ACOUSTIC INSULATION SYSTEMS FOR FLOORS AND WALLS

FONOSCUDO / E

FONOTAPE • FONOFOAM

FONOPARDUAL

FONOPARTAPE

ITALIANA® MEMBRANE

IMPERMEABILIZZANTI PROFESSIONALI

ACOUSTIC INSULATION

INTRODUCTION

Over the past few decades, noise that is harmful to human health and to the ecosystem has been evaluated with increasing attention and classified with precision, as follows: "any sound that causes undesired, disturbing or damaging effects to persons or which lowers the quality of the environment" (Decree of the President of the Italian Council of Ministers, March 1,1991).

Italian Law no. 447/1995 (art. 2) also provides an interesting definition of noise pollution, "The introduction of a level of noise into the living or outdoor environment that is annoying or disturbs human rest and activities; is harmful to human health; degrades ecosystems, material goods, monuments, living environments or outdoor environments; or interferes with the rightful use of such environments".

Noise in buildings.

Noise in buildings is categorized according to its origin:

- Airborne noise. *This noise is produced directly in the air. Its sources include voices, radios, televisions, and so on. It is propagated from one wall to the other by pressure waves in the air.*
- Noises generated by impact or percussive events. *IIn addition to normal airborne noise, floors are also (and principally) stressed by percussive noises made by solid bodies. These include footsteps, the movement of furniture, falling objects, etc. Percussive noise events create levels of sound energy that are so high that normal reinforced floors made of brick and cement are unable to provide a suitable degree of noise insulation, so the vibrations propagate through the materials and throughout the building.*
- Noises made by utility systems. *This noise is generated by utility systems inside or close to the affected environment. The most commonly perceived noises are made by water drains, pipes, and gas burners.*

Italian law also establishes mandatory acoustic standards for buildings.

To reduce human exposure to noise, article 1 of the D.P.C.M. dated December 5, 1997 and entitled, "Determination of passive acoustic requirements for buildings" (published in The Official Gazette of the Italian Republic, Series gen., no. 297 dated December 1997) mandates acoustic standards for sources of sound inside buildings, as well as passive acoustic standards for buildings and their components under construction.

In article 2 of the D.P.C.M. dated December 5, 1997, living environments are broken down into the categories listed on Table A

TABLE **A**	CLASSIFICATION OF LIVING ENVIRONMENTS (ART. 2)
Category **A**	Buildings used as residences or for similar uses;
Category **B**	Buildings used as offices or for similar uses;
Category **C**	Buildings used as hotels or rooming houses, or for similar uses;
Category **D**	Buildings used as hospitals, clinics, or sanitariums, or for similar uses;
Category **E**	Buildings used for scholastic purposes at any level, or for similar purposes;
Category **F**	Buildings used for recreational or religious purposes, or for similar purposes;
Category **G**	Buildings used for commercial or similar purposes;

In article 3, passive acoustic standards are set for buildings, the components of buildings, and for internal sources of sound.
The relative parameters are listed on Table B.

TABLE **B**	PASSIVE ACOUSTIC STANDARDS FOR BUILDINGS AND FOR THEIR COMPONENTS AND UTILITY SYSTEMS				
Category listed on Table **A**	Parameters				
	R_W	$D_{2m,n,T,w}$	$L_{n,w}$	L_{ASmax}	L_{Aeq}
1.**D**	55	45	58	35	25
2.**A**,**C**	50	40	63	35	35
3.**E**	50	48	58	35	25
4.**B**,**F**,**G**	50	42	55	35	35

In the use of a noise insulation product, the principal parameters of reference are the "Noise level from footsteps on floors, normalized (Ln), as specified in EN ISO 1406:1996 standards" and the "Index of noise level from footsteps on floors, normalized (Ln, w), to be calculated according to the procedure described in UNI 8270 :1987 standards (Part 7, par. 5.2.e) and subsequent additions".

FONOSCUDO / E

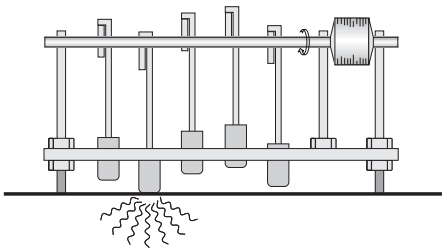
INSULATION SYSTEMS AGAINST IMPACT NOISE

Evaluating noise generated by impact.

Noise from footsteps is propagated both into the underlying environment and into adjacent rooms. It diffuses to varying degrees that depend on the structural properties of the building.

A mechanical generator has been used to develop methods of measuring such noise and to study the behavior of floors in living areas in response to it. Normalized to international standards, this instrument places stresses on building structures in specifically defined ways.

The machine actuates five hammers placed in a straight line at a distance of 100 mm from each other. A camshaft lifts the hammers in sequence and then releases them in free fall from a constant height of 40 mm. Each hammer weighs 500 grams, is made of steel, has a cylindrical head with a diameter of 30 mm, and a round striking surface with a radius of 500 mm.



The effect generated by the machine is similar to that of a person walking normally in a room. With this machine, mathematical measurements can be taken using repeatable events with known dynamic properties, and results from laboratories in different countries can be compared.

Taking a measurement involves operating the generator on a floor and then measuring the noise transmitted into the underlying environment, usually by analyzing ranges of octaves or thirds of octaves. The noise level for each range is corrected by a factor that accounts for absorption by the environment receiving the noise.

The quality of the floor being tested is expressed by the absolute value of the sound level measured in the underlying environment: the better the floor, the lower the sound level.

The noise of footsteps that radiates from a normal cement floor with rigid flooring and no special anti-noise measures is unacceptable. The thickness or density of the floor could simply be increased, but this approach would be uneconomical and result in insurmountable problems deriving from the static nature of the floor. Thus, the most common solutions are "elastic flooring" or "the floating floor".

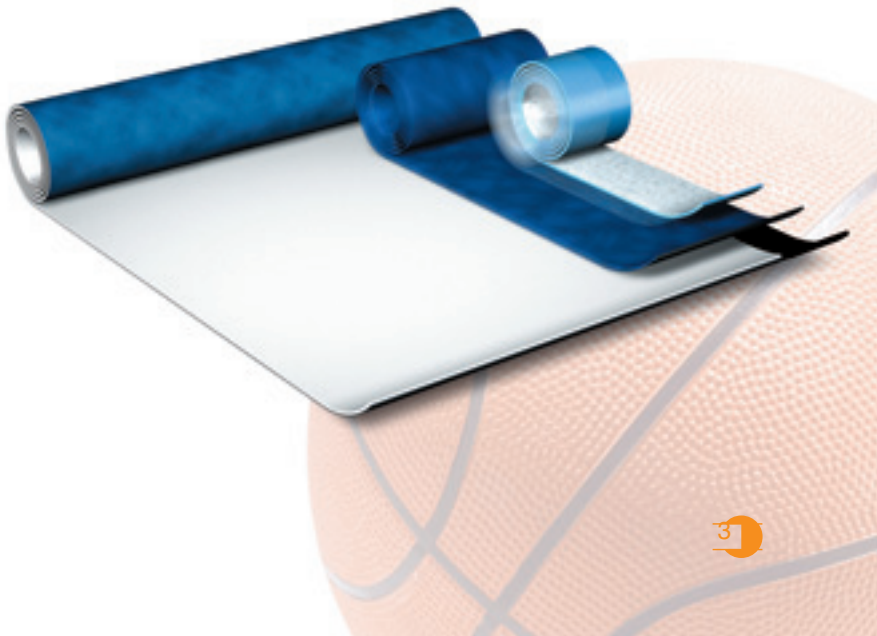
Elastic flooring.

The installation of elastic flooring directly on the surface of the floor produces an insulating effect that depends on the softness of the material used. The result is abatement of noise, which begins at a certain frequency and regularly increases from there.

The floating floor.

If the goal is to abate noise generated by footsteps but also to have rigid flooring, it is essential to resort to a floating floor that consists of a second floor laid on the load-bearing floor.
Sandwiched between the two floors is a resilient support that also insulates the surrounding walls.

FONOSCUDO/E, FONOTAPE and FONOFOAM by ITALIANA MEMBRANE S.p.A. create a "FLOATING FLOOR" system that solves the problem of noise from the impact of footsteps.



USING A FLOATING FLOOR TO INSULATE AGAINST NOISE FROM FOOTSTEPS

PRODUCTS

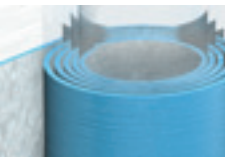
FONOSCUDO / E

Acoustic insulation consisting of a triple layer:
- *Heavyweight non-woven polyester fabric;*
- *A bituminous compound with sound-absorbing additives;*
- *Non-woven polypropylene fabric.*

This product has an average thickness of around 8 mm and is produced in rolls with a length of 10 meters and a width of 1.05 meters. The membrane has a selvage of 5 cm to permit overlapping.

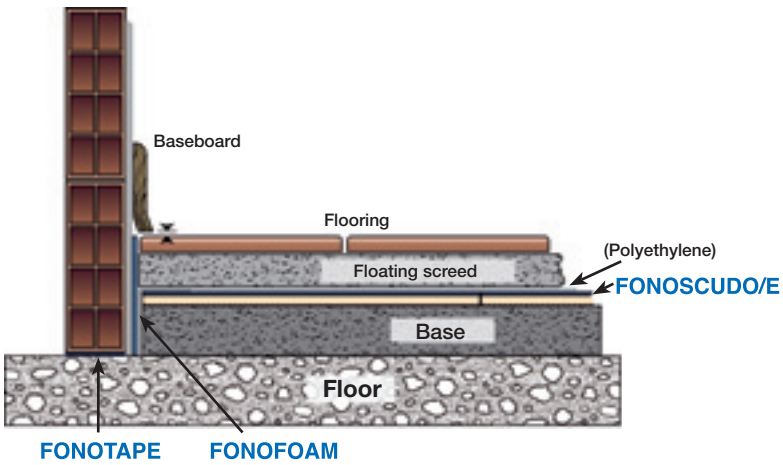
FONOTAPE

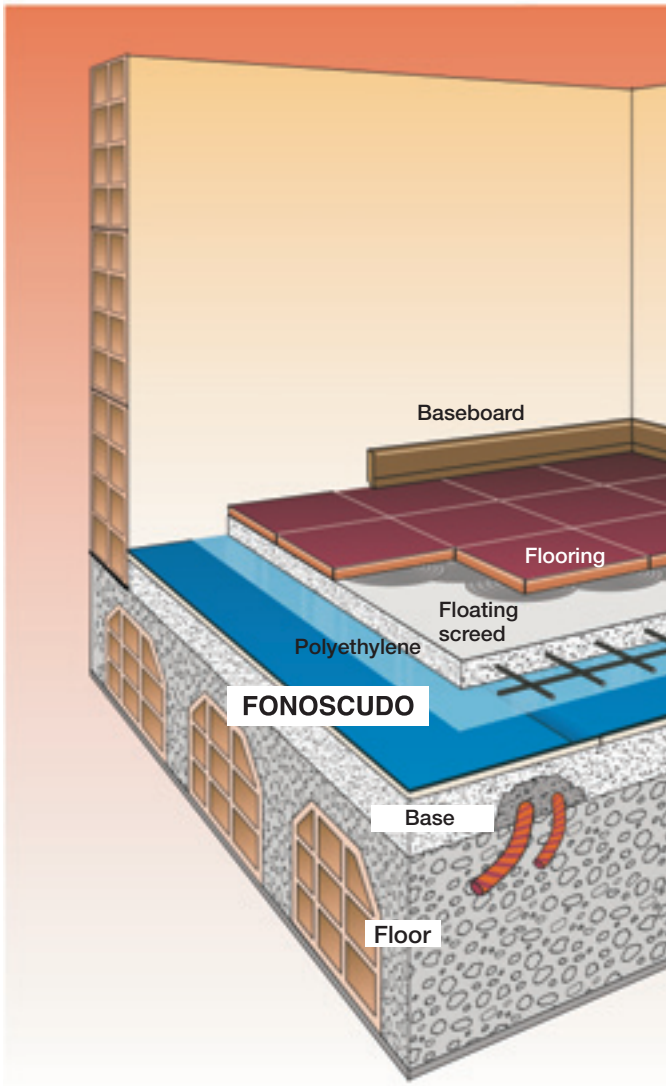
A strip of sound-absorbing elastomeric membrane with thickness of 4 mm, reinforced with non-woven polyester fabric. This strip is used to prevent the transmission of impact and vibration to the floor.
It is installed under dividing walls.
Available widths: 14-20-25-33 cm.
Length of strip: 10 meters.

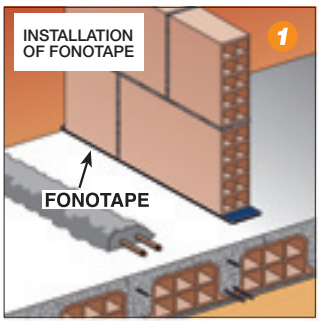


FONOFOAM

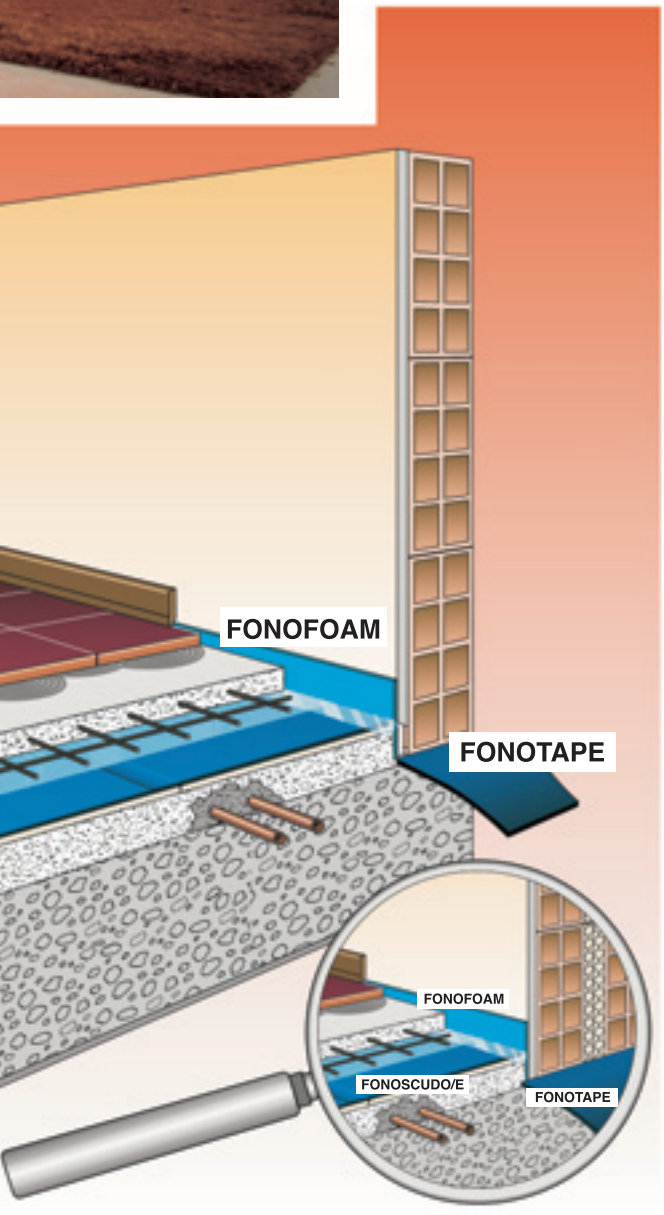
A separating strip about 5 mm thick made of adhesive polyethylene foam (AD) or non-adhesive foam with tape. The strip is used to prevent contact between floating screeds and vertical walls.
Width: 10-15 cm.
Length: 50 meters.







INSTALLATION



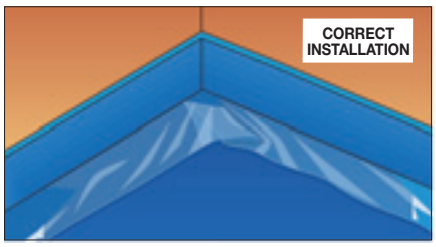
1. *Before pouring the dividing walls, install* FONOTAPE *to absorb their vibrations.*

2. *Prepare the sub-base using light concrete or other material. Be sure to enclose the pipes. Before pouring, place strips of* FONOFOAM *polyethylene foam along the walls.*

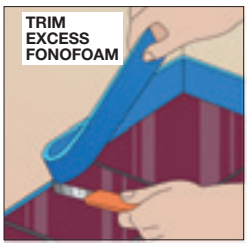
3. *Install* FONOSCUDO / E *acoustic insulation, which has an overlap wing of 5 cm and can withstand traffic at the construction site. Use adhesive tape to seal overlapped areas. It is good practice to lay polyethylene film before pouring the screed.*

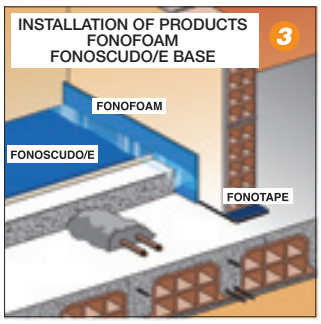
4. *The floating screed must be at least 6 cm thick and reinforced with an electrowelded net with a 5x5 mesh.*

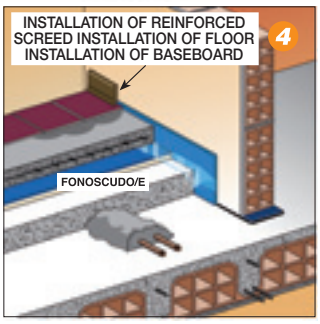
Apply FONOFOAM along the inside of the internal corners of walls. Make sure the material adheres tightly.



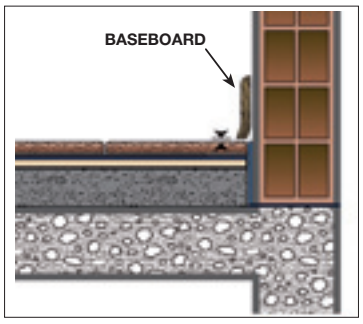
Use a cutting blade to remove excess FONOFOAM.

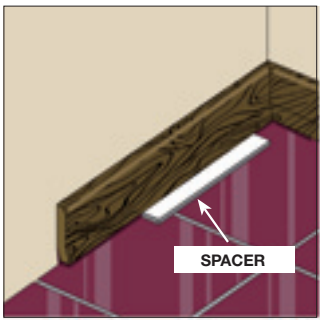


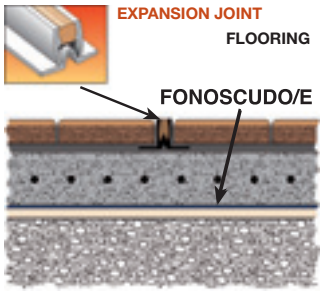


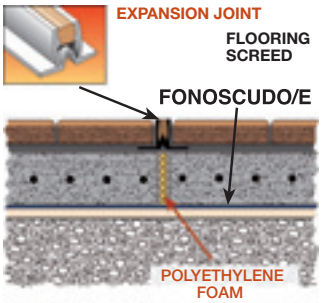


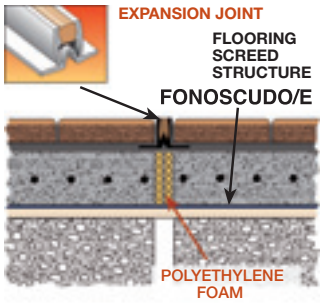
To prevent creating an acoustic bridge, avoid contact between baseboard and floor.



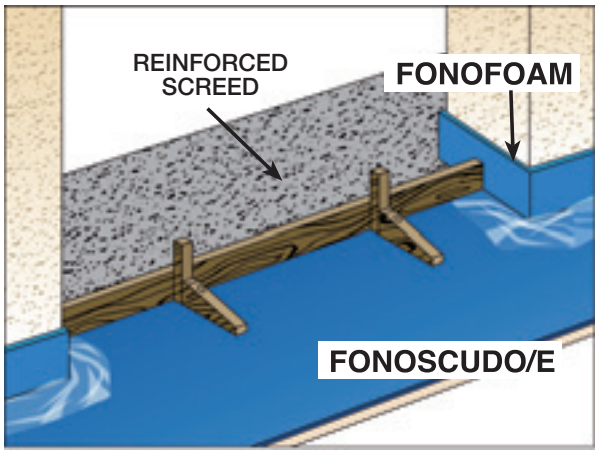


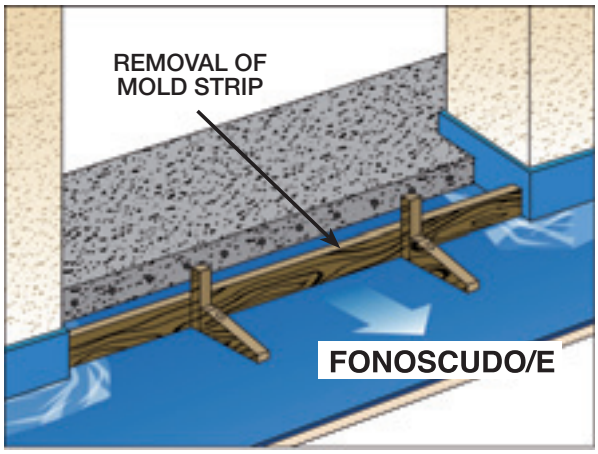


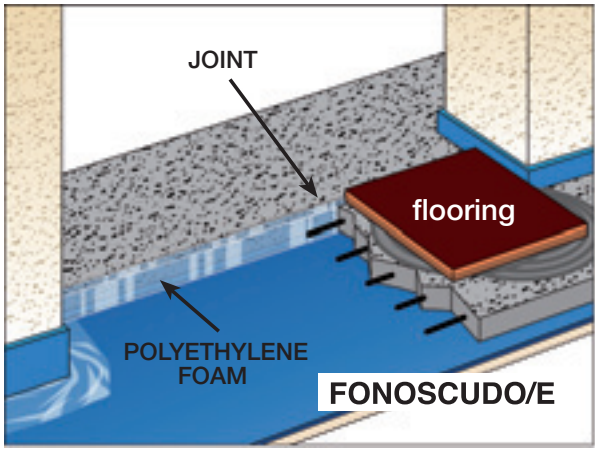




INSTALLATION







Joint near the threshold of a door.

REPORT - TEST

CSI

Costruzioni — Fisica Tecnica

RAPPORTO DI PROVA

FONOSCUDO/E

ITALIANA MEMBRANE S.P.A.

UNI EN ISO 140/6 - UNI EN ISO 717/2

Originale: CLIENTE — Copia: LABORATORIO

CSI report - test no. 0133/DC/ACU/03 dated February 13, 2004 performed using UNI EN ISO 140/6 and UNI EN ISO 717/2 test methods

CSI

Costruzioni — Fisica Tecnica

RAPPORTO DI PROVA

FONOSCUDO/E

ITALIANA MEMBRANE S.P.A.

UNI EN 29052-1

Originale: CLIENTE — Copia: LABORATORIO

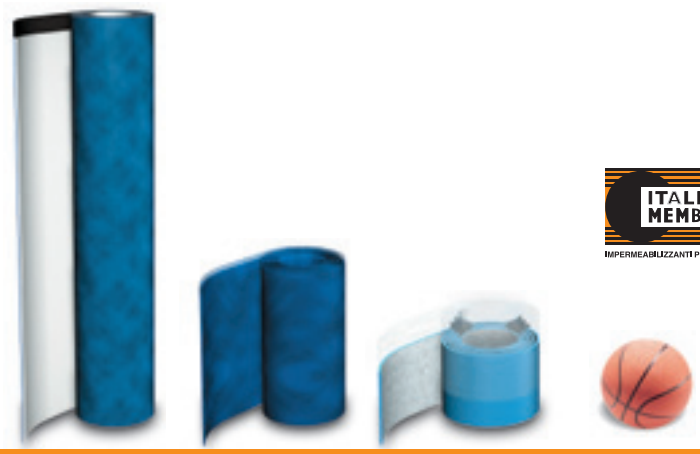
IMQ

CSI report - test no. 0076/DC/ACU/05 dated August 5, 2004 performed using UNI EN ISO 29052-1 test methods

FONOSCUDO / E

FONOTAPE • **FONO**FOAM

Using a "Floating Floor" to insulate against the noise of footsteps.



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EXTRACT FROM TECHNICAL SPECIFICATIONS

A "floating floor" solution will be used to insulate floors from the noise of footsteps.

When erecting outer walls and dividing walls, insert strips of sound-absorbing elastomer material such as 4 mm Fonotape under the footing of the bricks.

Lay insulated, protected utility pipes on the floor. Avoid crossing the pipes.

Along the outer walls, apply a strip of 5 mm Fonofoam polyethylene foam extending above the level of the finished flooring.

Prepare a sub-base with light concrete or sand stabilized with lime or cement.

Lay acoustic insulation on the installation surface, which must be clean and free from unevenness. The 8 mm thick insulation will consist of heavyweight non-woven polyester fabric doubled with a bituminous compound containing noise-absorbing additives, which is in turn covered on top with non-woven polypropylene fabric such as Fonoscudo/E. The product will be supplied in rolls with length of 10 meters and width of 1.05 meters, and with selvage of 5 cm to permit overlapping. The fabrics must cover the distance from wall to wall and have a 5 cm overlap. The insulating material must be firmly set between both layers of fabric. Next, before the screed is constructed, lay 0.20 mm polyethylene film as a separating layer to prevent mortar or water from seeping into the perimeter of the room or under the insulating material.

Complete the screed (at least 6 cm thick) under the flooring - reinforce with electrowelded net (5x5 mesh).

Lay the flooring and trim any excess Fonofoam polyester foam strip.

Install the baseboard, but make sure it does not lay directly on the flooring.

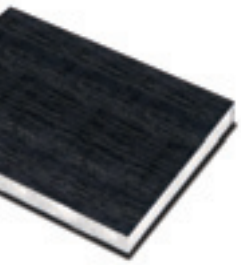
SPECIFICATIONS **FONOSCUDO / E • FONOTAPE • FONOFOAM**

THICKNESS OF PRODUCTS	*UNIT*	*FONOSCUDO/E*	*FONOTAPE*	*FONOFOAM*
Heavyweight non-woven polyester fabric	*mm*	*≃6,5*		
Membrane	*mm*	*1,5*		
Total thickness	*mm*	*≃ 8*	*4*	*5*
DIMENSIONS OF PRODUCT				
Width of heavyweight non-woven polyester fabric	*cm*	*100*		
Width of membrane	*cm*	*105*		
Width of lateral selvage	*cm*	*5*	*14-20-25-33*	*10-15*
Length of roll	*m*	*10*	*10*	*50*
Waterproofing as per UNI EN 1928		*absolute*	*absolute*	
Resistance to passage of water vapor as per EN 1931	*μ*	*⩾ 100.000*	*⩾ 100.000*	
Coefficient of thermal conductivity of membrane	*W/m°K*	*λ = 0,17*		
Coefficient of thermal conductivity of non-woven polyester fabric	*W/m°K*	*λ = 0,045*		

ACOUSTIC INSULATION PARAMETERS FONOSCUDO/E (UNI EN ISO 140/6 and UNI EN ISO 717/2)		
ISO performance index of bare floor at 500 Hz	L_{nwo}	*73,5 dB*
ISO performance index of floor at 500 Hz with FONOSCUDO/E	L_{nw}	*45,5 dB*
Improvement as difference in indexes (CSI 0133/DC/ACU/03)	$\Delta L = L_{nwo} - L_{nw}$	*28 dB*
Apparent dynamic stiffness of material (CSI certification as per UNI EN 29052 p.1)	*s'*	*7 MN/m³*

INSULATION OF WALLS AGAINST AIRBORNE NOISE

PRODUCTS

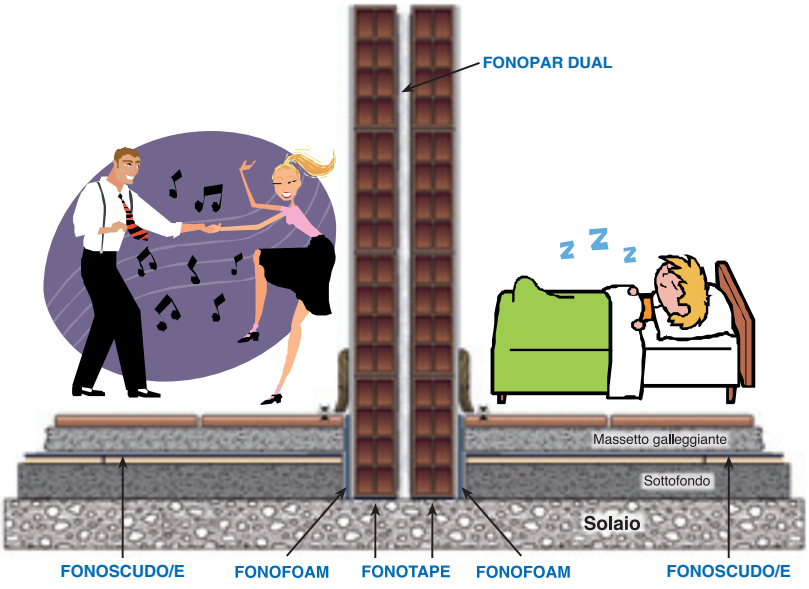


FONOPARDUAL

Thermoacoustic insulating panel composed of a board of 50 mm polyester fiber with surface mass of 11 kg/m², covered both sides with elastomeric membranes with mass of 4 kg/m².
The polyester fiber is fire rated Class 1.
This self-supporting panel is designed mainly for use as thermoacoustic insulation for double walls made of brick.
The material is produced in 1000 x 1400 mm panels and supplied on pallets of 20 sheets each for a total of 28 m².

FONOPARTAPE

Insulating adhesive tape used to seal panels.
Made of gray high-density polyester foam with thickness of 3 mm.



Noise can come from sources inside or outside a building. The main sources of noise in the external environment consist of traffic, industrial production, etc. Inside living areas, noise can be generated by utility systems and activities performed by people. Current law - in the form of a decree dated November 14, 1997 and entitled "Limits on Sources of Sound", and a decree dated December 5, 1997 and entitled, "Passive acoustic requirements for buildings" - mandates the monitoring and limitation of noise emissions in new buildings or in case of renovation.

A sound wave hitting a flat, uniform structure is:

- *partially reflected into the disturbing environment;*
- *partially absorbed and dissipated in the form of heat;*
- *partially transmitted into the disturbed environment;*
- *partially transmitted into adjoining structures.*

To properly insulate two environments, engineers take advantage of the sound insulation properties of composite structures.
To create good sound insulation, "sandwiched" walls are used; that is, walls composed of bricks (even of different thicknesses) and porous or fibrous materials with a high sound-absorbing capacity. A "sandwich" consisting of layers of materials with different densities has good insulation properties because sound crossing through such an structure is reflected and absorbed, and thus loses strength.
The performance of a double wall is higher than that of a simple wall because sound energy leaving the first wall is reflected multiple times, and thus abated, as it passes through the dividing chamber and into the second wall.

The chamber in double walls may be:

- *left unfinished, as a simple air chamber;*
- *filled with porous and fibrous materials that absorb sound very effectively;*
- *built with one of the two walls covered along the inside with a layer of acoustic insulation.*

The sound insulating power of double walls depends on:

- *the weight per square meter of the two walls;*
- *the size of the air chamber;*
- *the type and thickness of the materials inside the chamber;*
- *the elasticity of the system that connects the two walls.*

When a double wall is designed, it is good practice to include a way to interrupt the continuity between the walls, floors and pillars by using suitable products to insulate points of contact and thus prevent vibrations from being transmitted.
In double structures, the single elements must have a minimum number of points of contact or support and/or points in common to reduce the exchange of vibration.
To accomplish this, a material with low dynamic stiffness and high resistance to compression is usually included between the component and its point of contact.
The material in the chamber must allow air to circulate easily and must be able to dissipate a portion of the sound energy that strikes it.
Good results are obtained by either cementing or mechanically lining one of the two walls on the inside of the chamber with a fibrous sound-absorbing material with good resistance to air flow, a relatively high surface mass, and low dynamic stiffness.

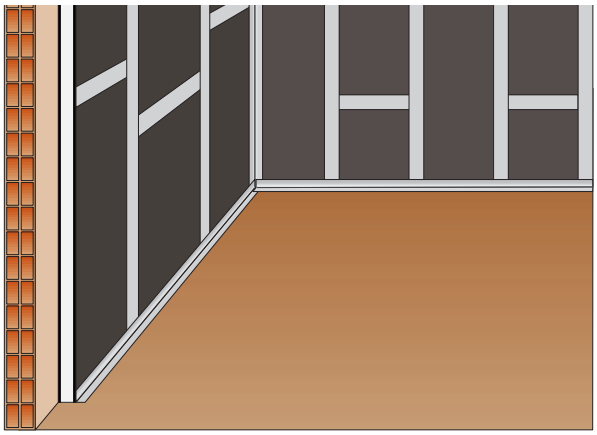
FONOPARDUAL

FONOPARTAPE

Insulation of walls against airborne noise.

INSTALLATION

- *Prepare the installation surfaces so they are entirely free from irregularities.*
- *Place FONOPAR DUAL panels on the desired installation surface and fasten them together with FONOPAR TAPE adhesive tape.*
- *The insulation must be continuous along all vertical and horizontal joints, not only between the panels, but also between the floor, ceiling and walls.*



TEST REPORT

Acoustic insulation - CSI test report no. 0075/DC/ACU/06 dated August 3, 2006

Thermal conductivity - CSI test report no. 0025/DC/TTS/06 dated July 25, 2006

SPECIFICATIONS **FONOPAR DUAL • FONOPAR TAPE**

	UNIT	FONOPAR DUAL	FONOPAR TAPE
Heavyweight non-woven polyester fabric	*mm*	*≃50*	
Width	*mm*	*1000*	
Length	*mm*	*1400*	
Weight of membrane	*kg/m²*	*4*	
Massa superficiale pannello	*kg/m²*	*11*	
Reaction to fire of polyester fiber (UNI 9177)	*/*	*Class 1*	
Insulation of walls from airborne noise (UNI EN ISO 140-3 / UNI EN ISO 717-1) CSI test report no. 0075/DC/ACU/06 dated August 3, 2006	*dB*	*Rw = 32*	
Apparent thermal conductivity (EN 12667) CSI test report no. 0025/DC/TTS/06 July 25, 2006	*W/(mk)*	*λ* = 0,0401*	
Thermal resistance	*m² k/w*	*1,246*	
Thickness	*mm*		*3*
Width	*m*		*0,1*
Length	*m*		*100*

FONOSCUDO / E

FONOTAPE • **FONO**FOAM

USING A "**FLOATING FLOOR**" TO INSULATE AGAINST THE NOISE OF FOOTSTEPS

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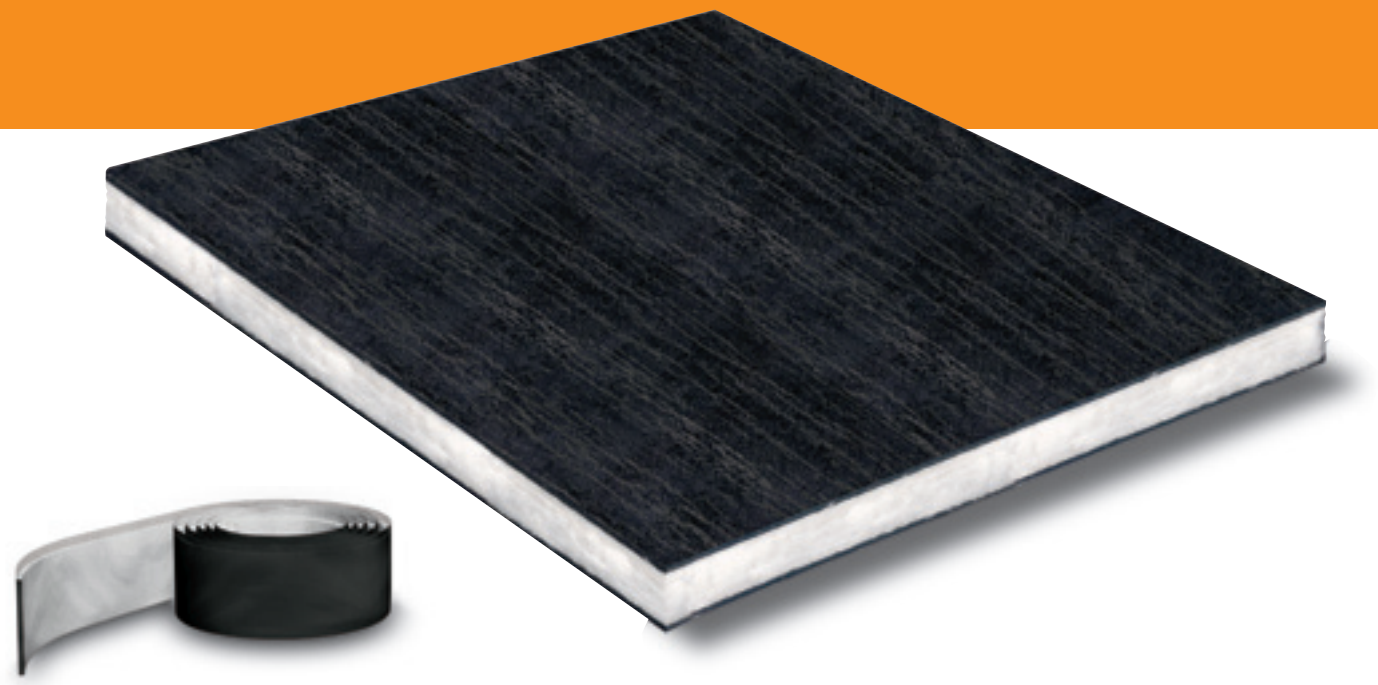
FONOPARDUAL

FONOPARTAPE

INSULATION **OF WALLS** AGAINST AIRBORNE NOISE



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ENVIRONMENTAL MANAGEMENT SYSTEM UNI EN ISO 14001

UNI EN ISO 9001 QUALITY SYSTEM

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