n,w} = L_{n,w,eq} - \Delta L_w + K$$

where **K** = 3

$$L_{n,w} = \mathbf{51\ dB}$$

FONOSTOPDuo double-layer

$$fo = 160 \sqrt{\frac{s'}{m'}} = 53 \text{ Hz}$$

$$\Delta L_w = 30 \text{ Log } \left(\frac{f}{fo}\right) + 3 = \mathbf{32\ dB}$$

where **f** = 500 Hz (of reference)

$$L_{n,w} = L_{n,w,eq} - \Delta L_w + K$$

where **K** = 3

$$L_{n,w} = \mathbf{47\ dB}$$

FONOSTOPDuo+FONOSTOPTrio

$$fo = 160 \sqrt{\frac{s'}{m'}} = 48 \text{ Hz}$$

$$\Delta L_w = 30 \text{ Log } \left(\frac{f}{fo}\right) + 3 = \mathbf{33{,}5\ dB}$$

where **f** = 500 Hz (of reference)

$$L_{n,w} = L_{n,w,eq} - \Delta L_w + K$$

where **K** = 3

$$L_{n,w} = \mathbf{45{,}5\ dB}$$

ANIT Associated

The data in this publication is the result of laboratory tests or observations on site and this does not guarantee the repeatability of the results in equivalent systems.

• FOR ANY FURTHER INFORMATION OR ADVICE ON PARTICULAR APPLICATIONS, CONTACT OUR TECHNICAL OFFICE • IN ORDER TO CORRECTLY USE OUR PRODUCTS, REFER TO INDEX TECHNICAL SPECIFICATIONS •

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TOTAL QUALITY index UNI EN ISO 9001 — Environmental Management Systems index UNI EN ISO 14001 — index "GBC Italia" Associated — lavorosicuro

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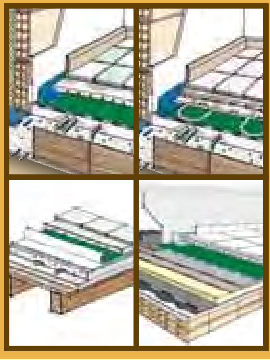
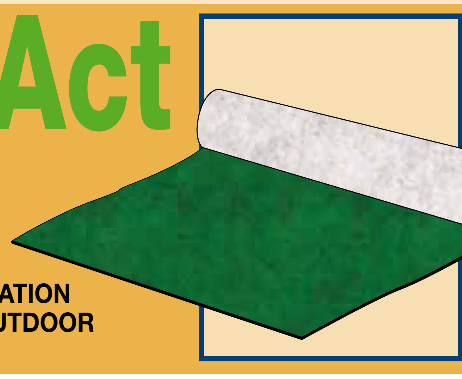
The figures shown are average indicative figures relevant to current production and may be changed or updated by INDEX S.p.A at any time without previous warning. The advice and technical information provided, is what results from our best knowledge regarding the properties and the use of the product.



FONOSTOPAct



DOUBLE LAYER HIGHLY RESILIENT ACOUSTIC INSULATION AGAINST FOOT TRAFFIC NOISE FOR INDOOR AND OUTDOOR FLOOR SLABS WITH FLOATING FLOOR

CHARACTERISTICS	IMPACT ON THE ENVIRONMENT		
ACOUSTIC INSULATION	ECO GREEN	RECYCLABLE	NON-DANGEROUS WASTE

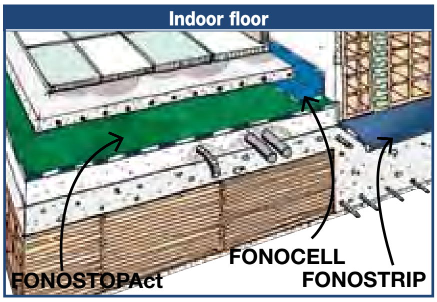
PROBLEM

The installation of resilient material between the floating screed, on which any type of flooring can be laid, and the load-bearing floor slab, reduces the spreading of impact noise or foot traffic noise (ΔLw) and increases insulation against airborne noise (ΔRw). It also represents the most flexible and effective insulation technique available.
The levels of insulation against foot traffic noise imposed by DPCM dated 5th December 1997 (Premier's Decree) determine the need to avail of insulating materials of maximum efficiency but that are thin enough to be compatible with the parameters usually foreseen in the plans of the building. Furthermore, seeing as the acoustic specifications are measured on site, such insulation materials must also be compatible with the real situation of the building site; they consequently must be resistant to the noise of men and equipment and they must not move while the floorings are laid.

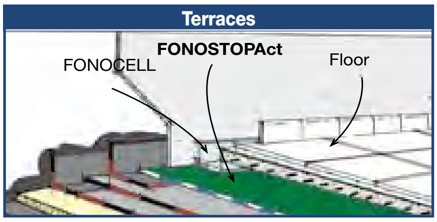
SOLUTION

FONOSTOPAct is an acoustic insulation product against foot traffic noise made up of a sound-resistant foil coupled with a sound-resilient non-woven polyester fabric obtained with a special "elastic needling" procedure, being an exclusive INDEX project. The sound-resistant foil is a seamless waterproof and airtight element, which optimises acoustic performance by filling-in pores that may occur in the building work, through which airborne noise would spread, consequently re-establishing continuity, being an appreciated feature especially in discontinuously laid floors. The foil also stops the fresh cement grout, spread over the insulation material when creating the screed, from encapsulating the fibres of the non-woven fabric, which would consequently eliminate its elastic properties. The non-woven fabric is an elastic separation layer between rigid elements, screed and floor slab, which reduces the transmission of vibrations caused by foot traffic on the paved floating screed and also vibrations of the screed induced by airborne noise deriving from various sound sources such as voices, radios, televisions, etc. The fibrous nature of the non-woven fabric, even if very thin, represents another element that favours the insulating capacities of the material also against airborne noise that closed cell insulating materials do not offer. The fibres are not irritant, they are flexible and do not crumble when compressed or folded. The sound-resilient non-woven fabric acts as a spring in the physical "spring-mass" system model, in which a mass, being the floating screed, is loaded on a spring, being the sound-resilient fabric, resting on a rigid support, being the load-bearing floor slab. The relatively low unit load of the floating screed (0.008÷0.012 kg/cm²) means that materials commonly defined to be elastic, such as rubber sheeting, in the specific case, have excessive dynamic stiffness, making them inadequate to absorb vibrations generated by foot traffic on the screeds whereas, within specifically defined limits of non-excessive compressibility, softer materials such as **FONOSTOPAct** have the just dynamic stiffness which is proportioned with the low unit load of the screed.
FONOSTOPAct is resistant to both site traffic during laying and to the perforating action of rough parts of irregular foundations under the load of the floating screed in the work phase. Even if it is light in weight, it is heavy enough and has such a strong "grip" (adherence to the laying surfaces) that it does not move under site traffic. **FONOSTOPAct** is the outcome of research activities of Index in the field of acoustic insulation. It is designed meticulously for the specific purpose for which it is to be used and does not derive from rejects of other production cycles or from the adaptation of materials conceived for other applications. The waterproofing and air-tightness of the sound-resistant foil, the elasticity of the non-woven sound-resilient fabric, gauged based on the weight of the screed, the mass per unit area of the just weight, the grip of the fabric on the laying surface, combined with a good resistance to static and dynamic punching, are all features of **FONOSTOPAct**, which added to correct laying on site, contribute in satisfying the limits imposed by the Italian Premier's Decree dated 5th December 1997. **FONOSTOPAct** is produced in rolls of 1,05×10 meters. The sound-resistant foil of the top face, which is lined with a green textile finish, is 5 cm longer than the white non-woven sound-resilient fabric of the bottom face; this is done to create an overlap wing, which protects the side joining line of the sheets against the intrusion of cement mortar of the screed, which would otherwise create an acoustic bridge once it sets hard.

Indoor floor



Terraces



METHOD OF USE AND PRECAUTIONS

SINGLE LAYER APPLICATIONS. The rolls of **FONOSTOPAct** are to be unrolled in their natural unrolling direction with the top green face facing upwards and are to be overlapped at the sides by arranging the overlap wing on the adjacent sheet and carefully matching-up the non-woven fabric of the faces underneath. On the short side, the sheets are not overlapped but are carefully brought together end-to-end.
The sheets will cover the whole floor slab and are to be blocked and trimmed-off at the foot of the perimeter walls of the room to be insulated.
All the longitudinal overlapping lines and the transversal joining lines of the sheets are then to be carefully sealed with the special adhesive SIGILTAPE, stuck over the same.
To insulate the floating screed from perimeter walls, the latter are to be lined with 10 cm of the extruded polyethylene separation self-adhesive FONOCELL strip, to limit the thickness of the screed, which will be turned over by 5 cm and glued on the insulation material laid on the floor slab where it will be further secured with adhesive SIGILTAPE.
Note. Make sure you lay FONOCELL on terraces only after the waterproof coat has been protected by a layer of plaster mortar reinforced with a metal net and make sure to seal the gap between the flooring and the skirting board with a flexible sealant.

DOUBLE LAYER APPLICATIONS. If you are installing **FONOSTOPAct** in a double layer, make sure the first layer will be laid on site in the opposite direction to the natural unrolling direction of the roll, with the top green face facing the floor slab and the white face facing upwards. Overlap the sheets lengthwise along the overlap strip and bring the ends of the sheets together without overlapping them; the sheets of the first layer will cover the whole floor slab and are to be blocked and trimmed-off at the foot of the perimeter walls of the room to be insulated but not sealed.
The second layer will then be unrolled parallel with the first layer, in its natural unrolling direction, with the top green face facing upwards, making sure to offset it to lay it over the joining lines of the first layer.
The laying and sealing methods of the second sheet will be those already explained for system A laid in a single layer.

FONOSTOPAct

Thickness	7,5 mm approx	
Roll size	1,05×10,00 m	
Mass per unit area	1,5 kg/m² approx	
Heat capacity per unit area (¹)	1,620 KJ/m²K	
Thermal resistance **R**	0,130 m² K/W (²)	
Dynamic stiffness • FONOSTOPAct monostrato • FONOSTOPAct doppio strato (³)	Apparent dynamic stiffness s'_t = 7 MN/m³ s'_t = 4 MN/m³	Dynamic stiffness s' = 27 MN/m³ s' = 14,5 MN/m³
Theoretical estimate of the reduction level in foot traffic noise (⁴) • FONOSTOPAct single layer • FONOSTOPAct double layer	 ΔL_w = 26 dB ΔL_w = 30 dB	
Compression tests under constant load of 200 kg/m² (EN 1606) • FONOSTOPAct single layer • FONOSTOPAct double layer (³)	Reduction of thickness ≤1 mm ca. ≤1 mm ca.	
Compression capability (EN 12431:2000 - Determination of thickness) • FONOSTOPAct single layer • FONOSTOPAct double layer (³)	 ≤2 mm ≤3 mm	
Resistance • to impact (EN 12730) • to static loading (EN 12691)	 35 kg 20 cm	
Impermeability (EN 1928)	1 KPa	
Aqueous vapour diffusion coefficient	μ = 80.000	
Thermal conductivity coefficien λ • Non-woven fabric • phonoresilient foil	 0,045 W/mK 0,170 W/mK	

(¹) Apparent value obtained by calculating values of every component expressed per unit area of whole product (m²) (²) Value established on the material subjected to a load of 1 KPa (100 kg/m²) (³) FONOSTOPAct laid in a double layer with white faces set opposite each other. (⁴) Simplified calculation method TR UNI 11175 (Guide to the Standards of the UNI EN 12354 series for predicting the acoustic performance of buildings) for screeds with surface density of 100 kg/m²

WARNING: only the dynamic stiffness values **s'**, ringed in red, are values useful for an estimate calculation conforming to standard EN 12354-2.

The dynamic stiffness was calculated in the Applied Acoustics Laboratory of INDEX S.p.A., after measuring dynamic stiffness and air permeability.

MODULAR ACOUSTIC INSULATION AGAINST FOOT TRAFFIC NOISE

With rigid cement floor slabs, in the most frequently encountered cases, just one layer of **FONOSTOPAct** is sufficient to respect the limits imposed by the decree for residential buildings and hotels, whereas for superior requirements, the insulation effectiveness can be increased by laying two layers of **FONOSTOPAct**.

THEORETICAL ESTIMATE OF THE REDUCTION LEVEL IN FOOT TRAFFIC NOISE

Example of simplified calculation method
TR UNI 11175 - (Guide to the Standards of UNI EN 12354 series for predicting the acoustic performance of buildings) for
FLOOR SLAB OF 20+4 IN CLAY-CEMENT MIX OF 300 kg/m²
LIGHTENED FOUNDATION WITH DENSITY OF 300 kg/m³
thickness 10 cm ($L_{n,w,eq}$ = 76 dB)
SCREEDS WITH SURFACE DENSITY m'=100 kg/m²

Calculation of the **fo** resonance frequency of the floating screed system, resilient layer:

FONOSTOPAct single-layer

$$fo = 160\sqrt{\frac{s'}{m'}} = 160\sqrt{\frac{27}{100}} = 83\ \text{Hz}$$

$$\Delta L_w = 30 \text{ Log } \left(\frac{f}{fo}\right) + 3 = \mathbf{26\ dB}$$

where **f** = 500 Hz (of reference)

$$L_{n,w} = L_{n,w,eq} - \Delta L_w + K \quad \text{where } K = 3$$

$$L_{n,w} = \mathbf{53\ dB}$$

FONOSTOPAct double-layer

$$fo = 160\sqrt{\frac{s'}{m'}} = 160\sqrt{\frac{14{,}5}{100}} = 61\ \text{Hz}$$

$$\Delta L_w = 30 \text{ Log } \left(\frac{f}{fo}\right) + 3 = \mathbf{30\ dB}$$

where **f** = 500 Hz (of reference)

$$L_{n,w} = L_{n,w,eq} - \Delta L_w + K \quad \text{where } K = 3$$

$$L_{n,w} = \mathbf{49\ dB}$$

ANIT Associated

The data in this publication is the result of laboratory tests or observations on site and this does not guarantee the repeatability of the results in equivalent systems.

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TOTAL QUALITY index UNI EN ISO 9001
Environmental Management Systems index UNI EN ISO 14001
index "GBC Italia" Associated
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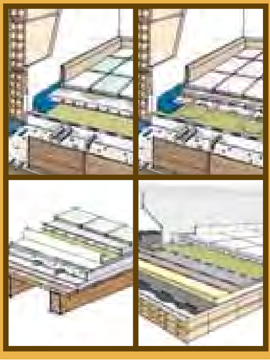
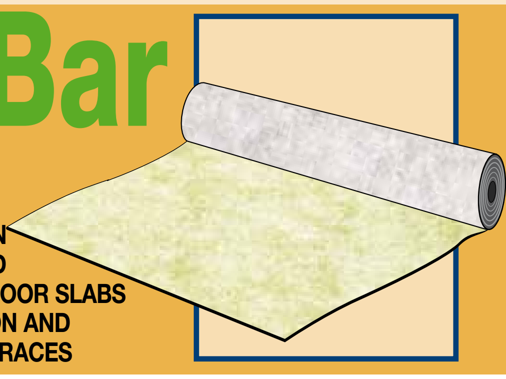


FONOSTOPBar



MULTI-FUNCTIONAL DOUBLE LAYER ACOUSTIC INSULATION AGAINST FOOT TRAFFIC NOISE WITH HIGH RESILIENCE AND MECHANICAL RESISTANCE FOR INDOOR AND OUTDOOR FLOOR SLABS WITH FLOATING FLOORS. IT ALSO WORKS AS A PROTECTION AND SEPARATION SHEET FOR THE WATERPROOF LAYER OF TERRACES

CHARACTERISTICS	IMPACT ON THE ENVIRONMENT		
ACOUSTIC INSULATION	ECO GREEN	RECYCLABLE	NON-DANGEROUS WASTE

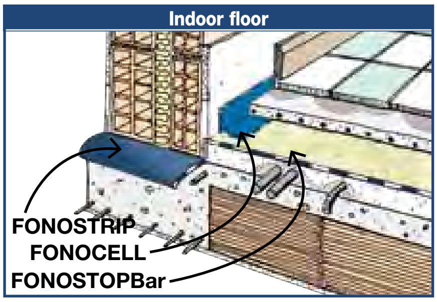
PROBLEM

The installation of resilient material between a floating screed, on which any type of flooring can be laid, and the load-bearing floor slab, reduces the spreading of impact noise or foot traffic noise (**ΔLw**) and increases insulation against airborne noise (**ΔRw**). It also represents the most flexible and effective insulation technique available.
The levels of insulation against foot traffic noise imposed by DPCM dated 5th December 1997 (Premier's Decree) determine the need to avail of insulating materials of maximum efficiency but that are thin enough to be compatible with the parameters usually foreseen in the plans of the building. Furthermore, seeing as the acoustic specifications are measured on site, such insulation materials must also not move while laying the floorings. If these are then laid on rough supports or lightened yielding foundations, they must also be particularly resistant to the typical situations of major building sites where the material is subject to heavy traffic with little attention paid by the various builders.

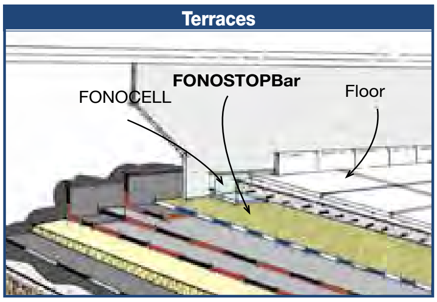
SOLUTION

The need to increase perforation resistance of materials for insulating floor slabs against foot traffic noise with the "floating floor technique" is particularly strong in major work sites, but this often translates into an increase of the material's dynamic stiffness, which consequently leads to a reduction in the insulating properties.
INDEX has designed a new insulation product against foot traffic noise, named **FONOSTOPBar**. It is light (about 1 kg/m^2), but offers high mechanical resistance, privileging resistance to punching. Moreover, in addition to increasing resistance to static punching, in order also to increase resistance to dynamic punching, the elasticity of the material had to be increased. This simultaneously resulted in the beneficial effect of achieving an optimum dynamic stiffness to such an extent to also obtain high acoustic insulation performance, superior to most of the rival materials on the same market section.
FONOSTOPBar is INDEX's new acoustic insulation product against foot traffic noise. It is supplied in rolls. Its top face consists of a thin protective foil in non-woven thermally fixed polyester fabric.
This foil is a protective barrier against stress caused by site traffic and laying procedures of the screed on lightened, yielding foundations, but is also a shield against perforation caused by the roughness of the floor slab if laying in a double face-opposite-face layer.
The bottom face is made up of a sound-resilient layer in non-woven polyester fabric with special "elastic needling", being an exclusive INDEX project, which guarantees that thickness is maintained under load and also an excellent elastic reaction.
The fibres are not irritant, they are flexible and do not crumble when compressed or folded.
FONOSTOPBar also has a high ultimate elongation rating, which enables it to adapt to uneven laying surfaces without breaking.
FONOSTOPBar is supplied in rolls of 1×15 meters. The lining of the top face of the product prevents the liquid mortar - when the screed is laid - from encapsulating the fibres of the elastic non-woven fabric underneath.
This would eliminate its insulating properties, while the free fibres of the fabric underneath adhere to the foundations and prevent the sheet from moving when the upper layers are being laid, thus guaranteeing the certainty of correct laying on site.

Indoor floor



Terraces



METHOD OF USE AND PRECAUTIONS

SINGLE LAYER APPLICATIONS. The rolls of **FONOSTOPBar** are to be unrolled in their natural unrolling direction with the bottom face covered with softer non-woven fabric facing the laying surface. The **FONOSTOPBar** sheets should not be overlapped, but should be brought close to each other and the joining lines must always be sealed with adhesive SIGILTAPE.
The sheets will cover the whole floor slab and are to be blocked and trimmed-off at the foot of the perimeter walls of the room to be insulated.
To insulate the floating screed from perimeter walls, the latter are to be lined with 10 cm of the extruded polyethylene separation self-adhesive FONOCELL strip, to limit the thickness of the screed, which will be turned over by 5 cm and glued on the insulation material laid on the floor slab where it will be further secured with adhesive SIGILTAPE.
Note. Make sure you lay FONOCELL on terraces only after the waterproof coat has been protected by a layer of plaster mortar reinforced with a metal net and make sure to seal the gap between the flooring and the skirting board with a flexible sealant.

DOUBLE LAYER APPLICATIONS. If you are installing **FONOSTOPBar** in a double layer, the first layer will be laid on site in the opposite direction to the natural unrolling direction of the roll, with the bottom face covered with softer non-woven fabric facing upwards. The **FONOSTOPBar** sheets should not be overlapped, but should be brought close to each other. The sheets of the first layer will cover the whole floor slab and are to be blocked and trimmed-off at the foot of the perimeter walls of the room to be insulated but not sealed. The second layer will then be unrolled parallel with the first layer, in its natural unrolling direction, making sure to offset it to lay it over the joining lines of the first layer. The laying and sealing methods of the second sheet will be those already explained for single layer applications.

FONOSTOPBar

Thickness	6,5 mm approx	
Roll size	1,00×15,00 m	
Mass per unit area	1,0 kg/m² approx	
Heat capacity per unit area (1)	1,650 KJ/m²K	
Thermal resistance **R**	0,115 m² K/W (2)	
Dynamic stiffness • FONOSTOPBar single layer • FONOSTOPBar opposite double layer	Apparent dynamic stiffness s'_t = 9 MN/m³ s'_t = 5 MN/m³	Dynamic stiffness **s'** = 29 MN/m³ **s'** = 18 MN/m³
Theoretical estimate of the reduction level in foot traffic noise (2) • FONOSTOPBar single-layer • FONOSTOPBar double layer	ΔL_w = 26 dB ΔL_w = 29 dB	
Compression tests under constant load of 200 kg/m² (EN 1606) • FONOSTOPBar single-layer • FONOSTOPBar double layer (1)	Reduction of thickness ≤1 mm approx ≤1 mm approx	
Compression capability (EN 12431:2000 - Determination of thickness) • FONOSTOPBar single-layer • FONOSTOPBar double layer (1)	≤2 mm ≤3 mm	
Resistance • to static loading (EN 12730) • to impact (EN 12691)	35 kg 20 cm	
Impermeability (UNI-EN 13111)	Waterproof	
Aqueous vapour diffusion coefficient	μ = 8.000	
Thermal conductivity coefficient λ	0,045 W/mK	

(1) Apparent value obtained by calculating values of every component expressed per unit area of whole product (m²). (2) Value established on the material subjected to a load of 1 KPa (100 kg/m²)
(3) FONOSTOPBar laid in a double layer with white faces set opposite each other.
WARNING: only the dynamic stiffness values **s'**, ringed in red, are values useful for an estimate calculation conforming to standard EN 12354-2.
(4) Simplified calculation method TR UNI 11175 (Guide to the Standards of the UNI EN 12354 series for predicting the acoustic performance of buildings) for screeds with surface density of 100 kg/m².
La rigidità dinamica è stata calcolata nel laboratorio di Acustica applicata della INDEX S.p.A. dopo la misura della rigidità dinamica e della permeabilità all'aria.

MODULAR ACOUSTIC INSULATION AGAINST FOOT TRAFFIC NOISE

With rigid cement floor slabs, in the most frequently encountered cases, just one layer of **FONOSTOPBar** is sufficient to respect the limits imposed by the decree for residential buildings and hotels, whereas for superior requirements, the insulation effectiveness can be increased by laying two layers of **FONOSTOPBar**.

THEORETICAL ESTIMATE OF THE REDUCTION LEVEL IN FOOT TRAFFIC NOISE

Example of simplified calculation method
TR UNI 11175 - (Guide to the Standards of UNI EN 12354 series for predicting the acoustic performance of buildings) for
FLOOR SLAB OF 20+4 IN CLAY-CEMENT MIX OF 300 kg/m²
LIGHTENED FOUNDATION WITH DENSITY OF 300 kg/m³
thickness 10 cm ($L_{n,w,eq}$ = 76 dB)
SCREEDS WITH SURFACE DENSITY **m'**=100 kg/m²
Calculation of the **fo** resonance frequency of the floating screed system, resilient layer:

FONOSTOPBar single-layer

$$fo = 160\sqrt{\frac{s'}{m'}} = 160\sqrt{\frac{29}{100}} = 86 \text{ Hz}$$

$$\Delta L_w = 30 \text{ Log } \left(\frac{f}{fo}\right) + 3 = \mathbf{26\ dB}$$

where **f** = 500 Hz (of reference)

$$L_{n,w} = L_{n,w,eq} - \Delta L_w + K \qquad \text{where } K = 3$$

$$L_{n,w} = \mathbf{53\ dB}$$

FONOSTOPBar double-layer

$$fo = 160\sqrt{\frac{s'}{m'}} = 160\sqrt{\frac{18}{100}} = 68 \text{ Hz}$$

$$\Delta L_w = 30 \text{ Log } \left(\frac{f}{fo}\right) + 3 = \mathbf{29\ dB}$$

where **f** = 500 Hz (of reference)

$$L_{n,w} = L_{n,w,eq} - \Delta L_w + K \qquad \text{where } K = 3$$

$$L_{n,w} = \mathbf{50\ dB}$$

ANIT Associated

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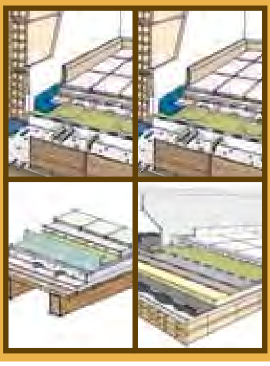
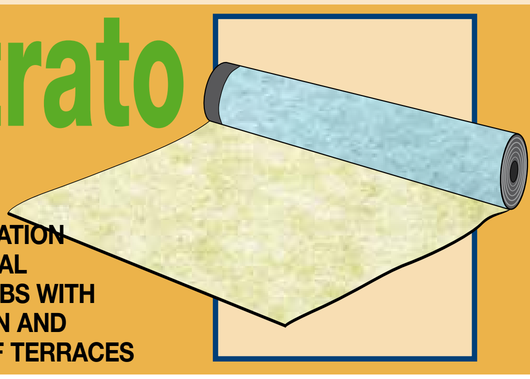


FONOSTOPStrato



MULTI-FUNCTIONAL DOUBLE LAYER ACOUSTIC INSULATION AGAINST FOOT TRAFFIC NOISE WITH HIGH MECHANICAL RESISTANCE FOR INDOOR AND OUTDOOR FLOOR SLABS WITH FLOATING FLOORS. IT ALSO WORKS AS A PROTECTION AND SEPARATION SHEET FOR THE WATERPROOF LAYER OF TERRACES

CHARACTERISTICS	IMPACT ON THE ENVIRONMENT		
ACOUSTIC INSULATION	ECO GREEN	RECYCLABLE	NON-DANGEROUS WASTE

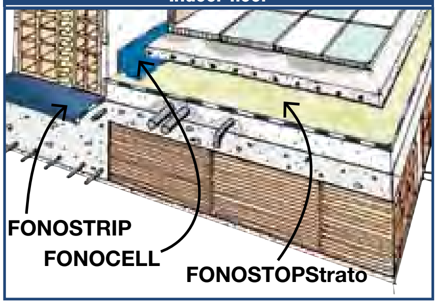
PROBLEM

The installation of resilient material between a floating screed, on which any type of flooring can be laid, and the load-bearing floor slab, reduces the spreading of impact noise or foot traffic noise (ΔL_w) and increases insulation against airborne noise (ΔR_w). It also represents the most flexible and effective insulation technique available.
The levels of insulation against foot traffic noise imposed by the Premier's Decree (DPCM) dated 5th December 1997 also apply to floor slabs of terraces where the lack of an insulation layer against foot traffic noise between the flooring screed and the thermal and waterproofing insulation layering often carries the transmission of noise directly to the rooms below. What's more, if the floor screed is cast directly on the waterproof coat, any cracks that form in the floors of the terraces could damage the waterproof coat underneath.

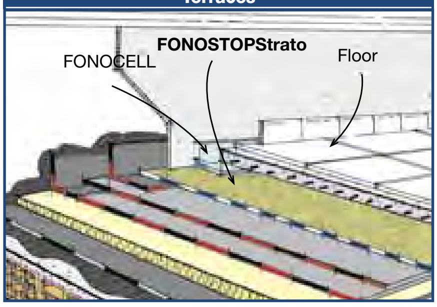
SOLUTION

The use on terraces of economic acoustic insulation products that are too light and that may perforate on foundations or on yielding thermal insulation products or that move under building site traffic, defy any savings expected because numerous acoustic bridges could form. For this specific field of use INDEX has designed a new insulation product against foot traffic noise, named **FONOSTOPStrato**. It is light (about 1 kg/m^2), but offers high mechanical resistance, privileging resistance to punching. Moreover, in addition to increasing resistance to static punching, in order also to increase resistance to dynamic punching, the elasticity of the material had to be increased. This simultaneously resulted in the beneficial effect of achieving a dynamic stiffness in line with most of the rival materials on the same market section.
FONOSTOPStrato is an acoustic insulation product against foot traffic noise supplied in rolls of 1×15 meters. Its top face consists of a thin protective foil in non-woven thermally fixed polyester fabric. This foil acts as a protective barrier against stress caused by site traffic and laying procedures of the screed on lightened, yielding foundations, but also acts as a shield against perforation caused by the roughness of the floor slab if laying in a double face-opposite-face layer.
The foil of the top face is 5 cm longer than the white non-woven sound-resilient fabric of the bottom face; this is done to create an overlap wing, which protects the side joining line of the sheets against the intrusion of cement mortar of the screed, which would otherwise create an acoustic bridge once it sets hard. The bottom face consists of a resilient layer of non-woven polyester fabric with special "elastic needling", being an exclusive INDEX project, which guarantees that thickness is maintained under load and also a good elastic reaction. The fibres are not irritant, they are flexible and do not crumble when compressed or folded.
FONOSTOPStrato also has a high ultimate elongation rating, which enables it to adapt to uneven laying surfaces without breaking. The lining of the top face of the product prevents the liquid mortar - when the screed is laid - from encapsulating the fibres of the elastic non-woven fabric underneath, which would eliminate its insulating properties, while the free fibres of the fabric underneath adhere to the foundations and prevent the sheet from moving when the upper layers are being laid. **FONOSTOPStrato** is a multi-functional acoustic insulation product. It is used to insulate both indoor floors and terrace paving, for which it is also acts as an excellent protective layer of the waterproof coat while the screed is being laid. If the screed is demolished, it prevents the coat from breaking and facilitates repair work.
FONOSTOPStrato, also protects the waterproof coat against the transmission of cracks generated by dimensional variations in the overlying cement hood.

Indoor floor



Terraces



METHOD OF USE AND PRECAUTIONS

SINGLE LAYER APPLICATIONS. The rolls of **FONOSTOPStrato** are to be unrolled in their natural unrolling direction with the bottom face covered with softer non-woven fabric facing the laying surface. They are to be overlapped at the sides by arranging the overlap wing on the adjacent sheet and carefully matching-up the non-woven fabric of the faces underneath.
On the short side, the sheets are not overlapped but carefully brought together end-to-end.
The sheets will cover the whole floor slab and are to be blocked and trimmed-off at the foot of the perimeter walls of the room to be insulated.
All the longitudinal overlapping lines and the transversal joining lines of the sheets are then to be carefully sealed with the special adhesive SIGILTAPE, stuck over the same.
To insulate the floating screed from perimeter walls, the latter are to be lined with 10 cm of the extruded polyethylene separation self-adhesive FONOCELL strip, to limit the thickness of the screed, which will be turned over by 5 cm and glued on the insulation material laid on the floor slab where it will be further secured with adhesive SIGILTAPE.
Note. Make sure you lay FONOCELL on terraces only after the waterproof coat has been protected by a layer of plaster mortar reinforced with a metal net and make sure to seal the gap between the flooring and the skirting board with a flexible sealant.

DOUBLE LAYER APPLICATIONS. If you are installing **FONOSTOPStrato** in a double layer, make sure the first layer will be laid on site in the opposite direction to the natural unrolling direction of the roll, with the bottom face covered with softer non-woven fabric facing upwards. Overlap the sheets lengthwise along the overlap strip and bring the ends of the sheets together without overlapping them; the sheets of the first layer will cover the whole floor slab and are to be blocked and trimmed-off at the foot of the perimeter walls of the room to be insulated but not sealed. The second layer will then be unrolled parallel with the first layer, in its natural unrolling direction, making sure to offset it to lay it over the joining lines of the first layer. The laying and sealing methods of the second sheet will be those already explained for the system laid in a single layer.

FONOSTOPStrato

Thickness	4,0 mm approx	
Roll size	1,00×15,00 m	
Mass per unit area	1,0 kg/m² approx	
Heat capacity per unit area (1)	0,950 KJ/m²K	
Thermal resistance **R**	0,075 m² K/W (2)	
Dynamic stiffness • FONOSTOPStrato single-layer	Apparent dynamic stiffness s'_t = 20 MN/m³	Dynamic stiffness s' = 57 MN/m³
Theoretical estimate of the reduction level in foot traffic noise (3)	ΔL_w = 21 dB	
Resistance to tensile stress (UNI-EN 12311-1) • ultimate tensile stress • ultimate elongation	500/500 N/50 mm 50/100%	
Impermeability (UNI-EN 13111)	Supera la prova	
Aqueous vapour diffusion coefficient	μ = 8.000	
Thermal conductivity coefficient λ	0,045 W/mK	

(1) Apparent value obtained by calculating values of every component expressed per unit area of whole product (m²) (2) Value established on the material subjected to a load of 1 KPa (100 kg/m²)
WARNING: only the dynamic stiffness values **s'**, ringed in red, are values useful for an estimate calculation conforming to standard EN 12354-2.
(3) Simplified calculation method TR UNI 11175 (Guide to the Standards of the UNI EN 12354 series for predicting the acoustic performance of buildings) for screeds with surface density of 100 kg/m².
The dynamic stiffness was calculated in the Applied Acoustics Laboratory of INDEX S.p.A., after measuring dynamic stiffness and air permeability.

INDEX's exclusive production systems are covered by registered patents.

MODULAR ACOUSTIC INSULATION AGAINST FOOT TRAFFIC NOISE

THEORETICAL ESTIMATE OF THE REDUCTION LEVEL IN FOOT TRAFFIC NOISE

Example of simplified calculation method
TR UNI 11175 - (Guide to the Standards of UNI EN 12354 series for predicting the acoustic performance of buildings) for
FLOOR SLAB of 20+4 IN CLAY-CEMENT MIX OF 300 kg/m²
LIGHTENED FOUNDATION WITH DENSITY OF 300 kg/m³
thickness 10 cm ($L_{n,w,eq}$ = 76 dB)
SCREEDS WITH SURFACE DENSITY m'=100 kg/m²

Calculation of the **fo** resonance frequency of the floating screed system, resilient layer:

$$fo = 160\sqrt{\frac{s'}{m'}} = 160\sqrt{\frac{57}{100}} = 120 \text{ Hz}$$

$$\Delta L_w = 30 \text{ Log } \left(\frac{f}{fo}\right) + 3 = \mathbf{21\ dB}$$

where **f** = 500 Hz (of reference)

$$L_{n,w} = L_{n,w,eq} - \Delta L_w + K \quad \text{where } K = 3$$

$$L_{n,w} = 58 \text{ dB}$$

Conside ring the numerous possible uses and the possible interference of conditions or elements beyond our control, we assume no responsibility regarding the results which are obtained. The purchasers, of their own accord and under their own responsibility, must establish the suitability of the product for the envisaged use.

The figures shown are average indicative figures relevant to current production and may be changed or updated by INDEX S.p.A at any time without previous warning. The advice and technical information provided, is what results from our best knowledge regarding the properties and the use of the product.

ANIT Associated

The data in this publication is the result of laboratory tests or observations on site and this does not guarantee the repeatability of the results in equivalent systems.

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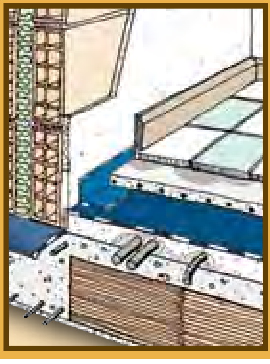
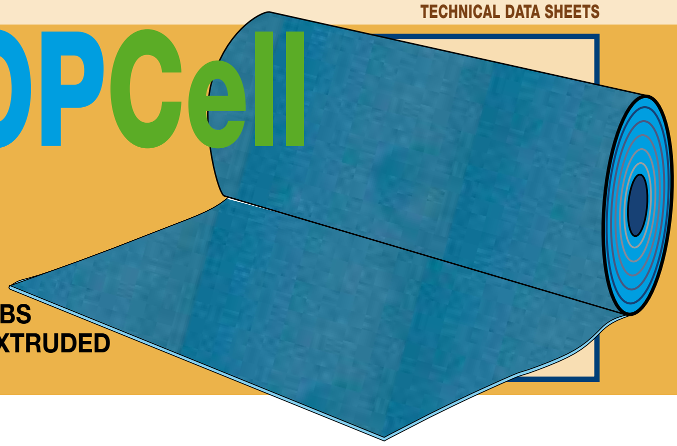


FONOSTOPCell



ACOUSTIC INSULATION AGAINST FOOT TRAFFIC NOISE FOR INDOOR FLOOR SLABS WITH FLOATING FLOORS, MADE UP OF EXTRUDED CLOSED CELL POLYETHYLENE

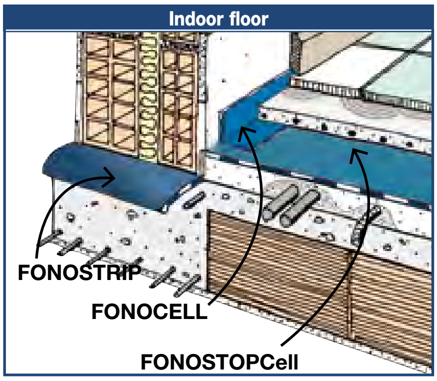
CHARACTERISTICS	IMPACT ON THE ENVIRONMENT		
ACOUSTIC INSULATION	ECO GREEN	RECYCLABLE	NON-DANGEROUS WASTE

PROBLEM

The installation of resilient material between a floating screed, on which any type of flooring can be laid, and the load-bearing floor slab, reduces the spreading of impact noise or foot traffic noise (**ΔLw**) and increases insulation against airborne noise (**ΔRw**). It also represents the most flexible and effective insulation technique available. When economic resources are limited, it is difficult to respect the levels of insulation against foot traffic noise imposed by the Premier's Decree (DPCM) dated 5th December 1997.

SOLUTION

FONOSTOPCell is an acoustic insulation sheet against foot traffic noise for indoor floating floors made of extruded closed cell polyethylene. It is waterproof, watertight, resistant to hydrocarbons, alkali and acids. When laid with care, taking the due precautions, **FONOSTOPCell** will obtain a suitable insulation even if economic resources are limited.
FONOSTOPCell is waterproof and during the casting of the screed, the cement grout does not impregnate the sheet, hence guaranteeing the certainty of the expected result.
FONOSTOPCell is mainly used for the acoustic insulation of indoor floating screeds, but since it can be easily modelled in individual spots and around pipes, it can also be wrapped around pipes that cross building partitions in order to prevent the transmission of vibrations.
FONOSTOPCell is an insulation product with efficient dynamic stiffness suitable for the acoustic insulation against foot traffic noise under floating screed. It is a very light sheet (150g/m²) hence much care must be taken so as not to displace the insulating sheets when laying the cement screed, and not to perforate the insulation material and damage the sheet joins. Failing this, any acoustic bridges created by rigid connections to the floor slab underneath, caused if the cement mixture should seep through the material and stick to the floor slab underneath, would substantially reduce the acoustic insulation of the material. For the same reason, it is also a good rule to lay the screed as soon as possible so as not to expose the material to building site traffic which could damage it.



METHOD OF USE AND PRECAUTIONS

The rolls of **FONOSTOPCell** are to be unrolled in their natural unrolling direction, the sheets should not be overlapped, but should be brought close to each other and the joining lines must always be sealed with adhesive SIGILTAPE.

The sheets will cover the whole floor slab and are to be blocked and trimmed-off at the foot of the perimeter walls of the room to be insulated.
To insulate the floating screed from perimeter walls, the latter are to be lined with 10 cm of the extruded polyethylene separation self-adhesive FONOCELL strip, to limit the thickness of the screed, which will be turned over by 5 cm and glued on the insulation material laid on the floor slab where it will be further secured with adhesive SIGILTAPE.

FONOSTOPCell

Thickness	5,0 mm approx	
Roll size	1,25×100 m	
Density	30,0 kg/m³	
Dynamic stiffness • FONOSTOPCell	Apparent dynamic stiffness s'_t = 32 MN/m³	Dynamic stiffness s' = 32 MN/m³
Theoretical estimate of the reduction level in foot traffic noise ([1])	ΔL_w = 25,5 dB	
Resistance to tensile stress (UNI-EN 12311-1) • ultimate tensile stress • ultimate elongation	 23/32 N/50 mm 65/70%	
Impermeability (UNI-EN 13111)	Waterproof	
Aqueous vapour diffusion coefficient	μ = 2.000	
Thermal conductivity coefficient λ	0,044 W/mK	

([1]) Simplified calculation method TR UNI 11175 (Guide to the Standards of the UNI EN 12354 series for predicting the acoustic performance of buildings) for screeds with surface density of 100 kg/m².
WARNING: only the dynamic stiffness values **s'**, ringed in red, are values useful for an estimate calculation conforming to standard EN 12354-2.
The dynamic stiffness was calculated in the Applied Acoustics Laboratory of INDEX S.p.A., after measuring dynamic stiffness and air permeability.

MODULAR ACOUSTIC INSULATION AGAINST FOOT TRAFFIC NOISE

THEORETICAL ESTIMATE OF THE REDUCTION LEVEL IN FOOT TRAFFIC NOISE

Example of simplified calculation method
TR UNI 11175 - (Guide to the Standards of UNI EN 12354 series for predicting the acoustic performance of buildings) for
FLOOR SLAB of 20+4 IN CLAY-CEMENT MIX OF 300 kg/m²
LIGHTENED FOUNDATION WITH DENSITY OF 300 kg/m³
thickness 10 cm ($L_{n,w,eq}$ = 76 dB)
SCREEDS WITH SURFACE DENSITY m'=100 kg/m²

Calculation of the **fo** resonance frequency of the floating screed system, resilient layer:

$$fo = 160\sqrt{\frac{s'}{m'}} = 160\sqrt{\frac{32}{100}} = 90{,}5 \text{ Hz}$$

$$\Delta L_w = 30 \text{ Log}\left(\frac{f}{fo}\right) + 3 = \mathbf{25{,}5\ dB}$$

where **f** = 500 Hz (of reference)

$$L_{n,w} = L_{n,w,eq} - \Delta L_w + K$$

where **K** = 3

$$L_{n,w} = \mathbf{54\ dB}$$

ANIT Associated

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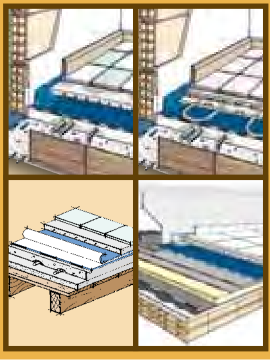
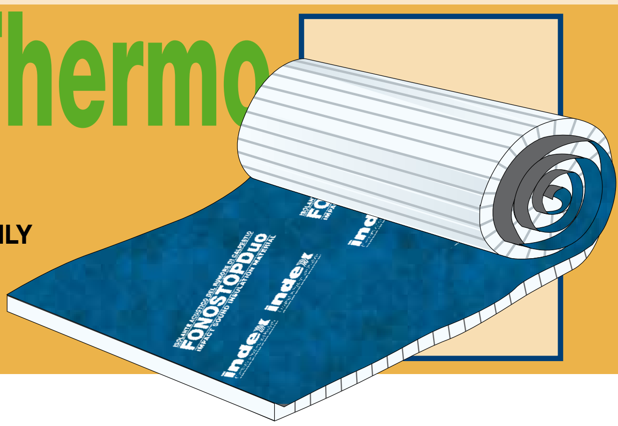


FONOSTOPThermo



THERMAL INSULATION COUPLED WITH HIGHLY RESILIENT ACOUSTIC INSULATION AGAINST FOOT TRAFFIC NOISE, SUPPLIED IN ROLLS FOR INSULATING INTERMEDIARY FLOOR SLABS

CHARACTERISTICS		IMPACT ON THE ENVIRONMENT		
ACOUSTIC INSULATION	THERMAL INSULATION	ECO GREEN	RECYCLABLE	NON-DANGEROUS WASTE

PROBLEM

To resolve problems of acoustic and thermal insulation one quite often has to use two separate products.

SOLUTION

INDEX has designed **FONOSTOPThermo** to resolve the thermal-acoustic insulation problems of floor slabs with just one product.

FONOSTOPThermo is supplied in rolls and consists of the well-known FONOSTOPDuo insulation against foot traffic noise, on the bottom face of which expanded sintered polystyrene strips EPS 120 are glued. In this way the product can be wound in rolls, which makes it easier and quicker to lay than products supplied in panels.

FONOSTOPDuo is a thin yet highly effective acoustic insulation against foot traffic noise, and represents the most efficient insulation method against foot traffic noise of the product range of INDEX. It is made up of a soundproof foil, coupled with a non-woven polyester fabric obtained with a special "elastic needling" procedure, being an exclusive INDEX project.

The efficiency of the acoustic insulation against foot traffic noise is provided mainly by the special non-woven fabric that remains elastic over time.

The non-woven fabric is an elastic separation layer between rigid elements, screed and floor slab, which reduces the transmission of vibrations caused by foot traffic on the paved floating screed and also vibrations of the screed induced by airborne noise deriving from various sound sources such as voices, radios, televisions, etc. The fibrous nature of the non-woven fabric, even if very thin, represents another element that favours the insulating capacities of the material also against airborne noise that closed cell insulating materials do not offer. The synthetic fibres are not irritant, they are flexible and do not crumble when compressed or folded

The soundproof foil is a seamless waterproof and airtight element, which optimises acoustic performance by filling-in pores that may occur in the building work; the foil prevents the "non-woven fabric" from getting soaked with fresh cement mortar that would annul its elasticity, plus it also acts as a vapour barrier for the underlying thermal insulation when the floor slab borders with unheated rooms.

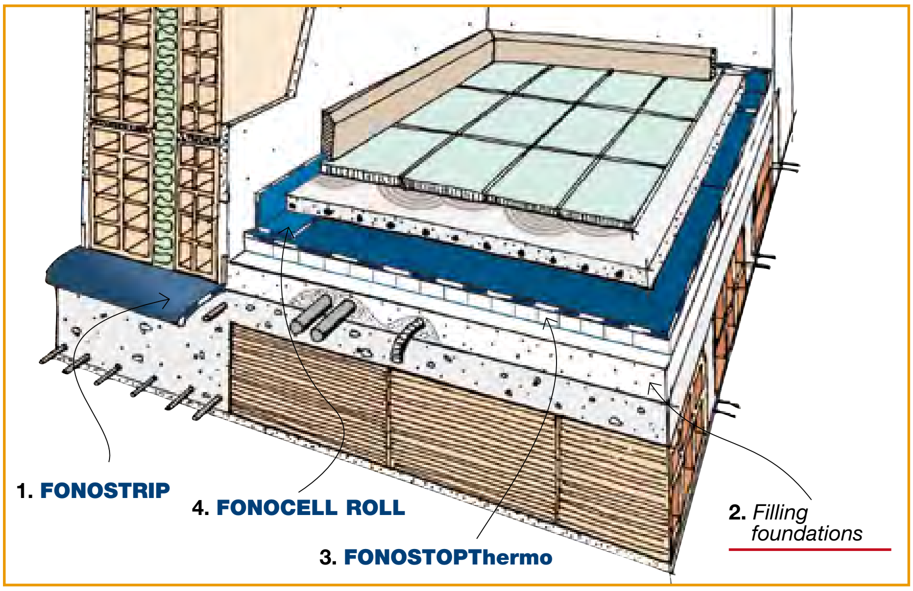
The efficiency of the thermal insulation is provided mainly by the layer of self-extinguishing AE sintered expanded polystyrene EPS 120 with high resistance to compression, which stops the thickness from altering over time.

The EPS 120 material is a stable waterproof insulation product, with conductivity coefficient λ=0,035 W/mK, which is cut in 50 mm strips.

FONOSTOPThermo is supplied in 100 cm wide rolls, complete with 5 cm overlap wing made up of the soundproof foil; the top face of the product has a light-blue textile finish whereas the bottom face is made up of the insulation strips in white EPS 120.

FIELDS OF USE

FONOSTOPThermo is used mainly when the acoustic insulation against foot traffic noise needs to be integrated with a thermal insulation product, especially when the floor slab borders with unheated rooms; it can also be beneficially used as a base for underfloor heating systems, before laying the heating pipes, under a reinforced cement-based screed or screed in unreinforced self-levelling anhydrite.



METHOD OF USE AND PRECAUTIONS

The rolls of **FONOSTOPThermo** are to be unrolled in their natural unrolling direction with the top light-blue face facing upwards and are to be overlapped at the sides by arranging the overlap wing on the adjacent sheet and carefully matching-up the polystyrene strips of the faces underneath. On the short side, the sheets of **FONOSTOPThermo** are carefully brought together end-to-end. They will cover the whole floor slab and are to be blocked and trimmed-off at the foot of the perimeter walls of the room to be insulated. All the longitudinal overlap lines and the transversal joining lines of the sheets are then to be carefully sealed with the special adhesive SIGILTAPE, stuck over the same.

To ensure the correct acoustic performance of the floating screed, utility piping must not be buried in the screed layer but in the layer of the filling foundations underneath the insulation material.

The floating screed must be completely detached not just from the floor slab but also from the walls and from anything coming out of the slab that should cross it.

To do this, starting from the insulation material laid on the slab surface, the perimeter walls are to be lined by 15 cm with the special FONOCELL angular self-adhesive elements in expanded polyethylene, which will be turned up and over the surface by 5 cm to glue them to the sheets of **FONOSTOPThermo** on which they will be further blocked with the adhesive SIGILTAPE.

FONOSTOPThermo

Sound-resilient foil FONOSTOPDuo				
Thickness	7,5 mm approx			
Mass per unit area	1,6 kg/m²			
Watertightness	watertight			
Water vapour diffusion coefficient (soundproof foil)	μ 100,000			
Dynamic stiffness (ITC certificate conforming to UNIEN29052 p. 1st) load 200 kg/m²	Apparent dynamic stiffness s'_t = 4 MN/m³		Dynamic stiffness s' = 21 MN/m³ (1)	
Thermal conductivity λ	0,039 W/mK (5)			
Heat capacity per unit area (2) (4)	1,620 KJ/m²K			
Thermal resistance **R**	0,135 m² K/W (5)			
Reaction to Fire class	**Class 1** (3)			
Expanded polystyrene EPS 120				
Designation code (EN 13163)	EPS EN13163-T1-L1-W1-S1-P3-DS(N)5-BS170-CS(10)120			
Compression strength 10% compression (EN 826)	≥120 KPa **[** CS(10)120 **]**			
Dimensional stability 48 h at 23°C R.H. (EN 1604)	±0,5% **[** DS(N)5 **]**			
Bending strength (EN 12089)	≥170 KPa **[** BS170 **]**			
Long term water absorption by immersion (EN 12087)	<5%			
Water vapour transmission (EN 12086)	30÷70 μ			
Thickness T1	20 mm	30 mm	40 mm	50 mm
Thermal resistance R_D (EN 12667)	0,55 m²K/W	0,85 m²K/W	1,10 m²K/W	1,40 m²K/W
Thermal conductivity	0,035 W/mK			
Specific heat	1,20 KJ/kgK			
Reaction to fire (EN 13501-1)	Euroclass E			
Prodotto: FONOSTOPThermo				
Type	**25**	**35**	**45**	**55**
Thickness (5)	26 mm	36 mm	46 mm	56 mm
Heat capacity per unit area (4)	3,16 KJ/m²K	3,46 KJ/m²K	3,76 KJ/m²K	4,06 KJ/m²K
Thermal resistance **R** (5) (EN 12667)	0,65 m²K/W	0,95 m²K/W	1,20 m²K/W	1,50 m²K/W
Roll size	1x10 m	1x8 m	1x6 m	1x5
Width of sound-resilient foil	1,05 m	1,05 m	1,05 m	1,05 m

(1) Certification ITC CNR n° 3402/RP/01. (2) Apparent value obtained by calculating the values of the individual components. - (3) Approval of the Ministry of the Interior no. VR172B41C100002.
(4) Apparent value obtained by calculating values of every component expressed per unit area of whole product (m²). (5) Value established on the material subjected to a load of 1 KPa (100 kg/m²)
WARNING: The dynamic stiffness values **s'** marked in red are the only ones useful for provisional calculation in conformity with EN 12354-2.

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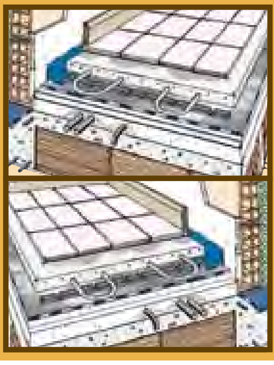
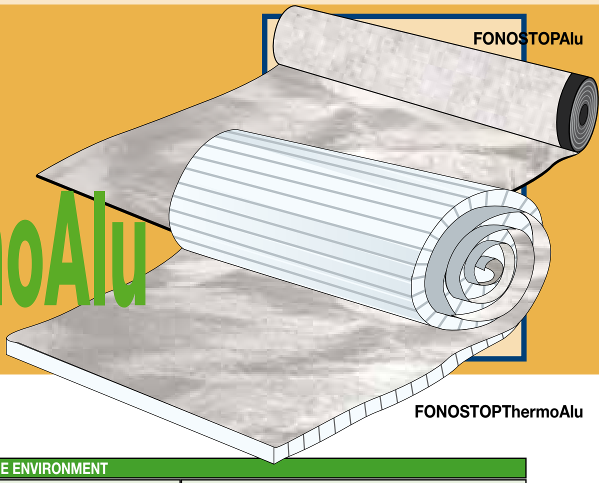


FONOSTOPAlu

DOUBLE-LAYER HIGHLY RESILIENT ACOUSTIC INSULATION AGAINST FOOT TRAFFIC NOISE, LINED WITH ALUMINIUM FOIL, FOR INSULATING SLABS WITH UNDERFLOOR HEATING

FONOSTOPThermoAlu

THERMAL INSULATION COUPLED WITH HIGHLY RESILIENT ACOUSTIC INSULATION AGAINST FOOT TRAFFIC NOISE, LINED WITH ALUMINIUM FOIL, SUPPLIED IN ROLLS, FOR INSULATING SLABS WITH UNDERFLOOR HEATING



CHARACTERISTICS		IMPACT ON THE ENVIRONMENT		
ACOUSTIC INSULATION	THERMAL INSULATION	ECO GREEN	RECYCLABLE	NON-DANGEROUS WASTE

PROBLEM

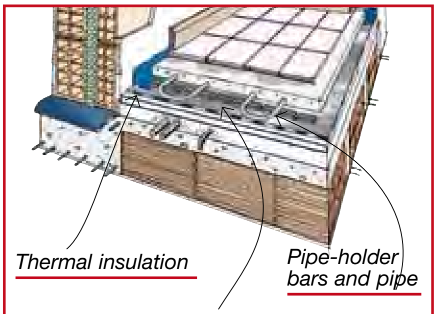
Insulation panels normally used in heated floors act as thermal insulators but not as sufficient acoustic insulators against foot traffic noise according to the levels imposed by DPCM 05/12/1997. What's more, the parameters usually foreseen in the building plans often impose the simultaneous reduction in the screed that incorporates the piping network, which could cause uneven heating of the floor, creating "strips of heat".

SOLUTION

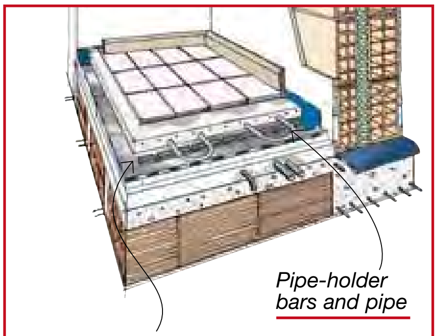
FONOSTOPAlu is a multi-purpose acoustic insulation against foot traffic noise made up of a soundproof foil with top face lined with reflecting aluminium foil protected by a plastic film (reflectance ~ 90%) with high thermal conductivity ($\lambda \sim 236$ W/mK) and very high heat diffusion rate (diffusivity $\alpha = 8{,}2 \cdot 10\text{-}5$ m²/s). It is consequently a specific insulation product designed for floor slabs with underfloor heating, where the top aluminium coated face distributes the heat in the floating floor evenly by conduction, consequently distributing the temperature of the floor surface and eliminating the problem of "strips of heat", even in rather thin screeds.
The foil is impermeable to water, gas and water vapour, it protects the underlying layers while laying the screed and protects the thermal insulation against water vapour, which starting from the warm face of the same, tends to dampen it and reduce its insulation capacities. The soundproof foil on the bottom face is coupled with non-woven polyester sound-resilient fabric obtained through a special "elastic needling" process, being an exclusive INDEX project. The fibres are elastic and do not crumble when compressed or bent. **FONOSTOPAlu**, unlike many plastic cellular insulation materials, even if it is light, has sufficient weight and has such a strong "grip" (adherence to laying surface) that it does not move under site traffic.
FONOSTOPAlu is the outcome of research activities of Index in the field of acoustic insulation. It is designed meticulously for the specific purpose for which it is to be used and does not derive from rejects of other production cycles or from the adaptation of materials conceived for other applications
FONOSTOPAlu is produced in rolls of 10×1.05 meters. The top aluminium coated face has a textile overlap wing of 5 cm, which protects the side joining line of the sheets against the intrusion of cement mortar of the screed, which would otherwise create an acoustic bridge once it sets hard.
INDEX has designed **FONOSTOPThermoAlu** to resolve the thermal-acoustic insulation problems of floor slabs with underfloor heating with just one product. **FONOSTOPThermoAlu** is the result of coupling **FONOSTOPAlu** with an expanded polystyrene panel cut in strips, so that the product can be wound in rolls making it easier and quicker to lay than products supplied in panels. The top layer of **FONOSTOPAlu** is a seamless waterproof and airtight element, which optimises acoustic performance; the foil prevents the "non-woven fabric" from getting soaked with fresh cement mortar that would annul its elasticity, plus it also acts as a vapour barrier for the underlying thermal insulation when the floor slab borders with unheated rooms. The efficiency of the thermal insulation is provided mainly by the layer of self-extinguishing AE sintered expanded polystyrene EPS 120 with high resistance to compression, which stops the thickness from altering over time. The EPS 120 material is a stable waterproof insulation product, with conductivity coefficient λ=0,035 W/mK, which is cut in 50 mm strips. **FONOSTOPThermoAlu** is supplied in 100 cm wide rolls, complete with 5 cm textile overlap wing; the top face of the product is lined with aluminium foil whereas the bottom face is made up of the insulation strips in white EPS 120.

FIELDS OF USE

FONOSTOPAlu is used for the acoustic insulation against foot traffic noise of intermediary floor slabs with underfloor heating. It is generally laid over standard flat and smooth insulation panels, before laying the heating pipes. When there is not enough room for the thermal insulation, **FONOSTOPAlu** can be used on its own, laying it on the cement-based foundations before laying the pipes.
FONOSTOPThermoAlu is used for the thermal-acoustic insulation of floor slabs with underfloor heating and fulfils all the functions requested on its own.
Both products can be used under a reinforced cement-based screed or under a screed in unreinforced self-levelling anhydrite.



4. **FONOSTOPAlu**



FONOSTOPThermoAlu

METHOD OF USE AND PRECAUTIONS

In the case of FONOSTOPAlu the thermal insulation panels are laid first, whereas FONOSTOPThermoAlu is laid directly on the foundations. The rolls of FONOSTOPAlu or FONOSTOPThermoAlu are to be unrolled in their natural unrolling direction with the top aluminium-coated face facing upwards and are to be overlapped at the sides by arranging the overlap wing on the adjacent sheet and carefully matching the elements up. On the short side, neither materials are overlapped but are carefully brought together end-to-end. They will cover the whole floor slab and are to be blocked and trimmed-off at the foot of the perimeter walls of the room to be insulated. All the longitudinal overlap lines and the transversal joining lines of the sheets are then to be carefully sealed with the special adhesive SIGILTAPE, stuck over the same. The floating screed must be completely detached not just from the floor slab but also from the walls and from anything coming out of the slab that should cross it. To do this, starting from the insulation material laid on the slab surface, the perimeter walls are to be lined by 15 cm with the special FONOCELL angular self-adhesive elements in expanded polyethylene, which will be turned up and over the surface by 5 cm to glue them to the insulation layer on which they will be further blocked with the adhesive SIGILTAPE.
Any parts or pipes that should cross the insulation sheet and the floating screed vertically shall be lined carefully with FONOCELL. The heating pipes will then be laid, which will be held in position by special modular plastic bars in which the seats for the pipes are arranged, every 5 cm, and which will be glued in advance to the aluminium-coated

(continua)

FONOSTOPAlu

Thickness • Alu-foil	6,5 mm approx 0,012 mm	
Roll size	1,05×15,0 m	
Mass per unit area	1,1 kg/m^2	
Watertightness (EN 1928)	1 KPa	
Water vapour diffusion coefficient (soundproof foil)	μ 1.500.000	
Dynamic stiffness (ITC certificate conforming to UNIEN29052 p. 1st) load 200 kg/m^2	Apparent dynamic stiffness s'_t = 4 MN/m^3	Dynamic stiffness s' = 21 MN/m^3 (¹)
Theoretical estimation of the reduction level in foot traffic noise (¹)	ΔL_w = 28 dB	
Compression testing under load of 200 kg/m^2 (EN 1606)	Reduction in thickness ≤1 mm ca.	
Compressibility (EN 12431:2000 - Established thickness)	≤2 mm	
Resistance to loading • static (EN 12730) • dynamic (EN 12691)	35 kg 20 cm	
Thermal conductivity • Non-woven fabric λ • Alu-foil λ	0,045 W/mK 236 W/mK	
Thermal diffusion • Alu-foil	α = 8,2 · 10-5 m^2/s	

FONOSTOPThermoAlu

ACOUSTIC PERFORMANCE: *see FONOSTOPAlu specifications*

Expanded polystyrene EPS 120

Designation code (EN 13163)	EPS EN13163-T1-L1-W1-S1-P3-DS(N)5-BS170-CS(10)120			
Compression strength 10% compression (EN 826)	≥120 KPa **[** CS(10)120 **]**			
Dimensional stability 48 h at 23°C R.H. (EN 1604)	±0,5% **[** DS(N)5 **]**			
Bending strength (EN 12089)	≥170 KPa **[** BS170 **]**			
Long term water absorption by immersion (EN 12087)	<5%			
Water vapour transmission (EN 12086)	30÷70 μ			
Thickness T1	20 mm	30 mm	40 mm	50 mm
Thermal resistance R_D (EN 12667)	0,55 m^{2}K/W	0,85 m^{2}K/W	1,10 m^{2}K/W	1,40 m^{2}K/W
Thermal conductivity	0,035 W/mK			
Specific heat	1.20 kJ/kgK			
Reaction to fire (EN 13501-1)	Euroclass E			

FONOSTOPThermoAlu

Type	25	35	45	55
Thickness (*)	26 mm	36 mm	46 mm	56 mm
Thermal resistance **R** (*) (EN 12667)	0,65 m^{2}K/W	0,95 m^{2}K/W	1,20 m^{2}K/W	1,50 m^{2}K/W
Roll size	1×10 m	1×8 m	1×6 m	1×5
Width of sound-resilient foil	1,05 m	1,05 m	1,05 m	1,05 m

(*) Value established on the material subjected to a load of 1 KPa (100 kg/m^2).
WARNING: The dynamic stiffness values **s'** marked in red are the only ones useful for provisional calculation in conformity with EN 12354-2.

(segue)
face with a strip of hot extruded glue using the special electrical glue gun. The heating pipes, in the case of reinforced cement-based screeds, can be bound or secured with appropriate devices to the electrically welded metal reinforcement but for both systems, what's most important is never to perforate or secure the pipes across the insulation material, otherwise its insulating properties will be jeopardised. The screed is then laid without perforating the insulation or moving the overlaps. The screed will be prepared and sized according to the instructions of the designer of the heating system.

ANIT Associated

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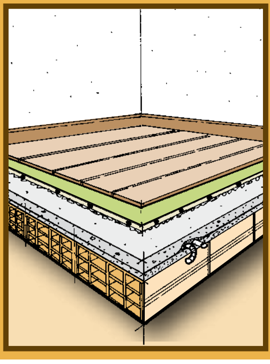


FONOSTOPLegno

DOUBLE LAYER ACOUSTIC INSULATION AGAINST FOOT TRAFFIC NOISE FOR FLOATING TONGUE-AND-GROOVE FLOORS

CHARACTERISTICS		IMPACT ON THE ENVIRONMENT		
ACOUSTIC INSULATION	FIRE REACTION	ECO GREEN	RECYCLABLE	NON-DANGEROUS WASTE

PROBLEM

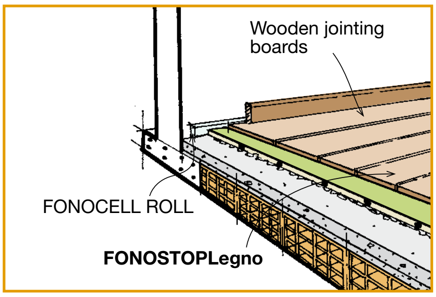
The thin insulating sheets usually used under floating wood floors reduce foot traffic noise inside the room where it is generated and are not sufficiently effective to prevent the transmission of foot traffic noise, through the floor slab, to adjacent rooms.

SOLUTION

FONOSTOPLegno is an acoustic insulation against foot traffic noise specific for floating wood floors made up of a sound-resilient foil, lined with a non-woven green polypropylene textile finish, coupled with a non-woven high-density elastic polyester fabric.
The fibres are not irritant, they are flexible and do not crumble when compressed or folded.
FONOSTOPLegno has a high friction coefficient referred to cement laying surfaces. It is heavy enough so as not to move when laying the wood floor, thus ensuring insulation continuity and stability.
Only when applying on an old smooth floor is it preferable to prepare the laying surface with a coat of adhesive FONOCOLL of 80-100 g/m^2 that fixes the insulation while laying the wood boards.
FONOSTOPLegno resists building site traffic and has a high-density non-woven polyester fabric, highly resistant to crushing, which maintains its performance long-term.
FONOSTOPLegno is applied directly under the flooring without installing a screed in-between, of which the dynamic stiffness is gauged for the type of use of the product.
To avoid breakages or problems along the floor joins, the dynamic stiffness chosen is the outcome of the compromise between elasticity and resistance to crushing.
FONOSTOPLegno has a compression resistance 5 times higher than FONOSTOPDuo.
FONOSTOPLegno also protects the wood floor above, because the foil of the top face of the product is waterproof and resistant to water vapour that could rise from the foundation.
FONOSTOPLegno, thanks to its limited thickness, insulates the transmission of foot traffic noise when it is laid in-between the floor slab and the floating wood floors used in the civil building industry. It can be used in new builds but also for restoring acoustic insulation of existing flooring.
It is also used under cement screeds, in special cases where very high compression resistance is required.

METHOD OF USE AND PRECAUTIONS

The rolls of **FONOSTOPLegno** are to be unrolled in their natural unrolling direction with the top green face facing upwards, on a smooth foundation, which should be clean and dry, without any bumps or dips.
The sheets should not overlap, but should be brought close to each other and the joining lines must always be sealed with adhesive SIGILTAPE, stuck over them.
The insulation material will be blocked and trimmed-off at the foot of the walls and anything protruding from the surface of the floor slab.
To avoid acoustic bridges when laying the floor, do not lay it right up to the walls. As a precaution, use a strip of self-adhesive extruded polyethylene, and just stick it at the foot of the walls. It will ensure that the walls are separated from the floor. The strip is trimmed-off after the floor has been laid completely

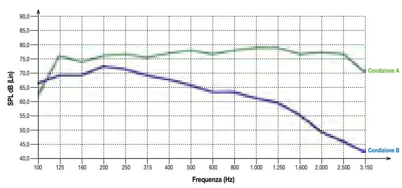


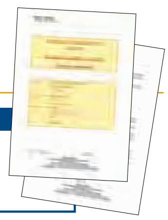
FOOT-TRAFFIC NOISE - VALUATION INDEX L'_{nw} (Measured during laying)

Description	Thickness (cm)
Condition A	
Gypsum plaster	1.5
Slab in clay/cement mix	20+4
Light cement for levelling (polystyrene + sand)	5.0
Screed in sand and finishing cement	3.5
Floor (wood parquet glued on screed)	1.5
Total floor	**about 35.5**
EXPERIMENTAL VALUE	**78.0 dB**

Description	Thickness (cm)
Condition B	
Gypsum plaster	1.5
Slab in clay/cement mix	20+4
Light cement for levelling (polystyrene + sand)	5.0
Screed in sand and finishing cement	3.5
Fonolegno panel not glued on screed	0.5
Floor (wood parquet glued on Fonolegno)	1.5
Total floor	**about 36.0**
EXPERIMENTAL VALUE	**59.0 dB**

COMPARISON OF SOUND SPECTRA





MUSURED DURING LAYING

Certification "Studio di Acustica Applicata"

FONOSTOPLegno

Mass per unit area	**1,8 kg/m²**
Roll size	1,00×10 m
Thickness	5,0 mm approx
Dynamic stiffness • FONOSTOPLegno	Apparent dynamic stiffness s'_t = 43 MN/m³ — Dynamic stiffness s' = 72 MN/m³
Width of phono resilient foil	100 cm
Width of non-woven fabric	100 cm
Aqueous vapour diffusion coefficient (phonoresilient foil)	100.000 μ
Impermeability (1 m of water column)	Waterproof
Thermal conductivity coefficient • phonoresilient foil λ • non-woven fabric λ	 0,170 W/mK 0,045 W/mK
Crushing under constant load (2 KPa×122 giorni) (EN 1606)	0,2 mm
Resistance to compression • crushing 1 mm • crushing 2 mm	 5,87 kPa 62,40 kPa
Thermal resistance at 10°C **R** (EN12667)	0,10 m²K/W
Thermal conductivity λ	0,044 W/mK (1)
Heat capacity per unit area (2)	1,790 KJ/m²K
Thermal resistance **R**	0,097 m² K/W (1)
Volatile Organic Compound (VOC) emissions (EN ISO 16000-9) • after 48 hours • after 28 days	 << minimal value required by prEN (3) << minimal value required by prEN (3)
Fire reaction class (UNI 9177)	**Class 1 (4) (6)**
Fire reaction class (EN 13501-1)	**Euroclass C_{fl}-s1 (5)**
Certifications	LAPI, CATAS

(1) Value established on the material subjected to a load of 1 KPa (100 kg/m²). (2) Apparent value obtained by calculating values of every component expressed per unit area of whole product (m²)
(3) Certificate "CATAS" - Research and development centre and test laboratory for the wood-furnishing industry n. 108145/1. (4) Certificate LAPI n. 5935. (5) Certificate LAPI n. 085.0DC0050/08.
(6) Approval of the Ministry of Interior No. VR2172B41C100004.

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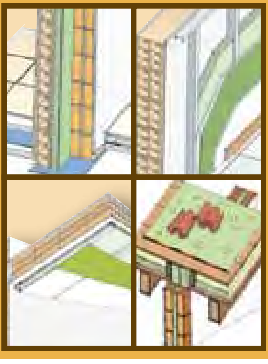


TOPSILENTBitex TOPSILENTAdhesiv TOPSILENTDuo

ACOUSTIC INSULATION MADE UP OF A HIGH DENSITY SOUND-RESISTANT FOIL WITH VERY HIGH CRITICAL FREQUENCY FOR THE ACOUSTIC AIRTIGHT PLASTERING OF AIR SPACES IN BRICK WALLS AND ACOUSTIC IMPROVEMENT OF PLASTERBOARD WALLS

CHARACTERISTICS		IMPACT ON THE ENVIRONMENT		
ACOUSTIC INSULATION	FIRE REACTION	ECO GREEN	RECYCLABLE	NON-DANGEROUS WASTE

PROBLEM

How to acoustically insulate the air spaces of brick walls or to improve the acoustic performance of plasterboard walls with sound-resistant foils that are lead-free, since lead is toxic.

SOLUTION

TOPSILENT is a high density foil that has the acoustic properties of a foil of lead even if it is completely lead-free.

It acoustically insulates just like a foil of lead of the same weight, but is free from the typical toxicological problems of this metal. **TOPSILENTBitex**, in the standard version, is a foil with polypropylene textile coating on both faces, which consequently results to be a particularly efficient "gripper" to many types of adhesives, be they synthetic or with hydraulic bonding agents.

TOPSILENTDuo is the version where one of the faces with the polypropylene finish is replaced by thick felt in non-woven polyester fabric with dynamic stiffness of 21 MN/m³, which further contributes in acoustic insulation.

In **TOPSILENTAdhesiv**, one of the faces of the polypropylene finish is replaced by a coating of self-adhesive product protected by a silicone film.

FIELDS OF USE

The foils of **TOPSILENTBitex**, **TOPSILENT-Adhesiv** and **TOPSILENTDuo** are used in the building industry to improve the acoustic properties of plasterboard panels of insulating false-walls and false-ceilings. They can also be used to line the inside of wooden shutter boxes to improve the acoustic insulation of external walls, or as shock-absorbers on metal sheet panels. **TOPSILENTDuo** can also be used successfully in the insulation of light wood floors, where it adds a high level of insulation against foot traffic noise and provides a contribution due to its weight. **TOPSILENTBitex**, **TOPSILENTAdhesiv** and **TOPSILENTDuo** can advantageously substitute plastering and internal rendering of the air space of traditional double walls. **TOPSILENTDuo** will be laid with the face covered with the non-woven felt face against the wall. Seeing as it is strongly resistant to water vapour, in the case of external walls, it will be laid on the warm face of the insulation fibre acting as a vapour barrier.

METHOD OF USE AND PRECAUTIONS

The foils can be glued to the plasterboard or wood panels with FONOCOLL on the coloured part of the polypropylene fabric. To glue on brick and concrete walls, use plaster-based glue GIPSCOLL (for securing to brick or concrete walls, you are recommended to apply the **TOPSILENT** foil using polypropylene dowels). They can be screwed to the metal frame or stapled with metal staples to a pre-existent panel.

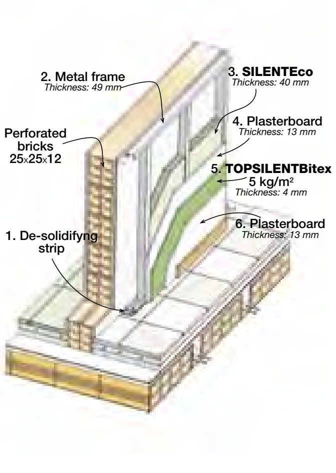
FONOCOLL is a glue product in water emulsion for the rapid gluing of **TOPSILENTBitex** and **TOPSILENTDuo** on plasterboard or wood panels in acoustic insulation systems. The glue is spread on the panel in a ratio of 150÷200 g/m².

TOPSILENTDuo is applied in boxes with the face covered with felt facing the outside. If it is used as an acoustic insulation in floors, it is to be laid face down. The width of 120 cm is to be used for coupling on plasterboard panels, while the width of 100 cm is also available for other uses.

TOPSILENTAdhesiv reduces laying times and does not require the use of nails. Simply remove the silicone film and press the sheet on the surface to be insulated. Laying by simple self-adhesion is to be suspended when the temperature is lower than +5°C and/or aided by hot air or flame tools when the temperature is below +10°C and/or in particular conditions of damp.

ACOUSTIC INSULATION OF WALLS CERTIFIED BY "IEN G. FERRARIS"

LEAN-TO FALSE-WALL IN PLASTERBOARD ON METAL FRAME



CHARACTERISTICS OF WALL
- Total thickness 23 cm
- Weight 178 kg/m²

SOUNDPROOFING POWER

R_w = 61,3 dB

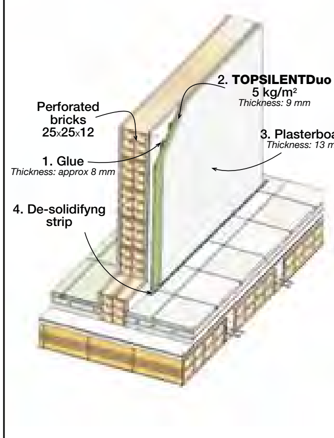
TRANSMITTANCE

U = 0,5365 W/m²K

CERTIFICATION

"IEN G. Ferraris"
n. 35561/07

THIN FALSE-WALL IN GLUED PLASTERBOARD



CHARACTERISTICS OF WALL
- Total thickness 18 cm
- Weight 167 kg/m²

SOUNDPROOFING POWER

R_w = 51,9 dB

TRANSMITTANCE

U = 1,3425 W/m²K

CERTIFICATION

"IEN G. Ferraris"
n. 35561/08

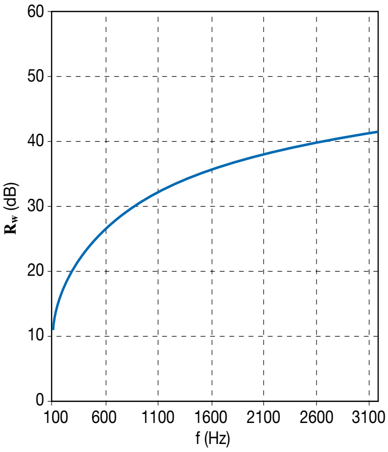
	TOPSILENTDuo	TOPSILENTBitex		TOPSILENTAdhesiv
Mass per unit area	**5 kg/m²**	**4 kg/m²**	**5 kg/m²**	**5 kg/m²**
Roll size	0,60×8,50 m	0,60×11,50 m 1,20×8,50 m	0,60×11,50 m 1,20×8,50 m	1,00×8,50 m
Thickness • total • phono-resilient foil • non-woven fabric	 9 mm 4 mm 5 mm	 3 mm 3 mm –	 4 mm 4 mm –	 4 mm 4 mm –
Specific heat	1,70 KJ/KgK	1,70 KJ/KgK	1,70 KJ/KgK	1,70 KJ/KgK
Aqueous vapour diffusion coefficient	μ = 100.000	μ = 100.000	μ = 100.000	μ = 100.000
Thermal conductivity coefficient λ • phono-resilient foil • non-woven fabric	 0,170 W/mK 0,045 W/mK	 0,170 W/mK –	 0,170 W/mK –	 0,170 W/mK –
Critical frequency (thickness 10 mm, dens. 1.250 kg/m³)	>85.000 Hz	>85.000 Hz	>85.000 Hz	>85.000 Hz
Dynamic stiffness (UNI EN 29052/1)	s' = 21 MN/m³	–	–	–
Phono-insulating power (calculated value)	27 dB	24 dB	27 dB	27 dB
Fire reaction class (UNI 9177)	**Class 1** (¹)	**Class 1** (²)	**Class 1** (²)	–
Certifications	Istituto Giordano	Istituto Giordano		

(¹) Certification Istituto Giordano n. 171105/RF3601. Approval of "Ministry of Interior" n. VR2172B10D100003.
(²) Certification Istituto Giordano n. 171105/RF3602. Approval of "Ministry of Interior" n. VR2172B10D100003.

FREQUENCY ANALYSIS OF THE SOUND-INSULATING POWER

To estimate the soundproofing power of the sound-resistant foil **TOPSILENTBitex**, one can theoretically consider a wall made of just the material (lab tests too also exploit the same method: the soundproofing power of the sample material is measured in 1 m x 1 m) exploiting the indications available in technical literature to evaluate its level.
We therefore consider our even wall made up of just **TOPSILENTBitex** having the following physical characteristics:
MASS PER UNIT AREA m' = 5 Kg/m²
DENSITY ρ = 1.250 Kg/m³
and evaluate its soundproofing power in terms of frequency according to the equation below that illustrates the Law of Mass:
R = 20 log (ρ f) – 42,5

ρ [Kg/m²]	f [Hz]	R [dB]
5	100	11,4794
5	125	13,4176
5	160	15,5618
5	200	17,5
5	250	19,4382
5	315	21,44561
5	400	23,5206
5	500	25,4588
5	630	27,46621
5	800	29,5412
5	1000	31,4794
5	1250	33,4176
5	1600	35,5618
5	2000	37,5
5	2500	39,4382
5	3150	41,44561



From what is expressed through the application of this law, one can see that the soundproofing power is not to be considered constant for all the frequencies, but increases by 6 dB per octave. In actual fact, such trend really only occurs at intermediate frequencies. In the low frequency zone, there is a problem related to the fact that the walls "enter" in resonance with the sound. These frequencies depend on the contour conditions (geometric characteristics of the walls and binding method). As for the high frequencies, one will notice another zone where the curve is no longer linear, at a specific frequency, called "coincidence frequency", where the wall starts to vibrate (flexing vibration), reducing its soundproofing power **R**; this phenomenon only occurs if the sound waves have a different affect compared to the normal direction on the wall.

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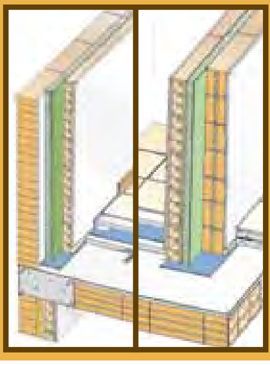
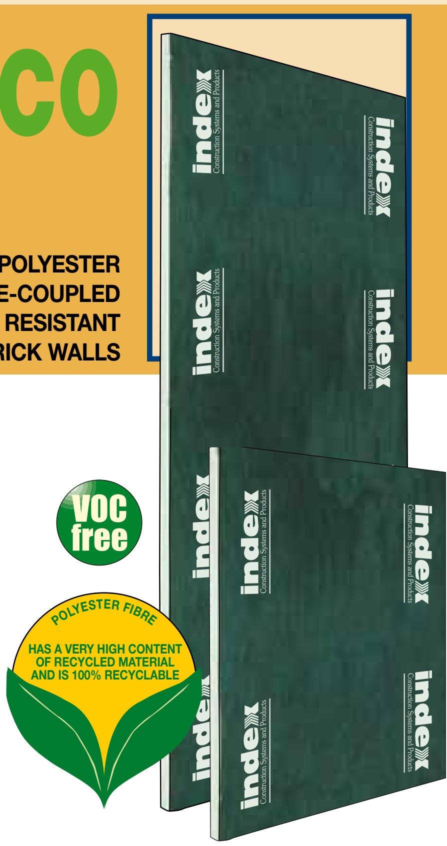


TOPSILENTEco

SELF-BEARING THERMAL-ACOUSTIC INSULATION PANELS WITH POLYESTER FIBRE BASE, NON-TOXIC, HEAT-SEALED, FREE FROM GLUES, PRE-COUPLED WITH A HIGH DENSITY SOUND-RESISTANT FOIL, AIRTIGHT AND RESISTANT TO VAPOUR, FOR INSULATING DOUBLE BRICK WALLS



CHARACTERISTICS			IMPACT ON THE ENVIRONMENT		
ACOUSTIC INSULATION	THERMAL INSULATION	FIRE REACTION (Reazione al fuoco)	ECO GREEN	RECYCLABLE	NON-DANGEROUS WASTE

PROBLEM

Many of the thermal insulation products used to fill-in the air spaces of walls do not insulate against noise, are permeable to air and vapour, are small in size and therefore laying is necessarily bound to the simultaneous building of the false-wall.

SOLUTION

TOPSILENTEco is a pre-coupled panel obtained by joining a polyester fibre insulation product with a high density sound-resistant foil with high resistance to air and water vapour that acts as both acoustic and thermal insulation.
With regard to acoustic insulation, the fibre of the composite material dissipates the sound energy that crosses the air space of the double wall, while the airtight foil seals the pores in the wall so that the internal face of the air space does not need to be plastered.
With regard to thermal insulation, the fibre is also an excellent thermal insulator. Its efficiency is maintained over time by the foil, which is always to be turned over towards the inside of the compartment to be insulated. This foil, in the insulation of external perimeter walls, does indeed act as a vapour barrier and keeps the thermal insulation obtained by the fibres dry and unaltered.
TOPSILENTEco is a thermal-acoustic insulation product whose fibrous part consists of non-toxic polyester wool obtained from recycled PET soft drink and mineral water bottles.
The fibre thus obtained is to be considered as a dually ecological material because it frees the environment of high volumes of waste and because the product obtained through a glue-free thermal process does not irritate the skin and does not sting.
The production cycle of the fibres of **TOPSILENTEco**, seeing as it is a recycling process, also has very low environmental impact and low consumption of energy compared to that of other insulation materials that derive from raw virgin materials.
The fibres of **TOPSILENTEco** do not irritate the skin of workers while cutting the panels and this is why the panels are not packed in plastic sacks.

FIELDS OF USE

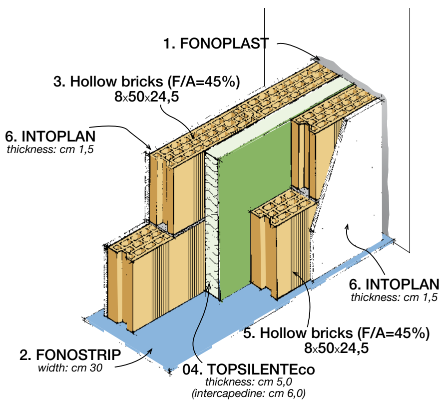
TOPSILENTEco is suitable for the thermal-acoustic insulation of air spaces in external perimeter walls and internal dividing walls between different dwellings.
The coupling of the insulation material and the foil reduces application times and makes laying easier. The advantages of the coupling of the insulation material and the foil are further enhanced by the special configuration of the panels combined with the large sizes in which they are produced (100×142cm, 100×285 cm). The supply dimensions make them convenient to use in association with plasterboard walls and false-walls just as a preventative insulation of the wall to be treated, on which the metal frame will then be installed to which the plasterboard panels are screwed.

METHOD OF USE AND PRECAUTIONS

Laying is simple and quick and can be done by just one operator without having to simultaneously erect the false-wall and without having to use special tools.
TOPSILENTEco is glued to the wall with the face covered with the foil facing the operator. Simply apply a strip of approximately 15 cm of GIPSOLL glue on the fibrous face on the top end to hold the 100×142 panel in place, whereas another strip will be required in the middle to hold the 100×285 cm panels. It takes just a few minutes; the panel on which the adhesive is applied is put in place and lightly pressed against the wall using a painter's roller; it holds straight away and the operator can carry on fitting the next panel, finally, to ensure greater resistance to air and water vapour, the joining lines of the panels are sealed with the adhesive SIGILTAPE.
The glue is prepared by mixing the GIPSCOLL powder with water (it takes 600 g per strip), until a thick paste is obtained, which will be applied using a trowel or toothed spatula. Its consistency and adhesiveness should be such to hold the panel on the wall immediately, even when still wet, without having to wait for it to set and without having to use supports. The false-wall that will be built subsequently will be kept slightly detached from the insulation to prevent the elastic reaction of the insulation layer from deforming it or knocking it down in the setting phase of the mortar.
If the material needs to be cut, first cut the foil with a Stanley knife and then cut the polyester wool with a long-bladed Stanley knife or an alternative saw with smooth blade. Do not use toothed-bladed saws.

ACOUSTIC INSULATION OF WALLS CERTIFIED BY "ITC-CNR"

DOUBLE WALL 8÷8



CHARACTERISTICS OF WALL

- Total thickness 25 cm
- Weight 243 kg/m²

SOUNDPROOFING POWER

R_w = 56,0 dB

TRANSMITTANCE

U = 0,3249 W/m²K

CERTIFICATION

ITC "ITC-CNR" n. 4166RP06

TOPSILENTEco

Thickness of polyester fibre	**40 mm**	**50 mm**	**60 mm**
Panel size	1,00×1,42 m 1,00×2,85 m	1,00×1,42 m 1,00×2,85 m	1,00×1,42 m 1,00×2,85 m
Density of polyester wool	30 kg/m³	30 kg/m³	30 kg/m³
Thickness of of sound proofing foil	2 mm approx	2 mm approx	2 mm approx
Mass per unit area of sound proofing foil	2,5 kg/m²	2,5 kg/m²	2,5 kg/m²
Apparent dynamic stiffness	$s'_t \leq 30$ MN/m³	$s'_t \leq 30$ MN/m³	$s'_t \leq 30$ MN/m³
Specific heat • polyester fibre • sound proofing foil	 1,200 KJ/kgK 1,700 KJ/kgK	 1,200 KJ/kgK 1,700 KJ/kgK	 1,200 KJ/kgK 1,700 KJ/kgK
Diffusion coefficient of acqueous vapour • polyester fibre • sound proofing foil	 μ 1 μ 100.000	 μ 1 μ 100.000	 μ 1 μ 100.000
Thermal conductivity coefficient λ • polyester fibre • sound-proofing foil	 0,037 W/mK 0,170 W/mK	 0,037 W/mK 0,170 W/mK	 0,037 W/mK 0,170 W/mK
Thermal resistance	1,093 m² K/W	1,363 m² K/W	1,633 m² K/W
Resistivity to air flow r	3,90 KPa/sm²	3,90 KPa/sm²	3,90 KPa/sm²
Volatile Organic Compound (VOC) emissions (EN ISO 16000-9) • after 48 hours • after 28 days	 << minimal value required by prEN 12052 (1) << minimal value required by prEN 12052 (1)	 << minimal value required by prEN 12052 (1) << minimal value required by prEN 12052 (1)	 << minimal value required by prEN (1) << minimal value required by prEN (1)
Fire reaction class (UNI 9177) • polyester fibre • sound-proofing fois **(*)**	 **Class 1** (does not drip) **Class 1**	 **Class 1** (does not drip) **Class 1**	 **Class 1** (does not drip) **Class 1**
Certifications	ITC CATAS		

(1) Certificate "CATAS" - Research and development centre and test laboratory for the wood-furnishing industry n. 10571/1.
(*) Test performed with sound proofing foil of 5 kg/m².
NOTE. TOPSILENTEco is a thermal-acoustic insulation panel that can also be used as thermal insulation in the building trade just like other thermal insulation products. This product is currently not subject to CE marking because the specific European EN standard is still being defined.

INDEX's exclusive production systems are covered by registered patents.

Conside ring the numerous possible uses and the possible interference of conditions or elements beyond our control, we assume no responsibility regarding the results which are obtained. The purchasers, of their own accord and under their own responsibility, must establish the suitability of the product for the envisaged use.

The figures shown are average indicative figures relevant to current production and may be changed or updated by INDEX S.p.A at any time without previous warning. The advice and technical information provided, is what results from our best knowledge regarding the properties and the use of the product.

ANIT Associated

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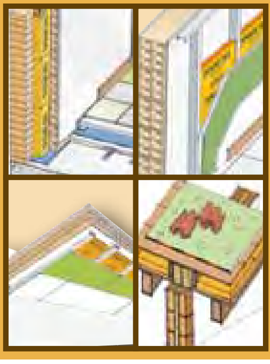
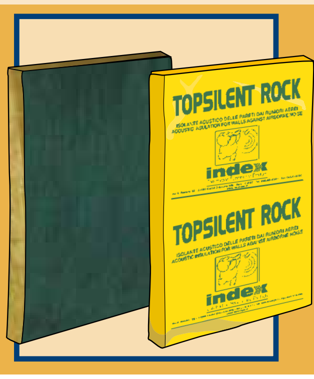
TOTAL QUALITY index UNI EN ISO 9001 — Environmental Management Systems index UNI EN ISO 14001 — index "GBC Italia" Associated — lavorosicuro

03/2010en



TOPSILENTRock



SELF-BEARING THERMAL-ACOUSTIC INSULATION PANELS WITH ROCK WOOL BASE, PRE-COUPLED WITH A HIGH DENSITY SOUND-RESISTANT FOIL, AIRTIGHT AND RESISTANT TO VAPOUR FOR INSULATING AIR SPACES IN TRADITIONAL DOUBLE WALLS AND WALLS AND FALSE-WALLS ON A METAL FRAME LINED WITH PLASTERBOARD. THE PRODUCT CAN BE SUPPLIED AS FOLLOWS:
• VERSION IN POLYETHYLENE PACKAGING • VERSION WITHOUT PACKAGING

CHARACTERISTICS			IMPACT ON THE ENVIRONMENT		
ACOUSTIC INSULATION	THERMAL INSULATION	FIRE REACTION (Reazione al fuoco)	ECO GREEN	RECYCLABLE	NON-DANGEROUS WASTE

PROBLEM

Many thermal insulation products used to fill-in air spaces in brick walls do not insulate against noise and are permeable to air and vapour.

SOLUTION

TOPSILENTRock is a thermal-acoustic insulation panel, coupled with a sound-resistant foil that also acts as a vapour barrier.
It is suitable for insulating air spaces in internal dividing walls between different dwellings and for insulating external perimeter walls.
It consists of a fire-proof rigid panel in high density rock wool with thermo-setting resins, with reaction to fire in European class B-s1,d0. One face of the panel is lined with the high density TOPSILENTBitex foil, which has the acoustic insulation properties of a foil of lead but is actually completely free from lead. TOPSILENTBitex acts as an insulation plastering resistant to air, vapour and noise.
In the packaged version, each panel is protected by polyethylene packaging that protects it against damp and prevents contact with the fibres and also dispersion of the same in the environment. The marking "Side A – Side facing the user" identifies the face on which the TOPSILENTBitex foil is glued.

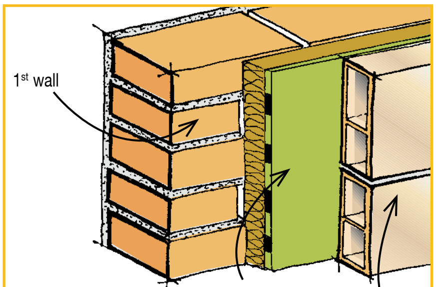
TOPSILENTRock reduces site work.
Just one product is laid to apply both the thermal-acoustic insulation and the layer resistant to air and vapour. With **TOPSILENTRock** there is no longer any need to plaster the internal face of the air space.

FIELDS OF USE

TOPSILENTRock is used in the building industry for the acoustic insulation of internal walls and for the acoustic and thermal insulation of external perimeter walls.
It is used to fill-in air spaces in double walls where the fibrous part reduces vibrations and connective movements of air, while the sound-resistant foil seals the pores in the wall.
It can also be used to insulate plasterboard walls.

METHOD OF USE AND PRECAUTIONS

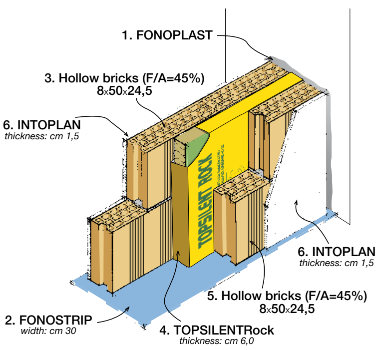
The **TOPSILENTRock** panel is fitted in the air space progressively as the second part of the double wall is erected.
With the packaged version, once you have laid the first row of bricks of the second wall, insert the panels, resting them against the existing wall with the marking "Side A – Side facing the user" towards the operator.
Continue erecting the wall, taking care not to compress the insulation material, but keeping it slightly detached from the panel, otherwise, if the wall is erected before the mortar has set, it could be deformed or demolished by the elastic reaction of the insulation material.
Rest the second row of panels on the first after the height of the wall has risen above the first row of panels.
In plasterboard walls and false-walls on framework, fit the insulation panel in its seat on the metal uprights with the marking "Side A – Side facing the user" towards the operator, the same as in the case of false-walls. With the unpackaged version, the face of the panel facing the operator will be that lined with the green fabric.
To cut the panel, first cut the foil with a Stanley knife and then cut the wool with a ripsaw for wood.



TOPSILENTRock unpacked version
Face towards the operator during laying

ACOUSTIC INSULATION OF WALLS CERTIFIED BY "ITC-CNR"

DOUBLE WALL 8÷8



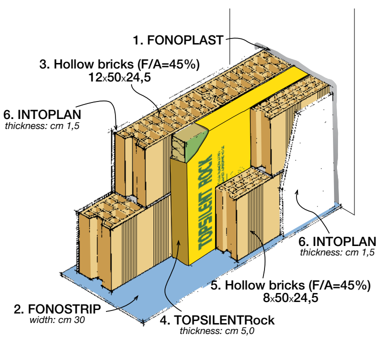
CHARACTERISTICS OF WALL
- Total thickness 25 cm
- Weight 245 kg/m²

SOUNDPROOFING POWER
R_w = 55,0 dB

TRANSMITTANCE
U = 0,3016 W/m²K

CERTIFICATION
ITC
"ITC-CNR"
n. 4165RP06

DOUBLE WALL 12÷8



CHARACTERISTICS OF WALL
- Total thickness 28 cm
- Weight 288 kg/m²

SOUNDPROOFING POWER
R_w = 57,0 dB

TRANSMITTANCE
U = 0,3204 W/m²K

CERTIFICATION
ITC
"ITC-CNR"
n. 4167RP06

TOPSILENTRock

Thickness of rock wool	**40 mm**	**50 mm**	**60 mm**
Panel size	0,60×1,00 m	0,60×1,00 m	0,60×1,00 m
Rock wook density	40 kg/m^3	40 kg/m^3	40 kg/m^3
Thickness of sound proofing foil	2,5 mm approx	2,5 mm approx	2,5 mm approx
Mass per unit area of sound proofing foil	2,5 kg/m^2	2,5 kg/m^2	2,5 kg/m^2
Specific heat • rook wool • sound proofing foil	 1,030 KJ/kgK 1,700 KJ/kgK	 1,030 KJ/kgK 1,700 KJ/kgK	 1,030 KJ/kgK 1,700 KJ/kgK
Aqueous vapour diffusion coefficient (sound proofing foil)	μ 100.000	μ 100.000	μ 100.000
Thermal conductivity coefficient λ • rook wool • sound proofing foil	 0,035 W/mK 0,170 W/mK	 0,035 W/mK 0,170 W/mK	 0,035 W/mK 0,170 W/mK
Thermal resistance	1,11 m^2 K/W	1,41 m^2 K/W	1,71 m^2 K/W
Resistivity to air flow r	14,9 KPa/sm^2	14,9 KPa/sm^2	14,9 KPa/sm^2
Fire reaction class (EN 13501-1)	**Euroclass B, s1-d0 (*)**	**Euroclass B, s1-d0 (*)**	**Euroclass B, s1-d0 (*)**
Marcatura CE Norma di riferimento EN13162 — CE designation code for thermal insulation (EN 13162)	MW-EN13162-T4-DS(TH)-WS-MU1	MW-EN13162-T4-DS(TH)-WS-MU1	MW-EN13162-T4-DS(TH)-WS-MU1
Certifications			

(*) Certificate LAPI n. 730.0DC0050/06.

ANIT Associated

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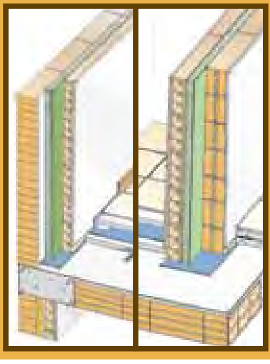
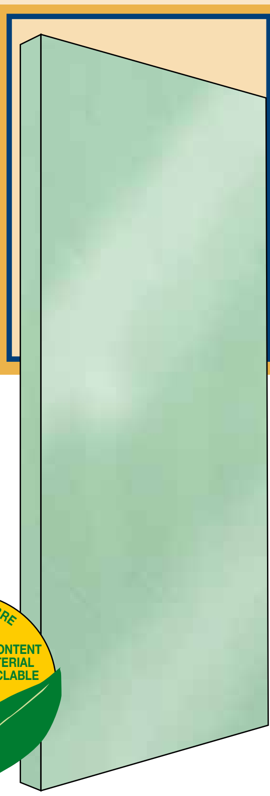
03/2010en



SILENTEcoEster



SELF-BEARING THERMAL-ACOUSTIC INSULATION PANELS WITH POLYESTER FIBRE BASE, NON-TOXIC, HEAT-SEALED, FREE FROM ADHESIVES, PRE-COUPLED WITH A HIGH DENSITY SOUNDPROOFING FOIL, AIRTIGHT AND RESISTANT TO VAPOUR, FOR INSULATING DOUBLE BRICK WALLS

CHARACTERISTICS		IMPACT ON THE ENVIRONMENT		
ACOUSTIC INSULATION	THERMAL INSULATION	ECO GREEN	RECYCLABLE	NON-DANGEROUS WASTE

PROBLEM

Many of the thermal insulation products used to fill-in the air spaces of walls do not insulate against noise, are permeable to air and vapour, are small in size and therefore laying is necessarily bound to the simultaneous building of the false-wall.

SOLUTION

SILENTEcoEster is a large self-bearing pre-coupled panel obtained by joining a polyester fibre insulation product with a film of the same kind having very high air and water vapour tightness, and that acts as both acoustic and thermal insulation.
SILENTEcoEster is the self-bearing and large version of the naked SILENTEco panel.
The fibre is an excellent thermal insulator whose efficiency is maintained over time by the built-in vapour barrier, which is always positioned facing the inside of the room to be insulated and which keeps the insulating fibres dry and unaltered in the insulation of external perimeter walls.
With regard to acoustic insulation, the fibre of the composite material dissipates the sound energy that crosses the air space of the double wall.
SILENTEcoEster is a thermal-acoustic insulation product whose fibrous part consists of non-toxic polyester wool obtained from recovering and recycling mineral water and soft drink bottles in PET through the environment friendly disposal of Solid Urban Waste
The fibre thus obtained is to be considered as a dually ecological material because it frees the environment of high volumes of waste and because the product obtained through an adhesive-free thermal process does not irritate the skin and does not sting.
The production cycle of the fibres of **SILENTEcoEster**, seeing as it is a recycling process, also has very low environmental impact and low consumption of energy compared to that of other insulation materials that derive from raw virgin materials.
The fibres of **SILENTEcoEster** do not irritate the skin of builders, not even when cutting the panels and this is why the panels are not packed in plastic sacks.

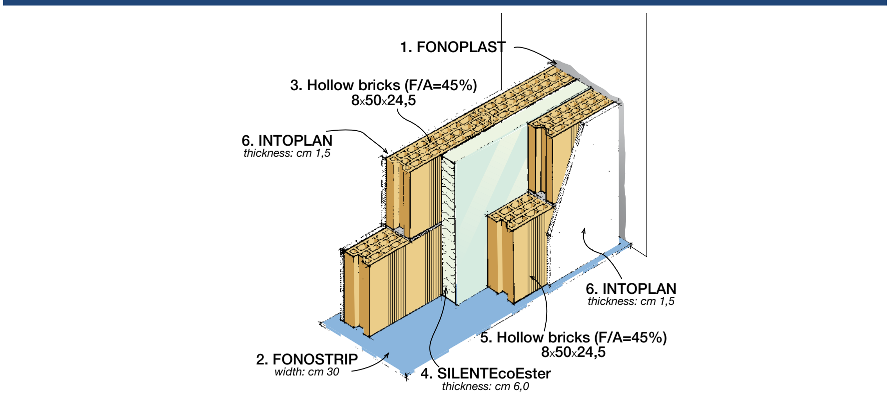
FIELDS OF USE

SILENTEcoEster is suitable for the thermal-acoustic insulation of air spaces in external perimeter double walls but can also be used in association with plasterboard walls and false-walls just as a preventive insulation of the wall to be treated, on which the metal framework will then be installed to which the plasterboard panels are screwed.
The special configuration of the large panels in which it is produced (100×285 cm) cuts down application times and makes laying easier.

METHOD OF USE AND PRECAUTIONS

Laying is simple and quick and can be done by just one operator without having to simultaneously erect the false-wall and without having to use special tools.
SILENTEcoEster is applied with the face lined with the film facing the inside of the building, the panel is light and self-bearing and generally holds itself in place once set next to the wall and the false-wall can be erected immediately.
If the false-wall is erected at a later date or in particular situations, a 15-cm strip of GIPSCOLL must be laid on the fibrous face at the top end.
It takes just a few minutes; the panel on which the adhesive is applied is put in place and lightly pressed against the wall using a painter's roller; it holds straight away and the operator can carry on fitting the next panel.
To guarantee better air and water vapour tightness, the joining lines between the panels are then sealed with an adhesive tape.
The adhesive feasibly used to secure the panel is prepared by mixing GIPSCOLL powder with water (it takes 600 g per strip), until a thick paste is obtained, which will be applied using a trowel or a toothed trowel. Its consistency and adhesiveness should be such to hold the panel on the wall immediately, even when still wet, without having to wait for it to set and without having to use supports.
The false-wall that will be built subsequently will be kept slightly detached from the insulation to prevent the elastic reaction of the insulation layer from deforming it or knocking it down when the mortar sets.
If the material needs to be cut, first cut the foil with a Stanley knife and then cut the polyester wool with a long-bladed Stanley knife or an alternative saw with smooth blade. Do not use toothed-bladed saws.

DOUBLE WALL 8÷8



	SILENTEcoEster	
Thickness of the polyester fibre	60 mm	80 mm
Panel sizes	1.00×2.85 m	1.00×2.85 m
Mass per unit area	1200 g/m^2	1600 g/m^2
Density	20 kg/m^3	20 kg/m^3
Diameter of fibres	17.9÷28 μm	17.9÷28 μm
PET film thickness	23 μm	23 μm
PET film mass per unit area	32 g/m^2	32 g/m^2
PET film vapour transmission • Sd • μ	 4.32 m 188,000	 4.32 m 188,000
Composition	100% PET	100% PET
LEED credit (MR Credit 4)	contains 75% of material that can be recycled (1/2pre+1 post)	contains 75% of material that can be recycled (1/2pre+1 post)
Apparent dynamic stiffness	s't ≤ 30 MN/m^3	s't ≤ 30 MN/m^3
Specific heat	1,200 kJ/kg K	1,200 kJ/kg K
Water vapour diffusion coefficient (fibre)	μ = 1	μ = 1
Working temperature range	–40°C ÷ +110°C	–40°C ÷ +110°C
Thermal conductivity λ	0.040 W/m K	0.040 W/m K
Thermal Resistance **R**	1.50 m^2K/W	2.00 m^2K/W
Lower heating power	21,600 kJ/kg	21,600 kJ/kg
Airtightness **r**	2.26 KPas/m^2	2.26 KPas/m^2

ANIT Associated

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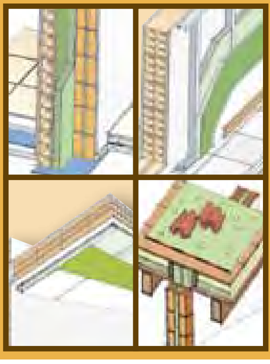
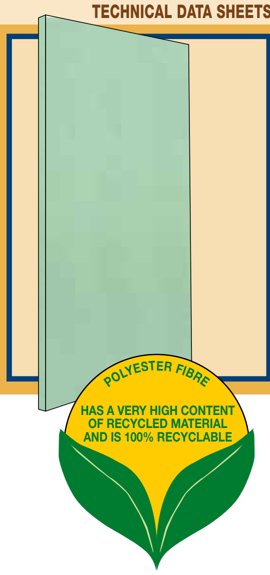


SILENTEco



SELF-BEARING THERMAL-ACOUSTIC INSULATION PANELS WITH POLYESTER FIBRE BASE, NON-TOXIC, HEAT-SEALED, FREE FROM GLUES. USED TO FILL-IN AND REDUCE RESONANCE IN THE AIR SPACE OF DOUBLE BRICK WALLS OR OF FALSE-WALLS AND FALSE-CEILINGS ON A METAL FRAME LINED WITH PLASTERBOARD

CHARACTERISTICS			IMPACT ON THE ENVIRONMENT		
		Reazione al fuoco			
ACOUSTIC INSULATION	THERMAL INSULATION	FIRE REACTION	ECO GREEN	RECYCLABLE	NON-DANGEROUS WASTE

PROBLEM

When laying in homes that are already inhabited, it is advisable to use a product that can be handled without any particular precautions.

SOLUTION

SILENTEco is an insulation product in panels with base of polyester fibre bonded exclusively with a glue-free thermal procedure. The fibre derives from recycled PET soft drink and mineral water bottles.
It may consequently be considered as an ecological product because it frees the environment of high volumes of waste, recovers considerable energy and raw material resources and the panel is also non-toxic seeing as it is fabricated with a physical process that is free from pollutant glues and resins. It does not contain mineral fibres, it is not irritant and does not sting.
It is an extremely flexible panel and can be handled without any precautions in particular, seeing as the fibre does not break when folded.

FIELDS OF USE

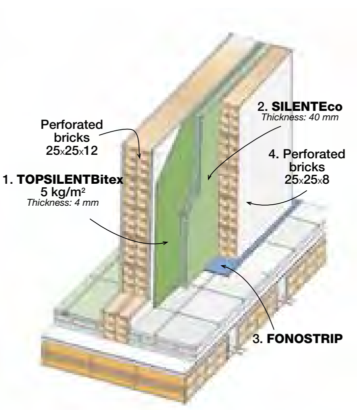
It is used as an insulating filler for air spaces between traditional brick walls and air spaces between false-walls and false-ceilings in plasterboard. In view of the fact that is non-toxic, it is particularly appreciated in refurbishing homes that are already inhabited.

METHOD OF USE AND PRECAUTIONS

The panels are mounted in the air spaces of brick walls as the same are progressively erected, whereas they are inserted in the dedicated seats of metal frames on which plasterboard panels are secured. The panels are to be kept under cover and away from damp. The panel can be cut using a long-bladed Stanley knife or alternatively with a saw with smooth blade. Toothed saws are not suitable.

ACOUSTIC INSULATION OF WALLS CERTIFIED BY "IEN G. FERRARIS"

DOUBLE INSULATED WALL 12÷8

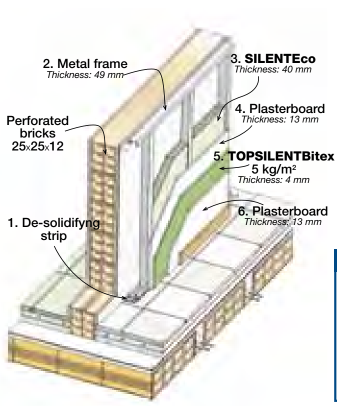


CHARACTERISTICS OF WALL
- Total thickness 29 cm
- Weight 260 kg/m²

SOUNDPROOFING POWER
R_w = 52,3 dB

CERTIFICATION
ien
"IEN G. Ferraris"
n. 35561/09

LEAN-TO FALSE-WALL IN PLASTERBOARD ON METAL FRAME



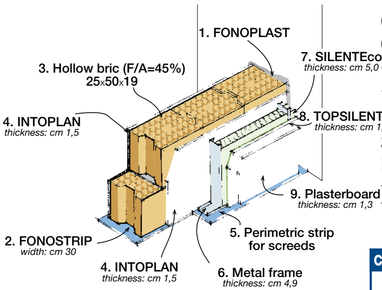
CHARACTERISTICS OF WALL
- Total thickness 23 cm
- Weight 178 kg/m²

SOUNDPROOFING POWER
R_w = 61,3 dB

CERTIFICATION
ien
"IEN G. Ferraris"
n. 35561/07

ACOUSTIC INSULATION OF WALLS CERTIFIED BY "ITC-CNR"

DETACHED FALSE-CEILING IN PLASTERBOARD ON METALLIC FRAME ON A 25 BLOCK

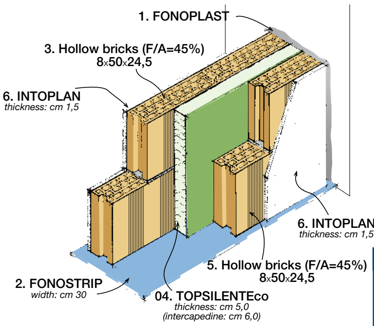


CHARACTERISTICS OF WALL
- Total thickness 37 cm
- Weight 228 kg/m²

SOUNDPROOFING POWER
R_w = 68,0 dB

CERTIFICATION
ITC
"ITC-CNR"
n. 4214RP06

DOUBLE WALL 8÷8



CHARACTERISTICS OF WALL
- Total thickness 25 cm
- Weight 243 kg/m²

SOUNDPROOFING POWER
R_w = 56,0 dB

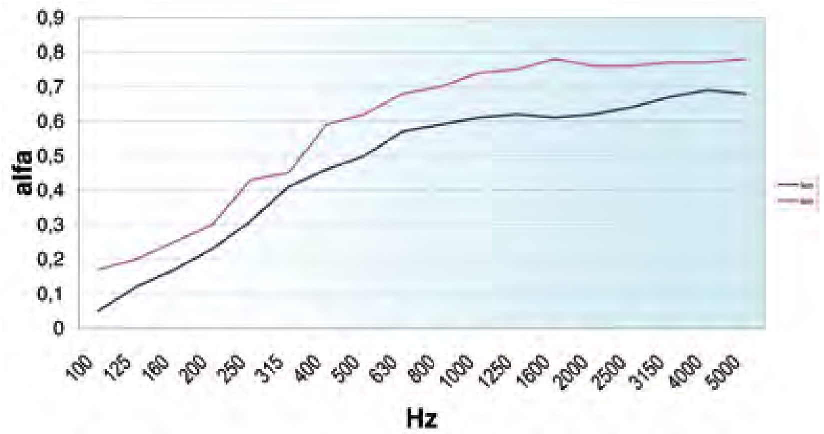
CERTIFICATION
ITC
"ITC-CNR"
n. 4166RP06

Alternatively: **SILENTEco** + TOPSILENTBitex = TOPSILENTEco

SILENTEco

Total thickness	**40 mm**	**50 mm**	**60 mm**
Panel size	0,60×1,42 m	0,60×1,42 m	0,60×1,42 m
Density	20 kg/m^3	20 kg/m^3	20 kg/m^3
Fibre diameter	17,9÷28 µm	17,9÷28 µm	17,9÷28 µm
Apparent dynamic stiffness	$s'_t \leq 30$ MN/m^3	$s'_t \leq 30$ MN/m^3	$s'_t \leq 30$ MN/m^3
Specific heat	1,200 KJ/kgK	1,200 KJ/kgK	1,200 KJ/kgK
Aqueous vapour diffusion coefficient	µ 1	µ 1	µ 1
Use temperature range	–40°C ÷ +110°C	–40°C ÷ +110°C	–40°C ÷ +110°C
Thermal conductivity λ	0,040 W/mK	0,040 W/mK	0,040 W/K
Thermal resistance	1,00 m^{2}K/W	1,25 m^{2}K/W	1,50 m^{2}K/W
Lower heat value	21.600 W/mK	21.600 W/mK	21.600 W/mK
Resistivity to air flow r	2,26 KPa/sm^2	2,26 KPa/sm^2	2,26 KPa/sm^2
Fire reaction class **(EN 9177)**	**Class 1** (does not drip)	**Class 1** (does not drip)	**Class 1** (does not drip)
Certifications			

ACOUSTIC ABSORPTION COEFFICIENT



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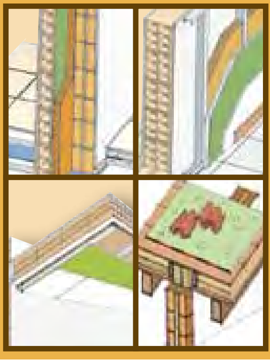


SILENTRock

SELF-BEARING PANELS IN ROCK WOOL FOR THE THERMAL-ACOUSTIC INSULATION OF AIR SPACES IN TRADITIONAL DOUBLE WALLS AND WALLS AND FALSE-WALLS ON A METAL FRAME LINED WITH PLASTERBOARD

CHARACTERISTICS			IMPACT ON THE ENVIRONMENT		
ACOUSTIC INSULATION	THERMAL INSULATION	FIRE REACTION (Reazione al fuoco)	ECO GREEN	RECYCLABLE	NON-DANGEROUS WASTE

PROBLEM

Many thermal insulation products used for filling-in the air spaces of walls do not insulate against noise.

SOLUTION

SILENTRock is a thermal-acoustic panel, suitable for insulating the air spaces of internal dividing walls between different dwellings and for insulating external perimeter walls.
It consists of a rigid fireproof panel of high density rock wool treated with thermo-setting resins.
SILENTRock is fire resistant and is classified A1 pursuant to standard EN 13501-1 and class 0 pursuant to Italian standards.
The rock fibre of **SILENTRock** is insensitive to damp and the panel remains stable as the temperature varies.

FIELDS OF USE

SILENTRock is used in the building industry for the acoustic insulation of internal walls and for the acoustic and thermal insulation of external perimeter walls.
It is used to fill-in air spaces in double walls, where the fibrous part reduces vibrations and connective air movements.
It can also be used for insulating walls and false-walls in plasterboard fitted on metal framework.

METHOD OF USE AND PRECAUTIONS

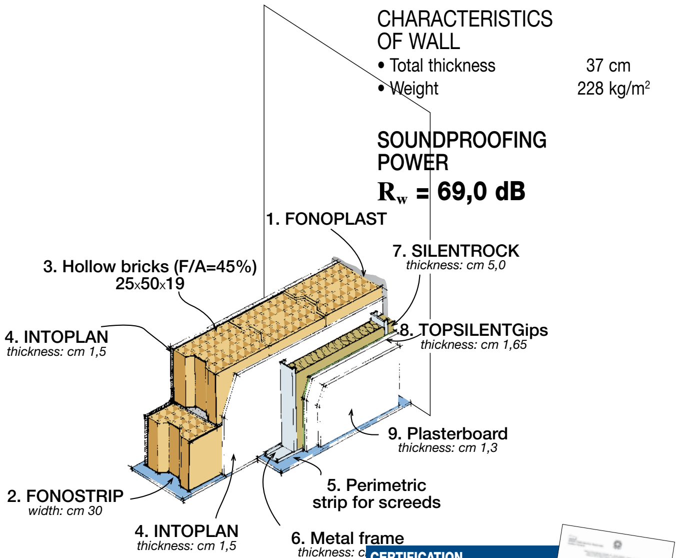
The **SILENTRock** panel is fitted in the air space progressively as the second part of the double wall is erected.
Once you have laid the first row of bricks of the second wall, insert the panels, resting them against the existing wall.
Continue erecting the second wall, taking care not to compress the insulation material, but keeping it slightly detached from the panel, otherwise, if the wall is erected before the mortar has set, it could be deformed or demolished by the elastic reaction of the insulation material.
Rest the second row of panels on the first after the height of the wall has risen above the first row of panels.
The panels can also be glued to the existent wall using GIPSCOLL glue distributed over the panel.
In walls and false-walls in plasterboard on framework, fit the insulation panel in its seat on the metal uprights, the same in the case of false-walls.
Use a ripsaw for wood to cut the panel.

ACOUSTIC INSULATION OF WALLS CERTIFIED BY "ITC-CNR"

DETACHED FALSE-CEILING IN PLASTERBOARD ON METALLIC FRAME ON A 25 BLOCK

CHARACTERISTICS OF WALL
- Total thickness 37 cm
- Weight 228 kg/m²

SOUNDPROOFING POWER
R_w = 69,0 dB



CERTIFICATION

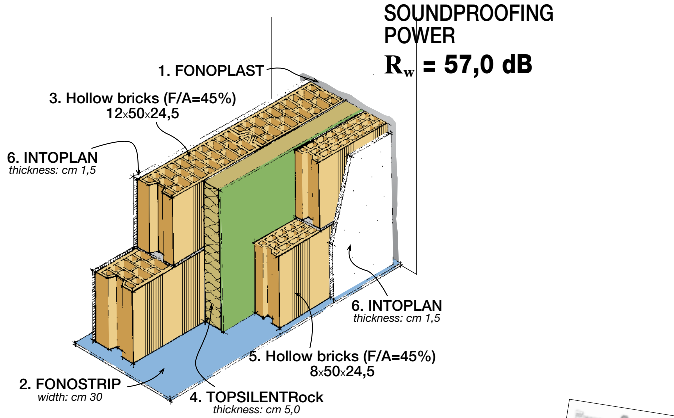
ITC

"ITC-CNR"
n. 4213RP06

DOUBLE WALL 12÷8

CHARACTERISTICS OF WALL
- Total thickness 28 cm
- Weight 288 kg/m²

SOUNDPROOFING POWER
R_w = 57,0 dB



CERTIFICATION

ITC

"ITC-CNR"
n. 4167RP06

Alternatively: **SILENTRock** + TOPSILENTBitex = TOPSILENTRock

SILENTRock

Total thickness	**40 mm**	**50 mm**	**60 mm**
Panel size	0,60×1,00 m	0,60×1,00 m	0,60×1,00 m
Density	40 kg/m³	40 kg/m³	40 kg/m³
Sound absorption coefficient (at 1000 Hz)	0,85 α_w	0,96 α_w	0,99 α_w
Specific heat	1,030 KJ/kgK	1,030 KJ/kgK	1,030 KJ/kgK
Aqueous vapour diffusion coefficient	μ = 1	μ = 1	μ = 1
Thermal conductivity coefficient λ	0,035 W/mK	0,035 W/mK	0,035 W/mK
Thermal resistance	1,10 m²K/W	1,40 m²K/W	1,70 m²K/W
Resistivity to air flow **r**	14,9 KPa/sm²	14,9 KPa/sm²	14,9 KPa/sm²
Fire reaction class (EN 13501-1)	**Euroclass A1**	**Euroclass A1**	**Euroclass A1**
Marcatura CE Norma di riferimento EN13162 — CE designation code for thermal insulation (EN 13162)	MW-EN13162-T4-DS(TH)-WS-MU1	MW-EN13162-T4-DS(TH)-WS-MU1	MW-EN13162-T4-DS(TH)-WS-MU1
Certifications	ITC		

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Conside ring the numerous possible uses and the possible interference of conditions or elements beyond our control, we assume no responsibility regarding the results which are obtained. The purchasers, of their own accord and under their own responsibility, must establish the suitability of the product for the envisaged use.

The figures shown are average indicative figures relevant to current production and may be changed or updated by INDEX S.p.A at any time without previous warning. The advice and technical information provided, is what results from our best knowledge regarding the properties and the use of the product.

ANIT Associated

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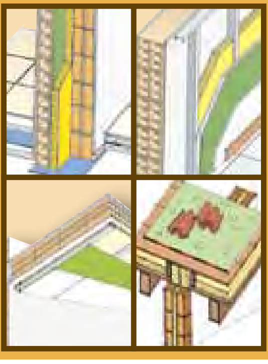


SILENTGlassEco

SEMI-RIGID THERMAL-ACOUSTIC INSULATION PANELS WITH GLASS WOOL BASE PRODUCED WITH AN INNOVATIVE RESINOUS BINDER OF VEGETABLE ORIGIN, ODOURLESS, FREE FROM PHENOLS, FORMALDEHYDES AND COLORANTS, FOR THERMALLY INSULATING AND REDUCING THE RESONANCE IN THE AIR SPACES OF DOUBLE BRICK WALLS AND OF FALSE-WALLS AND FALSE-CEILINGS IN PLASTERBOARD.

CHARACTERISTICS			IMPACT ON THE ENVIRONMENT		
ACOUSTIC INSULATION	THERMAL INSULATION	FIRE REACTION (Reazione al fuoco)	ECO GREEN	RECYCLABLE	NON-DANGEROUS WASTE

PROBLEM

Many thermal insulation products used to fill-in the air spaces of walls do not insulate against noise.

SOLUTION

SILENTGlassEco is a new thermal-acoustic insulation product with glass wool base and low environmental impact:

- it is obtained through a new production process with lower emissions and lower energy consumptions compared to the former technology
- the new resin used to bind the glass fibres is of vegetable origin that replaces the phenol resins used in the former technology and is free from phenol and formaldehydes
- the panel and packaging are totally recyclable; **SILENTGlassEco** is produced 90% with inorganic raw materials, also exploiting 60% of raw materials recycled from post-consumption (i.e. glass bottles)

SILENTGlassEco is an odourless panel and is natural brown in colour due to the fact that the vegetable resin is free from artificial colorants; it is sufficiently stiff but soft to the touch and easy to handle, plus it is stable in time and does not sag in the air spaces.
SILENTGlassEco is a fibrous insulation product, highly airtight, making it an excellent acoustic insulator. In air spaces, it reduces the convective motion of air thus it is also an excellent thermal insulator.

FIELDS OF USE

SILENTGlassEco is used as a thermal-acoustic insulator for filling air spaces of double brick walls, walls, false-walls and light false-ceilings in plasterboard on metal framework.

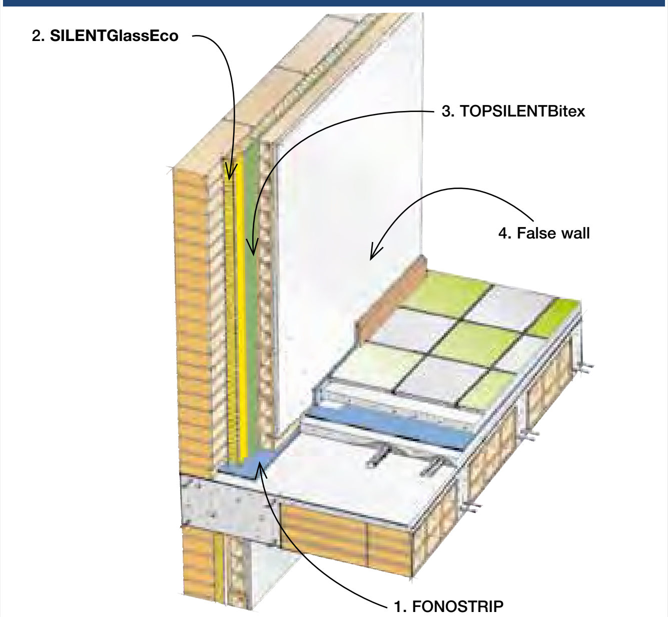
METHOD OF USE AND PRECAUTIONS

The **SILENTGlassEco** panel is fitted in the air space progressively as the second part of the double wall is erected. Once you have laid the first course of bricks of the second wall, insert the panels, resting them against the existing wall.
Continue erecting the second wall, taking care not to squash the insulation material, but keeping it slightly detached from the panel, otherwise, if the wall is erected before the mortar has set, it could be deformed or knocked down by the elastic reaction of the insulation material. Rest the second row of panels on the first after the height of the wall has risen above the first row of panels.
The panels can also be glued to the existent wall using GIPSCOLL glue distributed over the panel.
In walls and false-walls in plasterboard on framework, fit the insulation panel in its seat on the metal uprights (pressing slightly); the same applies in the case of false-walls.
Store the panels indoors, in a dry place.

ACOUSTIC INSULATION OF WALLS IN NEW BUILDINGS

EXTERNAL WALL

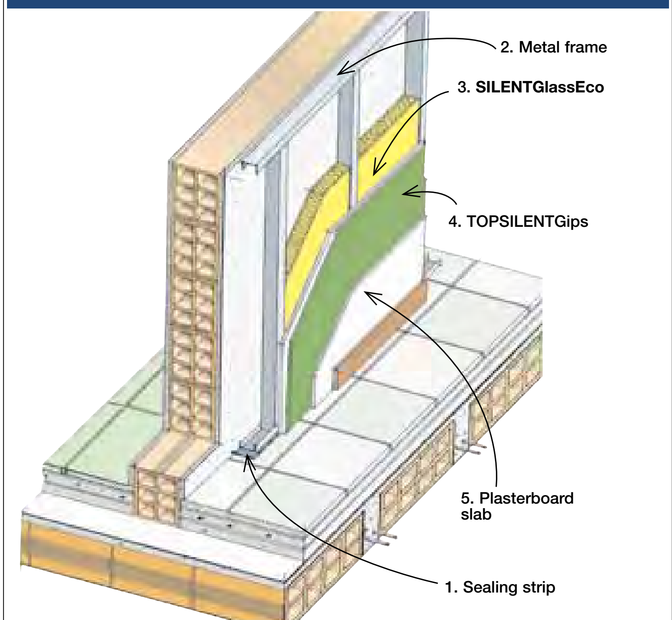
DOUBLE WALL 12÷8



ACOUSTIC INSULATION OF WALLS IN EXISTING BUILDINGS

INTERNAL WALL

PLASTERBOARD FALSE-WALL FITTED ON METAL FRAME



SILENTGlassEco

Total thickness	**40 mm**	**50 mm**	**60 mm**
Panel size	0,60×1,35 m	0,60×1,35 m	0,60×1,35 m
Density	30 kg/m³	30 kg/m³	30 kg/m³
Specific heat	0,850 KJ/kgK	0,850 KJ/kgK	0,850 KJ/kgK
Aqueous vapour diffusion coefficient	μ=1	μ=1	μ=1
Thermal conductivity λ_D	0,032 W/mK	0,032 W/mK	0,032 W/mK
Thermal resistance	1,25 m²K/W	1,55 m²K/W	1,85 m²K/W
Resistivity to air flow **r**	≥5 KPa/sm²	≥5 KPa/sm²	≥5 KPa/sm²
Fire reaction class (EN 13501-1)	**Euroclass A1**	**Euroclass A1**	**Euroclass A1**
Marcatura CE Norma di riferimento EN13162 — CE designation code for thermal insulation (EN 13162)	MW-EN13162-T4-WS-WL(P)-AFr5	MW-EN13162-T4-WS-WL(P)-AFr5	MW-EN13162-T4-WS-WL(P)-AFr5

ANIT Associated

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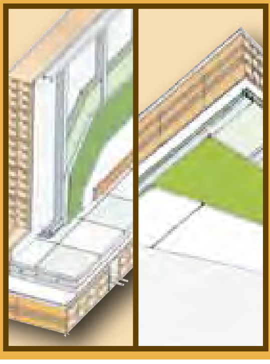
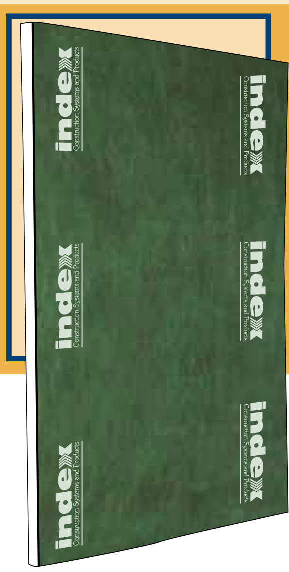


TOPSILENTGips



THERMAL-ACOUSTIC INSULATION IN PLASTERBOARD PANELS, PRE-COUPLED WITH A HIGH DENSITY SOUND-RESISTANT FOIL WITH VERY HIGH CRITICAL FREQUENCY FOR INSULATING WALLS, FALSE-WALLS AND FALSE-CELINGS FITTED ON METAL FRAMEWORK

CHARACTERISTICS		IMPACT ON THE ENVIRONMENT		
ACOUSTIC INSULATION	THERMAL INSULATION	ECO GREEN	RECYCLABLE	NON-DANGEROUS WASTE

PROBLEM

To increase the acoustic insulation of walls, false-walls and false-ceilings in plasterboard on metal framework, some systems are created that are made up of a number of panels overlapped, which take much longer to assemble.

SOLUTION

The increased weight of the wall in plasterboard increases acoustic insulation and this is why a number of panels are laid over each other or coupled on-site with heavy materials such as those of the TOPSILENT range, with high critical frequency that damp the vibrations on the panel. **TOPSILENTGips** is obtained in our factory by coupling a plasterboard panel with the TOPSILENTBitex foil. Consequently, the laying jobs previously carried out on-site are eliminated.

TOPSILENTGips is a prefabricated panel that provides higher acoustic insulation performance compared to that of the single plasterboard panel, thanks to the TOPSILENTBitex coupling, which is a high density elastomer foil with soundproofing power equal to a lead foil of the same weight but without the latter's toxic properties. **TOPSILENTGips** is indeed lead-free.

The acoustic insulation performance of **TOPSILENTGips** - whether fitted in false-walls on a metal framework next to a brick wall, or in walls made entirely of lined plasterboard on a metal frame - has been certified by ITC-CNR in Milan, using 13 mm plasterboard panels and TOPSILENTBitex weighing 5 Kg/m² pre-coupled on-site with FONOCOLL glue.

FIELDS OF USE

The **TOPSILENTGips** panel is used in the building industry to build walls with high acoustic insulation properties. In view of TOPSILENTBitex's high resistance to vapour migration, it also acts as a barrier against the vapour of the thermal-acoustic insulation material in the perimeter walls bordering the outside.

TOPSILENTGips can be used both for building insulating false-walls of existing walls and for building new walls made totally of plasterboard panels

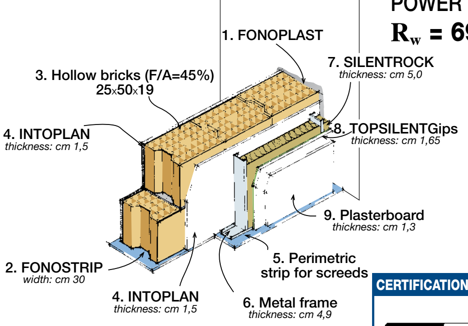
METHOD OF USE AND PRECAUTIONS

TOPSILENTGips panels are to be screwed to a metal frame and covered with another plasterboard panel, better still if with offset joins. For double panel walls, **TOPSILENTGips** can be installed in two ways: with the lined face against the frame; with TOPSILENTBitex in-between the two panels.The joining lines between the panels are then sealed with the joint concealing tape NASTROGIPS and grouted with the special finishing STUCCOJOINT filler. Store the panels indoors.

If you wish to line walls in brick or concrete, stick the panels with GIPSCOLL glue.

ACOUSTIC INSULATION OF WALLS CERTIFIED BY "ITC-CNR"

DETACHED FALSE-CEILING IN PLASTERBOARD ON METALLIC FRAME ON A 25 BLOCK



CHARACTERISTICS OF WALL

- Total thickness 37 cm
- Weight 228 kg/m²

SOUNDPROOFING POWER

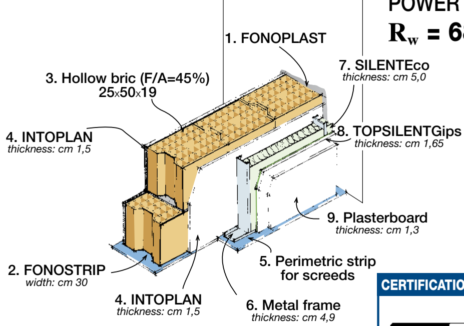
R_w = 69,0 dB

CERTIFICATION

ITC

"ITC-CNR"
n. 4213RP06

DETACHED FALSE-CEILING IN PLASTERBOARD ON METALLIC FRAME ON A 25 BLOCK



CHARACTERISTICS OF WALL

- Total thickness 37 cm
- Weight 228 kg/m²

SOUNDPROOFING POWER

R_w = 68,0 dB

CERTIFICATION

ITC

"ITC-CNR"
n. 4214RP06

TOPSILENTGips

Total thickness	**16,5 mm**
Panel size	1,20×2,00 m
Mass per unit area of sound proofing foil	15 kg/m^2
Specific height • plasterboard slab • sound proofing foil	 0,837 KJ/kgK 1,700 KJ/kgK
Aqueous vapour diffusion coefficient (sound proofing foil)	μ = 100.000
Fire reaction class (UNI 9177) • sound proofing foil	 **Class 1**
Certifications	ITC

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03/2010en

TOPSILENTDuogips

THERMAL-ACOUSTIC INSULATION IN PLASTERBOARD PANELS PRE-COUPLED WITH A HIGH DENSITY SOUND-RESISTANT FOIL WITH VERY HIGH CRITICAL FREQUENCY, NON-WOVEN POLYSTER FABRIC LINING WITH "ELASTIC NEEDLING", FOR INSULATING FALSE-WALLS GLUED IN VERY THIN LAYERS

CHARACTERISTICS		IMPACT ON THE ENVIRONMENT		
ACOUSTIC INSULATION	THERMAL INSULATION	ECO GREEN	RECYCLABLE	NON-DANGEROUS WASTE

PROBLEM

For the acoustic insulation of existent walls, there is often not enough room for a false-wall lined with plasterboard on a metal frame nor for the usual glued plasterboard false-walls pre-coupled with mineral wool.

SOLUTION

TOPSILENTDuogips offers acoustic insulation, even if minimal, but appreciable in existent walls with minimal thickness.

TOPSILENTDuogips is obtained by coupling a plasterboard panel with the TOPSILENTDuo foil, which in turn is made up of a high density sound-resistant foil lined with a non-woven polyester fabric obtained with a special "elastic needling" procedure, being an exclusive INDEX project.

The foil coupled with the plasterboard increases its weight and, seeing as it is elastic, modifies its critical frequency, while the non-woven fabric, even if thin, has a dynamic stiffness of **s'**= 21 MN/m³. This is the outcome of the compromise between elasticity and sufficient resistance to crushing, such to work as a shock-absorbing spring that dampens the vibrations of the two masses in which it is inserted, being the old wall and plasterboard panel with the foil, and consequently reduces the transmission of noise.

The fibres are not irritant, they are flexible and do not crumble when compressed or folded and this makes them particularly suitable also in homes that are already inhabited.

The insulation of **TOPSILENTDuogips** is applicable on existent walls with mass per unit area higher than 140 kg/m² and is even more effective in the interval between 140 and 200 kg/m².

Below this interval, there is on the other hand the risk of reducing the insulating properties of the existent wall rather than increasing them, even if for walls with mass per unit area up to 100 kg/m², the insulation level has always been measured on-site to have increased by around 3-4 dB.

For walls with mass per unit area higher than 200 kg/m², the increment reduces progressively to such a point where the intervention becomes basically of no use

As stated in the certificate of IEN G. Ferraris no. 35561/08, the **TOPSILENTDuogips** panel obtained by gluing the TOPSILENTDuo foil onto a plasterboard panel on-site, then all this glued onto a plastered wall made of perforated bricks 25×25×12 cm with a mass per unit area of 153 kg/m² has increased the thickness by only 3 cm and the soundproofing power by ΔR_w = 7 dB.

Bear in mind that an increase in the soundproofing power R_w of 6 dB represents a reduction of 75% of the sound energy transmitted and of 35% of the noise perceived.

FIELDS OF USE

TOPSILENTDuogips is used to insulate existent walls with mass per unit area higher than 140 kg/m² with the glued false-wall technique when there is not enough space for other systems.

METHOD OF USE AND PRECAUTIONS

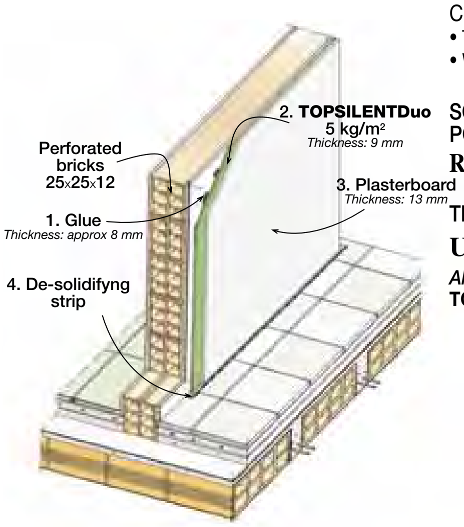
Spread GIPSCOLL glue (dotted or in strips) on the side lined with the non-woven fabric of the panel to be secured. Next, rest the panel against the wall, while keeping it detached from the floor with small wedges, which will be removed when the glue has set.

Next, fill the gap with an insulating liner in extruded polyethylene and grout the joining line of the panels with the special STUCCOJOINT filler reinforced with NASTROGIPS netted tape.

Handle the panels with care and store them indoors.

ACOUSTIC INSULATION OF WALLS CERTIFIED BY "IEN G. FERRARIS"

THIN FALSE-WALL IN GLUED PLASTERBOARD



CHARACTERISTICS OF WALL
- Total thickness 18 cm
- Weight 167 kg/m²

SOUNDPROOFING POWER

R_w = 51,9 dB

TRANSMITTANCE

U = 1,3425 W/m²K

Alternatively:
TOPSILENTDuogips = TOPSILENTDuo+Plasterboard

CERTIFICATION

"IEN G. Ferraris"
n. 35561/08

TOPSILENTDuogips

Total thickness	**21,0 mm**
Panel size	1,20×2,80 m
Mass per unit area	15 kg/m^2
Dynamic stiffness (UNI EN 29052/1)	s' = 7 MN/m^3
Specific height • plasterboard slab • sound proofing foil	 0,837 KJ/kgK 1,700 KJ/kgK
Aqueous vapour diffusion coefficient (sound proofing foil)	μ = 100.000
Fire reaction class (UNI 9177) • sound proofing foil	 **Class 1**
Certifications	

ANIT Associated

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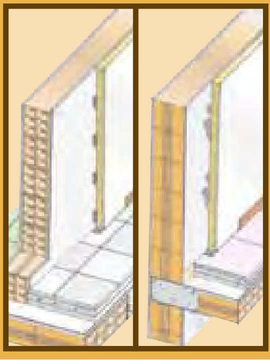


SILENTGips
SILENTGipsalu

THERMAL-ACOUSTIC INSULATION MADE OF PLASTERBOARD PANELS PRE-COUPLED WITH GLASS WOOL FOR INSULATING FALSE-WALLS GLUED TO EXTERNAL PERIMETER WALLS AND INTERNAL DIVIDING WALLS

CHARACTERISTICS		IMPACT ON THE ENVIRONMENT		
ACOUSTIC INSULATION	THERMAL INSULATION	ECO GREEN	RECYCLABLE	NON-DANGEROUS WASTE

PROBLEM

There is quite often very little space available to insulate an existent wall.

SOLUTION

SILENTGips and **SILENTGipsalu** are prefabricated panels used to create false-walls in walls that need additional thermal-acoustic insulation. They consist of 9.5-mm thick plasterboard panels coupled with a panel of glass fibre with density of 85 Kg/m³, produced in various thicknesses, chosen based on the insulation requirements. Silentgipsalu has a metal vapour barrier in aluminium foil inserted between the panel and the mineral wool to prevent the water vapour from condensing in the insulation layer. Once fitted, the panels do not need to be plastered and create a finished wall ready to be painted or covered.

FIELDS OF USE

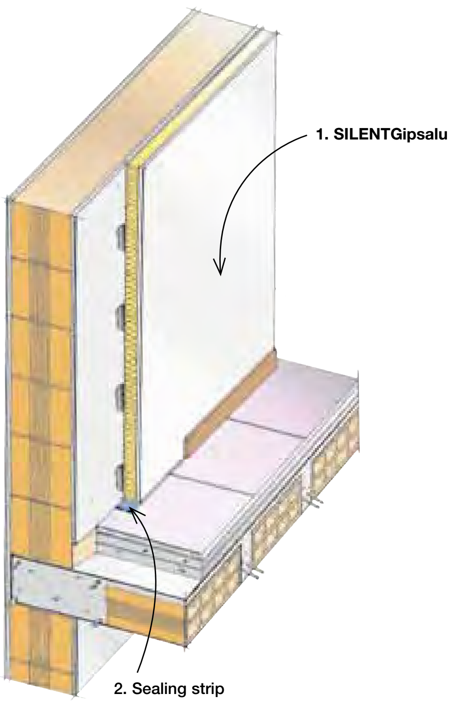
The **SILENTGips** panels are used in the building trade mainly to acoustically insulate internal walls and, considering the thermal insulation property of the glass wool, they are also used to insulate perimeter walls facing the exterior that need to be acoustically and thermally insulated.

METHOD OF USE AND PRECAUTIONS

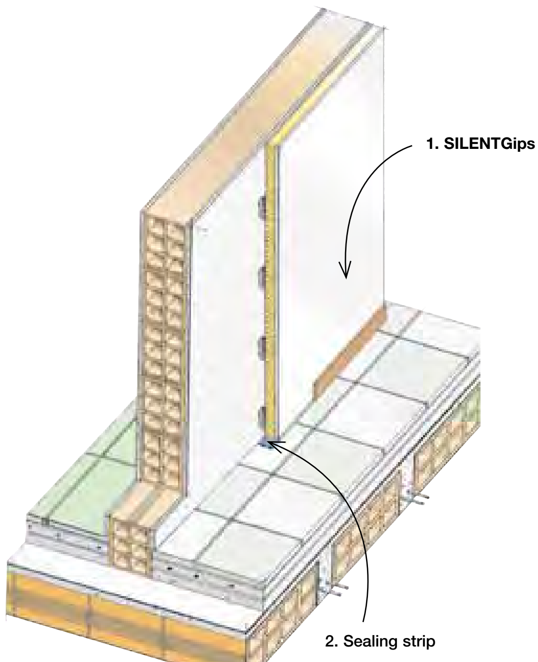
The panels are generally glued to the wall with the special GIPSCOLL adhesive, applied in dabs and the joints between the panels are appropriately sealed with NASTROGIPS and grouted with STUCCOJOINT, both plaster-based.
To ensure efficient acoustic insulation, the panels are to be glued to the wall keeping them separate from the floor, by fitting them on wedges, which will be removed after the glue has set. The space between the wall and the floor can then be filled with a strip of extruded polyethylene or glass fibre felt and then the skirting board can be installed. The surface of the panel substitutes plastering and can be painted over directly.

ACOUSTIC INSULATION OF WALLS IN EXISTING BUILDINGS

EXTERNAL WALL



INTERNAL WALL



	SILENTGipsalu		SILENTGips		
Total thickness	**29,5 mm**	**39,5 mm**	**29,5 mm**	**39,5 mm**	**49,5 mm**
Panel size	1,20×3,00 m	1,20×3,00 m	1,20×3,00 m	1,20×3,00 m	1,20×3,00 m
Thickness • glass wool • plasterboard slab • aluminium foil	 20,0 mm 9,5 mm 15 μ	 30,0 mm 9,5 mm 15 μ	 20,0 mm 9,5 mm –	 30,0 mm 9,5 mm –	 40,0 mm 9,5 mm –
Weight (tolerance -10%)	9,5 kg/m²	10 kg/m²	9,5 kg/m²	10 kg/m²	10,5 kg/m²
Specific heat • plasterboard slab • glass wool	 0,837 KJ/kgK 0,850 KJ/kgK	 0,837 KJ/kgK 0,850 KJ/kgK	 0,837 KJ/kgK 0,850 KJ/kgK	 0,837 KJ/kgK 0,850 KJ/kgK	 0,837 KJ/kgK 0,850 KJ/kgK
Diffusion coefficient of acqueous vapour • plasterboard slab • glass wool • aluminium foil	 μ = 8,4 μ = 1,3 μ = 600.000	 μ = 8,4 μ = 1,3 μ = 600.000	 μ = 8,4 μ = 1,3 –	 μ = 8,4 μ = 1,3 –	 μ = 8,4 μ = 1,3 –
Thermal resistance glass wool	0,571 m²K/W	0,834 m²K/W	0,571 m²K/W	0,834 m²K/W	1,097 m²K/W
Dynamic stiffness (UNI EN 29052/1)	s' = 2,2 MN/m³	s' = 2,2 MN/m³	s' = 2,2 MN/m³	s' = 2,2 MN/m³	s' = 2,2 MN/m³

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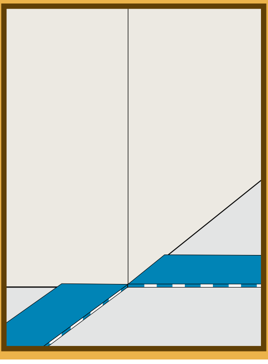
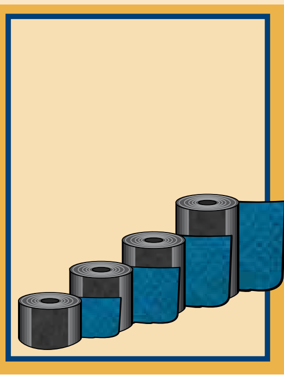


FONOSTRIP

ELASTOMERIC SOUND-DAMPING STRIP



CHARACTERISTICS	IMPACT ON THE ENVIRONMENT		
ACOUSTIC INSULATION	ECO GREEN	RECYCLABLE	NON-DANGEROUS WASTE

PROBLEM

Walls rigidly connected to the floor slab transmit noise also indirectly through the floors and the side walls.

SOLUTION

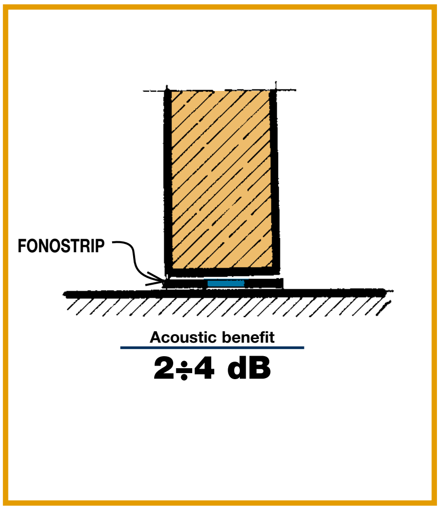
It is good practice to separate the wall at least from the floor slab with a strip of insulation material.
The acoustic benefit is 2÷4 dB.
Obviously, this solution should be carefully assessed if building in a seismic zone.
The use of plastic or too easily compressible materials could lead to cracks between wall and ceiling.
FONOSTRIP is an elastomeric sound-damping strip lined on both sides with a film of 4-mm thick polypropylene fibres which, laid under the dividing walls, prevents the transmission of impact and vibrations on the floor slab.
FONOSTRIP is made of a special alloy of reinforced elastomers, with high permanent elasticity, which dampens the vibrations of the wall resting on it.
The non-woven polyester fabric reinforcement prevents deformation under loads of the elastomeric alloy, avoiding the formation of cracks between wall and ceiling.
The surface textile finish of **FONOSTRIP** ensures good adhesion to cement mortar.
If the floors of the two rooms separated by the wall are made with the “floating screed” technique, then the transmission of noise will be reduced even further.

FIELDS OF USE

FONOSTRIP is used under indoor dividing walls, dividing walls between apartments and false-ceilings of exterior perimeter walls.

METHOD OF USE AND PRECAUTIONS

FONOSTRIP is supplied in strips of various heights and will be chosen at least 1-2 cm wider than the thickness of the wall to be insulated.
Lay the **FONOSTRIP** strip in dry state on a sufficiently smooth laying surface. Centre the wall over it, making sure that **FONOSTRIP** protrudes from both sides of the wall in order to avoid rigid connections to the floor slab, which would create “acoustic bridges”.
Any mortar protruding from the insulation strip must be removed.
To guarantee insulation continuity, accurately seal the joining lines of the **FONOSTRIP** strips, using the super-adhesive SIGILTAPE.



	FONOSTRIP			
Thickness	**4,0 mm**	**4,0 mm**	**4,0 mm**	**4,0 mm**
Roll size	0,14×10 m	0,20×10 m	0,25×10 m	0,30×10 m
Length sound proofing foils	14 cm	20 cm	25 cm	30 cm
Waterproofing	Waterproof	Waterproof	Waterproof	Waterproof
Diffusion coefficient of acqueous vapour (sound proofing foils)	100.000 μ	100.000 μ	100.000 μ	100.000 μ
Thermal conductivity coefficient • sound proofing foils λ	0,170 W/mK	0,170 W/mK	0,170 W/mK	0,170 W/mK
Dynamic stiffness (certification ITC UNI EN 29052 p. 1°) • load 200 kg/m² • load 400 kg/m²	$s'_t = s' = 449$ MN/m³ $s'_t = s' = 937$ MN/m³	$s'_t = s' = 449$ MN/m³ $s'_t = s' = 937$ MN/m³	$s'_t = s' = 449$ MN/m³ $s'_t = s' = 937$ MN/m³	$s'_t = s' = 449$ MN/m³ $s'_t = s' = 937$ MN/m³
Certification	ITC			

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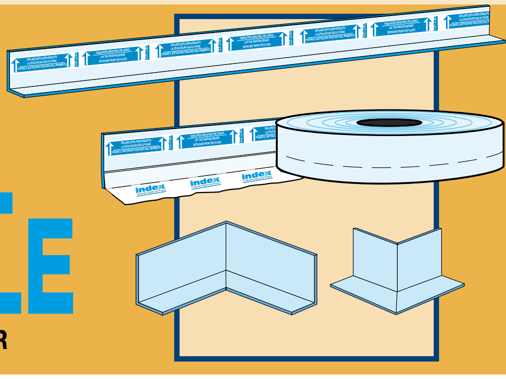
FONOCELL
FONOCELL ROLL
FONOCELL ANGLE



SELF-ADHESIVE STRIP OF EXTRUDED POLYETHYLENE FOR SEPARATING THE PERIMETER OF FLOATING SCREEDS

PROBLEM

The floating screed technique for the acoustic insulation against foot traffic noise presumes the complete separation of the cement hood also from perimeter walls but often the vertical turn-over of the same insulating material when laid flat is problematic.

SOLUTION

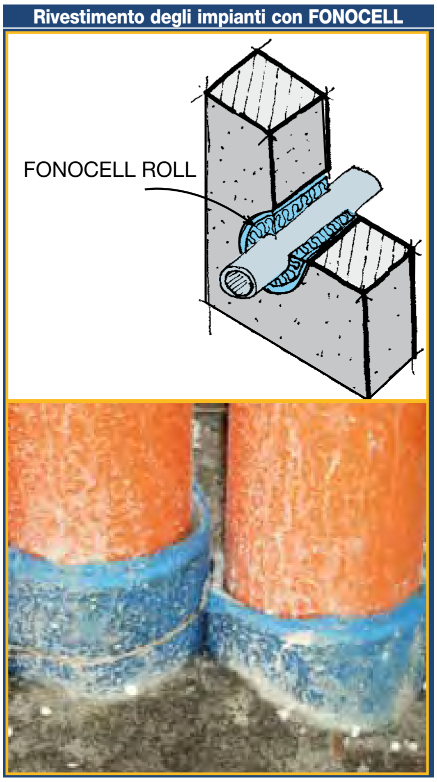
FONOCELL is a self-adhesive flexible and mouldable insulation strip made of extruded polyethylene that easily adapts to the shapes of walls; resistant and flexible, when it is stuck on the wall, through self-adhesion, and turned over on the resilient material of the flat part it guarantees the perimetric insulation of the floating screed and avoids acoustic bridges.

It is supplied in two versions: **FONOCELL** in pre-formed “L” bars and **FONOCELL ROLL** in pre-cut strips coupled with a polyethylene film that protrudes on one side, wound in rolls.
FONOCELL ROLL is also used to wrap and insulate pipes that cross walls and floors.
FONOCELL ANGLE is a pre-formed self-adhesive pre-sealed polyethylene insulation product in the shape of an internal corner and external corner and is a laying accessory for **FONOCELL**, to quickly and correctly insulate the corners to separate the perimeters of floating screeds.

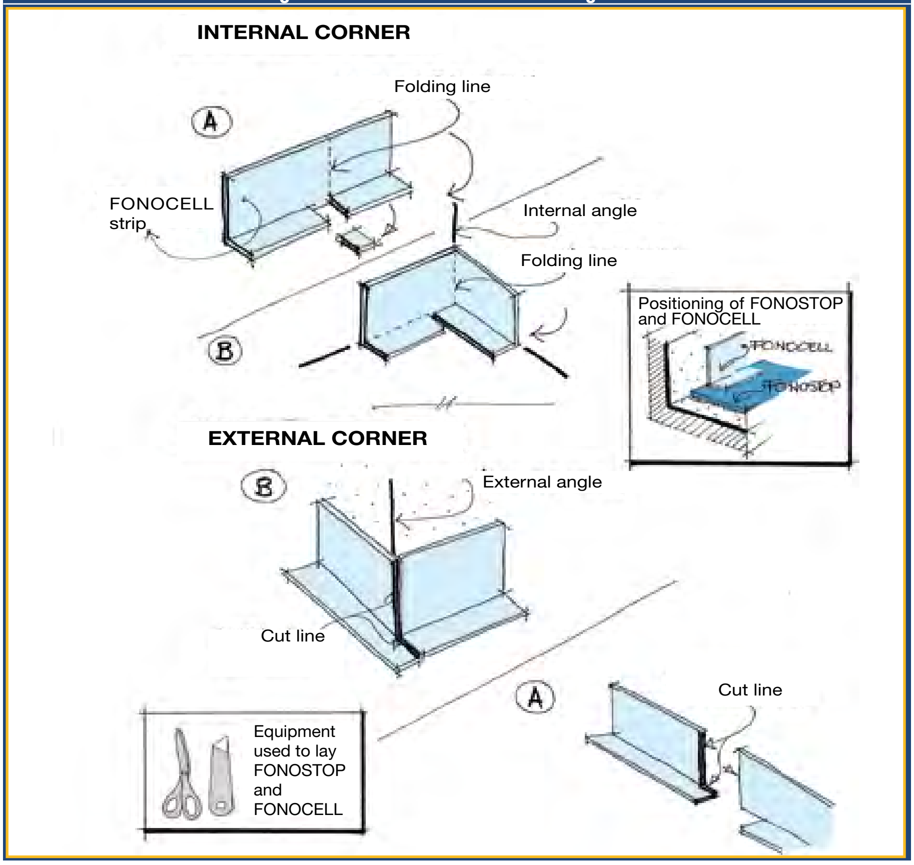
METHOD OF USE AND PRECAUTIONS

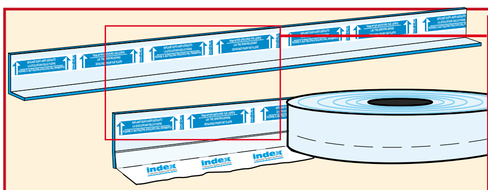
The previously plastered wall is lined with the 10-cm wide side of **FONOCELL**, while the 5-cm side is turned over on the insulation sheet on the flat part where it will be further secured with SIGILTAPE. The same tape will be used to join the **FONOCELL** elements together and to secure the parts wrapped around piping.
Warning! The excess part of **FONOCELL** that protrudes from the floating screed will be trimmed-off with a cutter only after the flooring has been laid.

Rivestimento degli impianti con FONOCELL



Creating external and internal corners using FONOCELL



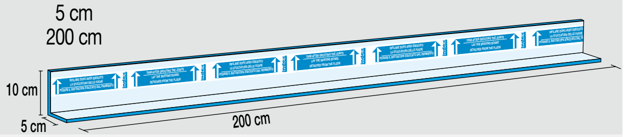


TRIM AFTER GROUTING THE JOINTS
LAY THE SKIRTING BOARD
DETACHED FROM THE FLOOR

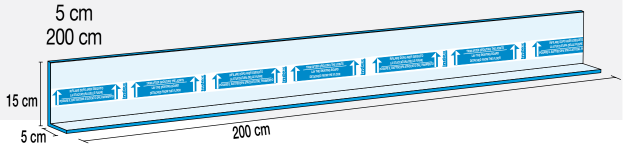
INDEX has customised FONOCELL and FONOCELL ROLL, by printing some important laying instructions on it in order to help the builder when preparing the floating floor to insulate against foot traffic noise.

FONOCELL

Thickness	**6,0 mm** approx
Pre-formed “L” dimensions • Height of vertical part • Length of horizontal part • Length	0,10+0,05×2,0 m 10 cm 5 cm 200 cm

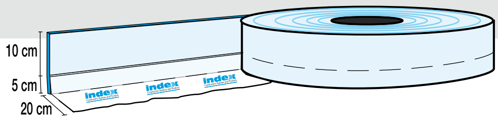


Pre-formed “L” dimensions • Height of vertical part • Length of horizontal part • Length	0,15+0,05×2,0 m 10 cm 5 cm 200 cm



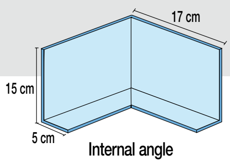
FONOCELL ROLL

Thickness	**6,0 mm** approx
Roll dimension • Height of extruded PE • Height of coupled strip • Pre-cut height	0,15×50,0 m 15 cm 20 cm 5 cm

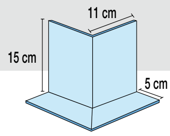


FONOCELL ANGLE

Thickness	**6,0 mm** approx
Pre-formed “L” dimensions • Height of vertical part • Length of horizontal part • Length of side	0,15×2,0 m 15 cm 5 cm approx 15 cm



Internal angle



External angle

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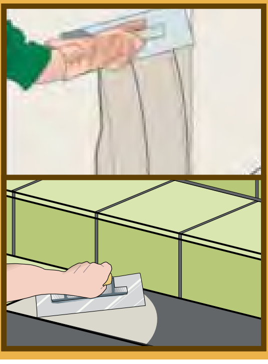


FONOELAST MONO

READY-TO-USE SINGLE-COMPONENT ELASTOMERIC VIBRATION DAMPING SEALING PASTE

CHARACTERISTICS			IMPACT ON THE ENVIRONMENT		METHOD OF USE	
A	H_2O					+5°C +35°C
ONE-COMPONENT	WATER BASED	ACOUSTIC INSULATION	ECO GREEN	RECYCLABLE	TO BE APPLIED BY INOX SPATULA	APPLICATION TEMPERATURE

PROBLEM

The use of normal cement mortar to connect the perimeter of dividing walls between different dwellings to the ceiling and the adjacent walls determines a rigid bond that favours flanking transmissions of noise

The use of perimeter separation strips, which definitely offer a better performance in terms of the containment of flanking transmissions of noise, also involves problems of poor adhesion and reduces the stability of the dividing brick wall.

SOLUTION

FONOELAST MONO is an elastomer-based paste, which improves elasticity and adhesion.

The paste is easy to work and sticks excellently to the support. Once set, it creates an elastic coating around the perimeter of the walls, which reduces the vibration of acoustic pressure waves transmitted to the structure laterally (flanking transmissions).

FIELDS OF USE

FONOELAST MONO is used to skim all normal indoor and outdoor supports in concrete, cement+lime mortar or cement mortar, cement foam, plaster, brickwork etc

FONOELAST MONO is used to create elastic perimeter seals with efficient features of resistance to compression and of adhesion to all types of supports, maintaining its elastic properties over time. The level of adhesion provided by **FONOELAST MONO** is much superior to that of normal building site mortar.

FONOELAST MONO, thanks to its elasticity and laying simplicity, is an excellent solution for insulating concrete staircases against foot traffic noise (internal tests highlight that the reduction index of foot traffic noise with a layer of 4÷5 mm of **FONOELAST MONO** is around 10 dB) and also for correcting existent floor slabs (by removing the existent flooring or directly on the actual flooring, you can separate the tiles, safeguarding the heights and improving comfort considerably). Thanks to its excellent adhesion to all types of supports (polyurethane, wood, aluminium etc.), **FONOELAST MONO** is also used to seal and fill-in the air spaces of door and window counter-frames.

METHOD OF USE

Preparing the laying surface.

The support must be compact and perfectly clean, free from dust, loose parts, oil and dirt in general. The surfaces must be free from stagnated water. Any irregular parts are to be grouted in advance with suitable mortar according to the type of support involved. The surfaces to be treated must be as flat as possible to avoid having to build up thicker parts, which consequently involves high consumptions of material.

The paste is ready-to-use.

Application. It is laid with a stainless steel trowel, skimming it evenly. One or more coats can be applied subsequently.

The application thickness is 3-5 mm.

To seal the counter-frames, you are recommended to use a piping bag or the 1 kg bag, cutting the corner of the bag to measure and squeezing the product out. When sealing the counter-frames, do not apply thicker than 2 cm.

COVERAGE

1,5 kg/m²×mm of thickness.

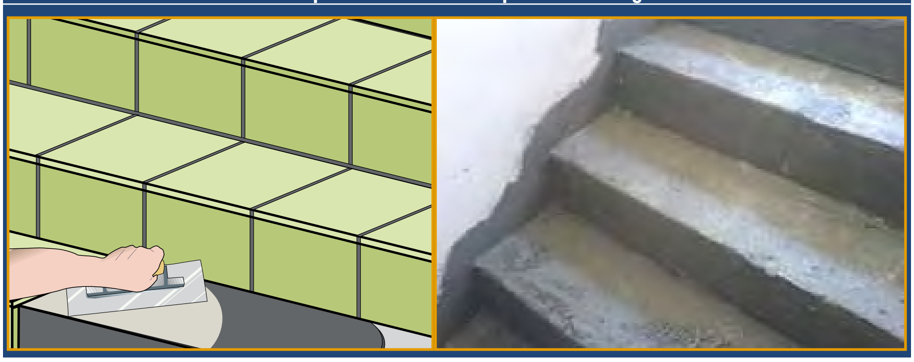
1,5 kg/dm³.

PRECAUTIONS

- Minimum application temperature: +5°C.
- Do not add water or other material to the mix.
- Do not apply too thick.
- Protect against rain while the product is setting
- Wash the tools with water after use.

FONOELAST MONO can be used around the whole perimeter of the wall.

FONOELAST MONO, used on stairs as a separating layer, guarantees a damping level of “impact noise” of shared parts of buildings



	FONOELAST MONO
Appearance	Creamy paste
Specific weight	1.50±0.05 kg/dm^3
Application temperature	+5°C÷+40°C
Adhesion to support	>1 N/mm^2
Vapour diffusion resistance	µ>1,500
Dynamic stiffness under a load of 200 kg/m^2	approx. 400 MN/m^3
Flammability	No
Shelf life	12 months

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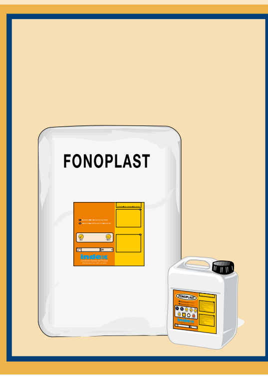
FONOPLAST



ELASTIC TWO-COMPONENT ELASTOMER-BASED VIBRATION DAMPING CEMENT MORTAR

CHARACTERISTICS			IMPACT ON THE ENVIRONMENT		METHOD OF USE	
AB	H_2O					+5°C +35°C
TWO-COMPONENT	WATER BASED	ACOUSTIC INSULATION	ECO GREEN	RECYCLABLE	TO BE APPLIED BY INOX SPATULA	APPLICATION TEMPERATURE

PROBLEM

The use of normal cement mortar to connect the perimeter of dividing walls between different dwellings to the ceiling and the adjacent walls determines a rigid bond and poor adhesion that favours the lateral transmission of noise and reduces the stability of the same.

SOLUTION

FONOPLAST is an elastic two-component mortar with base of cement-polymer, selected quartz sand and additives that improve elasticity and adhesion. The combination of the two components produces a mix that is easy to work and that sticks excellently to the support. Once set, it creates an elastic coating around the perimeter of the walls, which reduces the vibrations of the acoustic pressure waves that are transmitted to the structure laterally (lateral transmissions).

FIELDS OF USE

FONOPLAST is used to skim all normal indoor and outdoor supports in concrete, cement+lime mortar or cement, cement foam, plaster, brickwork etc. **FONOPLAST** is used to create elastic perimetric linings with good characteristics of resistance to compression and of adhesion to all types of support, maintaining the elastic properties over time. The level of adhesion provided by **FONOPLAST** is much superior to that of a normal building site mortar.

METHOD OF USE

Substrate preparation.
The support must be compact and perfectly clean, free from dust, loose parts, oil and dirt in general. The surfaces must be free from stagnated water. Any irregular parts are to be filled-in in advance with suitable mortar according to the type of support involved. The surfaces to be treated must be as flat as possible to avoid having to build up thicker parts, which consequently involves high consumptions of material.

Mix preparatin instruction.
Pour the B component (6 kg latex) in the dedicated container and gradually add the A component (25 kg powder), mixing with a stirrer drill at a slow rpm. Do not mix for too long to avoid incorporating air in the mix.

Application.
The product is laid evenly using a stainless steel trowel. One or more coats can be applied one after the other.
The application thickness is 3-4 mm.

COVERAGE

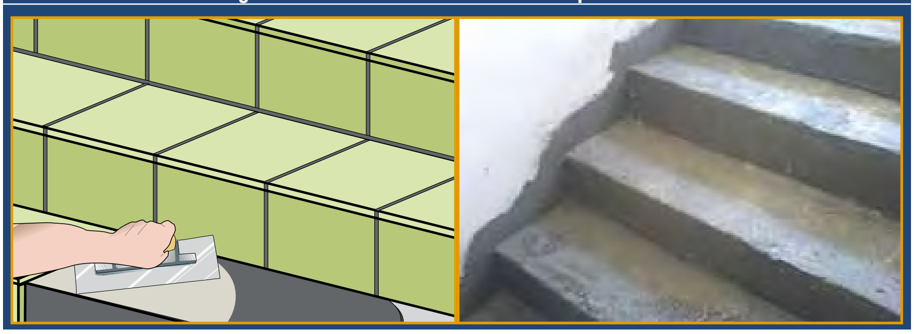
1,5 kg/m²×mm of thickness.

PRECAUTIONS

- Minimum application temperature +5°C.
- Do not add water once the mix starts to set.
- Do not apply too thick.
- Protect from rain while the product is setting.
- Clean the tools with water after use.
- Do not add other materials to the mix.

FONOPLAST and FONOSTRIP keep the wall separated right along the perimeter

FONOPLAST, used as a separating layer, guarantees a damping level of "impact noise" of shared parts of buildings: shared staircases and corridors in apartment blocks etc.



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5ª DIVISIONE 2ª LINEA

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FONOPLAST

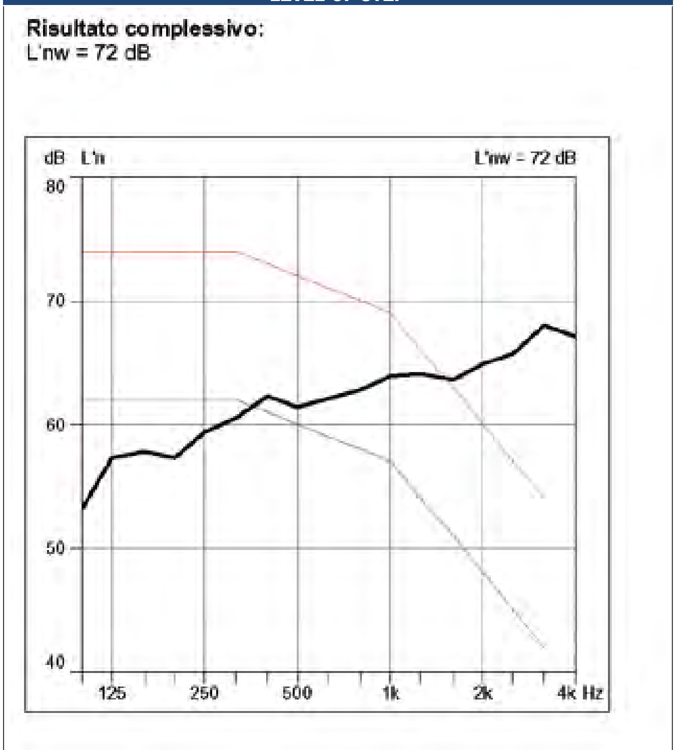
	Component A	Component B
Appearance	Powder	Milky liquid
Specific weight	1.48 kg/dm^3	1.05 kg/dm^3
Flammability	No	No
Shelf life:	12 months	12 months
FONOPLAST mix. Ratio 25:6.		
Specific weight	1,58±0,05 kg/dm^3	
Application temperature	+5°C÷+35°C	
Workability time	30 minutes	
Cold-state flexibility	–30°C	
Adhesion to support	>1 N/mm^2	
Water resistance (1 m water column)	Water proof	
Resistance to vapour diffusion	µ>1.500	
Dynamic stiffness under a load of 200 kg/m^2	900 MN/m^3	

SITE TEST OF THE DAMPING LEVEL OF FOOT TRAFFIC NOISE ON STEPS OF A STAIRCASE

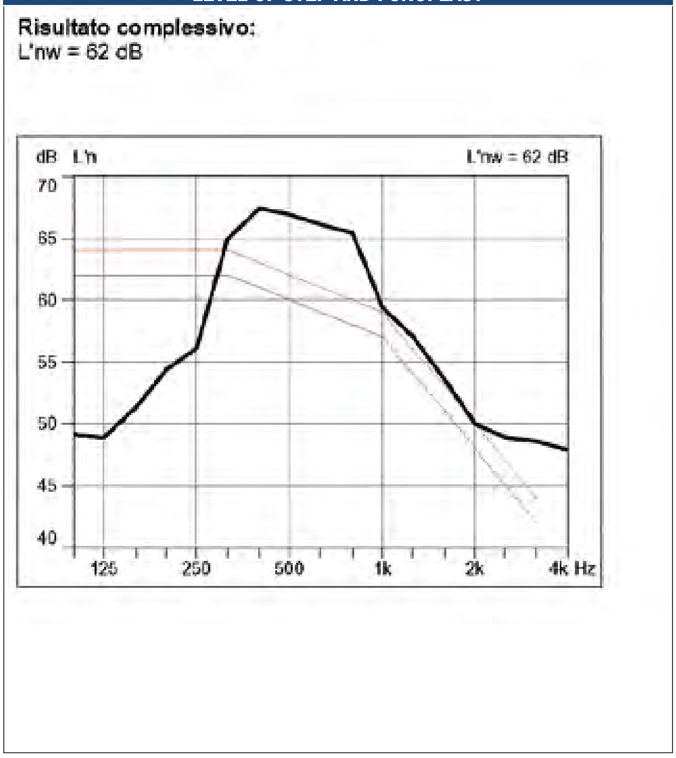
The test was carried out on a staircase fixed to the dividing wall of the stairwell of the receiving room.
The staircase was originally lined with granite slabs glued to the steps with cement mortar.
The volume of the receiving room was 225 m^3.
The test carried out with the tapping machine on the steps involved:

- the step in the centre of the wall with the original granite slab covering for which an acoustic level of L'_{nw} = **72 dB** was measured in the receiving room
- the step right below with the same granite slab on which a ceramic tile was glued on a layer of FONOPLAST of 4.5 g/m^2 for which an acoustic level of L'_{nw} = **62 dB** was measured in the receiving room.

LEVEL OF STEP



LEVEL OF STEP AND FONOPLAST



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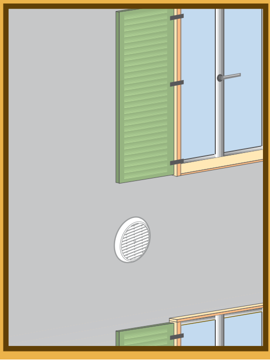
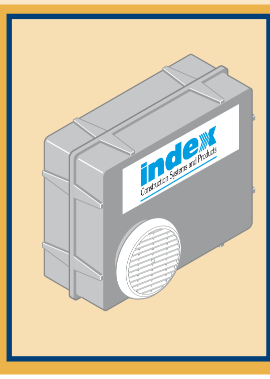


FONOPROTEX



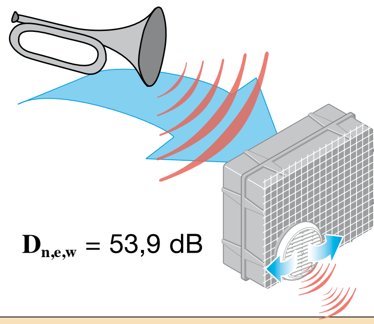
SILENCED AIR IN-TAKE FOR VENTILATION HOLES OF KITCHENS WITH HIGH ACOUSTIC INSULATION INDEX

PROBLEM

For kitchens where open flame gas appliances, ovens or hobs are installed, Italian safety standards (UNI CIG 7129/92) impose the creation of ventilation openings in the external walls of buildings to guarantee the inflow of air required for combustion.
Holes in perimeter walls must have a net cross section of 6 cm^2 for every KW of installed thermal power, with a minimum surface area of 100 cm^2.
Seeing as these openings let air through, they represent points of transmission of external noise into the home and therefore deteriorate the soundproofing performance of the external walls of our buildings.

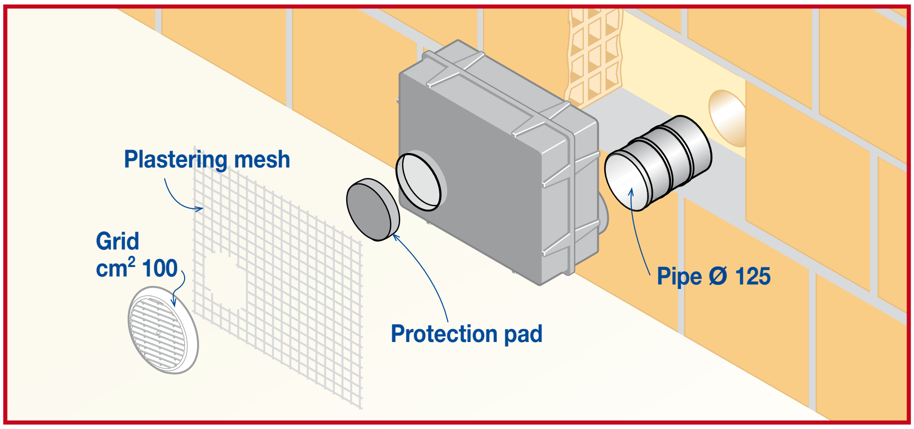
SOLUTION

In order to limit the exposure of human beings to noise, the outline law concerning acoustic pollution (447/95) and subsequent amendment DPCM 5/12/97 on the passive acoustic requirements of buildings, establish the observance of a minimum level of insulation for the perimeter walls of buildings (the requirement depends on the category of use of the building itself).
To obtain the correct level of comfort for those living in the buildings and to comply with these legislative requirements, a silenced air in-take shall be installed in the perimeter walls by the kitchen that limits the transmission of noise but still guarantees a free surface area of 100 cm^2.
FONOPROTEX is the soundproof silencer for ventilation holes that meets the insulation indexes of external walls ($D_{2m,nT,w}$) requested by current standards. The silenced air in-take **FONOPROTEX** is made of plastic and, thanks to its compactness and regular shape, is easy and very straightforward to install on site.
FONOPROTEX is lined internally with expanded polyurethane (open cells on polyester base) and is considerably flexible, fireproof (UL94), waterproof and harmless (it does not let-off fibres or dust).
The high insulation properties of **FONOPROTEX** are certified by the laboratories of Giordano Institute, where the insulation index resulted in $D_{n,e,w}$ = 53,9 dB following tests carried out pursuant to standards UNI EN ISO 7171-1 and ISO 140-10.
FONOPROTEX is the smallest silencer with the highest acoustic insulation index to be certified!
FONOPROTEX can be laid either vertically or horizontally indifferently, based on site requirements and is equipped with a plastering mesh on the face to be installed on site towards the building's interior.
Thanks to its compactness, the silenced air in-take **FONOPROTEX**, strongly limits thermal dispersions of perimeter walls (the particularly contained depth of just 15 cm means that it is easy and quick to lay, leaving plenty of space towards the outer part for thermal protection, in solutions either of single and double external walls.
The package of the silenced air in-take **FONOPROTEX** includes four joining cups with the wall and 3 aeration grids (2 white and 1 bronze colour) complete with filter and flow separator.



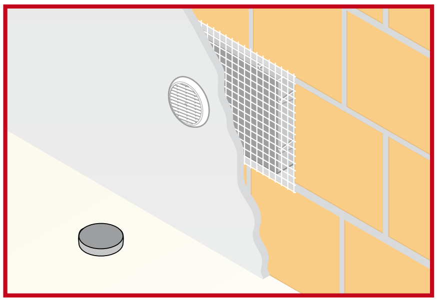
METHOD OF USE AND PRECAUTIONS

In all installations and even in kitchens with open flame gas appliances, **FONOPROTEX** can be fitted either with the holes arranged horizontally or vertically, because ventilation just has the function of feeding sufficient air for combustion and also to change the air.



The hole inlets of **FONOPROTEX** on both sides are male and have outside diameter of 120 mm to be fitted in a ø 120 mm hole or inside the ø 125 mm pipe supplied.

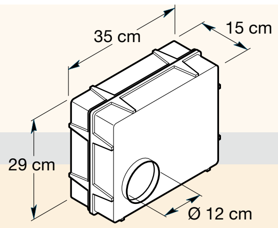
PLASTERING MESH. A mesh is applied on the external side of **FONOPROTEX** to make it easier to plaster and to avoid cracks.



The holes are protected in the installation phase by pads (to prevent debris from obstructing them), which will be removed before the grid is fitted.

FONOPROTEX

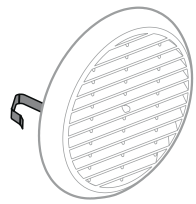
Dimensions		
• height	29 cm	
• length	35 cm	
• depth	15 cm	
• dimensions of aeration hole	ø 12 cm	
Air opening	100 cm^2	
Certification	Istituto Giordano	



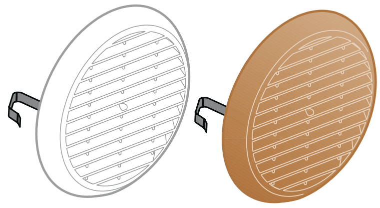
GRIDS SUPPLIED

FONOPROTEX is equipped with:

- 2 white grids with insect protection mesh for the inside and for the external wall.
- 1 copper colour grid with insect protection mesh for external walls with exposed or pinkish bricks.



Internal application

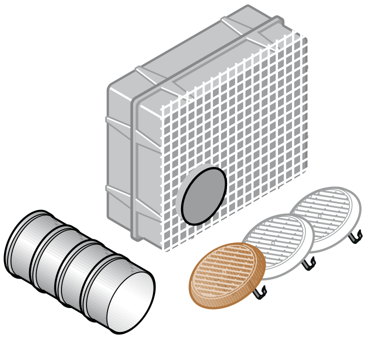


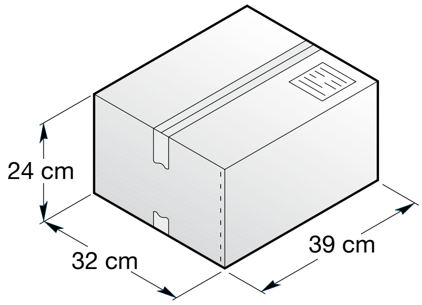
External application

PACKAGING

FONOPROTEX is supplied in a single package inside a cardboard box measuring 39×32×24 cm. Weight of package: 1.9 kg.

BOX CONTENTS
no. 1 **FONOPROTEX**
no. 1 fitted plastering mesh
no. 3 grids with flow separator :
no. 2 white
no. 1 copper colour
no. 1 modular extension pipe ø 125 m





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ANIT Associated

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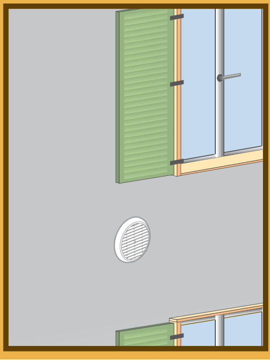
TOTAL QUALITY index UNI EN ISO 9001

Environmental Management Systems index UNI EN ISO 14001

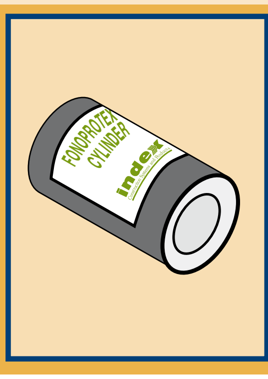
index "GBC Italia" Associated

lavorosicuro

02/2009en



FONOPROTEX CYLINDER



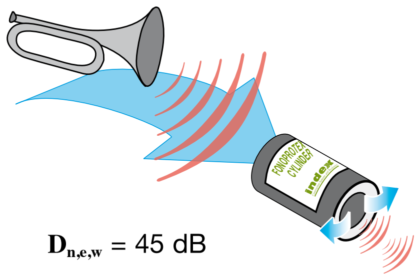
COMPACT SILENCED AIR IN-TAKE FOR VENTILATION HOLES OF KITCHENS WITH HIGH ACOUSTIC INSULATION INDEX

PROBLEM

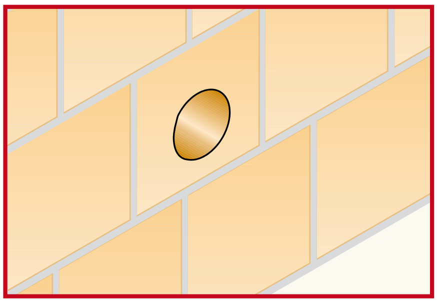
For kitchens where open flame gas appliances, ovens or hobs are installed, Italian safety standards (UNI CIG 7129/92) impose the creation of ventilation openings in the external walls of the buildings to guarantee the inflow of air required for combustion.
Holes in perimeter walls must have a net cross section of 6 cm² for every KW of installed thermal power, with a minimum surface area of 100 cm².
Seeing as these openings let air through, they represent points of transmission of external noise into the home and therefore deteriorate the soundproofing performance of the external walls of our buildings.

SOLUTION

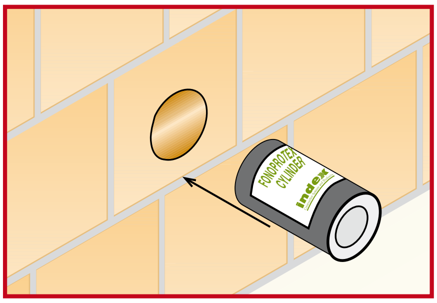
In order to limit the exposure of human beings to noise, the outline law concerning acoustic pollution (447/95) and subsequent Prime Minister's Decree (DPCM) dated 5/12/97 on the passive acoustic requirements of buildings, establish the observance of a minimum level of insulation for the perimeter walls of buildings (the requirement depends on the category of use of the building itself).
To obtain the correct level of comfort for those living in the buildings and to comply with these legislative requirements, a silenced air in-take shall be installed in the perimeter walls by the kitchen that limits the transmission of noise but still guarantees a free surface area of 100 cm².
FONOPROTEX CYLINDER is the silenced air in-take for ventilation holes that meets the insulation indexes of external walls ($D_{2m,nT,w}$) equested by current standards. richiesti dalla normativa vigente. The silenced air in-take **FONOPROTEX CYLINDER** is made of plastic and, thanks to its compactness and installation simplicity, it is the ideal solution for drastically limiting building site work: with **FONOPROTEX CYLINDER** it is not necessary to plan the position and seating in advance while building the perimeter walls; a hole (ø 200 mm) will simply be bored once the walls have been built, inserting **FONOPROTEX CYLINDER** in it and finishing off with a grid; easy, quick and no need for cutting out traces in the walls.
FONOPROTEX CYLINDER consists of a cylindrical box made of elastomeric polypropylene, with high resistance to impact; internally it has a plastic circular soundproofing element with constant knurling design; it is rot-proof, waterproof, does not crumble or go mouldy.
The high insulation properties of **FONOPROTEX CYLINDER** are certified by the laboratories of the CSI Institute, where the insulation index resulted in $D_{n,e,w}$ = 45 dB following tests carried out pursuant to standards UNI EN ISO 7171-1 and ISO 140-10.
FONOPROTEX CYLINDER is the smallest silenced in-take with the highest acoustic insulation index ever to be certified!
Thanks to its compactness, the silenced air in-take **FONOPROTEX CYLINDER**, strongly limits thermal dispersions of perimeter walls and can be applied without variations in the laying methods, in both new buildings and existent buildings.



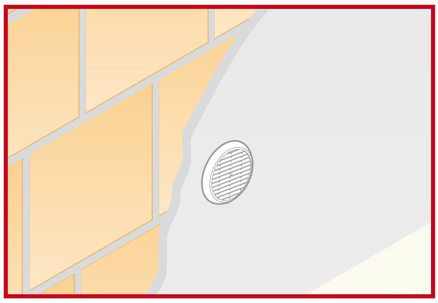
METHOD OF USE AND PRECAUTIONS



Bore a hole (diam.200 mm) in the plastered or unplastered wall.



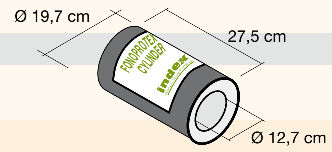
Insert **FONOPROTEX CYLINDER** in the hole.



Fit the grids after plastering
(grids not supplied in pack)

FONOPROTEX CYLINDER

Dimensions • length • diameter • dimensions of aeration hole	 27.5 cm 19.7 cm ø 12.7 cm
Air opening	120 cm^2
Fire performance (internal method)	class 1
Certification	CSI



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TOTAL QUALITY index UNI EN ISO 9001 | Environmental Management Systems index UNI EN ISO 14001 | index "GBC Italia" Associated | lavorosicuro

FONOCOLL

WATER-BASED ADHESIVE FOR GLUING TOPSILENTBitex AND TOPSILENTDuo ON LINED PLASTERBOARD PANELS OR WOOD

In some cases, it may be convenient to pre-couple the TOPSILENTBitex foil on plasterboard panels without using nails or metal staples.
FONOCOLL is an acrylic resin-based adhesive in aqueous dispersion and special additives, used to quickly glue sound-resistant foils TOPSILENTBitex and TOPSILENTDUO on panels of plasterboard and wood in acoustic insulation systems.
FONOCOLL makes on-site laying easier even when the first plasterboard panel of a double insulation system is already fitted on the frame. The adhesive will be laid on the panel in a vertical position and will be tested with a finger every now and again to check if it is dry.
Generally speaking, **FONOCOLL** is sufficiently dry after 15÷20 minutes, but is still sticky enough to glue and hold the foil of TOPSILENTBitex for the time required to fit the second plasterboard panel.

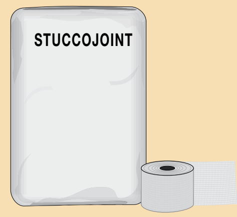
	FONOCOLL
Appearance	milky liquid
Packing	5 kg and 10 kg cans
Specific weight:	1.04±0.05 kg/litres
Solid content (5 hours at 165°C)	50%±1%
Brookfield viscosity (RVT5 - speed 20 at 25°C)	5.000-10.000 cps
Flash point	Not flammable
Stability in original cans	12 months

GIPSCOLL

SPECIAL PLASTER ADHESIVE

GIPSCOLL is an adhesive obtained by incorporating additives in the production phase of plaster grouting.
GIPSCOLL is used to glue pre-coupled lined plasterboard panels to walls and concrete, such as SILENTGips, SILENTIGipsalu and TOPSILENTDuogips, or to glue panels of TOPSILENTEco.
The **GIPSCOLL** mix can be applied using a trowel, in spots or strips, on the walls or on the materials to be glued. When positioning the panels, they should be pressed sufficiently against the wall in order to "squash" the adhesive so that there is sufficient adhesion surface.

NASTROGIPS STUCCOJOINT



TAPE AND FILLER FOR SEALING AND FINISHING-OFF LINED PLASTERBOARD PANEL JOINTS

NASTROGIPS is a netted joint-covering tape. It is used to seal panels of SILENTGips, SILENTGipsalu, TOPSILENTGips and TOPSILENTDuogips in acoustic insulation systems.
The joints covered with **NASTROGIPS** must then be finished-off with STUCCOJOINT filler to skim the panels.

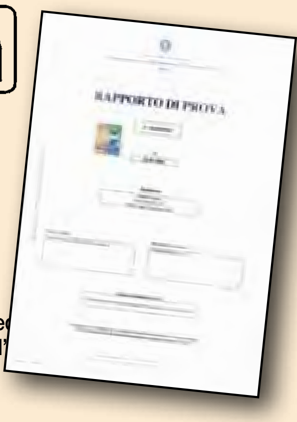
STUCCOJOINT filler is used to finish-off panels of glass wool pre-coupled with plasterboard, such as SILENTGips, SILENTGipsalu, and panels of TOPSILENTGips and TOPSILENTDuogips.
It can also be used to completely skim the above-mentioned panels or to repair damaged panels.
The joints must be previously reinforced and sealed with **NASTROGIPS**.
When used as a skimmer, it is advisable to apply two coats of **STUCCOJOINT**.

CERTIFICATION OF THE ACOUSTIC INSULATION PRODUCTS AGAINST FOOT TRAFFIC NOISE

FONOSTOPDuo

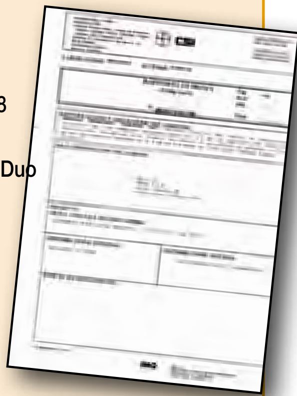
Certification
"ITC-CNR"
Institute for Construction Technologies n. 3402/RP/01

Determination of dynamic stiffness of FONOSTOPDuo UNI EN 29052 for calculating the insulation of a floor covered with "floating flooring material"


RAPPORTO DI PROVA

Certification "CSI" n. ME06/060/98

Acoustic insulation against foot-traffic noise of FONOSTOPDuo ISO 717/82 UNI 8270/7.

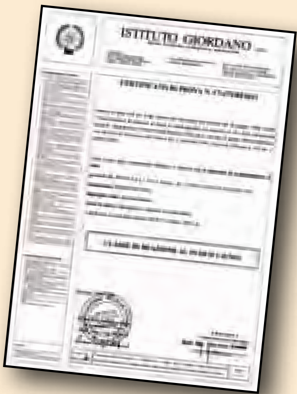


Certification "CATAS"
Research and development centre and test laboratory for the wood-furnishing industry no. 109570/1

Establishment of Volatile Organic Compound (VOC) emissions

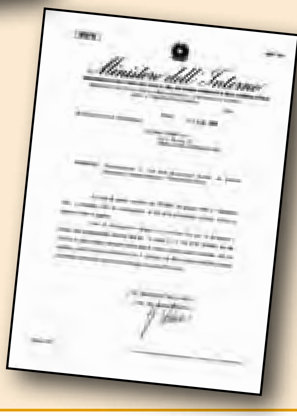
Certification "ISTITUTO GIORDANO"
Polytechnical research and certification centre n. 171472/RF3612

Determining the FIRE REACTION CLASS.


ISTITUTO GIORDANO

Approval
of "MINISTRY OF INTERIOR"
n. VR2172B41C100002

Determinatin
FIRE REACTION CLASS


Ministero dell'Interno

Sistema: FONOSTOPDuo+FONOSTOPDuo

Certification "ITC-CNR"
Institute for Construction Technologies n. 3403/RP/01

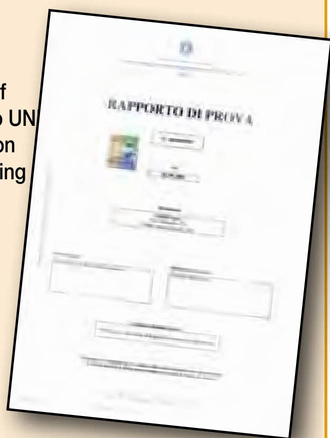
Determination of dynamic stiffness of FONOSTOPDuo double-layer UNI EN 29052 for calculating the insulation of a floor covered with "floating flooring material"


RAPPORTO DI PROVA

Sistema: FONOSTOPDuo+FONOSTOPTrio

Certification "ITC-CNR"
Institute for Construction Technologies n. 3404/RP/01

Determination of dynamic stiffness of FONOSTOPDuo with FONOSTOPTrio UNI EN 29052 for calculating the insulation of a floor covered with "floating flooring material"

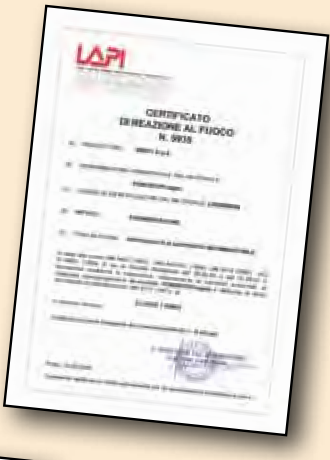

RAPPORTO DI PROVA

CERTIFICATION OF THE ACOUSTIC INSULATION PRODUCTS AGAINST FOOT TRAFFIC NOISE

FONOSTOPLegno

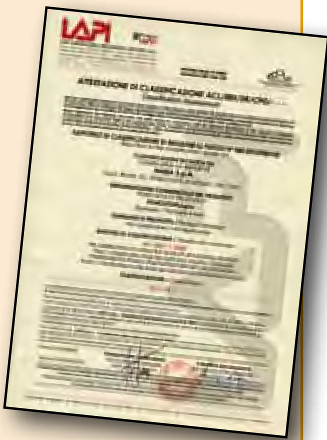
Certification “LAPI”
Laboratory for fire prevention
n. 5935

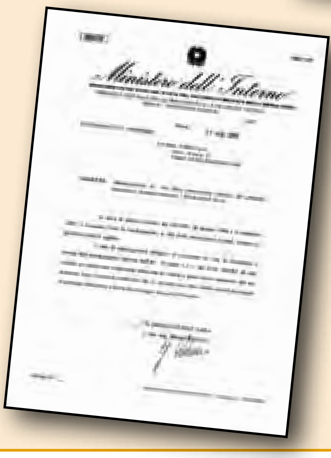
Determining the FIRE REACTION CLASS.
(Italian Classification)


CERTIFICATO
DI REAZIONE AL FUOCO
N. 5935

Certification “LAPI”
Laboratory for fire prevention
n. 085.0DC0050/08

Report on the REACTION TO FIRE CLASSIFICATION
(European Classification)





Approval of
“MINISTRY OF INTERIOR”
n. VR2172B41C100004

Determinatin
FIRE REACTION CLASS

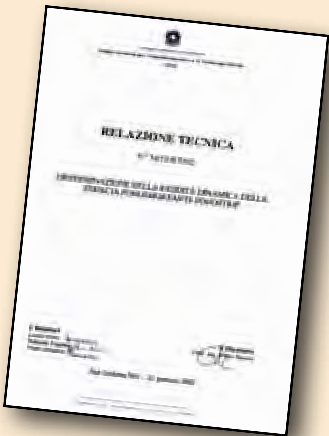
Certificazione “CATAS”
Research and development centre and test laboratory for the wood-furnishing industry
no 108145/1

Establishment of Volatile Organic Compound (VOC) emissions

FONOSTRIP

Certification “ITC-CNR”
Institute for Construction Technologies n. 3453/RT/02

Determination of dynamic stiffness of FONOSTRIP UNI EN 29052 for calculating the insulation of a floor covered with “floating flooring material”

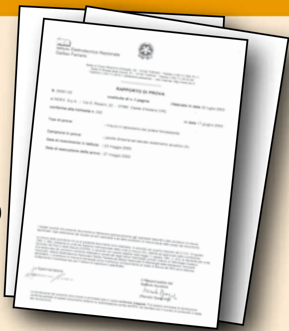

RELAZIONE TECNICA

CERTIFICATION OF THE ACOUSTIC INSULATION PRODUCTS AGAINST AIRBORNE NOISE

TOPSILENTBitex

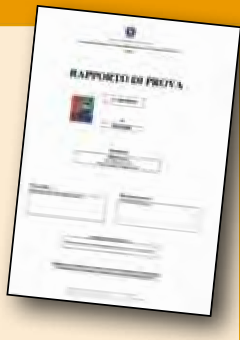
Certification “IEN G. FERRARIS”
National Electrotechnical Institute
n. 35561/05 - n. 35561/07 - n. 35561/09

Establishment of the wall’s soundproofing power



Certification “ITC-CNR”
*Institute for Construction Technologies*n. 4946/RP/09

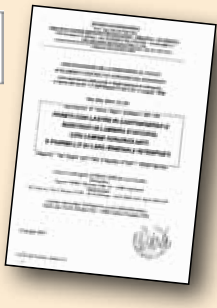
Establishment of the wall’s soundproofing power



STUDIO DI INGEGNERIA
Dott. Ing. Davide Dal Mas

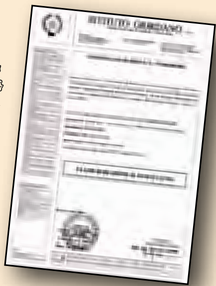
Certification n. 092.2007.22.06

Establishment of the FIRE RESISTANCE OF ELEMENTS, REI 120



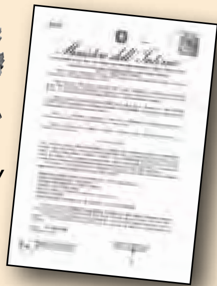
Certification “ISTITUTO GIORDANO”
Polytechnical research and certification centre
n. 171105/RF3602

Determining the FIRE REACTION CLASS.



Approval of “MINISTRY OF INTERIOR”
n. VR2172B10D100001

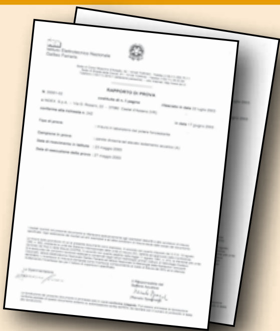
Determining the FIRE REACTION CLASS.



TOPSILENTDuo

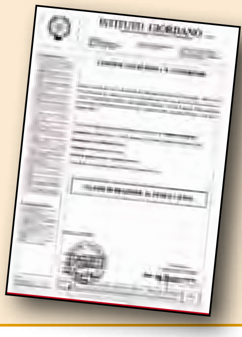
Certification “IEN G. FERRARIS”
National Electrotechnical Institute
n. 35561/03 - n. 35561/08

Establishment of the wall’s soundproofing power



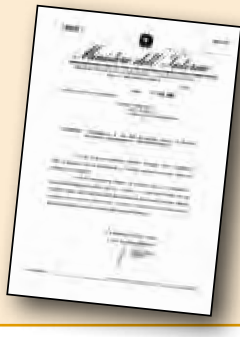
Certification “ISTITUTO GIORDANO”
Polytechnical research and certification centre
n. 171105/RF3601

Determining the FIRE REACTION CLASS



Approval of “MINISTRY OF INTERIOR”
n. VR2172B10D100003

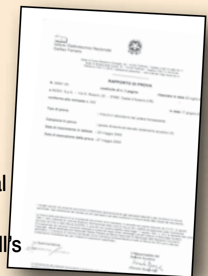
Determining the FIRE REACTION CLASS.



TOPSILENTEco

Certification “IEN G. FERRARIS”
National Electrotechnical Institute n. 35561/09

Establishment of the wall’s soundproofing power

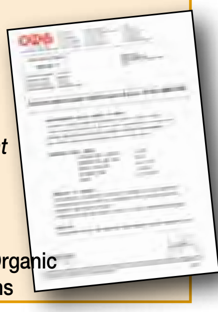


Certification “ITC-CNR”
Institute for Construction Technologies
n. 4166/RP/06

Establishment of the wall’s soundproofing power

Certification “CATAS”
Research and development centre and test laboratory for the wood-furnishing industry no 10571/1

Establishment of Volatile Organic Compound (VOC) emissions

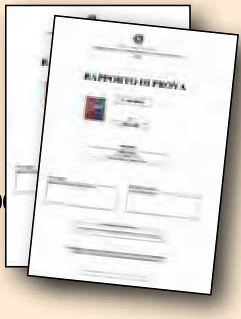


CERTIFICATION OF THE ACOUSTIC INSULATION PRODUCTS AGAINST AIRBORNE NOISE

TOPSILENTRock

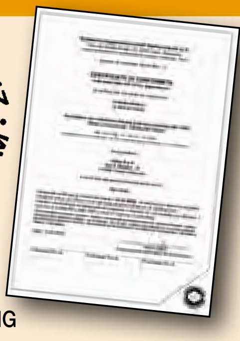
Certification "ITC-CNR"
Institute for Construction Technologies
n. 4165/RP/06 - n. 4167/RP/0

Establishment of the wall's soundproofing power



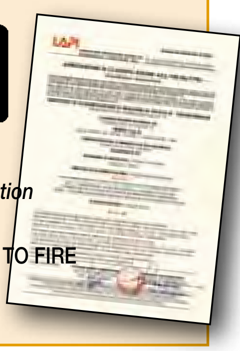
n. 06 44 266 i - 2

Certification of CONFORMITY FOR CE MARKING



Certification "LAPI"
Laboratory for fire prevention
n. 730.0DC0050/06

Report on the REACTION TO FIRE CLASSIFICATION (European Classification)



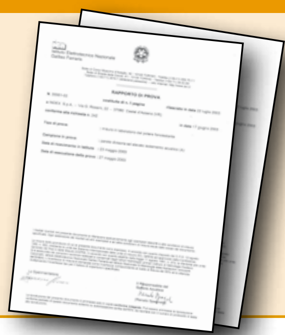
SILENTEco

Certification "ITC-CNR"
Institute for Construction Technologies
n. 4214/RP/06

Establishment of the wall's soundproofing power

Certification "IEN G. FERRARIS"
National Electrotechnical Institute
n. 35561/07 - n. 35561/09

Establishment of the wall's soundproofing power



SILENTRock

Certification "ITC-CNR"
Institute for Construction Technologies n. 4213/RP/06

Establishment of the wall's soundproofing power

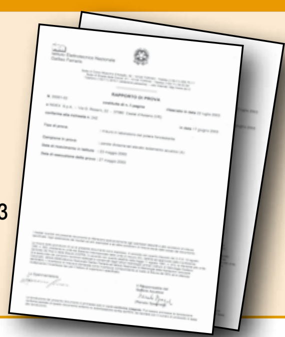
TOPSILENTGips

Certification "ITC-CNR"
Institute for Construction Technologies
n. 4213/RP/06 - n. 4214/RP/06

Establishment of the wall's soundproofing power

Certification "IEN G. FERRARIS"
National Electrotechnical Institute
n. 35561/05 - n. 35561/07 n. 35561/03

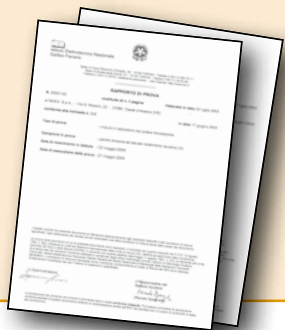
Establishment of the wall's soundproofing power



TOPSILENTDuogips

Certification "IEN G. FERRARIS"
National Electrotechnical Institute
n. 35561/08

Establishment of the wall's soundproofing power

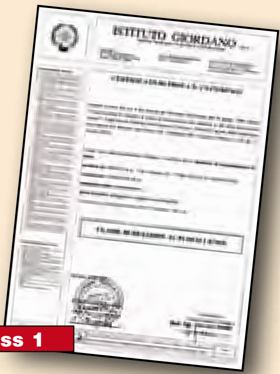


CERTIFICATION OF THE RESISTANCE TO FIRE

FONOSTOPDuo

Certification “ISTITUTO GIORDANO”
Polytechnical research and certification centre
n. 171472/RF3612

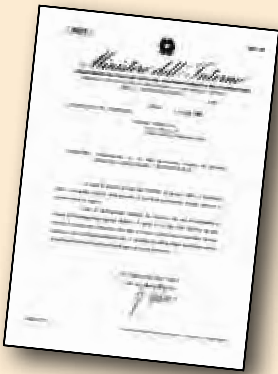
Determining the fire reaction class.



Class 1

Approval of “MINISTRY OF INTERIOR”
n. VR2172B41C100002

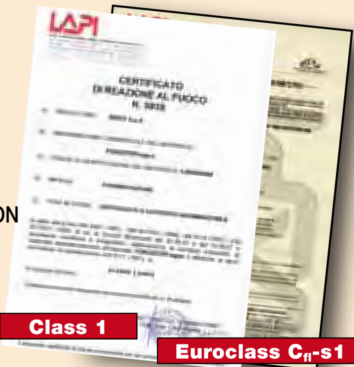
Determinatin FIRE REACTION CLASS



FONOSTOPLegno

Certification “LAPI”
Laboratory for fire prevention n. 5935
Determining the FIRE REACTION CLASS (Italian Classification)

n. 085.0DC0050/08
Report on the REACTION TO FIRE CLASSIFICATION
(European Classification)



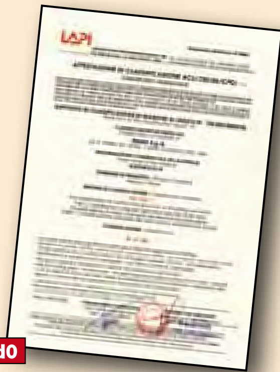
Class 1

Euroclass C_{fl}-s1

TOPSILENTRock

Certification “LAPI”
Laboratory for fire prevention
n. 730.0DC0050/06

Report on the REACTION TO FIRE CLASSIFICATION

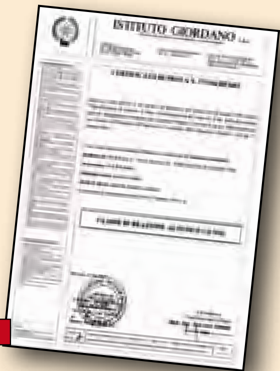


Class B, s1-d0

TOPSILENTBitex

Certification “ISTITUTO GIORDANO”
Polytechnical research and certification centre
n. 171105/RF3602

Determining the FIRE REACTION CLASS.



Class 1

Approval of “MINISTRY OF INTERIOR”
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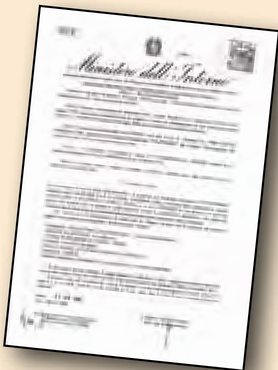
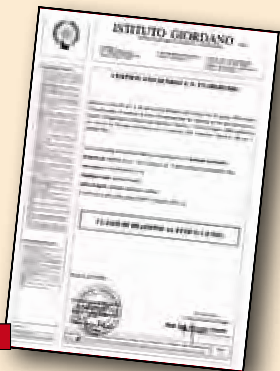
Determining the FIRE REACTION CLASS.



TOPSILENTDuo

Certification “ISTITUTO GIORDANO”
Polytechnical research and certification centre
n. 171105/RF3601

Determining the FIRE REACTION CLASS.



Class 1

Approval of “MINISTRY OF INTERIOR”
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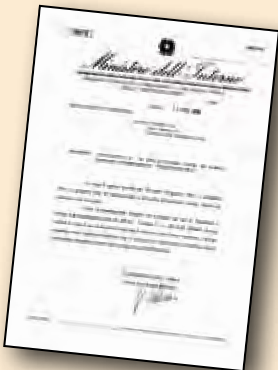
Determining the FIRE REACTION CLASS.



THE ACOUSTIC REQUIREMENTS OF BUILDINGS IN SOME EUROPEAN COUNTRIES

ANALYSIS OF FOREIGN LEGISLATIONS ON ACOUSTIC INSULATION

As is the case for Italy, with the enforcement of the DPCM (Decree of the President of the Council of Ministers) 5-12-1997 (this law covers all the building permission issued after 20th February 1998), which has been extensively analysed in the previous pages, there are also national legislations or specific laws aimed at containing the noise level inside buildings in many other European countries. We have included France, Germany, Portugal and the UK in our considerations.
Whilst considering the differences regarding the evaluation indices required (for example in France the insulation indices of partitions "D" are evaluated and not the soundproofing power indices **R'w** considered in Italy), along with the units of measurement considered appropriate (in Italy dB and in other countries including Spain and France in dB(A)) and the building methods relative to the territory.
Detailed analysis of information available in literature has made it possible to observe that the requirements set down by the DPCM 5-12-1997 are in line, if not sometimes slightly "softer" than in Italy's neighbouring countries.
Before entering into close examination and comparison of the requirements set down by the Italian Decree compared to "other" national legislations, we would especially like to examine how the acoustic Legislations of countries such as France, Germany, Portugal and the UK are structured.
Upon first reading, a subdivision according to the intended use categories of the building appears clear for all the Legislations considered. In other countries, unlike the content of the DPCM 5-12-97, it appears clear that it has been considered appropriate also to distinguish between the types of intended use of the rooms inside the buildings and how a different attitude has been considered and required in relation to buildings for "mixed" use or the requirements relative to the "communal parts" of a building.
If, for example, we consider the content relating to buildings for residential use in the French Decree (Arreté du juin 1999 relatif aux caractéristiques acoustiques des batiments d'habitation) or that shown in the extract of the German regulation DIN 4109 (substitutive of the Italian Decree), it can immediately be noted how the situations relative to the insulation requests of partition walls between adjacent accommodation are treated differently depending on the intended use of the internal rooms.
In the French legislation, the legal limit is considered differently according to whether the partition is for a kitchen or bathroom (minimum requirement 50 dB) or for a living room or bedroom (minimum requirement 53 dB), and the same philosophy is applied to partitions between communal parts (halls or landings) or areas intended for garages.
The same philosophy is also adopted in Germany (where, beyond the minimum legal limits, the regulation DIN 4109 also proposes increased insulation of the building elements in order to obtain a higher level of comfort) where minimum insulation levels are also considered for doors according to whether they lead into inhabited rooms (minimum requirement 27 dB) or doors leading into garages (minimum requirement 37 dB).
These requirements and many more regarding floor insulation, both from airborne noises and noises deriving from direct blows to the structure (in Italy unanimously known as foot-traffic noise), insulation of continuously and discontinuously operating systems, and roof insulation (not expressly mentioned in the DPCM 5-12-1997), make such Legislations extensively exhaustive and clear to those involved in the building process of property with the aim of obtaining the correct level of acoustic comfort inside the buildings and diversifying the properties offered according to more highly regarded certified acoustic characteristics (case of the French Qualitel Institute or the Icelandic Sound classification of dwellings IST 45:2003 created to conclude a certification procedure aimed at obtaining the "classification of the acoustic quality" of a building).
We would like to conclude this chapter with a brief and concise analysis of the passive requirements by comparing the requirements of the DPCM 5-12-1997 with those of the equivalent Decrees or Technical Regulations of the following countries:
- Germany
- France
- Portugal
- UK

Before doing so, we would like to start with a series of evaluations relating to the deviations found through a comparison of the following data.
We feel that in order to compare the values contained in the tables of the various Legislations more effectively, it is appropriate to consider the deviations in the data concerning units of measurement or the type of index represented.
With regard to the unit of measurement, it is important to consider the difference between a sound pressure level reported in dB (indicating the noise produced) and a level indicated and requested in dB(A), that is with values that take into consideration the human perception at the various frequencies (there are tables that group together the corrective factors. *See table 2.2 page 29 - Ettore Cirillo, "Acustica Applicata"*).
With regard to the types of indices adopted, the substantial difference lies in the collection method of the information regarding the soundproofing power index or the standardised acoustic insulation considered (for example for the French Legislation) of the vertical and horizontal separation elements, both methods describing the performance of the wall, but with slight differences in the calculation formulae.
A comparison of the data relating to the Italian category "A" (buildings used for residential use or assimilable), and contained only in the requirements regarding floors and partition and outer walls, is as follows.
In conclusion, as anticipated, the requirements of the countries studied coincide largely with the requirements of DPCM 5-12-1997. The only effective glaring discordance would seem to be connected with the requirements of outer walls.
In this case, the Italian Legislation requires an outer soundproofing power index of no less than 40 dB (reaching points of 48 dB for buildings used for scholastic use at all levels) that considering the obligations connected with the "fire prevention" and forced ventilation Laws, could be considered difficult to reach and decisively more restrictive compared to the other countries used in the comparison.

		ITALY	FRANCE	GERMANY	PORTUGAL	GREAT BRITAIN
DPCM 5-12-1997 CLASSIFICATIONS	$L'_{n,w}$ max	63	58 ($L'_{nT,w}$)		60	62 ($L'_{nT,w}$)
	R'_w min (floors)	50	53-50 (D_{nTA})	54	50 (D_{nw})	45 ($D_{nT,w+Ctr}$)
	R'_w min (walls)	50	53-50 (D_{nTA})	53	50	45 ($D_{nT,w+Ctr}$)
	$D_{2m,nt,w}$ min	40	30 ($D_{nTA,tr}$)		33 ($D_{2m,n,w}$)	

NEW BOUNDARIES: THE ACOUSTIC CLASSIFICATION PROCESS OF BUILDINGS

As mentioned in the previous paragraph, in addition to the legal passive acoustic requirements in buildings, some countries have implemented and put into place (either optionally like the French Qualitel or legally binding such as the Icelandic IST 45:2003 "Sound classification of dwellings" document) a "virtuous" process aimed at the "acoustic classification of buildings".

Unlike the minimum requirements established, these processes consider and classify the properties that can be distinguished for their high levels of acoustic comfort.

Taking the example of the indications of the Icelandic document (as carried out also for the French Qualitel), the distinction between the minimum requirement (relating only to the passive acoustic requirements of the building) and the considered "Comfort Level", also considering the "External Acoustic Climate" of the room being evaluated, appears to be clear (where outside the room refers to both the external sources of noise and the adjacent sources of noise for rooms used for residential use located next to noisy businesses).

This great difference between what can be considered a correctly insulated property and a property with high acoustic comfort is fundamental.

If we consider an apartment located in a building for residential use and we concentrate on the outer acoustic insulation ($D_{2m,nT,w}$ ≥40 dB), we could find ourselves in decidedly contrasting situations depending on the location of the building itself: close to a park, the apartment would be considered of high internal acoustic comfort, whereas close to a railway line (for example 15-20 m from the track) it would definitely be the opposite.

Definitively, the contents of the Icelandic regulation starts from the following inalienable assumption: the internal acoustic comfort of a room for residential use must be strongly linked to the acoustic climate of the neighbouring area (whether it is internal or external) and the classes of acoustic quality from "A" to "C" (corresponding to the minimum requirement) for new buildings, are indicated based on this, with the addition of class "D" for existing buildings (with less restricting requirements).

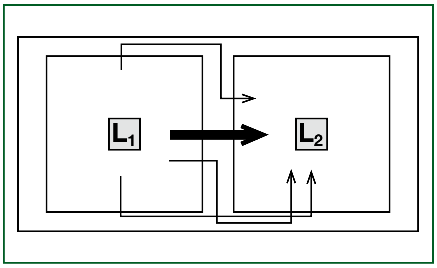
The indications relative to the evaluation indices for obtaining the required comfort are also of notable interest and inspiration (in the hope that an equivalent procedure will be established in Italy in the future taking into consideration the differences connected with the building types). These indices always consider the performance of the elements in relation to the intended use of the adjacent rooms, whether they are activities considered to be noisy (for example a separation element between a house and a room used for production or commerce such as a bar or restaurant) or communal areas of the same building (such as garages or porches).

The only issue that perhaps remains to be evaluated is a particularly delicate issue at the heart of these classification processes, related to the number and type of investigations to be carried out in the field to attest the classification of the building, without having to carry out compulsory testing on all the elements, an operation that would involve enormous investments in terms of time and money and that could bring about the failure of the acoustic qualification process.

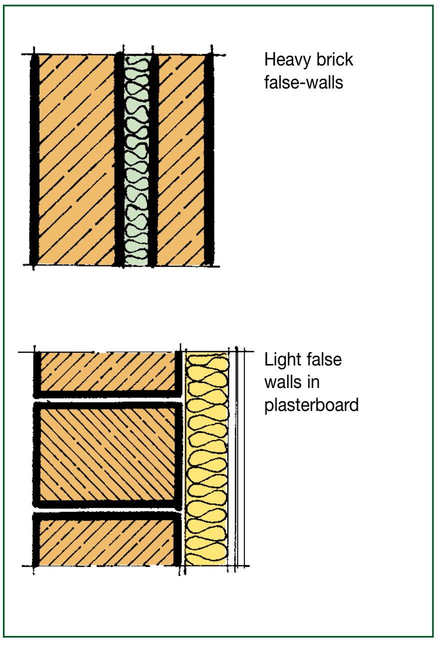
EXISTENT OCCUPIED BUILDINGS

USER'S GUIDE ON ACOUSTIC INSULATION TECHNIQUES

The correct acoustic insulation of a building in the planning and building phase only affects the costs relatively, whereas the acoustic insulation of one that is already occupied is rather expensive and reduces the volumes of the rooms.
First and foremost, one must bear in mind that noise does not derive exclusively from <u>direct transmission</u> through walls or floor slabs that border with the adjacent dwellings or with the outside, but also from <u>indirect transmission</u> through walls or floor slabs that are not directly involved in the noise source but that are still affected by vibration because they are connected rigidly to the bordering dividing walls, consequently the insulation will often not concern just perimeter walls and floor slabs but also the internal dividing walls.



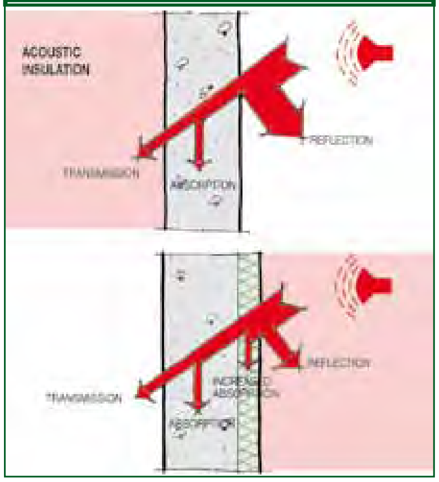
- The acoustic insulation of an occupied room is based on the creation of light false-walls and false-ceilings in dry plasterboard, with air space filled with fibrous insulation material, which are arranged next to the surfaces to be insulated without any rigid connections; this creates a dynamic spring-mass insulation system that dampens the vibrations of the air transmitted from walls and floor slabs involved in airborne noise generated from the outside or in the bordering dwellings, from foot traffic noise that the dwellers of the building cause on the floor slabs and from the noise of the utility systems installed in the building.



Compared to the old method based on the creation of heavy brick false-walls, the method based on plasterboard false-walls takes up less space, the wall is lighter and is built dry, which is an outstanding benefit in rooms that are already occupied, the installation of cables and pipes is simpler and, most important of all, the insulation levels obtained are much greater than those obtainable with a conventional wall.

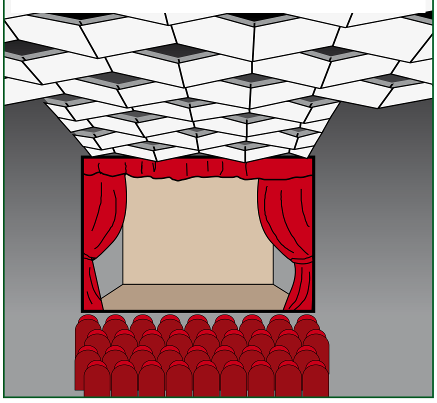
- One must remember that there is no miraculous insulation material, which glued to the wall, resolves the problems of acoustic insulation and the thick cusp-shaped panels or perforated panels used to correct the acoustics in theatres or cinemas do not have any acoustic insulation functions.

DO NOT MISTAKE INSULATION WITH ABSORPTION



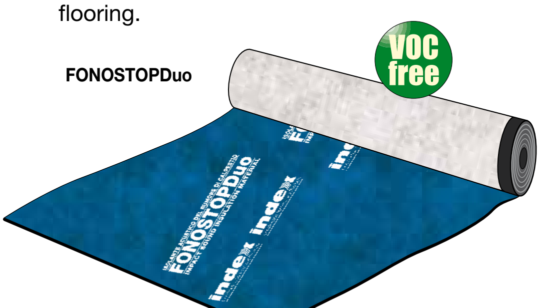
ACOUSTIC CORRECTION

Modifications of the superficial absorption of the wall made to correct the acoustics of the room do not affect the noise transmitted but just the noise reflected.



- Rigid closed-cell cellular insulation panels are perfect for thermal insulation but have no acoustic insulation properties against noise.
- The insulation panels to be fitted in the air spaces of an acoustic insulation system are fibrous. Less common is the use of elastic and/or open-cell cellular insulation materials, whereas of no use and in some cases even detrimental is the use of rigid closed-cell cellular insulation.

- Fibrous insulation materials that are appropriately protected by an impermeable soundproof foil in the building phase are used successfully also to insulate against foot traffic noise under a floating screed, but they also offer excellent results when they are laid between the old floor and a new floating wood floor, without demolishing the existent flooring.



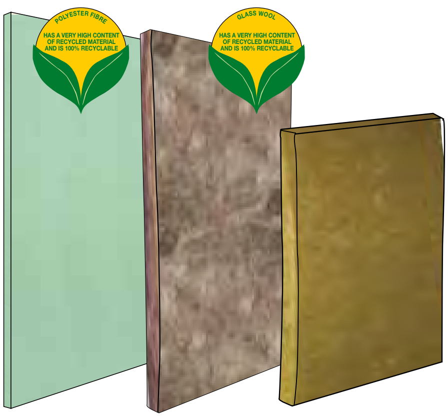
FLOATING SCREED

INSULATION OF WALLS AND CEILINGS

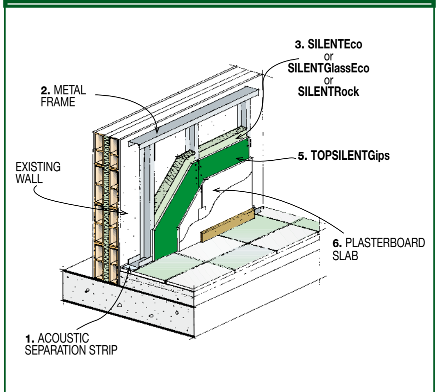
False-walls on metal framework. It is the most efficient insulation system available because the framework is self-bearing and enables the variation of the distance from the wall to be insulated and the installation of a number of panels, which in both cases, increases the soundproofing power of the system. The false-wall in plasterboard is fitted on metal uprights, secured to two tracks, of which one is screwed to the ceiling and the other to the floor and appropriately insulated with self-adhesive gaskets. The air space created by the metal aprights is filled with the fibrous insulation products SILENTEco, SILENTRock, TOPSILENTRock or SILENTGlass. We always recommend the installation of at least two overlapped panels, of which the first will be TOPSILENTGips, which is precoupled with a high density soundproof foil and the second will be a standard insulation panel that can be purchased from any builders' merchant.The minimum thickness to be calculated for the above-described system, fitted on a frame of 50 mm, to be able to provide an efficient level of insulation, is approximately 85 mm.

TOPSILENTGips

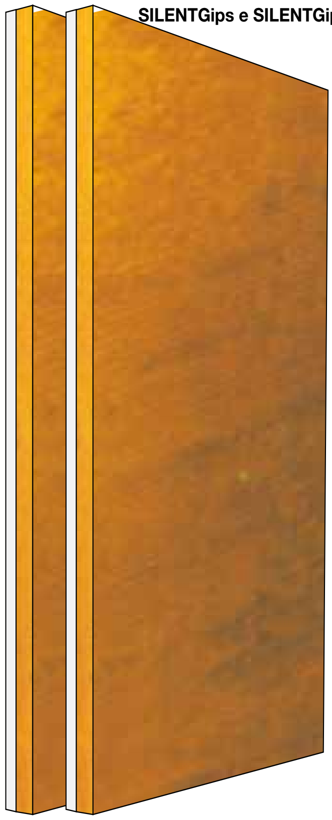
SILENTEco SILENTGlassEco SILENTRock



LIGHT FALSE-WALL ON METAL FRAME

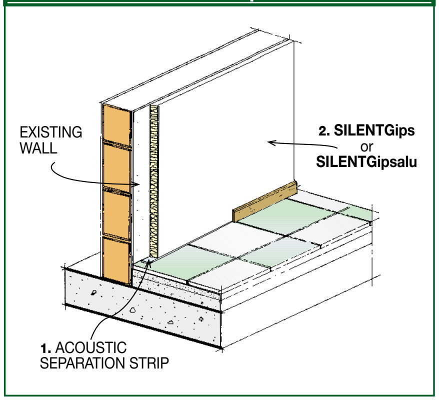


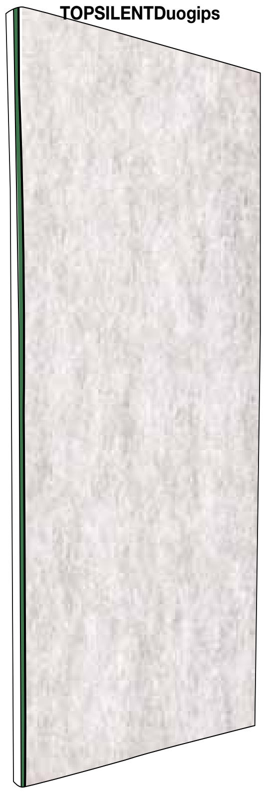
Glued false-walls. Glued false-walls such as SILENTGips and TOPSILENTDuogips provide a lower level of insulation and cannot generally be laid over other plasterboard panels to increase their insulation performance, but they take up less space than walls on metal framework; the first is more efficient while the second, which is thinner, is used just when the space available is minimal.
Both types consist of a plasterboard panel on the back of which, in the case of SILENTGips, a fibreglass panel is glued, while in the case of TOPSILENTDuogips, a soundproof foil coupled with non-woven polyester fabric with elastic needling is glued. Both are glued to the wall to be insulated using GIPSCOLL adhesive, which is applied on the fibrous face of the panel, thus creating an elastic bond and not a rigid bond between the plasterboard panel and the wall, because it is obtained via the fibreglass or polyester fabric that dampens acoustic vibrations.
The minimum thickness to be calculated for SILENTGips, including the adhesive, is approximately 35 mm for the panel of 29.5 mm and approximately 55 mm for the panel of 49.5 mm, whereas the thickness occupied by TOPSILENTDuogips is approximately 26 mm.



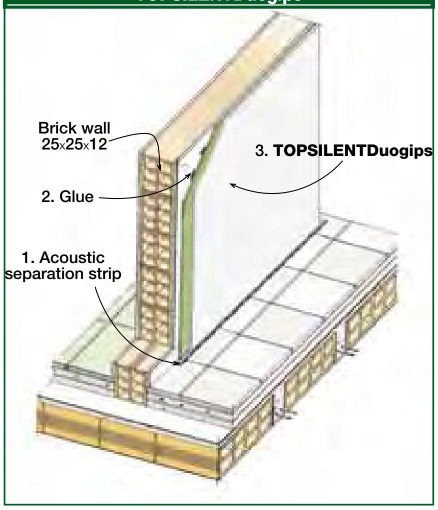
SILENTGips e SILENTGipsalu

LIGHT FALSE-WALL GLUED SILENTGips





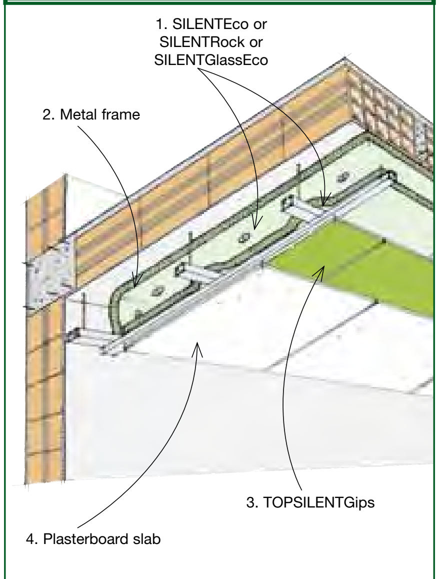
LIGHT FALSE-WALL GLUED TOPSILENTDuogips



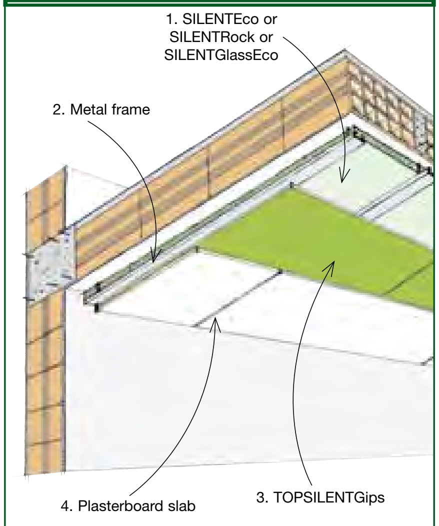
False-ceiling on metal framework. Ceilings are insulated in the same way as false-walls on metal framework with the difference being that the metal framework of the false-ceiling, on which the panel of TOPSILENTgips is screwed first and then a standard plasterboard panel, is borne elastically by some special metal hooks that hang the frame without screwing it rigidly to the ceiling, otherwise the foreseen insulation efficiency is lost completely.
The minimum reduction in height to be assessed is around 100 mm for systems on metal framework in adherence with the insulation of the air space of at least 40 mm created with panels of SILENTEco, SILENTRock or SILENTGlass, up to

200 mm and more if the height of the room allows for it, for systems on a hanging frame with hangers and double layer of insulation obtained with the same panels, of which the first is secured to the ceiling.

FALSE-CEILINGS ON A SUSPENDED METAL FRAME



FALSE-CEILINGS ON AN ADHERING METAL FRAME

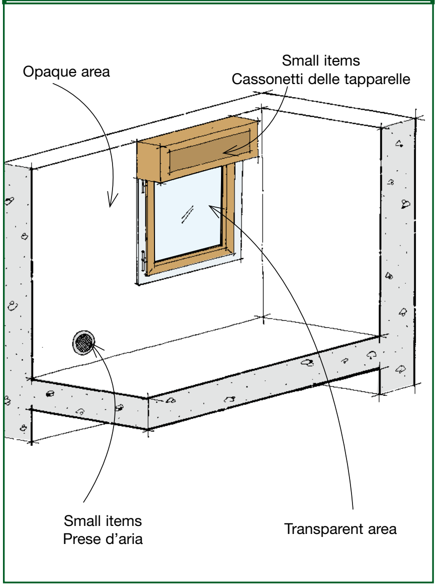


HOW TO PROTECT AGAINST NOISE FROM OUTSIDE THE BUILDING

In genere la parte muraria delle faccia-Generally speaking, the brick part of the external wall (opaque part) built correctly is heavy enough to protect against noise from the outside, consequently the main focus aims at the insulation of the part with windows (the transparent part) because this is where all the external noise, likewise for heat, comes from; if one lives in a rather noisy urban environment, one has to accept the idea of living with the windows closed and having to install air conditioning in summer.

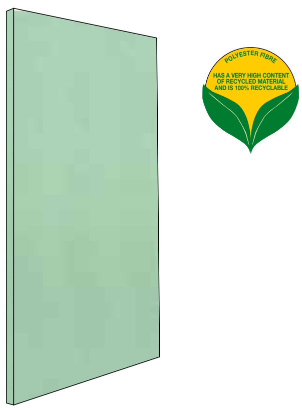
- To improve the situation in existent dwellings, as already explained, the first thing to do is replace the old windows and install at least double-glazed windows; when possible, the best and most efficient solution is to install double-glazed and hermetically sealed windows.

ELEMENTS OF THE EXTERNAL WALL

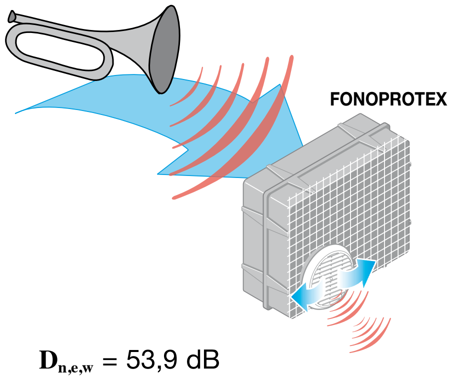


- The old wooden shutter boxes installed in old buildings are a major vehicle of noise and source of consistent thermal dispersion. The thermal-acoustic comfort of occupied rooms can be improved by gluing, on the inside of the old shutter boxes, on the wooden panels, the TOPSILENTBitex foil using FONOCOLL adhesive and subsequently lining the shutter box compartment with thermal-acoustic insulation panels SILENTEco, which can be glued using GIPSCOLL adhesive. SILENTeco is a polyester fibre based insulation product that does not contain mineral fibres, does not irritate skin and does not prick and therefore it can be easily handled, cut and shaped as required. If the space between the shutter box and the shutter roll is minimal, the compartment can be lined internally using the TOPSILENTDuo foil, with the face lined in non-woven white soundproof polyester fabric facing externally, using FONOCOLL adhesive on the wooden parts and GIPSCOLL adhesive on the bricked parts.

SILENTEco



- Openings created in external walls by kitchens where gas hobs and ovens are installed may considerably reduce the soundproofing power of the wall. Bear in mind that an opening of 100 cm², which is the minimum legal measurement, reduces the insulation of the wall by approximately 10 dB. FONOPROTEX is the silenced air intake distributed by INDEX with a net air flow cross section of 100 cm² complete with certified acoustic insulation of $D_{n,e,w}$ = 53,9 dB. FONOPROTEX is compact (35×29×15cm) and has a modular extension that makes it easy and quick to install in most external perimeter brick walls.

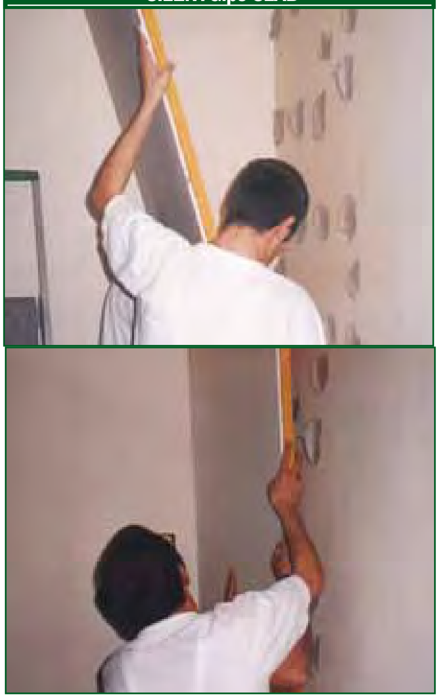


- During seasons in which balcony doors are left open, protection against external noise can be fulfilled by fitting barriers and bushy plants, which should be as high as possible, arranged up against the balcony railings, possibly integrating them with heavy sunshades that cover the whole of the railings; an even more protective solution would be to install a veranda.
- Very rarely is it advisable to acoustically insulate perimeter external walls because they are alone normally sufficiently heavy to guarantee acoustic protection. In the case of effectively weak external walls, the necessity and convenience to do so should be assessed only after replacing the part with windows.
- It could be convenient if the thermal insulation of the external walls is to be integrated and in such case, insulation materials and laying techniques should be chosen that are able to guarantee both thermal and acoustic insulation efficiency. The outer insulation applied on the external part of the perimeter wall is the system that guarantees total coverage of the external wall and offers the advantage of eliminating all the thermal bridges; for this system to be able to guarantee also an efficient acoustic insulation, fibrous insulation panels of mineral nature must be used (fibreglass or rock wool), of at least 6 cm in thickness and complete with acoustic certification; not to be used are closed-cell cellular plastic insulation products, which offer good thermal performance but poor acoustic performance, if not for systems that are based on the use of composite panels created by coupling both materials, but for which it is always advisable to request certification of the acoustic performance.

- When just one dwelling of a block of flats is to be acoustically and thermally insulated, the external wall can be insulated from the inside using systems based on the installation of a light false-wall fitted on metal framework or on the application of the light glued false-wall, remembering for the latter, to replace the SILENTGips panel, being the only one of the systems described earlier without a vapour barrier, with the SILENTGipsalu panel, made of plasterboard coupled with glass wool with built-in vapour barrier in aluminium foil.

POSITION THE SEALING STRIP

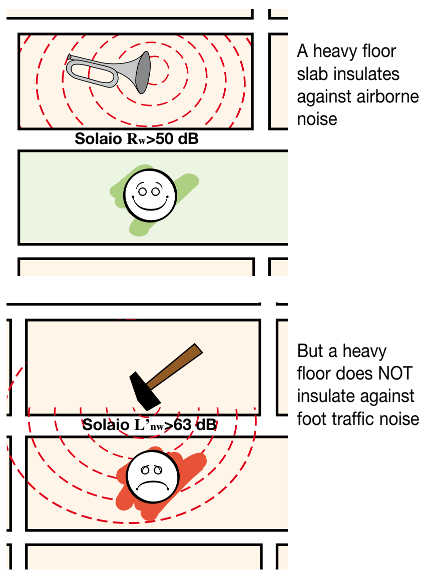
POSITION THE SILENTGips SLAB



- The precaution just explained is required in the thermal-acoustic insulation of the external wall because, being crossed by thermal dispersion combined with the migration of water vapour towards the outside, if it is not suitably protected by a vapour barrier, arranged on the warmest face of the brick wall, the water vapour could condensate in the coldest layers of the external wall.
- In some cases, the insulation against external noise, which directly crosses the external wall, could be insufficient if the noise that passes indirectly through the internal walls bound to the external wall is considerable, therefore it may be necessary also to insulate these too.

HOW TO PROTECT AGAINST NOISE FROM INSIDE THE BUILDING

- The boundary perimeter walls of buildings constructed when there was a boom in the building trade are often too light and easily transmit airborne noise created by voices, radios and televisions.
- The old plumbing and heating systems, lift wells and so on are often not sufficiently insulated.
- Cement-based floor slabs are generally heavy enough to reduce the transmission of airborne noise but do not insulate against impact or foot traffic noise caused by dragging chairs and furniture over the floor or by the dwellers walking around their home.



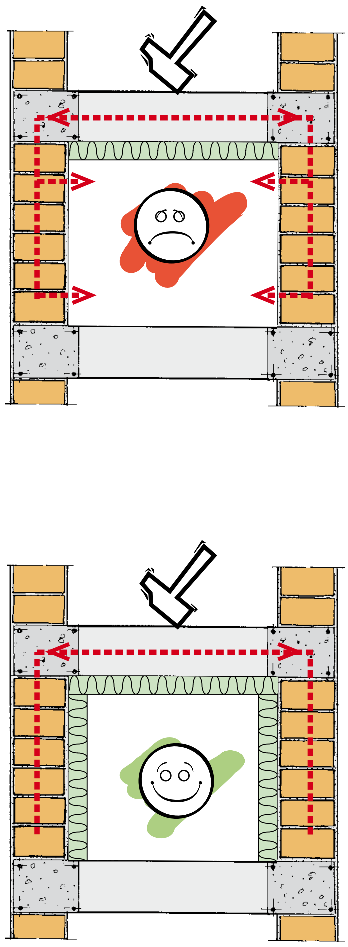
- More serious is the problem of old floors in wood, which being light and elastic, transmit airborne and foot traffic noise more easily.
- To protect against airborne noise from an apartment on the same floor, a false-wall is created on the wall bordering the other apartment, but this is sometimes not sufficient when the noise that passes indirectly is still considerable, consequently it may be necessary to insulate all the walls of the room to be insulated with the same technique. To avoid taking up living space, one can proceed in steps; first and foremost the boundary wall is insulated and then if this is still not sufficient, all the walls of the room will be insulated. Rarely is it necessary to insulate the ceiling too, because the indirect transmission of airborne noise through a heavy floor slab is very slight.

INSTALL THE METAL FRAME

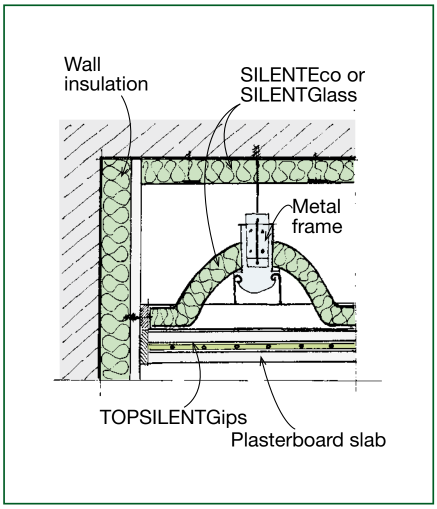
LAY SILENTEco

LAY THE PLASTERBOARD

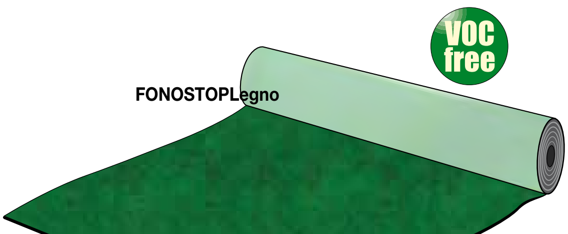
- To insulate against foot traffic noise and voices from the floor above, the false-ceiling must be installed, and seeing as foot traffic noise is much louder than airborne noise, the need to also insulate all the walls of the rooms on which the ceiling rests is more frequent; this however cannot be done in steps, as in the previous case, by just insulating the ceiling first and then subsequently creating the false-walls.



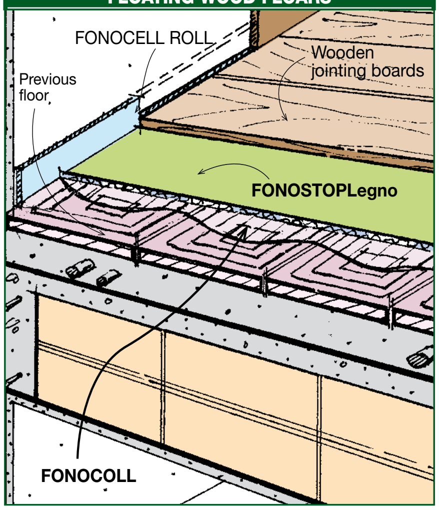
In this case, the decision must be made in advance, because to be able to install the insulation system correctly, the false-walls have to be installed first and then the false-ceiling and not vice versa, otherwise the false-ceiling is more restricted and insulates less.



- If you wish to install your own insulation against foot traffic noise that disturbs your neighbours, you can lay overlying resilient flooring such as carpet on the old stone or ceramic floor of your own home or lay a floating wood floor over it on a layer of FONOSTOPLegno. It is the specific insulation product against foot traffic noise for floating wood flooring, 5 mm thick and made up of a sound-resilient foil coupled with non-woven high density elastic polyester fabric and it takes up a total thickness of approximately 20 mm, flooring included.

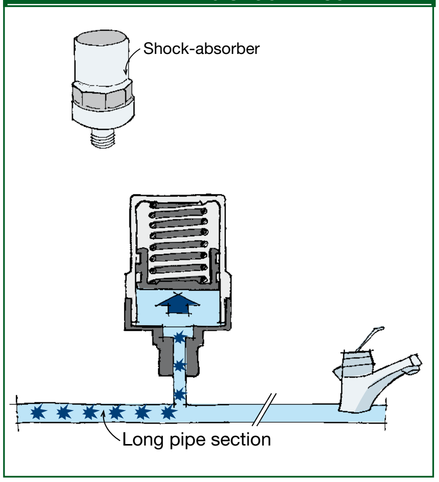


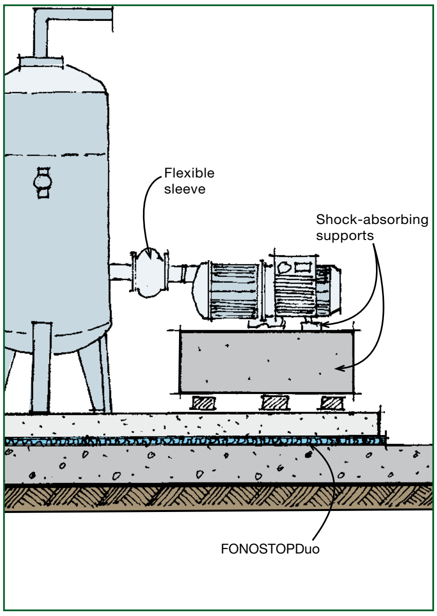
FLOATING WOOD FLOARS



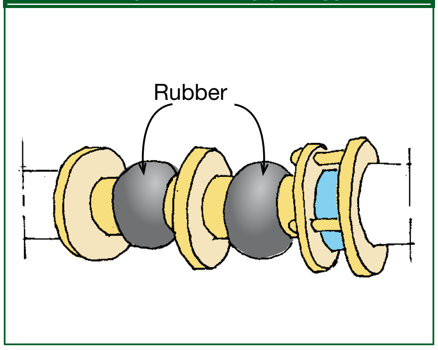
- Some noises of plumbing systems can be easily resolved by intervening directly at the source of the noise, which is often caused by the lack of flexible joints between pumps and surge tanks or water hammering shock-absorbers on the pipes, by the lack of shock-absorbing supports under moving machines, by poorly conformed taps, by the lack of pressure regulators, all of which are plant engineering problems that generate noise but that can be resolved at the source.

WATER HAMMERING SHOCK-ABSORBER

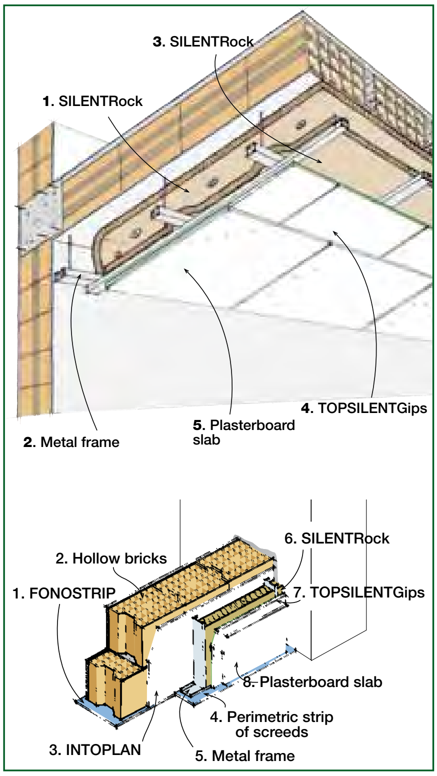




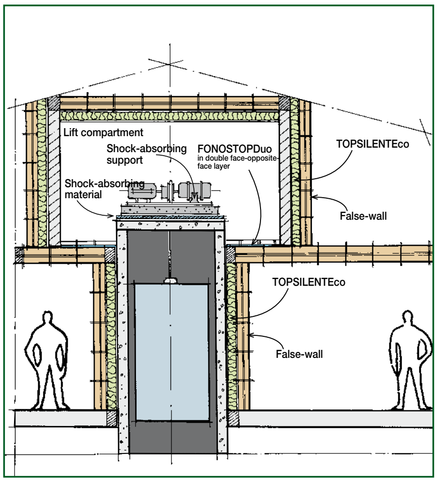
DETAILS OF THE JOINTS THE CONNECTION PIPE TO THE EXPANSION VESSEL



- The same can be done in compartments where the Heating, Conditioning and Aeration systems (HCA) are installed or that house the motors of lifts, by insulating the housing compartments against airborne noise and also by installing false-walls and false-ceilings in plasterboard on metal framework on the inside, preferring the SILENTRock panel, which has a higher fireproof power, to fill the air space in the case of boiler rooms; you can also insulate the transmission of vibrations of moving parts to the building structure, by installing appropriate shock-absorbing supports under the machinery and also intercept the vibrations carried along the pipes by insulating them from the structure with flexible sleeves and equipping them with flexible joints.



- If it is impossible to intervene at the source of the noise caused by an old system or a machine by identifying the wall/s where most of the noise passes directly, one can intervene with the same criteria indicated previously, insulating first the wall involved and then insulating the other walls if the indirect transmission of noise is still considerable.



ESSENTIAL GLOSSARY

Absorbent materials. Porous or fibrous materials used to line the surfaces of walls and ceilings of reception halls or entertainment halls capable of absorbing the sound weighing on them, used to correct the acoustics of the rooms. Some absorbent materials are also used to fill-in the air spaces of double walls and false ceilings to improve their acoustic insulation. They are fibrous or porous materials which through the resistance imposed by the air flow (r=**airtightness** depending on the density of the material) impose a loss of dissipated energy through friction (heat) on the sound emission.

Acoustic absorption. It is the ratio between the acoustic energy absorbed by a surface and the acoustic energy weighing upon it; a smooth and hard surface completely reflects the sound that hits it and in large rooms it forms an echo, whereas a porous and absorbent surface reduces the noise reflection inside a room and reduces the reverberation time.

Acoustic bridges. Rigid connections between elements making up a system that do not allow for complete detachment and transmit vibrations; due to such constructional defects, the whole acoustic performance of the elements are diminished.

Acoustic correction. Evaluation, analysis and solution of problems related to a perception of non-uniform sounds (a typical problem in conference halls or cinemas) caused by incorrect planning or incorrect choice of lining materials. By correcting the problem it is possible to obtain an extremely real-to-life perception of the sound emissions within the room treated.

Acoustic insulation of horizontal and vertical partitions of buildings. It reduces the transmission of airborne and foot traffic noise between rooms separated by a building partition (walls and floor slabs).

Acoustic pollution. Exposure to levels of harmful noise for the hearing system (very high levels for brief periods, high levels for long periods) deriving from different types of sound sources (traffic noise 70 dB, machinery noise 100-105 dB or other noise).

Airborne noise. Noise that is generated in the air and transmitted through the variation in the pressure of the air (for example, speech and noises of televisions or radios). In the building, the noises coming from the outside are distinguished, traffic etc., of which the insulation concerns the external wall of the building, from those generated by activities carried out inside the building, radios and televisions, conversation of dwellers etc. of which the insulation concerns the vertical and horizontal dividing partitions of the various dwellings of the building.

ANDIL. National Association of Italian brick and tile Producers.

ANIT. National thermal and acoustic Insulation Association.

Apex, subscript: diacritical signs, letters or numbers situated in the top right corner (apex) or bottom left corner (subscript) that accompany the symbols of the acoustic parameters and that change their meaning. They are used to identify the methods of measurement and expression to which the parameters refer. They are written in smaller letters than the symbol that they accompany.
Example: the following symbols of the soundproofing power (airborne) $\mathbf{R}$, $\mathbf{R}_w$, and $\mathbf{R'}_w$ identify the following respectively:

- $\mathbf{R}$ = soundproofing power of a dividing wall. It indicates the difference in sound level that the dividing wall is able to maintain between a disturbing room and a receiving room in laboratory-controlled conditions (without flanking transmissions)
- $\mathbf{R}_w$ = the addition of the subscript "$_w$" means that it is the evaluation index of the soundproofing power of the dividing wall measured in the laboratory or obtained through calculation (without flanking transmissions) that expresses the value in decibels of the reference curve at 500 Hz after fitting the curve according to the method specified in standard ISO717.
- $\mathbf{R'}_w$ = the addition of the apostrophe on the apex of the symbol means that the evaluation index refers to the measurement on site of the same parameter and therefore it comprises flanking transmissions and in this case, it is defined as the evaluation index of the apparent soundproofing power.

Apparent dynamic stiffness: $\mathbf{s'_t}$. It is measured in MN/m³, represented by the symbol s'_t and is obtained through calculation with standard UNI EN 29052/1 after measuring the resonance frequency, in compliance with standard ISO 7626-2 or ISO 7626-5, of the spring-mass system where the mass is a steel plate of 8±0.5 Kg and the spring is the resilient material involved. It is defined as apparent and cannot be used for the forecasting calculation because the contribution of the dynamic stiffness of the air or the gas within the material is also measured, represented by symbol s'_a.

Auditory perception. The human ear transforms the variations in the pressure of the air into auditory perceptions that do not just depend on the pressure but also on the frequency at which the variations in atmospheric pressure occur. While the microphone of the measuring instrument of the noise level faithfully measures the sound pressure at any frequency, the ear is an imperfect instrument that perceives sounds that have a frequency of between 20 and 15.000 Hz with a higher sensitivity in the range of frequencies between 500 and 5.000 Hz. In the "sensitivity zone", the ear is more sensitive to high frequency sounds compared to low frequency ones and, for example, it perceives a sound of 35 dB emitted at a frequency of 4.000 Hz and a sound of 90 dB emitted at 20Hz as being the same. The differing sensitivity of the ear at the various frequencies can be represented on the intensity/frequency graph, defined as the normal audiogram, by some curves of equal sensation (isosensitivity) called "sensitivity curves" with greater differences for low intensity sounds that are gradually annulled for sounds with intensity higher than 85 dB. At 1.000 Hz (a good sensitivity frequency of the ear), the physiological sound level perceived by the ear on the sensitivity curves coincides exactly with the physical level that can be measured with the instrument. For the same reason, the ear has an "auditory threshold" of the sound that varies with the frequency of the same and, for example, it is able to hear a sound of 8 dB emitted at 250 Hz but does not hear a sound of 50 dB emitted at 31 Hz. **In building too, when planning or assessing the acoustic insulation of a wall or of a floor slab, how the human ear perceives the sound is indeed taken into account.** The ear is not able to tolerate sounds of intensity higher than a level of 120 dB, called the "pain threshold" that causes painful sensations.

Background noise. The sound level and spectrum normally encountered in interior or exterior rooms acoustically characterises both the zone considered and the various human activities carried out and can be defined as "background noise". The sound level caused by traffic is high and is typical in town centres, the same as that encountered in some industrial environments that are considered to be noisy, whereas a rural zone is defined as silent. The consideration of the background noise is also important for the acoustic insulation of building partitions (just think of the insulation of the external wall in a very busy traffic environment or near an airport). The background noise often varies throughout the day (just think of the lower level of noise of traffic during the night-time). The level of background noise conceals sounds of lower intensity that are simultaneously produced in the same environment; it is for this reason that during the daytime we do not hear the sound of a neighbour's television but at night-time we are disturbed by it, because the background noise level is lower than that of the neighbour's television. The level of background noise can be compared with the level of water of a river, which when in high water periods, makes the surface of the water smooth and regular while in low water periods, the masses of the bed of the river appear, which represent the sources of the noise, but which have actually not diminished in intensity. Even a variation in the sound spectrum of the background noise may create a disturbing noise because the human ear has the ability to quantitatively identify a specific sound of different frequency composition, even if this has a quantitatively lower level. **The measurement of the background noise is always carried out in the receiving/disturbed room to evaluate the feasibility of the measurements of the acoustic insulation of the buildings; it determines the corrections to be made to the acoustic levels measured at the various frequencies. When measuring the insulation of the external wall, the test is carried out also outside in the emitting/disturbing room to decide whether to use it as a source or otherwise.**

Compressibility. Characteristic ability of a resilient material to deform elastically without altering the original thicknesses and mechanical features. This value can be estimated through laboratory tests following the indications given in standard UNI 12431.

Critical frequency. Frequency of the sound at which a wall vibrates with variation waves that have a rhythm (frequency) equal to that of the sound weighing on it and at whose frequency (called "**coincident frequency**") a deterioration in the insulating capacities of the wall is established with the consequent high transmission of noise. Each wall, based on its weight and rigidity, starts to resonate at a critical frequency at which the coincident effect occurs, which is typical of the wall. At the critical frequency, the soundproofing power of the wall deviates from the law of mass and there is an insulation gap that must be avoided, which is within the range of frequencies where the human ear is more sensitive. In the case of double walls, resonance occurs when both have the same critical frequency and in such case, the insulation defect is higher than that of a single wall of the same weight; this is why it is advisable to build walls of different weights. By filling the air spaces with fibrous insulation products to dissipate some of the energy, the entity of the loss in insulation at the critical frequency is reduced, especially when the walls are the same.

Decibel. Unit of measurement of the sound level. It is the logarithm of the ratio between the pressure measured and the minimum pressure of 0.00002 Pa corresponding to the minimum audibility threshold taken as a reference. The decibel is a mathematic artifice used in physics to also express other parameters whose variability range is rather ample. This measurement system does, however, not enable the linear appreciation of the sum or the difference of two sounds; if we are tangibly able to distinguish the size of a cord of 10 m as double that of one of 5 m, for the sound level measured in decibels, this is no longer possible because it is not a linear measurement, such as the meter, but a logarithmic one. The result is that two sounds emitted simultaneously from two adjacent and identical sources, for example two washing machines that each produces a noise of 60 dB, will not result in a noise level of 120 dB but of "just" 63 dB. Using the decibel logarithmic scale as the unit of measurement, the doubling of the sound pressure generated by the two washing machines is equal to an increase of "just" 3 dB. On the contrary, insulation that leads to a reduction of 3 dB is quite considerable because it halves the sound intensity, as if one of the washing machines has been turned off! Another "curious" aspect of the decibel is that if the two washing machines just mentioned emit a noise that differs one from the other by more than 10 dB, the resulting sound is basically that of the noisiest washing machine. If one machine produces a noise of 50 dB and the other a noise of 60 dB, the total noise level will be 60 dB.

Density. Ratio between the weight and the volume of a body.

Detachment. Action or building technique (ideal for the acoustic insulation of buildings) in which elements whose contact would enable the transmission of vibrations and consequently noise are isolated from one another, also through the addition of resilient materials (strip under the partition, see FONOSTRIP, and insulation products against foot traffic noise, see FONOSTOPDuo and Trio).

Direct transmission. Main path of the noise through the partition.

Dodecahedron. Omnidirectional sound source for measuring the acoustic insulation against airborne noise.

DPCM. Prime Minister's Decree.

Dynamic stiffness: **s'**. Intrinsic parameter of a resilient material, used for the forecasting calculation of the attenuation in the level of foot traffic noise ΔLw, which is represented by the symbol s'. It represents the elastic constant of the resilient material used for floating floors (the spring part of the spring-mass system), resting on a support (floor slab) considered to be rigid, which represents the behaviour of the floating screed on the insulating material, which, together with the weight of the mass (screed) weighing on the spring, is in relation with the natural free oscillation frequency of the system. It is defined as the ratio between the dynamic force and the dynamic movement; it is measured in MN/m^3 and it can be evaluated with standard UNI EN 29052/1 after having established the apparent dynamic stiffness s't with the same standard and only if the airtightness is known r, of the resilient material established in compliance with standard ISO 9053. Rigid materials have a high dynamic stiffness, which under the relative low unit load of the screed (**8÷12 grams/cm²**), determines an insufficient insulation level while, within specifically defined limits of non-excessive compressibility, softer materials such as FONOSTOPDuo have a lower dynamic stiffness, which in proportion with the low unit weight of the screed determines a good insulation level.

Evaluation index (of the insulation performance of partitions). The acoustic requisites imposed by the Prime Minister's Decree dated 5/12/1997 for building partitions are evaluation indexes. They are determined using the calculation foreseen by standard UNI EN ISO 717 part 1 and 2:1997 for both the insulation against airborne noise (717-1) and the insulation against foot traffic noise (717-2) of buildings and building elements, in order to convert the results of the acoustic insulation measurements carried out based on the frequency per bands of a third of an octave or of one octave (indicated in a graph called experimental curve) into an evaluation index that summarises, with a single value in dB, the insulation performance of the building partition and enables a rapid and practical comparison of the performance of different partitions.
To establish the index, the standard states the reference values in dB for each frequency range, which transferred to the decibel/frequency graph, create a reference curve (limit curve) that has the shape of a line split into three sections, which is then shifted parallel to itself on the graph of the experimental curve until the deviation between measured values and reference values are within the limits set by the standard. At this stage, just one reference curve is identified that represents the acoustic insulation performance of the partition, whose value in **dB at 500 Hz represents the index.**

False wall. A wall built next to an existent wall. Heavy walls are those made of conventional building material, light walls are those made of plasterboard panels on metal framework or glued to insulation panels (cladding).

Flanking transmission. Indirect propagation of noise through the rigid connections of boundary partitions with the partition of the building, which causes a reduction in the insulation potential foreseeable or foreseen by mere direct transmission.

Floor on floating screed. Constructional technique, currently considered to be the best technical solution for the correct insulation against foot traffic noise in buildings, where the floor does not rest directly on the slab but on a cement-based screed of 4÷6 cm in thickness, completely detached from the perimeter walls, laid on a thin layer of elastic material (4÷20 mm) installed on the floor slab.

Foot traffic noise level of floor slabs L_n.

- **$L'_{n,w}$ standard (index).** Insulation against foot traffic noise between rooms measured on site on a finished floor slab, complete with flooring and insulation, expressed as the index in linear dBs, which represents the noise, transmitted directly and laterally, measured in the receiving room (also near and/or on the same floor) when the tapping machine that knocks it is in use on the floor of the slab above. The Prime Minister's Decree dated 5/12/1997 sets the maximum levels of $L'_{n,w}$ for separating floor slabs between separate building units.
- **$L_{n,w,eq}$: equivalent standard (index)**: level of foot traffic noise, transmitted just directly on the resilient material, from a naked floor slab, without floor and floating screed, expressed as the index in linear dBs, measured in the laboratory or obtained through calculation, in the above-mentioned test conditions.
- **ΔL_w: attenuation of the level of foot traffic noise (index):** expressed as the index in linear dBs, typical of a floating screed of defined weight and of the type of resilient material considered, it is measured in the laboratory or obtained through calculation, knowing the dynamic stiffness of the resilient material. It represents the insulation contribution added to the naked floor slab by the floating screed.

Foot traffic noise, impact noise and collision noise. Generally speaking, the term defines impact sounds, in other words noise caused inside the building by the mechanical impact of a building element that is transmitted directly by the vibrations of the structural elements of the building (for example: the noise of a hammer used to knock nails in a wall, chairs or furniture dragged across the floor). The most common source is foot traffic on the floor. Strictly speaking, it also defines the impact noise generated by the tapping machine.

Forecasting calculation. Evaluation practicable by means of UNI standard reports, software, laboratory experiments, on-site testing, prepared to find the correct estimation of the insulating performance of building partitions that will subsequently measured on site.
Sound damping. Element that reduces the vibrations caused by sound transmission.

Laboratory measurement. Instrumental measuring procedure of the acoustic insulation of horizontal and vertical partitions and of the noise level of systems, carried out in the laboratory in compliance with standard test methods, of which the results are used to plan the insulation of the buildings in compliance with standard calculation methods.

Law of frequency. An experimental law used to evaluate the soundproofing power against airborne noise of walls and floor slabs, for which the insulation of the partition considered increases the higher the frequency of the noise weighing on the partition. The law states that at 500 Hz, a wall of 100 Kg/m², has a soundproofing power of 40 dB and that for each doubling and halving of the frequency, the soundproofing power increases or decreases by 4 dB.

Law of mass. An experimental law used to evaluate the soundproofing power against airborne noise of walls and floor slabs, in which the increase in the mass per unit area determines an increase in the insulation of the partition considered. The law states that at 500 Hz, a wall of 100 Kg/m², has a soundproofing power of 40 dB and that for each doubling and halving of the mass, the soundproofing power increases or decreases by 4 dB.

Mass per unit area. Ratio between the weight of an element and its unit surface, generally expressed in Kg/m².

Mass-spring-mass system. Model of physical system in which two masses are kept apart by a spring between them. In the acoustic insulation of buildings, it exemplifies the behaviour of double walls (the masses) separated by a "blade of air" (the spring) that can be filled with absorbent material or otherwise, which is generally fibrous.

Spring-mass system. Model of physical system in which a mass (screed) is loaded on a spring resting on a support (floor slab) considered to be rigid. In the acoustic insulation of buildings, it exemplifies the behaviour of the floating screed on resilient material where the latter represents the spring part of the system.

Measurement on site. Instrumental measuring procedure of the acoustic insulation of horizontal and vertical partitions and of the noise level of systems, carried out in the building, to test the acoustic requisites in compliance with standard test methods stated by the Prime Minister's Decree date 5/12/1997.

Noise of systems. Noise determined by the sound level of continuously operating systems (for example: fan coil units) and discontinuously operating ones (for example drains or lifts) of which the disturbing noise is measured in dB(A) and of which the limits L_{Aeq} and L_{ASmax} respectively are set by the Prime Minister's Decree dated 5/12/1997 as values to be measured on site in the room mostly disturbed, provided it is different to that in which the noise originates.

Passive acoustic requirements of buildings. Title of the Prime Minister's Decree dated 5/12/97; Implementation decree of the Outline Law on acoustic pollution no. 447 dated 1995 that states the **maximum levels** of noise of continuously and discontinuously operating systems and of foot traffic of floor slabs and establishes the **minimum insulating properties** of the external wall and dividing walls between two separate building units, measured on site, belonging to the buildings foreseen in table A of appendix A of the same Decree.

Resilient layer. It is an elastic separation layer between rigid elements whose main characteristic is that of stopping the transmission of vibrations in the structure of the building caused by impact (for example: foot traffic) on the partitions of the same.

Resonance. Phenomenon for which in particular conditions the amplitude of the vibrations of a material or of a system affected by periodic forces assumes particularly high values that determine a drop in the insulating capacity.

Resonance frequency. Supplementary resonance phenomena occur with deterioration in the soundproofing power at frequencies that depend on the dimensions of the wall. For heavy single-layer walls larger than 10 m2, the resonance frequencies are so low as not to be audible and are considered to be negligible compared to the deterioration in insulation that occurs at the critical frequency. In the case of windows, which are smaller, the phenomenon is greater and more sensitive, consequently the loss in insulation at the resonance frequency and also the greater deterioration that occurs at the critical frequency is taken into consideration. For double walls that can be represented by the mechanical model of two masses (the walls) separated by a spring system (the layer of air enclosed between them), the loss in insulation at the resonance frequency of the system is higher than that of a single wall of the same weight; therefore the optimum distance is calculated between the two walls so that the resonance frequency remains within the range of the inaudible low frequencies. The layer of air enclosed in the air space between two walls may also cause resonance due to its volume, which is reduced by filling it with fibrous material.

Reverberation time. Called "**echo effect**" in slang, it measures the time required for the energy of a sound signal to decay by a considerable percentage. The reverberation time is tested in large rooms where excessively long times prevent the intelligibility of speech or music. The measurement is obligatory for school buildings and the limits are those written in the memorandum of the Ministry of public works no. 3150 dated 22/05/1967.

Sound and noise. A sensation of the human ear affected by the variation in the pressure of the air generated by the vibration of a body, human larynges, speaker, sheet of metal etc. with characteristics (frequency and level) such to be heard by the human ear. It is characterised by the pressure level, measured in decibels (dB) and by the frequency, number per second, with which the variations in the pressure around the atmospheric pressure, expressed in hertz (Hz), occur. The combination of sounds with characteristics such to result unpleasant to the human ear is commonly called "**noise**", but in building in particular, it is more appropriate to call it "**unwanted sound**"; not everyone likes to hear a symphony of Beethoven that the neighbour plays in the middle of the night, but nobody could say that a symphony is a "noise".

Sound level meter. An instrument used to measure the sound pressure level, made up of a microphone, that translates the energy of acoustic vibration into an electrical signal which, appropriately amplified, expresses the level of noise in linear decibels, dB or dB L. The signal can be filtered and corrected by appropriate filters that reproduce the "sensitivity curves" of the human ear; three types are used for different sound intensities:

- A, one that mimics the sensitivity of the ear for sound levels from 0 to 55 dB
- B, for levels between 55 and 85 dB
- C, for levels above 85 dB

There is also a fourth type, "D" that is used to evaluate disturbance caused by aircraft noise. The level measured by the sound level meter complete with filters is, in this case, no longer expressed in dB L but in dB(A), dB(B) and dB(C) respectively, the so-called weighted decibels; basically speaking, they take the sensitivity of the human ear into consideration as if the ear is used to measure the sound instead of the sound level meter. The Prime Minister's Decree dated 5/12/1997 states that the linear dBs, in other words the sound level meter without weighted filters, are used to measure the insulation performance of a dividing wall, an external wall or a floor slab and dB(A)s to measure the disturbance caused by systems.

Soundproofing foil. A foil that optimizes the acoustic performance of the partitions by filling-in pores that may occur in a building, reestablishing continuity, to bring its acoustic performance near to that foreseen by the forecasting calculation (see TOPSILENT).

Soundproofing power (index): $\mathbf{R_w}$ and $\mathbf{R'_w}$. Performance of the acoustic insulation of a partition (walls and floor slabs) against airborne noise, generated inside the building, expressed in linear dBs as the index of the same, which identified by symbol R_w represents the difference in level of the noise that the partition is able to determine in the laboratory between the room where it is generated and the receiving room, completely disconnected from each other, when the noise passes through it by mere direct transmission. If on the other hand it is identified by the symbol R'_w, it represents the acoustic insulation against airborne noise between rooms separated by the partition considered; in other words it is the difference in level of the noise that the partition integrated in the building context is able to determine on site between the room where it is generated and the receiving room when the noise crosses it both directly and laterally through the boundary partitions. The relationship $R_w \geq R'_w$ is always valid because the flanking transmission of noise reduces the insulating performance of the partition when the latter is installed on site. The Prime Minister's Decree dated 5/12/1997 sets the minimum values of R'_w for the partitions between separate building units.

Sound resilient foil. A resilient laminar layer for reducing impact noise.

Sound propagation velocity. Sound only spreads through what is called "sound propagation medium", which may be of completely different nature: air, water, metal, building material etc. If there is no medium, the sound cannot spread. For example, in vacuum, no sounds are perceived. The velocity at which the noise "moves" depends on the medium in which it moves. In air, the propagation velocity is approximately 340 m/s, in building materials it may even reach 5.000 m/s (5.000 m/s for steel, 3.000 m/s for brick, much lower for insulation material).

Specific heat. Characteristic of a material expressed in kJ/kg°C that represents the energy (heat) required to raise the temperature of the weight unit by 1°C.
It is used to find the heat that a partition can accumulate, called thermal capacity, knowing the following parameters for each single composing layer: weight, average temperature and specific heat.

Standard acoustic insulation of external walls (index): $D_{2m,nTw}$. acoustic insulation of external walls against airborne noise generated **from the outside of the building**, expressed in linear dBs as the index of the same, which identified by the symbol $D_{2m,nTw}$ represents the difference in sound level, measured on site, that the external wall is able to determine between the outside environment where a sound source is arranged and an interior room delimited by the external wall itself. If the sound produced by the speaker used for testing is covered by the noise in the external environment, the sound source of the measurement on site will be the noise of prevailing traffic. The Prime Minister's Decree dated 5/12/1997 sets the minimum values of $D_{2m,nTw}$ for the insulation of external walls.

Subscript: see "***Apex, subscript***".

Tapping machine. Equipment used to measure the insulation against impact noise of floor slabs whose characteristics are set by standards, equipped with 5 metal hammers driven by a cam shaft that alternately hit the floor of the slab being tested. The noise caused by the machine is measured in the room below in linear decibels - dB L.

Thermal bridges. Elements of discontinuity of a building partition, characterized by a much lower thermal resistance and a temperature substantially different to that of the building component in which they are integrated, which are the seat of a higher transmission of heat and winter condensations of water vapour generated inside the building.

Thermal conductivity. Indicative value of the capacity of a material to transmit heat. It is expressed with the symbol λ and is measured in W/mK. Thermal insulation materials feature very low values of conductivity $\lambda \leq 0.10$ W/mK.

Thermal resistance. The opposite of the transmittance of the partition represents the thermal resistance of the same and it is the result of the total sum of the thermal resistance values of each single layer making it up, including the internal and external laminar resistance values, for each of which the ratio between the thickness of the layer s and the thermal conductivity λ of the composing material depends.

Transmittance: **U.** Numerical value in W/m2K that expresses (per surface unit) the quantity of heat dispersed from a building partition in one hour when the difference in temperature between the two rooms that the partition divides is 1°C. The transmittance value is used to size the heating systems, because it reveals the calories dispersed, for example, from an external wall in winter; by multiplying the transmittance value by the difference in existent temperature between the heated indoor room and the cold outside environment, you can calculate how much thermal energy the partition looses in 1 hour. Lower this value higher will be the Thermal Resistance R and therefore the thermal insulation of the element considered. **Thermal transmittance** is defined as the opposite of thermal resistance. To contain energy in buildings, the transmittance value of the building partitions for each climatic zone is subject to legal limits recently updated by Legislative Decree no. 192 dated 19/08/2005.

Ultrasound, infrasound. Sounds that are not heard by humans because their frequency is higher or lower than the sensitivity zone of the ear. Animals often distinguish both ultra and infrasounds that humans do not hear and in some cases they are able to emit them as calls or to find their bearings or to catch their prey. Ultrasounds are those with a frequency higher than 15.000 Hz while infrasounds are those with a frequency lower than 20 Hz.

Water tightness. Characteristic of a material, a technology or a constructional system that guarantees resistance to fluids (including air).

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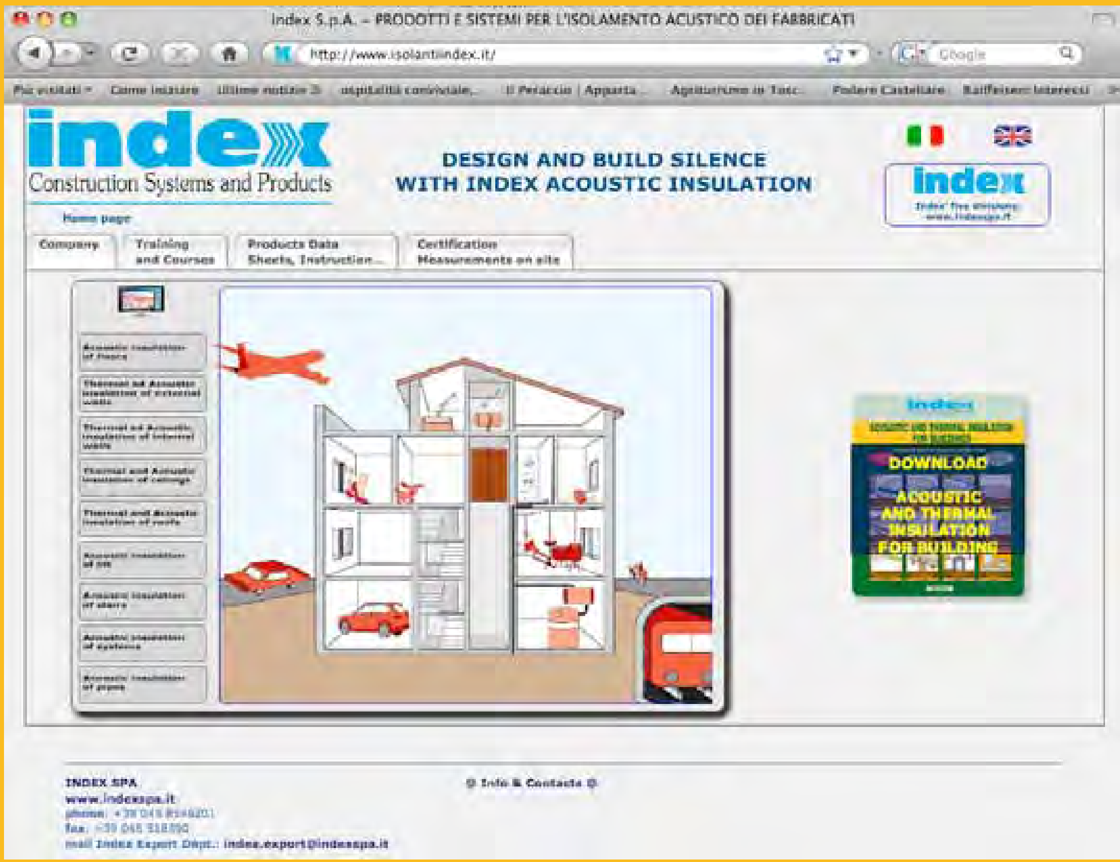

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