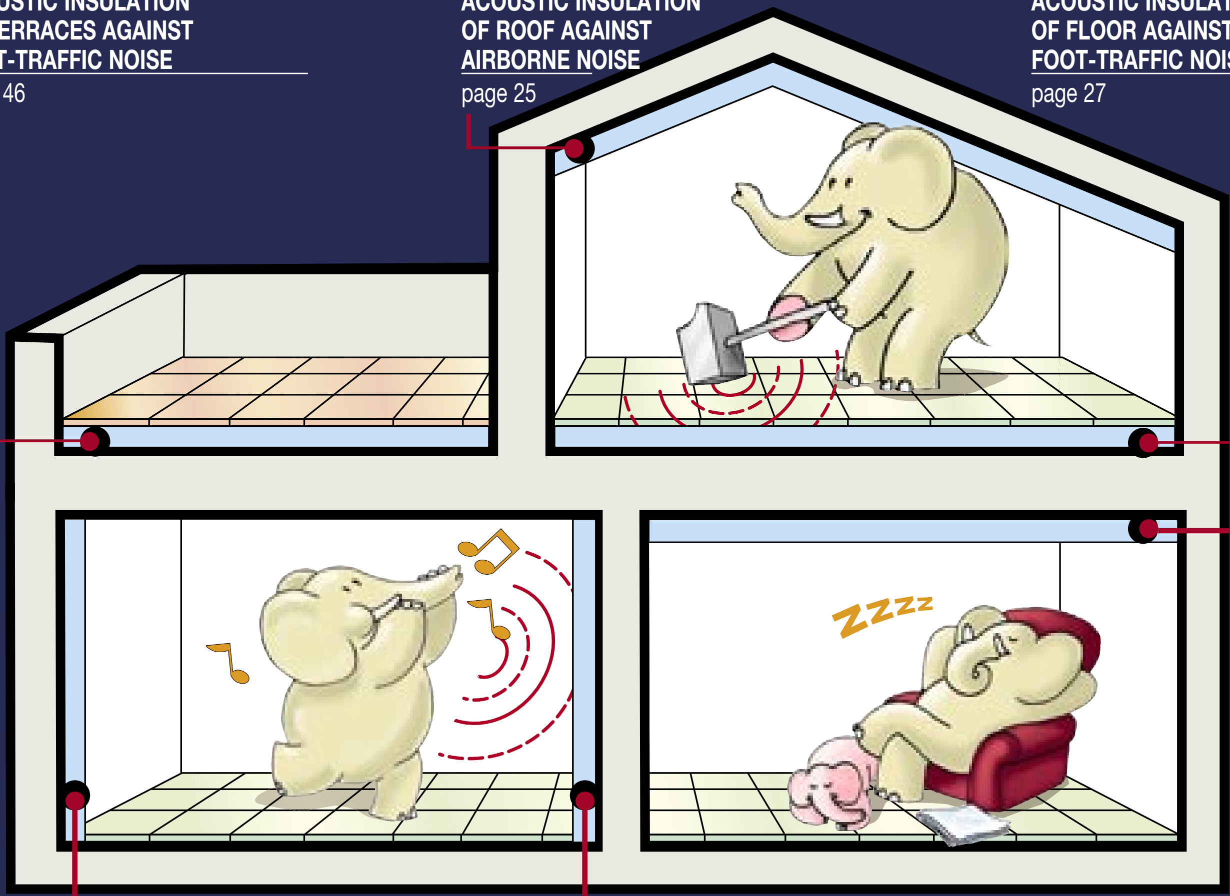
ACOUSTIC INSULATION FOR BUILDINGS

2007 EDITION

ACOUSTIC INSULATION OF TERRACES AGAINST FOOT-TRAFFIC NOISE
page 46

ACOUSTIC INSULATION OF ROOF AGAINST AIRBORNE NOISE
page 25

ACOUSTIC INSULATION OF FLOOR AGAINST FOOT-TRAFFIC NOISE
page 27



ACOUSTIC INSULATION OF EXTERNAL WALLS AGAINST AIRBORNE NOISE
page 9

ACOUSTIC INSULATION OF INTERNAL WALLS AGAINST AIRBORNE NOISE
page 9

ACOUSTIC INSULATION OF CEILINGS AGAINST ARIBORNE AND FOOT-TRAFFIC NOISE
page 47

SOLUTION FOR ACOUSTIC INSULATION OF FLOORS, WALLS AND CEILINGS IN NEW AND EXISTING BUILDINGS

index
Construction Systems and Products

2nd DIVISION 2nd LINE

5th DIVISION 2nd LINE

COMPANY

Structure. Research, innovation and training are the foundations on which Index has concentrated its efforts since the beginning of its activity. Established in 1978, Index soon became one of the most important companies in the world for the production of technologically advanced materials destined for the protection of residential, commercial, industrial buildings and major civil engineering works. In the early 1990s, the company branched out and started manufacturing other systems and products for the building industry.
Index is structured around five divisions that manufacture advanced systems and materials:

- 1st division. Waterproofing bitumen polymer membranes of various types.
- 2nd division. Thermal insulation in rolls and panels coupled with bitumen polymer membranes; thermal insulation in panels for refurbishing asbestos cement sheeting; soundproofing insulation.
- 3rd division. Binding liquid products for encapsulating asbestos cement sheeting, primers, waterproofing liquids, paints, bituminous mastics for insulation panels and sealants.
- 4th division. Damp-proofing plasters, finishing coats for the restoration and renewal of historical and modern buildings, waterproofing cements, shrink-resistant and protective mortars for concrete and masonry.
- 5th division. Products for the application of ceramic tiles, natural and composite stone, mosaic and wood.

Index has branches in Great Britain and France and over 100 distributors in the main countries of the five continents. It owns a company in America called BITEC based in Little Rock, Arkansas and through its engineering division has sold production lines and Know-How in the United States of America, Japan and China.

Research and development. Index continuously invests in research and development of systems and innovative products in its own laboratories or in collaboration with University Institutes and Italian and foreign Quality Control Institutes to supply the market with high-quality and long-lasting products. Also, the innovation of production processes is of prime importance that must go hand in hand with laboratory research.
Training. Furthermore, Index is a firm believer in the importance of training its internal personnel and the personnel of the customers because human resources, at all levels in a company, play an ever-increasingly important role and must therefore be constantly trained and updated in order to obtain the best performance, professionalism, innovation and adaptation to the continuous changes of the market.
Technical and commercial services. Index operates on the basis of Total Quality and offers technical and commercial services, pre-sales and post-sales services in all five divisions to give the best service to the operators of the market with the help of technical specifications and data sheets, available in paper form, CD-Rom or directly on-line in Internet.
Certifications. Amongst the world's leading companies, Index was the first Italian company in the sector to obtain in 1993 the most complete certification as a sure guarantee of quality and first class services. In 2003 it obtained the renewal of the UNI-EN 9001 – Ed. 2000 – Vision certification. Furthermore, in 2001 the company obtained the Environmental Certification in accordance with the standards UNI EN ISO 14001 which guarantees that the company respects environmental standards to the full in the light of continuous improvement.
The company possesses patents and certifications of quality for many products in Italy and abroad.

LEGENDA:

- Factory of Castel d'Azzano, Verona (Italia)
- Factory of Morrilton, Arkansas (USA).
- Subsidiaries
- *Italian Factory distributors*
- *Usa Factory distributors*

FORMATION

index AUDITORIUM

Human resources, at all levels in a company, play an ever-increasingly important role and must therefore be constantly trained and updated in order to obtain the best performance, professionalism, innovation and adaptation to the continuous changes of the market.
Based upon these principles, our AUDITORIUM is a modern, rational and welcoming structure consisting of an Aula Magna hall which seats up to 250 persons, a Bellini teaching room seating 40, a Rossini 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 more than 25,000 people.

External view

Hall

The Lecture Hall

The Lecture Hall

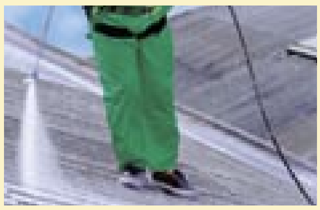
Bellini Room

Rossini Room

index
CENTRE FOR TRAINING AND TECHNICAL ADVANCEMENT

Program of the course

Practical lessons of the course 1^{st} and 2^{nd} Division



Practical lessons of the course 3^{rd} Division

Practical lessons of the course 4^{th} Division

Practical lessons of the course 5^{th} Division

INDEX

NOISE page 7

ACOUSTIC INSULATION OF WALLS AGAINST AIRBORNE NOISE page 9

- Technical intervention solutions in new buildings page 18
- Technical intervetion solutions in existing buildings page 20

THERMO-ACOUSTIC VERIFICATION OF WALLS page 23

ACOUSTIC INSULATION OF ROOF AGAINST AIRBORNE NOISE page 25

ACOUSTIC INSULATION OF FLOOR FROM FOOT-TRAFFIC NOISE page 27

- Technical intervention solutions page 34

ACOUSTIC INSULATION OF FLOOR AGAINST FOOT-TRAFFIC NOISE IN FLOOR HEATED ROOMS page 38

- Technical interventions solutions page 40

ACOUSTIC INSULATION OF WOOD FLOORS AGAINST FOOT-TRAFFIC page 42

ACOUSTIC INSULATION OF FLOATING WOOD FLOORS AGAINST FOOT-TRAFFIC NOISE page 44

ACOUSTIC INSULATION OF TERRACES AGAINST FOOT-TRAFFIC NOISE page 46

ACOUSTIC INSULATION OF CEILINGS AGAINST AIRBORNE AND FOOT-TRAFFIC NOISE page 47

- Technical interventions solutions page 48

SPECIFICATION ITEMS page 50

INDEX PRODUCT RANGE page 61

TECHNICAL DATA-SHEET page 63

CERTIFICATIONS OF PRODUCT page 70

MEASUREMENT - ON-SITE MEASUREMENT

INDEX MEASUREMENT

- CERTIFICATION - IEN G. Ferraris page 60
- CERTIFICATION - ITC-CNR page 62

ANDIL MEASUREMENT page 64

ON-SITE MEASUREMENTS

- Politecnico di Torino page 34
- Studio 360 page 47
- Studio di Acustica Applicata page 49

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

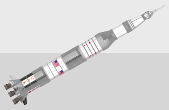
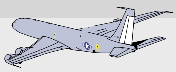
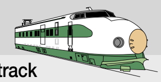
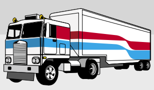
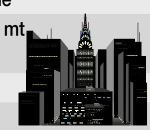
Material	Spreading speed
Steel	5000 m/sec.
Concrete	3000 m/sec.
Solid wood	1500 m/sec.
Water	1000 m/sec.
Air	340 m/sec.

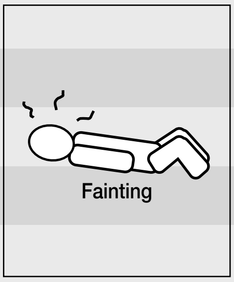
Walls are, in general, affected by airborne noise (voices, television sets, etc.) which generate pressure waves in the air to make the walls vibrate. These vibrations are transmitted to the air of nearby rooms thus transmitting the sound. Walls are only incidentally affected by impact, whereas floors, 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.

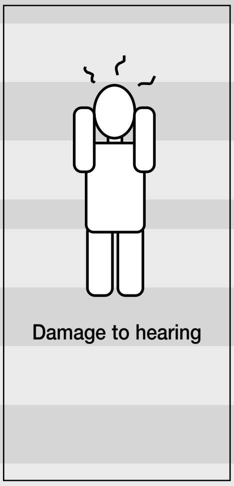
SCALE INDICATING THE INTENSITY LEVELS OF NOISE (dB A)

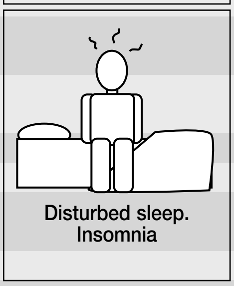
(abstract from "The noise primer" included in "Il mondo della tecnica" - UTET 1962 - vol. 2 - page 43 by Branch - 1970 page 2 and J.C. Migneron - "Acoustique Urbaine" - 1980 - page 12-13).

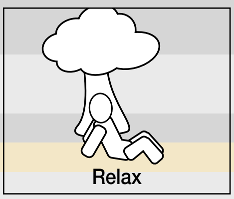
200	Saturn missile at launch at distance of 1 mt
140	Four-engined jet at take-off at distance of 25 mt
130	Automatic rock drill
130	High powered hydraulic press at a distance of 1 mt
125	Aircraft engine at distance of 7 mt
	– Threshold of pain –
120	Pneumatic drill
110	Car acoustic alarma at a distance 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 a purview of outline law no. 447 of 26/10/95, the DPCM of 05/12/97 establishes the passive acoustic requirements of the components of buildings. Before the decree was issued, Italian laws prescribed only certain values for the subsidised and school construction industries. Now the news set of regulations introduce some important new aspects, the outstanding one being, due to its consequences, the measurement of requirements during construction.
It is not enough to produce a certificate or project. The degree of insulation of walls, floors and systems must be verified directly in the constructed building. The "Sword of Damocles" of on-site measurement, which can be exercised at the contractual stage, calls for a more careful installation of insulating materials, and greater attention to construction details. This should be preceded by very careful planning of the building's acoustic design, with the help of a specialised acoustic technician. Any work done after the building is finished is much more costly and is not always feasible. In such cases, according to the trend in court rulings, the value of a building unit can depreciate by up to 30% of the previously agreed price.

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
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:

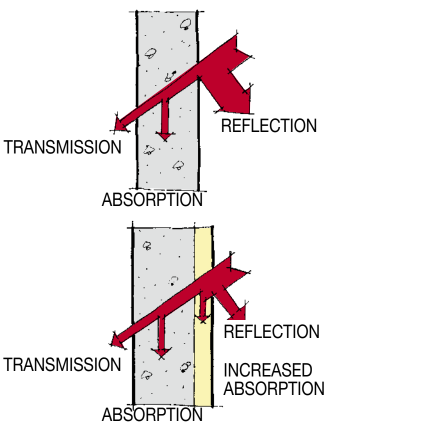
- Acoustic insulation of the building's façade: $D_{2m, nT, w}$
- The apparent sound insulating power of the walls separating two different dwellings: R'_w
- The foot-traffic noise level of a standard-conforming floor: $L'_{n w}$
- The level of acoustic pressure of the systems or services at
  - non-continuous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

ACOUSTIC INSULATION OF WALLS AGAINST AIRBORNE NOISE

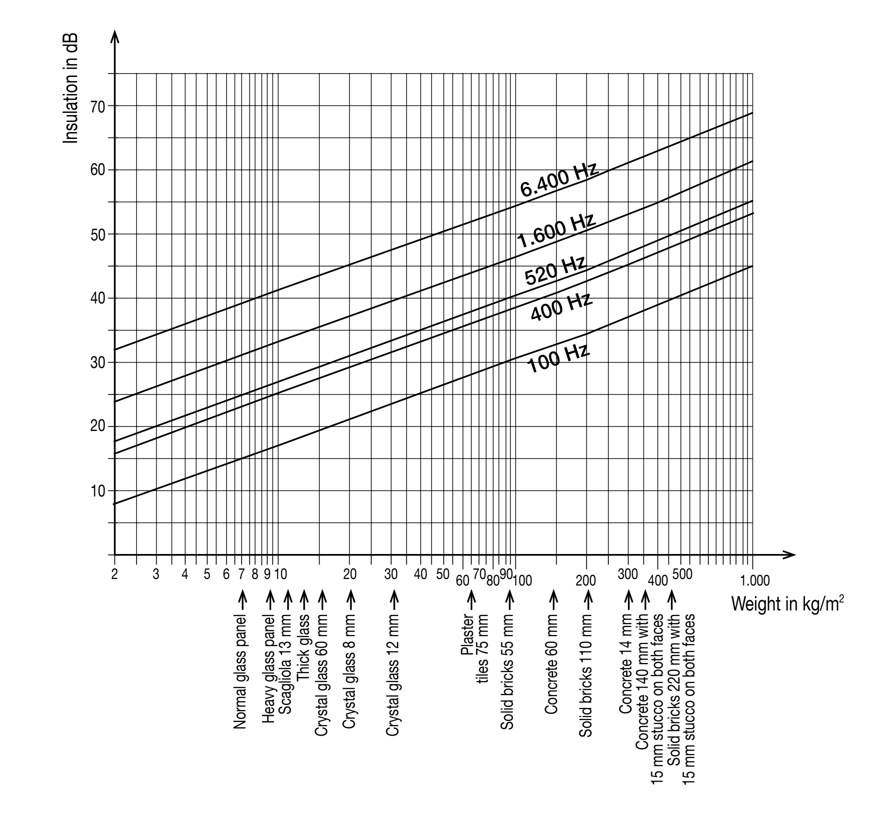
Airborne noise spreading in the air when it encounters an obstacle such as a wall or floor, causes it to vibrate, and part of the noise is transmitted while another part is reflected and absorbed. Acoustic insulation is aimed at reducing the noise transmitted through walls and floors to a different room 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 absorbing materials used for acoustic correction line the walls of the room where the noise is produced.

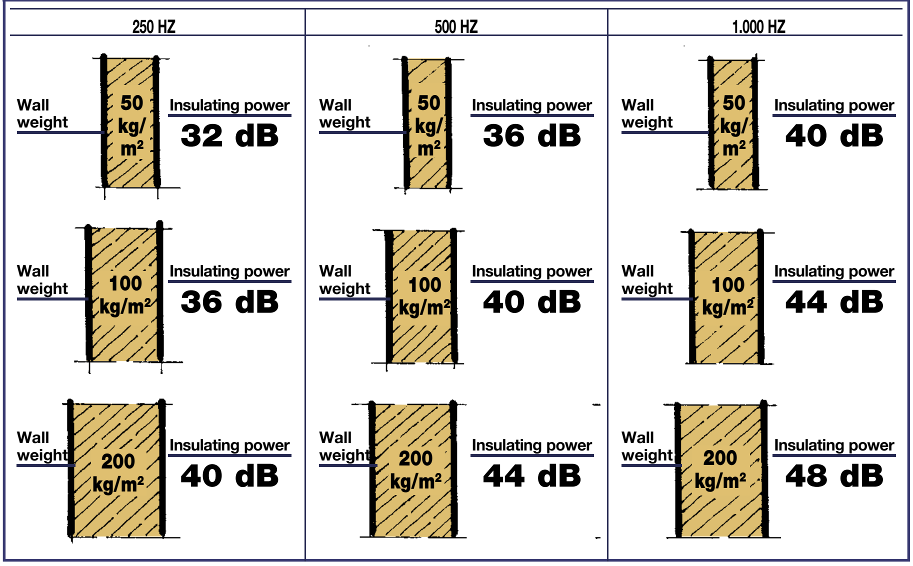
MASS LAW GRAPH



■ 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 50 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 ECOPOLIPIOMBO (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

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

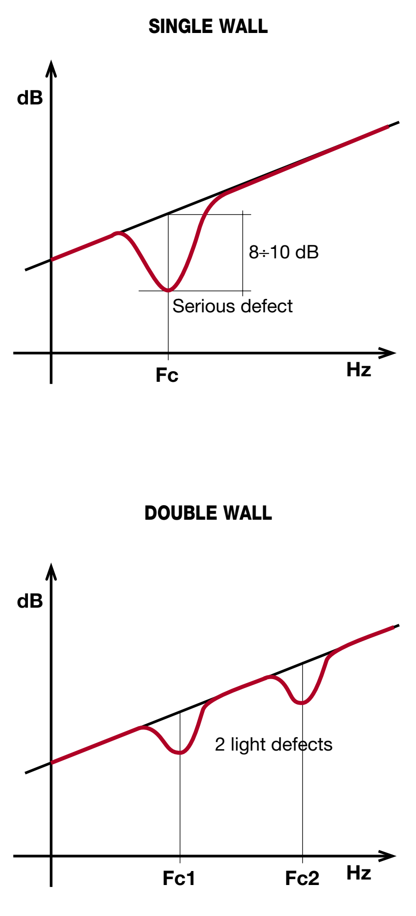


CRITICAL FREQUENCY VALUES OF SOME COMMON MATERIALS

Material	Mass (kg/m³)	Critical frequency for thickness values of 1 cm (Hz)
Leadpolymer	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

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.

SINGLE WALL AND DOUBLE WALL



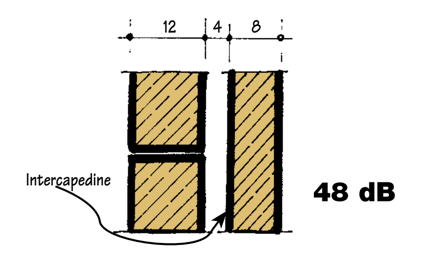
Fc: Critical frequency

The weight required to reach acoustic insulation of Rw≥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.

DOUBLE BRICK WALLS

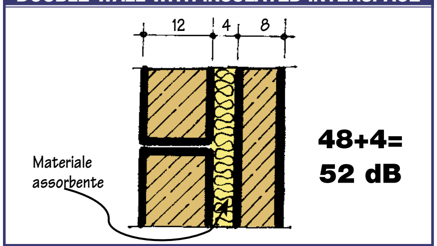
In the previous chapter, we saw how important it is for the two walls in a double-wall to have a different mass. However, in order to further improve insulation, measures can also be taken as regards the air interspace separating the walls. This space is the spring of the mass-spring-mass system consisting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

DOUBLE NO-INSULATED WALL



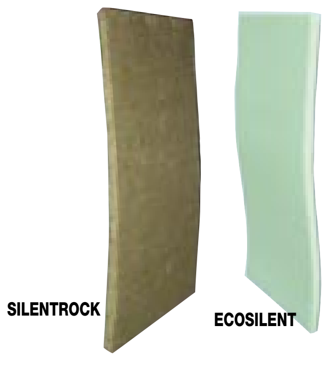
A double-wall is normally used for the perimeter walls of a dwelling and, for cost saving reasons, the interspace between traditional walls does not exceed 6 cm and is generally in the range from 3 to 5 cm.
If the interspace is filled with absorbing material (fibrous materials are usually employed), 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

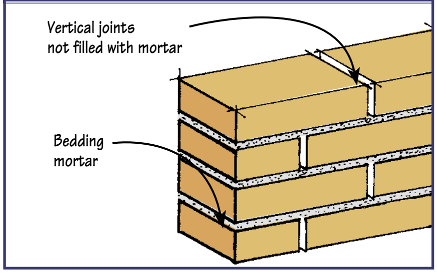
Porous materials permeable to the air must be used for filling interspaces. The cellular insulation materials normally used for thermal insulation, which have closed cells, are not suitable. In some cases, They can even worsen the acoustic performance of the layer configuration. For best results, the interspace thickness should be totally filled with fibrous insulating material (see the laying details for the SILENTGLASS and ECOSILENT fibrous insulating materials).



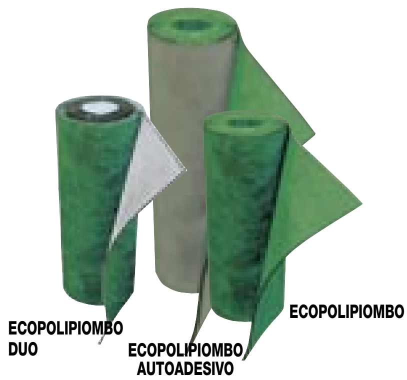
Wall porosity

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!

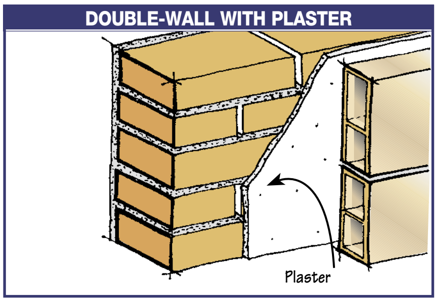
SINGLE WALL



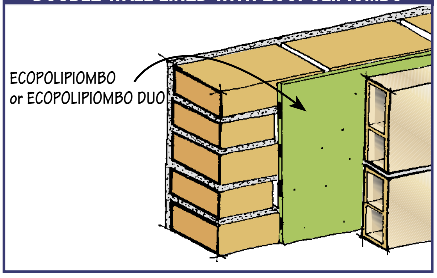
It's as if we had left an open window after building a perfectly insulated wall! This is why it is so important to apply a coat of plaster to weatherproof the wall. In the case of double-walls, the internal face of the interspace must also be plastered. Alternatively, the plaster can be replaced to good advantage by the ECOPOLIPIOMBO (Polymer+lead) sound-absorbing foil, which is much more impermeable than plaster and makes it possible to create a sealed interspace.
ECOPOLIPIOMBO is a foil which behaves acoustically like a lead foil of the same weight, but it does not contain Lead (Piombo in Italian) - hence the name ECOPOLIPIOMBO - because it insulates like lead but is free of the toxicological problems typical of this metal.



DOUBLE-WALL WITH PLASTER

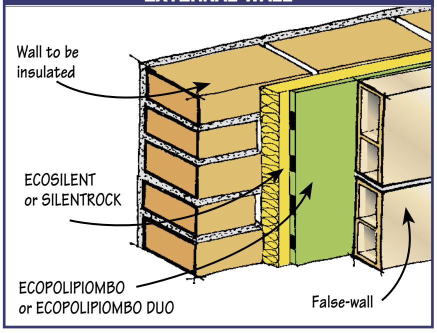


DOUBLE WALL LINED WITH ECOPOLIPIOMBO



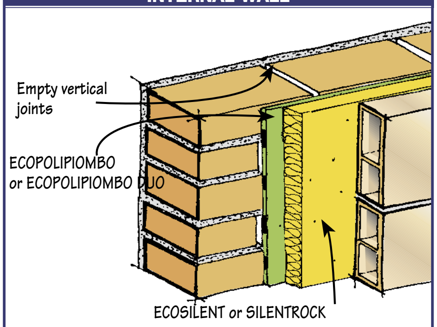
ECOPOLIPIOMBO and ECOPOLIPIOMBO DUO are highly resistant to aqueous vapour and can be used to replace the vapour barrier in metal foil normally employed to protect the thermo-acoustic insulation of outer perimeter walls, when they are applied on the warmer face of the insulation.

EXTERNAL WALL



For internal partition walls, POLIPIOMBO should be applied before the insulating material.

INTERNAL WALL



Alternatively: **SILENTROCK EP** or **ECOSILENT EP**

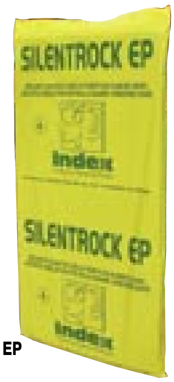
In this way, one can obtain acoustic insulation close to the theoretical insulation calculated according to weight and geometry. Obviously, for these very reasons, chases for electrical or hydraulic systems, routes, electrical boxes and connector blocks produce the same negative effects which, however,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

Pre-coupled insulation panels

To cut down on installation time and make installation easier, we can also supply insulation panels in mineral and synthetic fibre pre-coupled to ECOPOLIPIOMBO foil.

SILENTROCK EP is a thermal-acoustic insulation panel, coupled to a soundproofing foil which also acts as a vapour barrier. It is suitable for insulating the interspaces of internal dividing walls, between different building units and for insulating external perimeter walls.

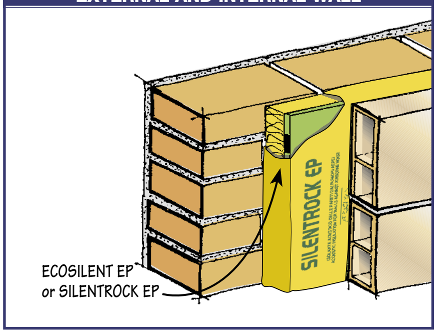
It consists of a rigid fireproof panel of high density rock wool treated with thermally-hardening resins. One face of the panel is covered with high density ECOPOLIPIOMBO foil. It is named in this way (Piombo = Lead) because it has the acoustic insulation properties of lead foil although it is completely lead-free.



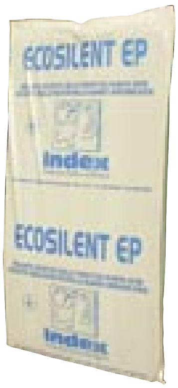
SILENTROCK EP

ECOPOLIPIOMBO acts like an insulation plaster, impermeable to air, vapour and noise.
SILENTROCK EP cuts down the time of building site operations. By laying a single product only, you apply both the thermal-acoustic insulation and the air and water tightness layer.
With SILENTROCK EP you no longer have to apply plaster on the internal face of the interspace.
To limit dispersion of fibres, every panel is wrapped in a polyethylene sheet on which the words "Side A - Side facing user" indicate the face on which the ECOPOLIPIOMBO foil is bonded.

EXTERNAL AND INTERNAL WALL



ECOSILENT EP consists of non-toxic polyester wool. This wool is obtained from the recovery and regeneration of the PET of fizzy beverages and mineral waters which are separated in the differentiated collection of city waste. It can be considered as a doubly ecological product, because a large quantity of waste is removed from the environment, a significant energy resource is recovered, and because the fibres are not irritating and are connected to each other by a thermal process free of bonding agents.



ECOSILENT EP

When the fibre is inserted in the interspaces, it reduces the vibrations and the connective movements of air in the interspaces.
ECOSILENT EP does not contain mineral fibres, does not irritate, and does not sting.
One face of this panel too is covered with high density ECOPOLIPIOMBO foil. Its position is indicated by the words "Side A - Side facing the user", indicated on the polyethylene sheet which covers every single panel.

Acoustic bridges in double-walls

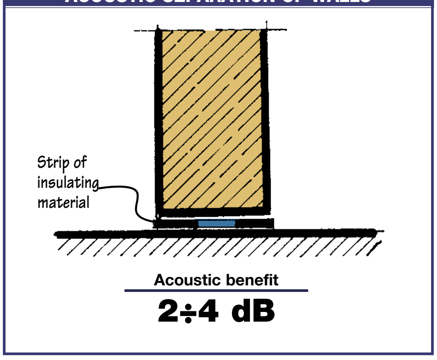
If there are rigid connections (acoustic bridges) between the two walls making up the double partition wall, the acoustic benefit of the double-wall is cancelled out and, instead we would have built a single wall with as many as two non-attenuated critical frequencies instead of one. Acoustic bridges can include: poorly finished mortar or even bricks laid so that they touch both walls.
That is why the good practice of filling the interspace with fibrous insulation material also serves to avoid these rigid contact points which cut down the theoretical level of insulation.

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

ACOUSTIC SEPARATION OF WALLS



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 56-57).

Acoustic insulation of single walls

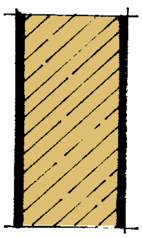
To foresee the acoustic performance of a rigid, single-layer single wall built with traditional materials (concrete, bricks/ tiles, cement materials in general), up to a weight of 700 Kg/m², one can use the empirical expression of the law of mass: $R_w = 15{,}4 \log m + 8{,}0$ which, in the case of walls in lightened mass bricks weighing $100 < m \leq 500$ Kg/m², becomes:
$R_w = 16{,}9 \log m + 3{,}6$.
For floors (for evaluation of the acoustically insulating power of airborne noise only, but not of foot-traffic noise), one can instead apply $R_w = 22{,}4 \log m - 6{,}5$.
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:

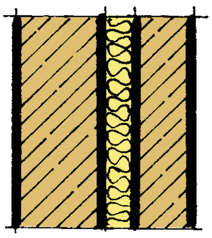
$R'w = Rw - a$	where "**a**" is the quantity of lateral transmissions.
$a \geq 5$ dB	for strong lateral transmissions, as in the case of a heavy wall with adjoining light walls
$2 \leq a \leq 5$ dB	medium local transmissions, as in the case of walls of similar weights
$a \leq 2$ dB	weak transmission, 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

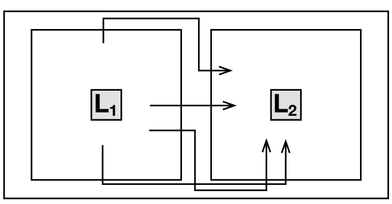


SINGLE WALL
Must exceed 500 kg/m²

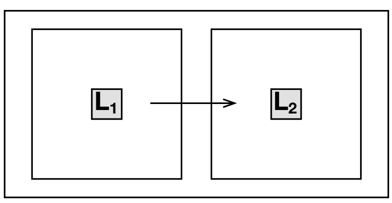


DOUBLE-WALL WITH MINERAL WOOL
Be sufficient 250 kg/m²

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



APPARENT SOUND INSULATING POWES R_w (laboratory measurement)



The false walls in coated plaster

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 SILENTROCK and ECOSILENT 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:

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

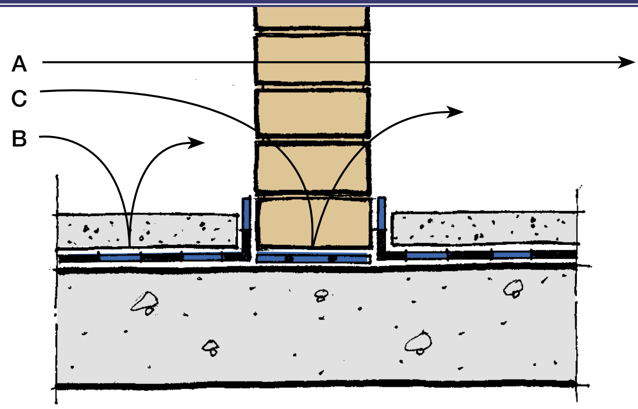
where m_1 and m_2 refer to the weight of the walls,

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 ECOSILENT or 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 - U20000780 - February 2004 version.

note: *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 ECOSILENT panel and a POLIPIOMBO 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 FONOSTOP DUO.

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



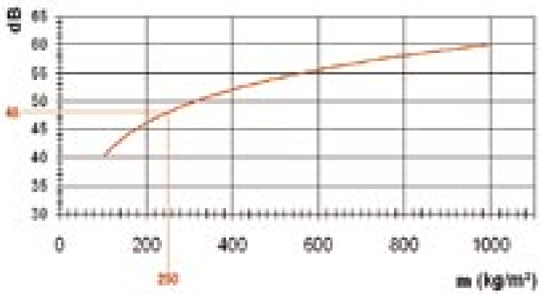
A = Direct passage of noise
B and C = Indirect transmission

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 FONOSTOP DUO, 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 POLIPIOMBO or POLOPIOMBO DUO and fill it completely with SILENTGLASS or ECOSILENT, SILENTROCK EP or ECOSILENT EP.**

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 aeric mass of the single wall or the sum of the aeric masses 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 ECOPOLIPIOMBO, 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.*

Forecast calculation of the evaluation index of apparent soundproofing power R'_w on site

As we have seen, the soundproofing power Rw of the wall can be calculated. Better still, a specific laboratory test can be available, which certifies the Rw measurement of an entire adequately insulated wall.
Of course, the test must have been rigorously performed according to the current standard (UNI-EN ISO 140) without any variations (see certificates IEN G. Ferraris of Turin, at the foot of this Guide). The test report must describe the type of materials used, the laying technique, as well as the weight and dimensions of the dividing element.
In this case, the careful observance of the very operating methods and the use of the given materials, is the most reliable method with a narrower margin of error compared to a simple forecasting calculation.
However, when installed, the soundproofing power of the wall will not have the same value because it will be reduced by the lateral transmissions which move along the adjacent elements, walls, ceilings and floors.
As a result, the soundproofing power R_w of the same wall will produce R'_w values (apparent soundproofing power measured on site) which differ according to different situations.
The degree of lateral transmission can also be calculated in conformity with the method in standard UNI-EN ISO 12354 - part 1, and calculation software programs are available also containing a database on the soundproofing power R_w of various construction types.
Overlooking to evaluate lateral transmission, or underestimating it, by applying simple average corrective coefficients can lead to blunders: e.g. as in the case shown in the drawings, where in an attic split into two building units by a wall with soundproofing power of R_w>50 dB, it was overlooked to consider that the shared ceiling consisted of a wooden roof with a ventilated interspace insulated by a panel in polystyrene from which the conversations in both rooms could be heard.
In this specific case, the partition between the two dwellings - located crossways with respect to the ventilation flow – has further complicated the problem. This is because the technician had to face the dilemma of acoustically insulating the interspace with a mineral wool filling, which would have obstructed the interspace between the two boardings, preventing them from being ventilated (see intervention solution on page 26 - “Acoustic insulation of the roof”).
That is why it is important for the project to be verified by an acoustics expert.

Warning
Do not confuse R_w with R'_w
R_w: the evaluation index of the soundproofing power of a single structure (wall and floor) <u>calculated or measured in a laboratory</u>.
Order of reliability:
- *laboratory certificate (UNI-EN ISO 140)*
- *correlation of laboratory test specifications to similar elements*
- *general relations from mathematical algorithms according to aeric mass and any other additional parameters.*

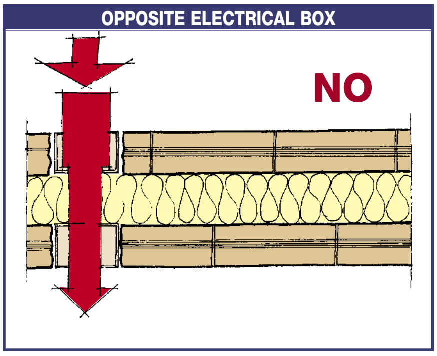
R'_w: the evaluation index of the apparent soundproofing power of an <u>installed</u> internal partition (legal requirement). In addition to the soundproofing power R_w of the dividing element, this also takes into account lateral sound transmissions.

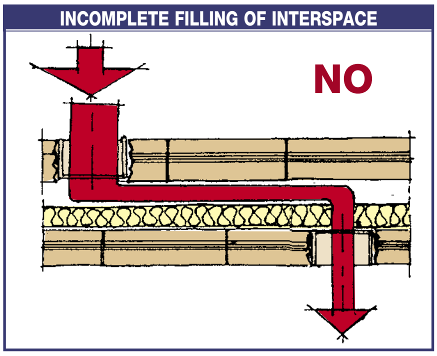
Main installation faults to be avoided

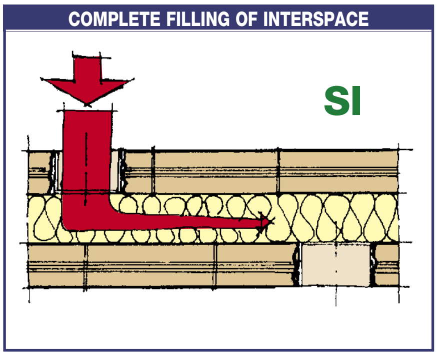
Whereas the degree of the lateral transmissions which reduce the wall’s soundproofing power can be estimated by calculations, laying/installation faults, on the other hand, cannot be foreseen but can be avoided only by carefully laying not only the insulating materials but also all the elements making up the stratigraphy of the wall and the systems installed in it.
Remember that the laboratory tests and the forecast calculation cannot take into account poor laying or the system installed in the walls, which are, however, all elements that negatively influence the sound insulation of the dividing element.
The following is a list of the most common errors which are encountered in the construction of walls and should be avoided.

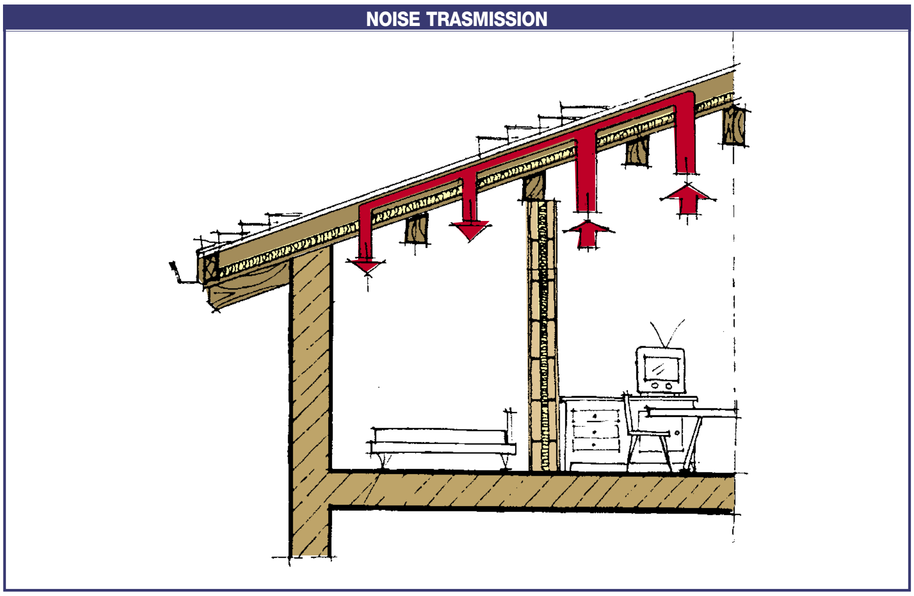
Avoid these errors:
- incomplete sealing of both horizontal and vertical brick progressions.
- laying broken bricks.
- incomplete or omitted sealing of the wall perimeter to the ceiling and along the adjacent walls.
- incomplete filling of the interspace with mineral or synthetic wool.
- insulating panels not correctly placed next to each other.
- traces of the system communicating between the two walls and electrical cases located to oppose each other.

Advice:
- use large bricks/tiles (25×25 cm) with a thickness of over 8 cm.
- build the double wall with two different weights (e.g. 12+8cm)
- plan interspaces larger than 4 cm (we recommend 6 cm)
- arrange for the walls to be laid on strips of resilient material (FONOSTRIP).
- plaster one of the internal faces of the interspace or cover it with ECOPOLIPIOMBO.

OPPOSITE ELECTRICAL BOX


INCOMPLETE FILLING OF INTERSPACE


COMPLETE FILLING OF INTERSPACE


NOISE TRASMISSION


■ THE FALSE-WALL IN COATED PLASTER

This is the most used system for correcting the acoustic faults of existing walls. Its great advantage is that it is a ‘dry’ construction method, not requiring dirt producing materials such as sand, cement, etc for installation. Moreover, excellent insulation results can be obtained with much lower thickness values and weights compared to a traditional brick false-wall.

That is why this system is by far preferable for restoring acoustic comfort in inhabited rooms.

The insulating system is not based on the law of mass as in the case of rigid, heavy traditional brick walls, where more weight equals more insulation. It is instead based on the dynamic insulation of ultra-light panels, such as plasterboard slabs, alternated with one or more interspaces, preferably filled with mineral or synthetic wool.

Increasing the acoustic insulation of existing walls

Often the acoustic insulation of existing partition walls does not guarantee sufficient protection and, therefore, the corrective preventive action systems can be selected from among the following solutions:

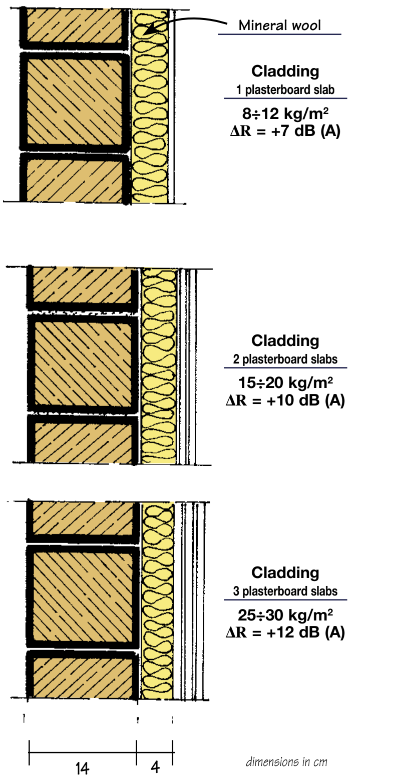
- build a brick false-wall of sufficient weight, separated by an interspace filled with mineral or synthetic wool acoustically separated from its surroundings;
- apply, toward the wall to be insulated, a light false-wall in plasterboard or wood panels, separated by an interspace filled with mineral or synthetic wool.

As we said, the second system is preferable in inhabited rooms, whereas the first is part of the category previously described, in this case of traditional brick double-walls. The improvement in dynamic insulation obtained with the light false-wall is the higher, the lighter the wall to be insulated. If, instead, the old wall is heavy, the obtained benefit is lower, although is still important as an absolute value. On can foresee increases of 15÷20 dB for light walls (80÷100 Kg/m²) and of 7÷12 dB for heavy walls (250÷300 Kg/m²). The figure on the left shows how insulation, interspace thickness being equal, increases according to the number of plasterboard panels of the false-wall.

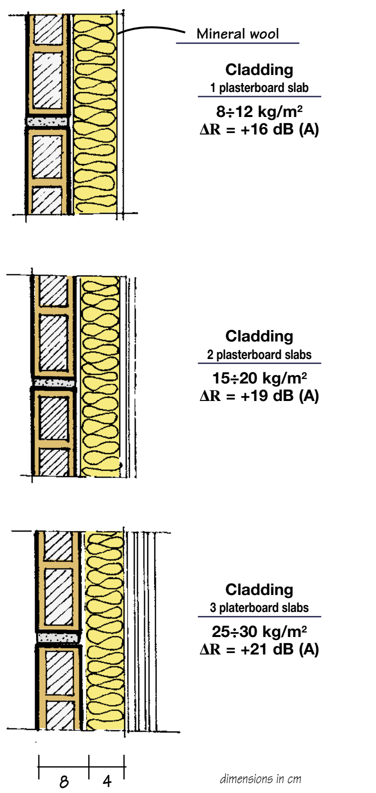
GUIDELINE IMPROVEMENT VALUES OF ACOUSTIC PROTECTION (ΔR) AS WEIGHT OF WALL AND CLADDING VARIES, HAVING INSTALLED A 4 CM THICK FIBROUS PANEL

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

WALL 300 kg/m²

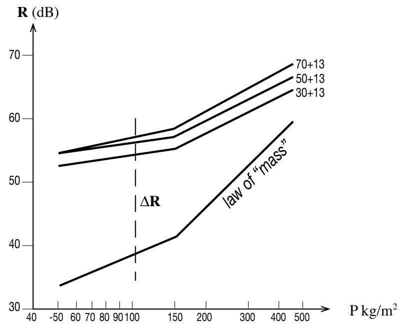


WALL 70 kg/m²



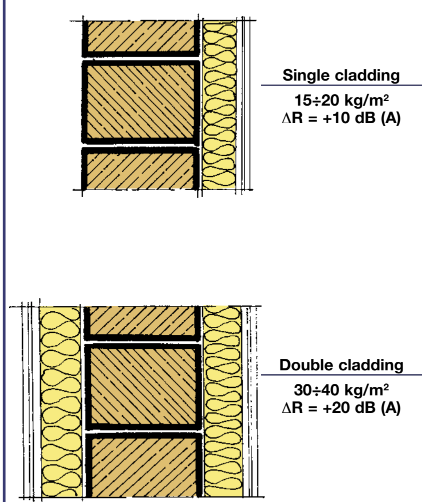
A further benefit can be obtained by increasing the thickness of the interspace filled with wool. This is especially recommended for insulating a heavy wall, as can be seen in the graph: the three sound absorbing power curves refer to three thickness values of insulated interspace of 30, 50 and 70 mm, protected by the same 13 mm plasterboard slab.

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



For heavy walls, to further increase insulation, it may be convenient to insulate both sides of the walls with a light false-wall. In that case, the total benefit will consist of the sum of the increases of the two false-walls. For example, as concerns the case in the previous figure, where insulation is increased by 10 dB on the heavy wall, by covering a face of the wall with 4 cm of mineral wool and two plasterboard slabs, a further increase of 20 dB can be obtained by repeating the work on the other face of the same wall.

HEAVY SINGLE WALL



Forecast calculation methods of the increase in soundproofing power R_w obtained with false-walls in lined plaster

To foresee the increase of the soundproofing power R_w of a wall which will be covered with a false-wall in plasterboard, the resonance frequency (**fo**) of the wall/false-wall system must be calculated.

For plaster slabs pre-coupled to mineral wool, such as SILENTGIPS, to be glued to the wall, the following formula is used:

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

where:
s' = dynamic rigidity of the mineral or synthetic wool (MN/m³)
m'_1 = aeric mass of the wall to be lined (kg/m²)
m'_2 = aeric mass of the false-wall (kg/m²)

Instead, in the case of a false-wall or false-ceiling on a metal frame, with the interspace filled with mineral or synthetic wool, with air flow resistance of >5 KPas/m², separated 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 = thickness of the interspace (**m**)
m'_1 = aeric mass of the wall to be lined (kg/m²)
m'_2 = aeric mass 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 of soundproofing power ΔR_w from the following table.

Frequenza di risonanza 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

Forecast calculation method of the soundproofing power R_w of a non-traditional wall on a metal frame consisting only of lined plaster and mineral or synthetic wool

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

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

where:
m' = aeric mass of the wall (kg/m²)
d = thickness of the interspace (cm)
e = thickness of the fibrous insulation (cm)

Installation systems of light false-walls

The improvement of insulation indicated in the previous chapters can be achieved in practice the more the light false-wall is disconnected from the wall to be treated and from the lateral walls along its perimeter. This is to avoid acoustic bridges which would frustrate the intervention.
Two types of intervention are possible:
- The SILENTGIPS prefabricated glued false-wall.
- The false-wall assembled on site over a metal frame where the interspace between the plaster slab and the existing wall should be filled with SILENTGLASS glass wool or with ECOSILENT polyester wool.


SILENTGLASS

Alternatively, SILENTROCK or the pre-coupled insulation products SILENTROCK EP and ECOSILENT EP can also be used. They should be inserted in the seat of the metal uprights, with the face covered with POLIPIOMBO facing toward the exterior of the false-wall.
The performance of the plaster slab can be improved by glueing the ECOPOLIPIOMBO or ECOPOLIPIOMBO DUO membrane over it with FONOCOL. These two products correct its critical frequency, moving it up to the high frequencies, outside our audible range.
To reduce installation time, it is convenient to use the EP GIPS slab in lined plaster pre-coupled to ECOPOLIPIOMBO.

EP GIPS is obtained in our factory by coupling a slab of lined plaster with ECOPOLIPIOMBO foil. Consequently, the laying operations which had previously been carried out on site are eliminated.
EP GIPS is a prefabricated slab which provides sound insulation performances greater than those of the single slab in plasterboard, thanks to coupling with ECOPOLIPIOMBO, a high density elastomer foil with soundproofing power equal to a lead foil of the same weight but without the latter's toxic properties.
EP GIPS is actually unleaded.
The sound insulation performances of EP GIPS - whether fitted on false-walls made on a metallic frame next to a brick wall, or on walls entirely of lined plaster on a metallic frame - were certified by laboratory I.E.N. Galileo FERRARIS of Turin, using 13 mm plasterboard slabs and ECOPOLIPIOMBO weighing 5 Kg/m2 pre-coupled on site with FONOCOLL glue.
The EP GIPS slab is used in the construction industry to make walls with high sound insulation properties. In view of ECOPOLIPIOMBO's high resistance to vapour migration, it can also act as a barrier against the vapour of the thermal-acoustic insulation material in the perimetric walls bordering the external ambient.
EP GIPS can be used both for building insulating false-walls of existing walls and for building new walls totally made of lined plaster slabs.
EP GIPS slabs should be installed on a metal frame to which they are secured with screws.
They are generally installed as the first layer of walls built with two plaster slabs, and can be positioned both with the lined face facing the frame or vice versa, with the lined face in between the two slabs.
If a single slab is being installed, the face lined with ECOPOLIPIOMBO should face the metallic frame.
The joining lines between the slabs are then sealed with joint covering tape.

EP GIPS


The light glued false-wall

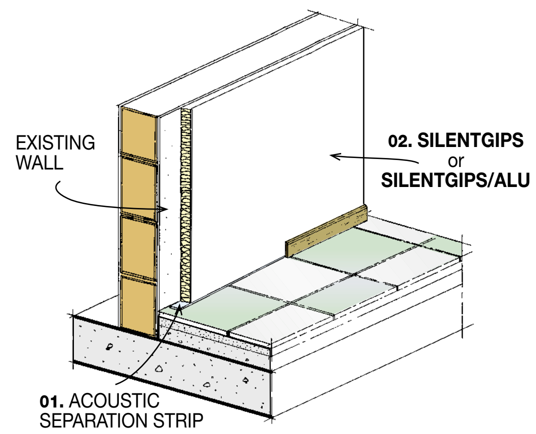
The system is based on the use of plaster slabs coupled to SILENTGIPS mineral wool. The slabs are glued on the wall to be insulated, with adhesives containing hydraulic binders, making sure that the slabs do not touch the floor, side walls and ceiling, to avoid generating lateral transmission of noise.
SILENTGIPS ALU, with its metallic anti-vapour screen is used if the perimetric wall facing outside has to be insulated.

Spread glue on the slabs to be secured. Next, lay the slab on the wall, while keeping it detached from the floor with small wedges, which should be removed when the glue has set.
Next, fill the fissure with an insulating seal in polyethylene foam or fibreglass.
Stucco the slab approach line with a seal suitable for joints. The degree of insulation increases as the thickness of the mineral wool component increases.

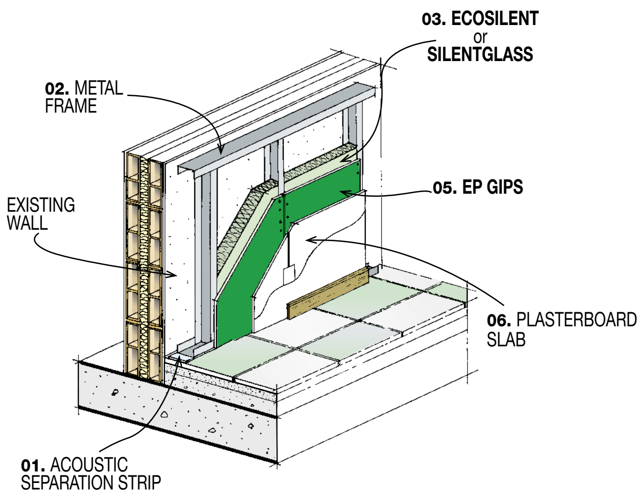
The light false-wall on a metal frame

Allows more planning freedom, because you can vary the distance from the wall and install several layers of slabs, alternated with anti-vibration materials, gradually increasing the degree of insulation.
Moreover, the mechanical fastening of the slabs at the between-slabs joint offers a greater guarantee of safety compared to the glued only solution.
This also facilitates installation of the plant.
In practise, one uses a technique similar to the one used for constructing the partitions in plasterboard only.
There are various types of metallic frames, with a common measurement of the fastening between-axes 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 perimetric rails screwed onto the ceiling and floor, suitably insulated with self-adhesive seals, which guarantee separation and reduce lateral transmission.
The interspace between slabs and wall is completely or partially filled with SILENTGLASS glass wool or ECOSILENT polyester wool or with panels SILENTROCK, SILENTROCK EP and ECOSILENT EP, which are inserted in the seat of the vertical uprights.
Next, screw-fasten the plasterboard slabs in one or more layers.
If you are installing a single layer only, the slab should be coupled beforehand to ECOPOLIPIOMBO phono-resistant foil. The latter improves its acoustic properties and acts as a vapour barrier if the external perimetric wall is insulated.
If you are installing a double layer, you may wish to insert the ECOPOLIPIOMBO DUO foil between the slabs. The foil integrates shifting the slab's resonance frequency.
In both cases, to speed up laying operations, it may be an advantage to use EP GIPS slabs pre-coupled to ECOPOLIPIOMBO.
Lay the slabs staggered between each other and the screw seat, and suitably stucco the approach joints.

LIGHT FALSE-WALLS GLUED



LIGHT FALSE-WALLS ON METAL FRAME



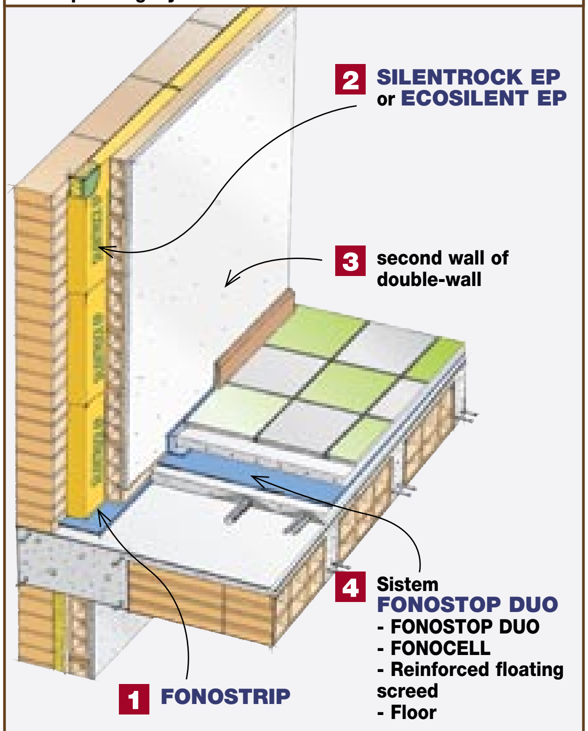
Alternatily **EP GIPS: ECOPOLIPIOMBO** + Plasterboard slab

TECHNICAL INTERVENTION SOLUTIONS IN NEW BUILDINGS

1 2 EXTERNAL WALL

1

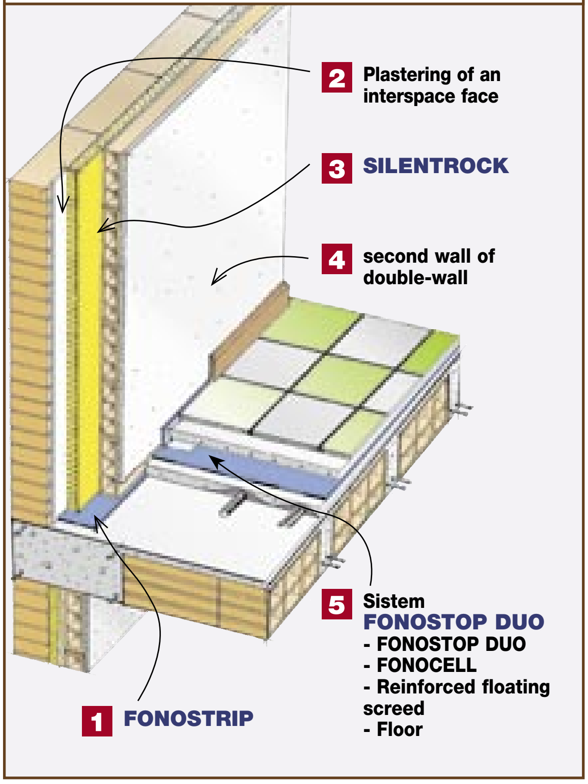
Acoustic insulation of external walls by double-wall with interspace filled with a sound insulation panel coated with a soundproofing layer



Alternatively **2**: SILENTROCK or ECOSILENT and ECOPOLIPIOMBO or ECOPOLIPIOMBO DUO

2

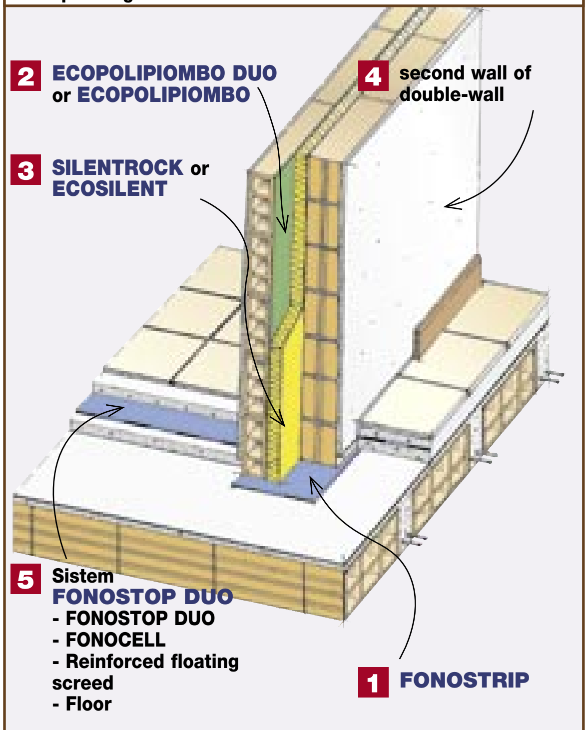
Acoustic insulation of external walls by double-wall with a plastered interspace filled with a sound insulation panel



3 4 INTERNAL WALL

3

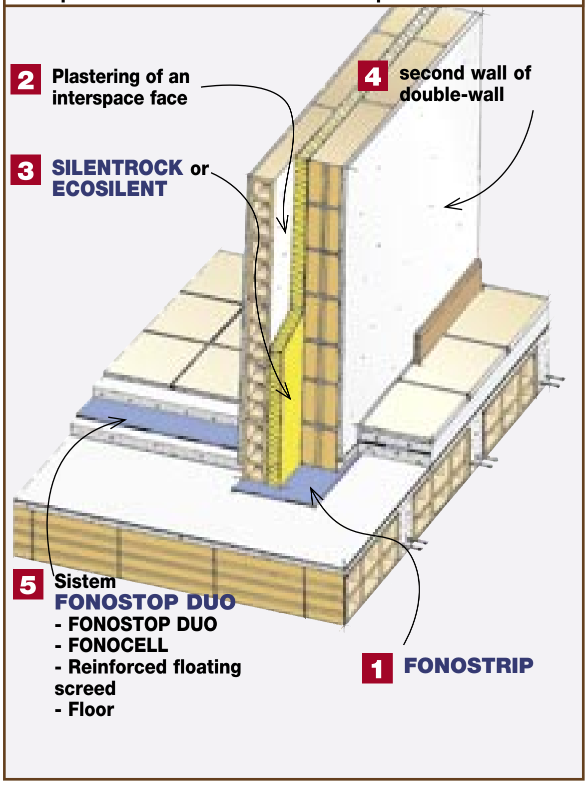
Acoustic insulation of internal walls by double-wall with lined interspace filled with a sound insulation panel or a soundproofing foil



Alternatively **2**+**3** = SILENTROCK EP or ECOSILENT EP

4

Acoustic insulation of internal walls by double-wall with interspace, with one of the internal faces plastered, and the interspace filled with a sound insulation panel



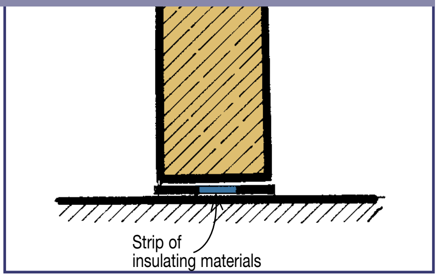
The specifications items are on page 50

LAYING METHOD AND DETAILS

3 JOBS RULE

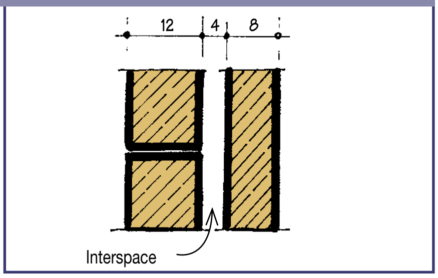
1

Always acoustically separate the walls
Acoustically separate the walls by raising them on FONOSTRIP soundproofing strips and then insulate, with FONOSTOP DUO, the floating floors of the adjoining rooms divided by the wall.



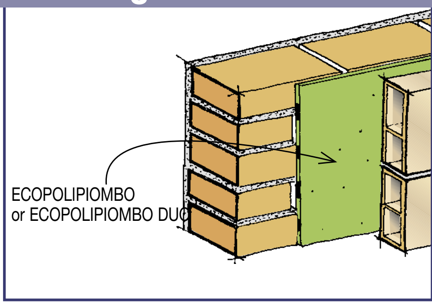
2

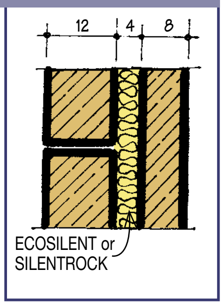
Always build double-walls
Build double-walls with partitions of different weight/thickness, bearing in mind that interspace must be larger for light walls.



3

Always line one face of the interspace and fill it completely.
Line one of the two faces with ECOPOLIPIOMBO or ECOPOLIPIOMBO DUO and fill it completely with SILENTROCK or ECOSILENT.
Alternatively, as a single solution, apply the pre-coupled SILENTROCK EP or ECOSILENT EP panel.

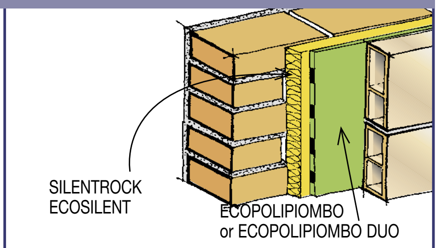




DETAILS

EXTERNAL WALL

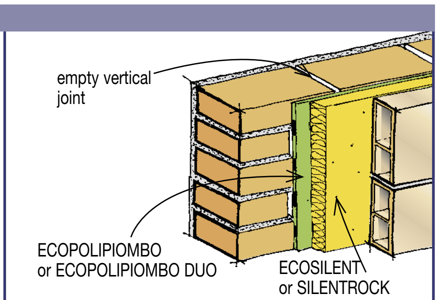
For external walls, the first step is: glue the fibrous insulating material on the first wall of the double-wall, using strips of SUPERFLEX PUR sealer, or secure them simply by nailing.
Next, the POLIPIOMBO foils are placed above, They are nailed onto the top of the wall with nails of sufficient length to take in the thickness of the fibrous insulating material.



Alternativly: **SILENTROCK EP or ECOSILENT EP**

INTERNAL WALL

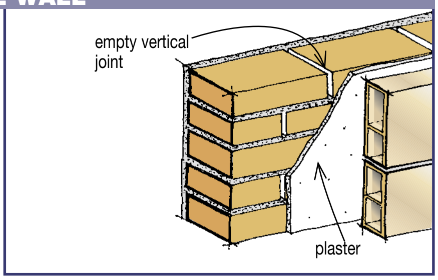
The mason does not generally fill the vertical joints of walls. That is why it is essential to position ECOPOLIPIOMBO or ECOPOLIPIOMBO DUO on one of the faces of the interspace. The foil should be nailed on the high part of the first wall of the double-wall and should be trimmed at its base. The approach lines of the pieces of fabric should be sealed with adhesive tape. Next, as the second wall is erected, gradually fill the interspace with the fibrous insulation panels. The insulation (in rolls or panels) can also be secured beforehand to ECOPOLIPIOMBO before the walls are erected, using strips of SUPERFLEX PUR, a polyurethane sealer in cartridges, or hot glue extruded with an electrical pistol.



Alternativly: **SILENTROCK EP or ECOSILENT EP**

INTERNAL AND EXTERNAL WALL

If it is decided not to use POLIPIOMBO or POLIPIOMBO DUO, one of the interspace faces must be plastered before the SILENTGLASS or ECOSILENT insulating panels are installed.

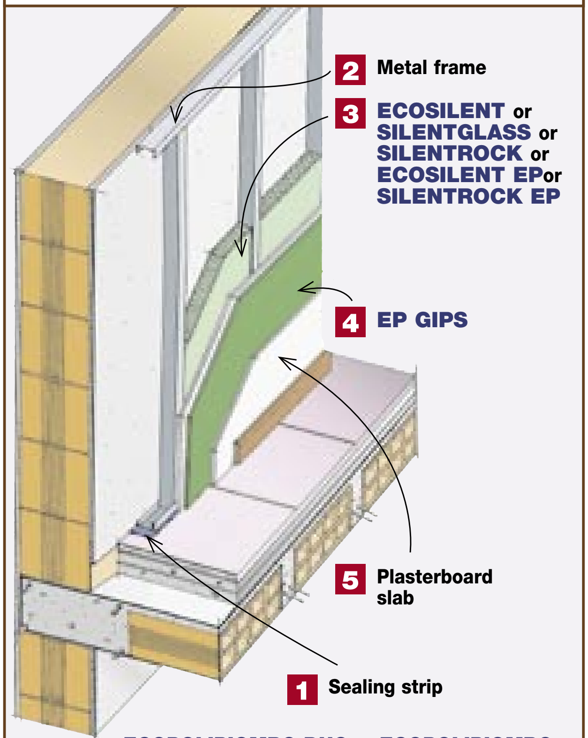


TECHNICAL INTERVENTION SOLUTIONS IN EXISTING BUILDINGS

1 2 EXTERNAL WALL

1

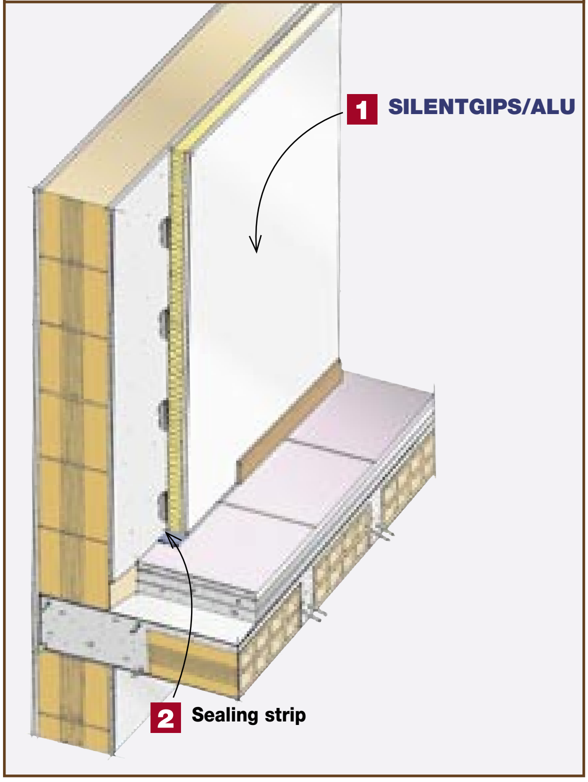
Acoustic insulation by a plasterboard wall fitted on a self-bearing metal frame



Alternatively: **ECOPOLIPIOMBO DUO** or **ECOPOLIPIOMBO** + plasterboard

2

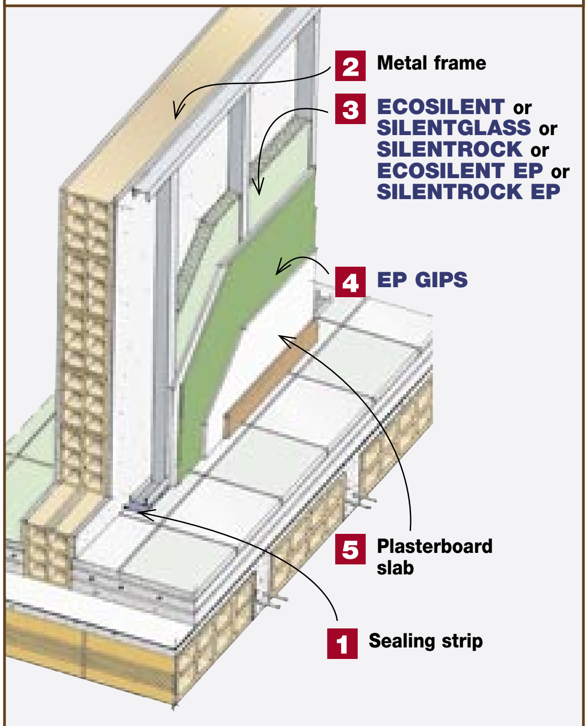
Acoustic insulation obtained by gluing a mineral wool panel coupled to a SILENTGIPS/ALU plaster slab



3 4 INTERNAL WALL

3

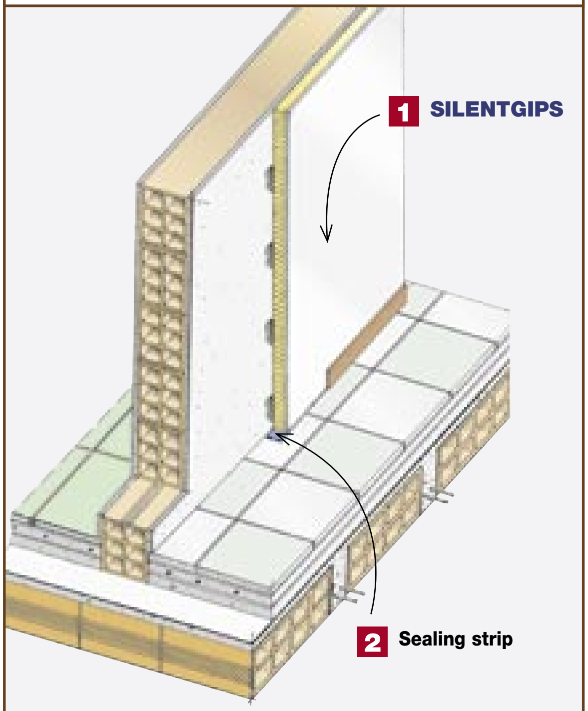
Acoustic insulation by a plasterboard wall fitted on a self-bearing metal frame



Alternatively: **ECOPOLIPIOMBO DUO** or **ECOPOLIPIOMBO** + plasterboard

4

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



The specifications items are on page 51

LAYING METHOD AND DETAILS

LAYING TECHNIQUE FOR FALSE-WALLS ON METAL FRAME

Install the metal frame

Lay ECOSILENT

First layer of plasterboard

Lay ECOPOLIPIOMBO DUO

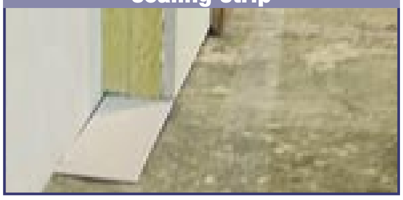
Lay and seal of plasterboard

LAYING TECHNIQUE FOR GLUED FALSE-WALLS

Spread GIPSCOLL glue

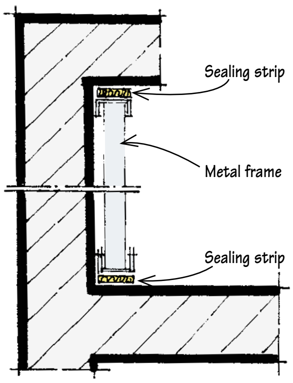
Position the SILENTGIPS slab

Position the sealing strip



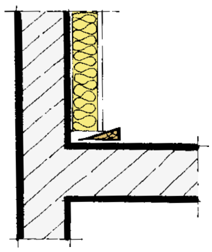
DETAILS

The sealing strip is positioned before the frame is laid

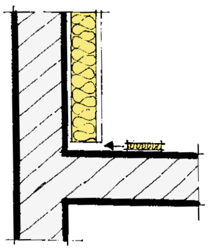


DETAILS

Thickness at foot of panels



Positioning the sealing strip



ACOUSTIC INSULATION OF THE FAÇADE AGAINST AIRBORNE NOISE

Whereas the soundproofing power of internal partitions, measured on site, and referred to in DPCM (Premier's Decree) of 5/12/97, is identified by the symbol R'_W, as regards perimetric façade walls, the law specifies that acoustic insulation be identified by the quantity $D_{2m,nTW}$ which is measured by a method that differs from that used for internal walls.

The soundproofing power R_W (measured in the laboratory or calculated) of the wall - the 'opaque' part of the façade - only partially influences insulation $D_{2m,nTW}$ which is conditioned mainly by the transparent parts, i.e. the windows, and by the presence of what are defined as "small elements", air intakes, roller shutter boxes, etc.

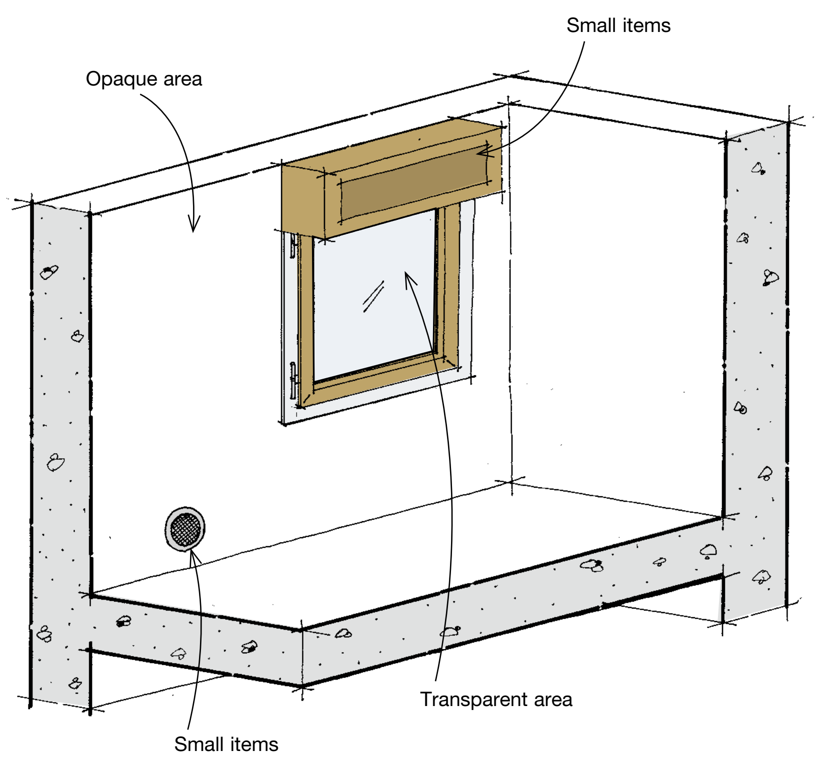
It is a commonly held opinion among acoustics technicians, that the opaque part, i.e. the wall, with estimated or measured soundproofing power of R_W>50 dB is sufficient to guarantee the respect of the limits imposed by the law for $D_{2m,nTW}$, specifically 40 and 42 dB (buildings in category A, C, B, F, G). Furthermore, full attention should be focused on judiciously selecting high insulation windows and frames, on the lay-out of suitably insulated air intakes, etc. - they should be installed with great care to avoid leaving open fissures through which noise can pass.

The acoustic insulation evaluation index of the façade ($D_{2m,nTW}$) identifies the resistance to the passage of noise coming from the outside of the portion of façade referring to every single room.

This requirement also depends on the countless factors linked to the shape and size of the building.

An in-depth analysis of the direction of the sound sources to which the building will be exposed and consequent evaluation of the size of the building, should be the first discriminating element among the choices of the planners; even without examining this subject with acoustic impact evaluations or studies of the acoustic climate, mainly requested during preventive investigations for future erection of schools,

FAÇADE ITEMS



hospitals or hotels, some simple measures are considered key to obtaining a good level of comfort: the distribution of internal rooms according to a "noise logic", whereby the bedrooms will certainly not face the road, the kitchen air intake will, if possible, be located in a recess or, at least, will not be exposed to the most persistent noise source (or even be confined in a service kitchenette) and anything else capable of reducing the level of exposure to the noise made by the occupiers.

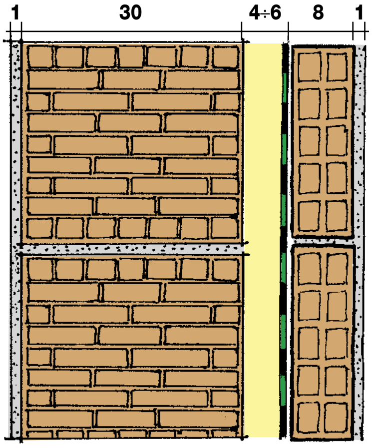
As regards the planning choices concerning the opaque parts, this document does not address any in-depth examination of the selection of glass panels and window frames. The requests concerning the passive acoustic requirements will have to be harmonised with the new legal provisions on thermal requirements, in connection with law decree No. 192 of 15 August 2005.

THERMO-ACOUSTIC VERIFICATION OF WALLS

External perimetric walls

As walls in general are built with elements heavier than the partitions between different dwellings, they can be considered as already suitable for obtaining an evaluation index of soundproofing power higher than 50 dB. It will therefore be sufficient to fill the interspace with self-supporting panels SILENTROCK EP (mineral wool coupled to ECOPOLIPIOMBO phono-resistant foil) or alternatively with ECOSILENT EP (synthetic polyester wool coupled to ECOPOLIPIOMBO) to obtain what we have indicated above.
The SILENTROCK EP and ECOSILENT EP panels are supplied in polyethylene packets with instructions on laying the ECOPOLIPIOMBO phono-resistant foil on the ‘warm face’ of the insulation, to avoid interstitial condensation problems (the side in question must remain visible to the operator when the panels are being laid.
Index’s solutions, evaluated and proposed to obtain façade walls with a good acoustic and thermal correspondence, as indicated below, were calculated for the severest climatic conditions, and take into consideration the requirements of law decree No. 192/05 referring to thermal insulation as specified, starting from 1st January 2006 and from 1st January 2009, in the most restrictive climatic zones, relating to zone F. As regards other construction types and in different climatic conditions, there will have to be as many professional evaluations concerning the new values of the transmittance coefficient **U** and of the forecast evaluation index of sound proofing power $\mathbf{R_w}$.

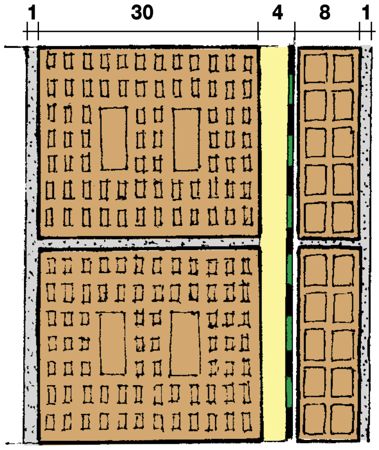
DOUBLE PERIMETRIC WALL IN HOLLOW BRICK, STANDARD 30+8



THERMAL INSULATION			
Transmittance	**Law.dec. 192/05**	**SILENTROCK EP**	**ECOSILENT EP**
ZONE F from 1/1/2006 **K**	0,4400 W/m²K	thickness 40mm 0,4030 W/m²K	thickness 40mm 0,4191 W/m²K
ZONE F from 1/1/2009 **K**	0,3500 W/m²K	thickness 60mm 0,3257 W/m²K	thickness 60mm 0,3417 W/m²K
ACOUSTIC INSULATION			
Soundproofing power	**DPCM 5/12/97**	**SILENTROCK EP**	**ECOSILENT EP**
$D_{2m,nT,w}$	40 dB	thickness 40÷60 mm (*) R_w>50 dB	

Note. When the soundproofing power **Rw** *of the opaque wall of the façade exceeds 50 dB, the insulation of the façade depends exclusively on the transparent parts and on the small elements (windows, boxes, ventilation holes, etc.).*
Note. According to the thermohygrometric verification, condensate does not form.
(*) According to the forecast calculation

PARETE DOPPIA PERIMETRALE IN LATERIZIO FORATO ALVEOLARE 30+8



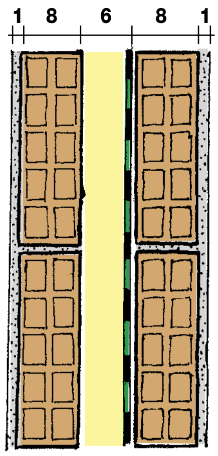
THERMAL INSULATION			
Transmittance	**Law.dec 192/05**	**SILENTROCK EP**	**ECOSILENT EP**
ZONE F from 1/1/2009 **K**	0,3500 W/m²K	thickness 40mm 0,3299 W/m²K	thickness 40mm 0,3452 W/m²K
ACOUSTIC INSULATION			
Soundproofing power	**DPCM 5/12/97**	**SILENTROCK EP**	**ECOSILENT EP**
$D_{2m,nT,w}$	40 dB	thickness 40 mm (*) R_w>50 dB	

Note. When the soundproofing power **Rw** *of the opaque wall of the façade exceeds 50 dB, the insulation of the façade depends exclusively on the transparent parts and on the small elements (windows, boxes, ventilation holes, etc.).*
Note. According to the thermohygrometric verification, condensate does not form.
(*) According to the forecast calculation

To conclude, the acoustic insulation of the façade will then mainly depend on the choice-decisions concerning the transparent part and the planner will focus on that part; in situations where the opaque part has an evaluation index of $\mathbf{R_w}$>50 dB, respect of the Legal limits should be considered as exclusively dependent on the other components that are part of the façade element.

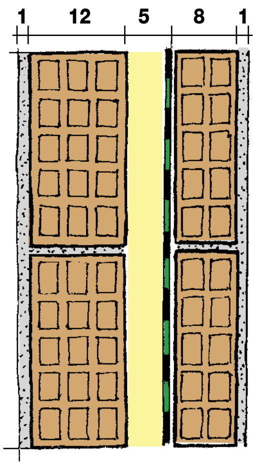
Internal partitions

The thermal verification took into consideration also the internal partitions respecting the acoustic requirements imposed by Prime Minister's Decree of 5/12/97, which had been measured at ITC-CNR (formerly ICITE), in connection with the requirement of the limit of **K**<0,800 W/m²K specified by law decree No. 192/05 for buildings in category E1 built in climatic zones C, D, E and F.



THERMAL INSULATION			
Transmittance	**Law.dec. 192/05**	**SILENTROCK EP**	**ECOSILENT EP**
ZONE F from 1/1/2006 **K**	0,8000 W/m²K	thickness 60 mm 0,3941 W/m²K	thickness 60 mm 0,4176 W/m²K
ACOUSTIC INSULATION			
Soundproofing power	**DPCM 5/12/97**	**SILENTROCK EP**	**ECOSILENT EP**
R'_w	50 dB (*)	thickness 60 mm R_w=55 dB (1)	thickness 60 mm $R_w \simeq$ 56 dB (2)

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



THERMAL INSULATION			
Transmittance	**Law.dec. 192/05**	**SILENTROCK EP**	**ECOSILENT EP**
ZONE F from 1/1/2009 **K**	0,8000 W/m²K	thickness 50 mm 0,4398 W/m²K	thickness 50 mm 0,4642 W/m²K
ACOUSTIC INSULATION			
Soundproofing power	**DPCM 5/12/97**	**SILENTROCK EP**	**ECOSILENT EP**
R'_w	50 dB (*)	thickness 50 mm R_w=57 dB (1)	thickness 50 mm R_w – 57 dB (2)

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

For all the specified cases, the hygrometric verification aimed at evaluating the probability of surface and interstitial condensate in the stratigraphy of insulated walls - by virtue of the high vapour barrier merits of the ECOPOLIPIOMBO foil coupled to panels (the foil should always face the warm surface of the perimetric wall) - always produced a negative result also in the coldest climatic zone.

Conclusions

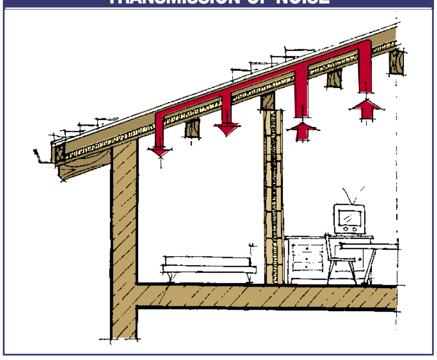
SILENTROCK EP and ECOSILENT EP panels - in the thickness values habitually used for acoustic insulation of double partition walls in brick between different property units in the same building, and for perimetric walls - have shown that they satisfy law decree No. 92 on thermal insulation, **without the need to integrate thermal insulation with different insulation panels**.

ACOUSTIC INSULATION OF ROOF AGAINST AIRBORNE NOISE

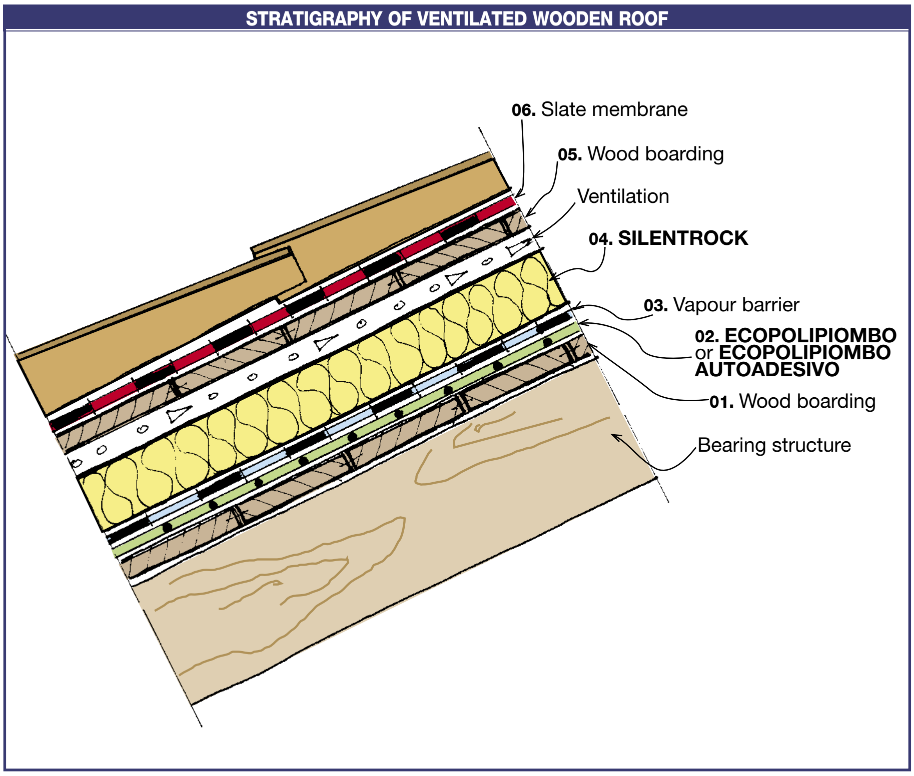
The recent legal regulations regarding passive acoustic requirements of buildings, did not impose any limits on the noise coming in from the outside through the roof, but only from the façade.
If we can take it for granted that a set of traditional covering layers in concrete or cement/clay mix is almost always sufficiently heavy to guarantee levels of $D_{w2m,nTw}$ higher than 45 dB and, in the case of terraces - as they are heavier - even of 55 dB, this is not as obvious when the roof is lighter as in the case of roofs of wood or of wood derivatives, such as OSB panels etc.
The ever increasing use of lofts as dwellings, and the wide use of ventilated wood roof for renovation work, combined with forgetful laws, can lead to the absurd situation whereby lofts that may be comfortable and thermally conform to legal regulations, but lack proper acoustic insulation.
There are essentially two acoustic problems that can affect wood 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 light weight, low cost, flexible use destinations and the aesthetic advantages of wood, make it a material particularly admired by planners and end users, on the other hand, these excellent generic requirements do not correspond to what is imposed by current laws on acoustic insulation.
The excessive lightness of the material, contrasting with the need for an adequate mass for acoustic insulation, combined with the countless irregularities in the covering surfaces, made up of the approach lines of the boards and panels, make wood roofs potentially inadequate to guarantee a good level of acoustic comfort.
Design will therefore be aimed at:
- making the covering layers as heavy as possible;
- sealing the irregularities of the boardings;
- using insulating materials of a type and thickness adequate for both thermal and acoustic requirements.

The measure to make heavier or double the first boarding bordering with the dwelling tends to satisfy the first requirement, and the use of an additional layer of ECOPOLIPIOMBO nailed to the boarding with Canadian tile nails, before the vapour barrier is laid, contributes to sealing the irregularities.
In the case of a double ventilated boarding, nailing is not necessary.
To the same end, in the case of a double ventilated boarding, laying a slate coated membrane on the second boarding, which supports the tile coat, also helps to seal the irregularities.
The choice of thermal-acoustic insulation material to satisfy both the requirements must necessarily concern fibrous insulation materials (the closed cell insulation materials normally used, in practise, provide thermal performance only), of sufficient thickness to satisfy the thermal requirements and, in any event, not less than 60 mm, and with a density of not less than 70 kg/m³, e.g. the SILENTROCK mineral wool panel.
The second problem in the case of a ventilated wooden roof concerns lateral transmission of airborne noise, which are particularly serious especially if using an unsuitable insulation panel.
The presence of a ventilation chamber, required for thermal reasons, creates a communication 'corridor' between inhabited rooms under the same roof. Moreover, when the ventilation direction of the roof runs perpendicularly with respect to the partition walls between adjoining rooms of different property, remedying the acoustic problem afterwards is particularly complicated and intrusive, because the acoustic in-filling obtained by completely filling the interspace with mineral or synthetic wool prevents it from being ventilated.

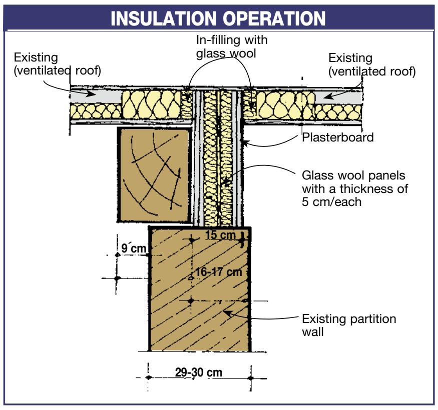
TRANSMISSION OF NOISE



STRATIGRAPHY OF VENTILATED WOODEN ROOF

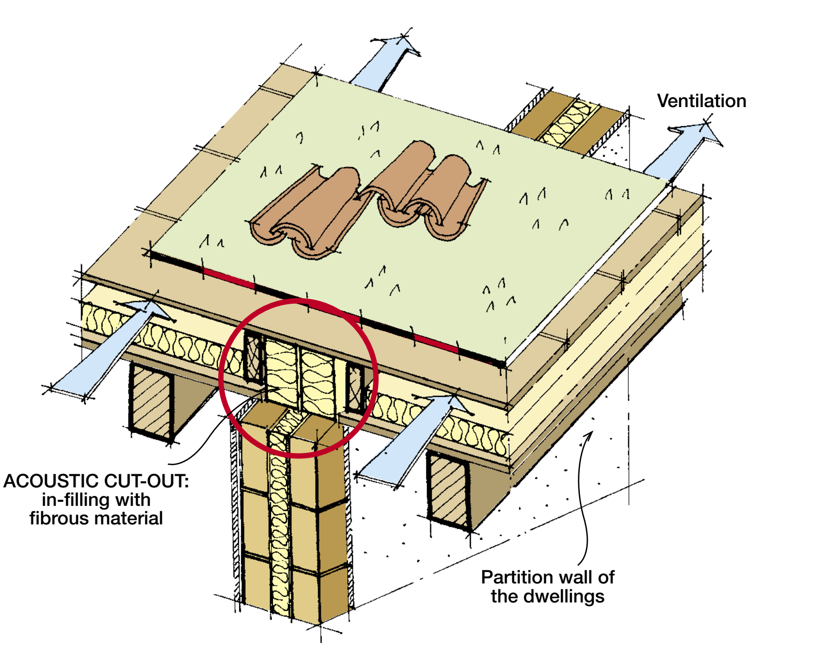


INSULATION OPERATION



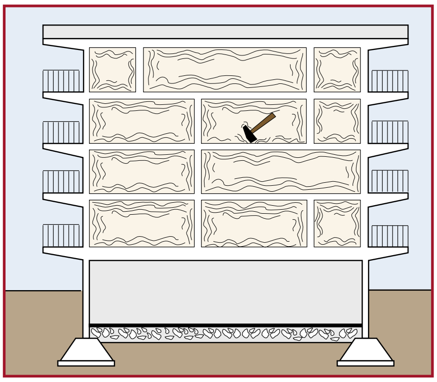
The use of fibrous insulating materials combined with preventive planning of roofs with a ventilation direction parallel to the direction of the separating walls makes it possible to intercept most of the lateral transmission of airborne noise.
In this case, the **acoustic cut-out** obtained by completely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

ACOUSTIC CUT-OUT



ACOUSTIC INSULATION OF FLOOR FROM FOOT-TRAFFIC NOISE

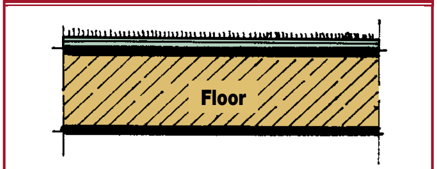
As we said in the introduction, noise generated by direct impact on the structure of the building spread very rapidly indeed throughout the building.



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 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 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:

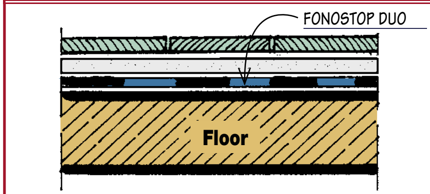
- Reduce impact energy at time of impact by inserting resilient flooring material between the blunt instrument and the floor.
  Carpets, frequency used in hotels, offers both excellent reduction of impact noise and high acoustic absorption.

FOOT-TRAFFIC NOISE SOLUTION: MOQUETTE



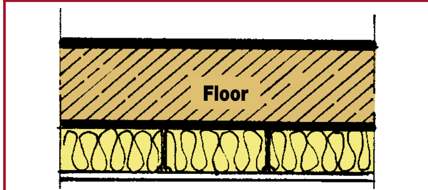
- Interrupt the continuity of the structure with soft, flexible material to stop vibrations. This is the case of the “floating floor”, which floats over flexible materials such as FONOSTOP DUO. A screed insulated from the structure is built, and can be floored with any type of material on which foot-traffic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



■ THE FLOATING FLOOR ON FONOSTOP DUO

A textile floor is not always welcome, and other types of resilient floors do not reach the degree of insulation of carpets. Furthermore, bear in mind that, in these cases, the type of floor can no longer be changed unless a floating screed is made. For a new building or total restructuring comparable to a new building, the “floating floor” is the solution offering the broadest selection range of flooring materials. It prevents transmission of vibrations to the structure and offers a natural contribution to aerial noise insulation as we mentioned in the chapters on brick walls.

ADVANTAGES OF ACOUSTIC INSULATION BY A FLOATING FLOOR

- It insulates both against foot-traffic noise and aerial noises.
- It halts the noise at its root and prevents transmission of vibrations through the whole building
- The floating screed can be floored with all types of flooring

FONOSTOP DUO

Fonostop Duo achieved an important award

ADVANTAGES OF FONOSTOP DUO

FONOSTOP DUO is a highly efficient insulation product enabling observance of the acoustic requirements specified for foot-traffic noises by Italian Decree of 05/12/97 which implemented law 447/95.
The law specifies that the level be measured on-site when the building has been constructed, and, therefore, the result depends also on the quality of installation/laying, and not only on the materials used.
Naturally, a strong secure insulating material resistant to perforations, which does not move when the screed is spread is surer to give good results.
FONOSTOP DUO is the insulation product for anti-perforation floors, which resists building site traffic.
FONOSTOP DUO consists of resistant elastic synthetic fibres which do not split and are not crushed when they are bent or compressed, as in the case of mineral fibres.
FONOSTOP DUO, although it is a thin light insulating material, unlike sheets of plastic foam material, does not move when the screed is spread. This is thanks to the ‘Velcro effect’ of the lower face which prevents it from moving, thus preventing “acoustic bridges” which could frustrate the insulating operations.


Conforms to law 447/95
Prime Minister’s Decree 5/12/97


Does not contain
harmful substances


Foot traffic and
perforation resistant


Elastic, flexible,
easy to lay


Waterproof
and soundproof


‘Velcro effect’ preventing
accidental movements

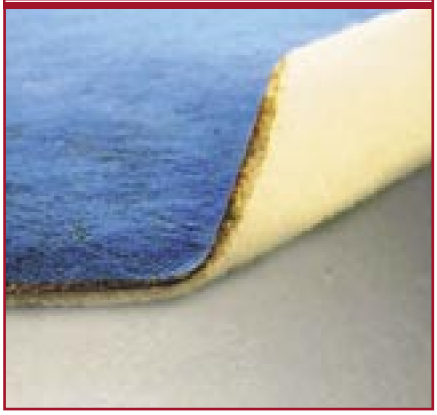
Dynamic rigidity an acoustic insulation against modular foot-traffic

Dynamic rigidity 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 rigidity 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 rigidity of a good quality insulation material must be in the range from 35 to 7MN/cu.m and acoustic attenuation is higher the lower the dynamic rigidity (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 rigidity 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 rigidity in the range from 21 to 9 MN/cu.m.
The first one, i.e. 21 MN/cu.m, is based on laying of a layer of FONOSTOP DUO, as we have already described.
If we increase the thickness of the phono-resilient material, the dynamic rigidity of the insulating layer is reduced, dropping to 11MN/cu.m and, therefore, the degree of acoustic insulation increases. Consequently, if we lay two layers of FONOSTOP DUO 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 FONOSTOP TRIO.

FONOSTOP TRIO

FONOSTOP TRIO is a foot-traffic acoustic insulation product, 12 mm thick, which, when combined with FONOSTOP DUO, makes it possible to create insulation systems with a thickness of about 19 mm. Dynamic rigidity is 9 MN/cu.m which guarantees even higher acoustic comfort levels.
FONOSTOP TRIO is a 3-layer insulation material consisting of a phono- impeding foil coupled on both faces with a non-woven fabric in phono-resilient polyester.
FONOSTOP TRIO has two opposing edges ensuring continuity of the non-woven fabric on both the sheet faces when the sheet is spread on the laying surface.
FONOSTOP TRIO is laid as the first layer of the insulation system, and then the second layer, i.e. FONOSTOP DUO is laid across the joining lines of the first layer.
With the introduction of this latter product, modular insulation solutions which satisfy any requirements are now possible, starting from the FONOSTOP DUO single-layer system.
The following table indicates the foot-traffic noise levels **L'nw** and the increase of phono-insulating power **ΔRw** for a floor of 20+4 in clay/cement weighing 237 Kg/m^2 with a 7 cm foundation lightened to a density of 800 Kg/cu.m. It starts from a level of foot-traffic noise **Lnw,eq**=77.66 dB and phono-insulating power **Rw**=48.74 dB (screed included) insulated with 5 cm (d: 2000Kg/cu.m) of floating screed on the three systems described above, which can be calculated with the simplified forecasting method specified in standard EN 12354-2.

SYSTEM A
FONOSTOP DUO



SYSTEM B
FONOSTOP DUO+FONOSTOP DUO

SYSTEM C
FONOSTOP TRIO+FONOSTOP DUO

	Sistem	Thickness	Dynamic rigidity	ΔL_w	L_{nw} Insulated floor (K=3 dB)	ΔR_w
A	FONOSTOP DUO	8 mm	21 MN/mc	28 dB	53 dB	7,63 dB
B	FONOSTOP DUO+FONOSTOP DUO	16 mm	11 MN/mc	32 dB	48 dB	10,63 dB
C	FONOSTOP TRIO+FONOSTOP DUO	19 mm	9 MN/mc	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.

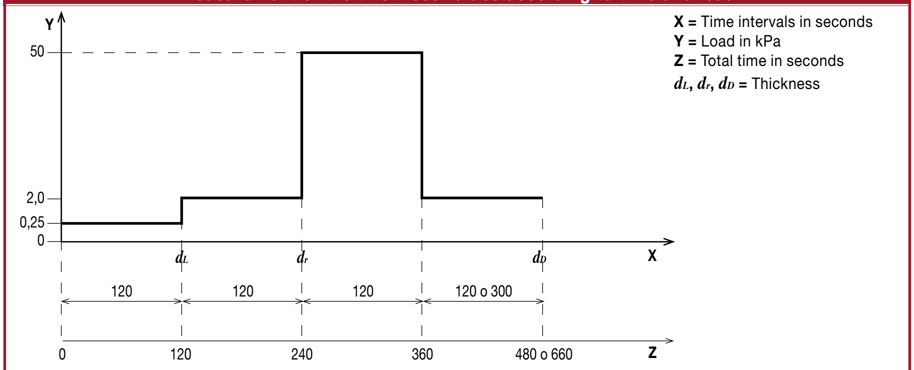
The maintenance of the acoustic performance of FONOSTOP DUO when subjected to foot-traffic on a reference floor (INDEX's internal method) was also measured. The ΔL_w was measured of a sample placed under a concrete slab of 50x70 cm at a load of 200 Kg/m².

Maintaining the acoustic performance

FONOSTOP DUO	Time	ΔLw
	• New	27 dB
	• 30 days	29 dB
	• 90 days	29 dB
	• 270 days	30 dB

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

Measurement of the thickness values according to time and load



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

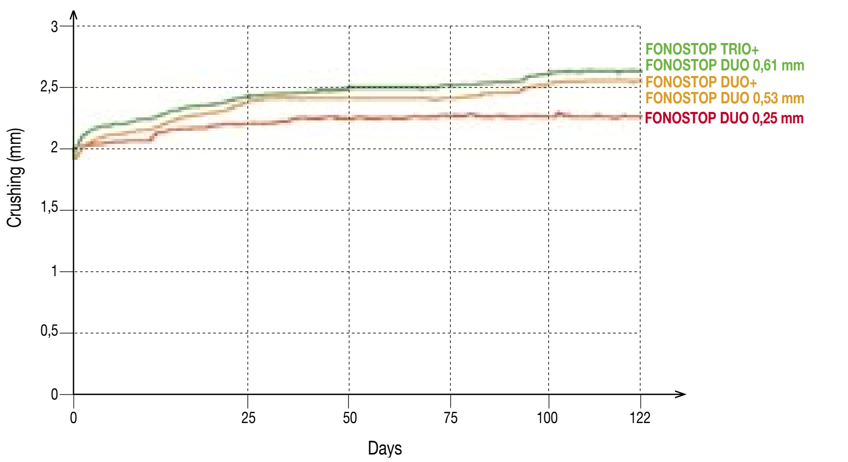
Compression capability of FONOSTOP DUO

	Compression capability	Level
FONOSTOP DUO	2 mm	CP2
FONOSTOP DUO+FONOSTOP DUO	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

	Crushing
FONOSTOP DUO	0,25 mm
FONOSTOP DUO+FONOSTOP DUO	0,53 mm
FONOSTOP DUO+FONOSTOP TRIO	0,61 mm



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 rigidity 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.
However, we must underscore the fact that Law DPCM of 05/12/1997, prescribes that noise level must be measured during application and, therefore, it is not enough to select a good insulation material and have the forecasting calculation done by an acoustics technician. To obtain a result depends on the care taken during laying.
Further below, we shall describe the application methods and the more common measures to obtain a good result. They will be summed up in the "6x3 golden rules", contained in a folder, which is also attached to the pallets of FONOSTOP DUO.

Apparently insignificant aspects of execution drastically reduce the insulation capabilities of the floating system, which should be perfectly free of any constraint which limits its possibility of oscillating on the resilient material.
The photo shows how the ceramic flooring laid on a floating floor was incorrectly connected in a rigid manner, with cement joints on the threshold of an apartment. This was repeated along the thresholds providing access to the balconies.
In the opinion of acoustics technicians with great experience of measurements on site, an error of this type on 90 cm of the access threshold reduces insulating properties by as much as 8 dB!!!

ACOUSTIC BRIDGE CAUSED BY THE LACK OF AN ELASTIC JOINT BETWEEN THRESHOLD AND FLOORING

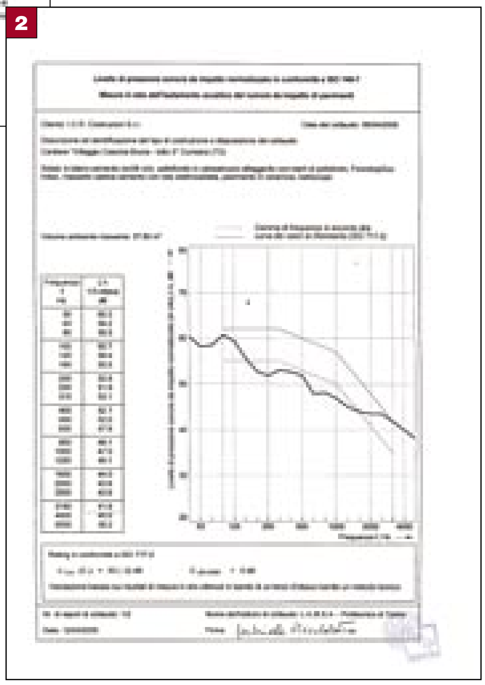
On-site measurements

For a measurement to be legally valid, the decree specifies that it must be carried out by a competent regional acoustics technician, whose name is on the regional list published by every region.
Tests carried out by a non recognised technician or by the supplier of insulating material can help guide or correct the laying of the insulation material at the construction stage, but are of no legal value either for approval by the competent authorities or in case of a dispute.
The test is generally carried out by measuring the noise level produced by the hammer machine located on the floor above the disturbed room, but it can also be carried out in a room of a different dwelling located on the same floor.
The measurement is made when all the door/window frames have been installed, observing the distances and minimum volumes specified in the UNI EN 140 p7 method, and in the inhabitants' living room.
A way for limiting the measuring problems, is to physically divide the kitchen from the living room. In practice, for most habitational solutions, bathrooms and kitchens are excluded, and living rooms and bedrooms are measured.
As can be seen in the certificate in the figure, drafted by the Turin Polytechnic following measurements taken during laying in a civil building in Cumiana (TO), insulated with a layer of FONOSTOP DUO, if the insulation is correctly applied, with attention to the details, the laying results are very close to those obtained with the estimate calculation. In this connection, compare the measurements of 52 dB and 53 dB, with the 52 dB calculated in the above table for a floor of 20+4 insulated with single-layer FONOSTOP DUO.

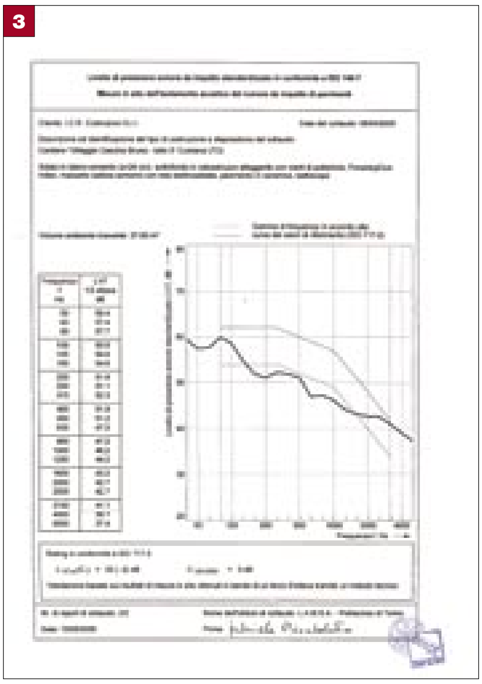
On-site measurements
Certificate issued by "Politecnico di Torino"

1

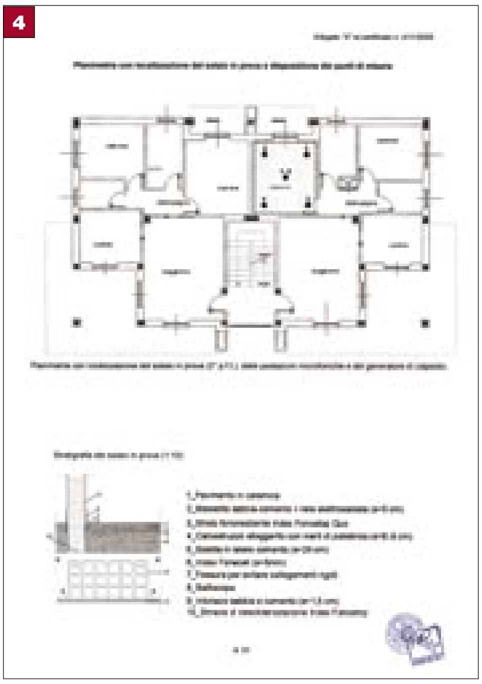
2



3



4



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 rigidity 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 rigidity of the resilient layer (**FONOSTOP DUO**) measured in conformity with European standard UNI EN 29052/1, and the area mass of the floating screed.

The dynamic rigidity of FONOSTOP DUO was certified by ICITE (now ITC-CNR) with:
- Certificate No. 3402/RP/01 for 1 layer of FONOSTOP DUO s'=21 MN/m³
- Certificate No. 3403/RP/01 for 2 layers (*) of FONOSTOP DUO s'=11 MN/m³

(*) Laid opposite each other, white face against white face.

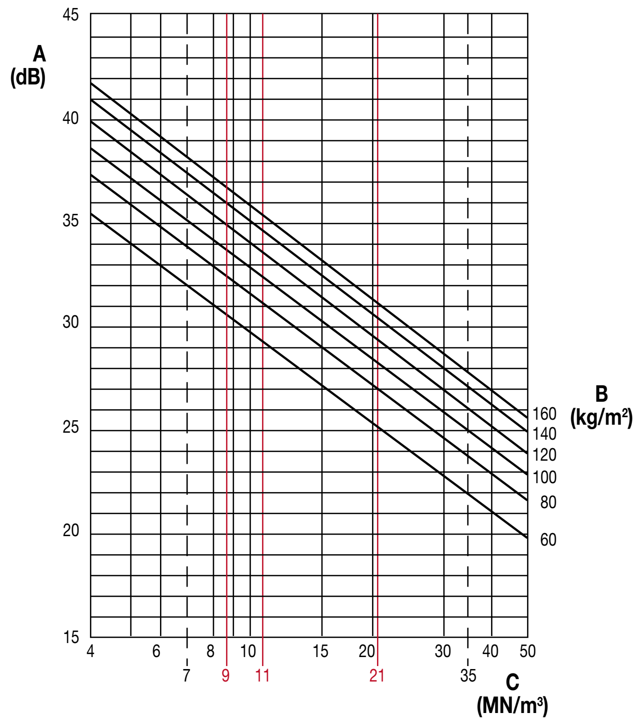
"**A**" = ΔL_w in dB
"**B**" = area mass of the floating screed in kg/m²
"**C**" = dynamic rigidity **s'** in MN/m³ of the insulation layer (UNI EN 29052/1)
s' = 21 of a single layer of FONOSTOP DUO
s' = 11 of a double layer of FONOSTOP DUO

Example. A screed of 100 kg/m² floating on a layer of FONOSTOP DUO 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



FONOSTOP TRIO+FONOSTOP DUO = 9
FONOSTOP DUO+FONOSTOP DUO = 11
FONOSTOP DUO =21

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 FONOSTOP DUO ΔL_w = 28 dB
- 2 layers of FONOSTOP DUO ΔL_w = 32 dB

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

with 1 layer of **FONOSTO DUO**: will be
$L'_{n,w}$ = 75+2-28 = 49 dB
with 2 layers of **FONOSTO DUO**: 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

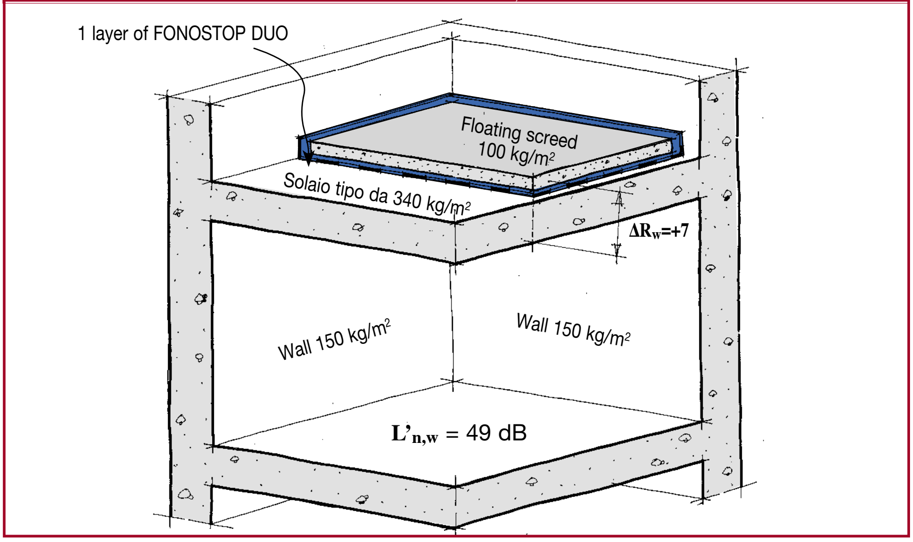
The acoustic benefit provided by insulating materials for the floating floor varies according to the type of insulated floor. The level of insulation obtainable on a cement floor, in concrete and clay-cement mix cannot be compared to that obtained in a wood floor. The latter value is much lower, and 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 FONOSTOP DUO. 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 FONOSTOP 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

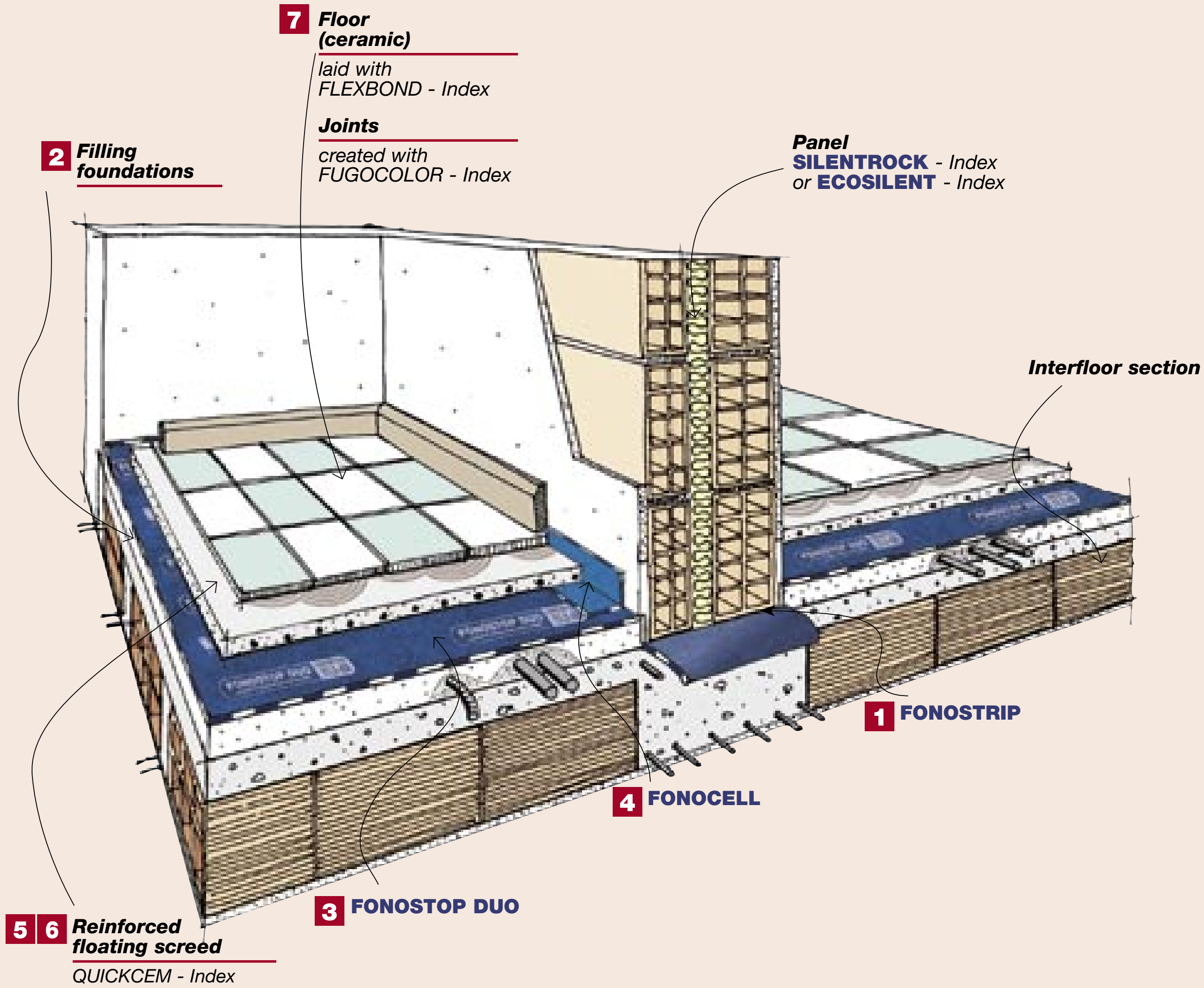
(see the boxes ringed in red in the table)

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 FONOSTOP DUO 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 **Rw** 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 FONOSTOP DUO	FONOSTOP DUO +FONOSTOP DUO	FONOSTOP TRIO +FONOSTOP DUO	1 layer of FONOSTOP DUO	FONOSTOP DUO +FONOSTOP DUO	FONOSTOP TRIO +FONOSTOP DUO	1 layer of FONOSTOP DUO	FONOSTOP DUO +FONOSTOP DUO	FONOSTOP TRIO +FONOSTOP DUO	1 layer of FONOSTOP DUO	FONOSTOP DUO +FONOSTOP DUO	FONOSTOP TRIO +FONOSTOP DUO	1 layer of FONOSTOP DUO	FONOSTOP DUO +FONOSTOP DUO	FONOSTOP TRIO +FONOSTOP DUO	1 layer of FONOSTOP DUO	FONOSTOP DUO +FONOSTOP DUO	FONOSTOP TRIO +FONOSTOP DUO
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

TECHNICAL INTERVENTION SOLUTIONS

Acoustic insulation for floors against foot-traffic noise

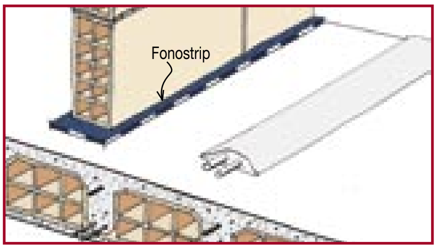


The specifications items are on page 52

LAYING METHOD

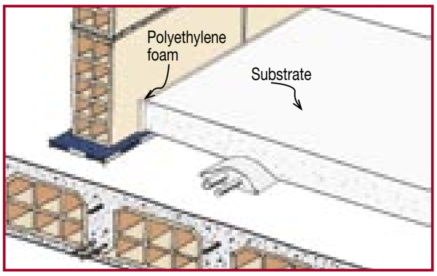
1 Laying FONOSTRIP

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.



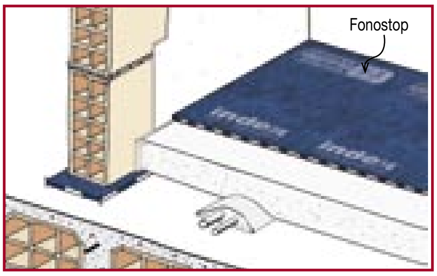
2 Filling foundations

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.



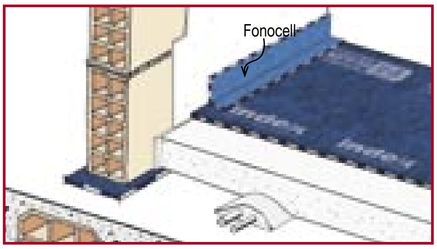
3 Laying FONOSTOP DUO

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



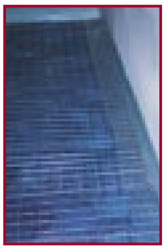
4 Laying FONOCELL

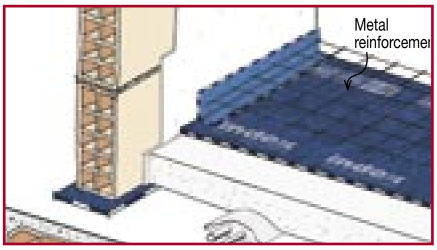
The reinforced floating screed is separated from the projecting walls is obtained by use of a self-adhesive strip in expanded polyethylene with a tab of polyethylene film at the bottom.



5 Laying the metal reinforcement

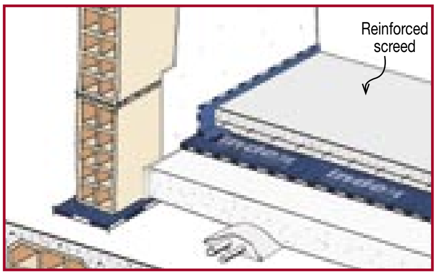
The reinforcement of the screed consists of an electro-welded galvanised metal mesh with links of about 5×5 cm.





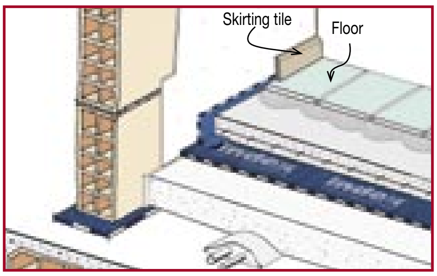
6 Laying the screed

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.



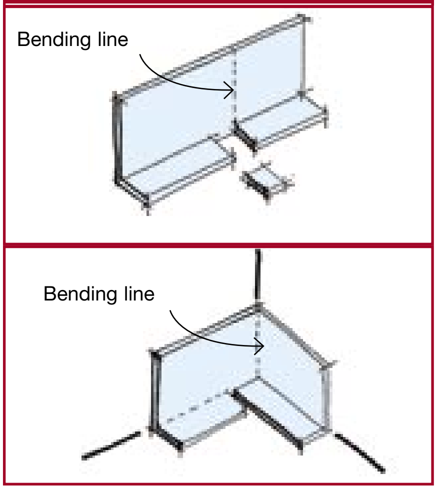
DETAILS

Laying FONOCELL

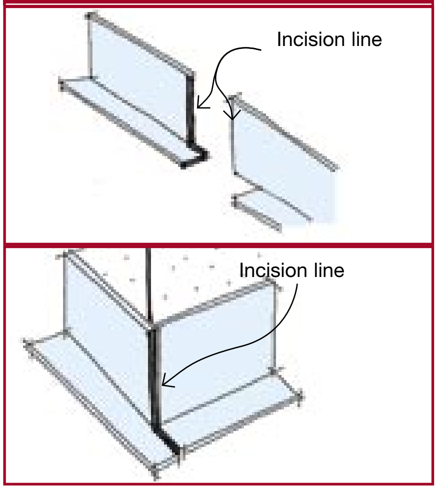
Positioning of FONOCELL. internal and external corner.

If FONOCELL is not laid in the corners so that it adheres to the walls, when the screed is spread, this can crack FONOCELL

Internal corner



External corner

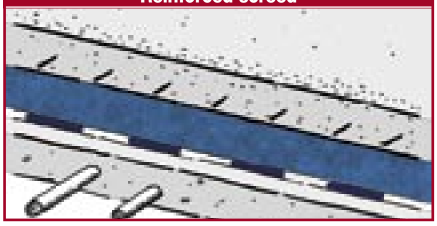


The screed

Gaps may be left between the screeds. Always provide metal reinforcement.

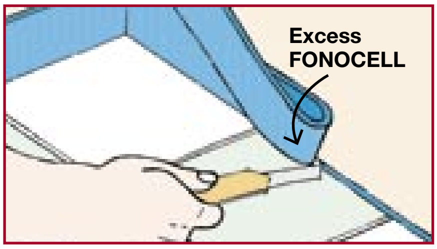
Non-reinforced screed

Reinforced screed



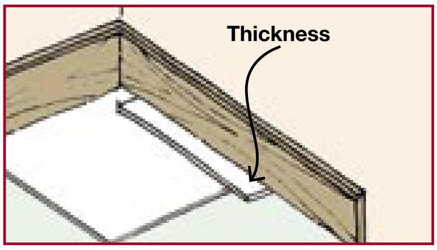
Removed excess FONOCELL

There is too much FONOCELL after the floor is laid. The surplus can easily be removed with a cutter.



Thikness under skirting tile

Contact between floor and skirting can create an acoustic bridge. Use a shim (e.g. sheets of paper) to be removed after the skirting has been fitted.



State of the screeeds

Both anhydrite and cement screeds can be used on FONOSTOP DUO. The anhydrite screed does not require any reinforcement.
Cement screed is normally packaged in a "humid" consistency (*class s1*)*, or in a "plastic" consistency (*class s2*)*.
If you are using mixes with a "semifluid" consistency (*class s3*)*, with a "fluid" consistency (*class s4*)* or with a superfluid consistency (*class s5*)*, you must first bond SIGILTAPE fabric-lined adhesive tape across the overlapping lines of FONOSTOP DUO. Use this tape to seal and connect FONOCELL at the foot of the walls, over FONOSTOP DUO and to bond the elements to each other. Also use SIGILTAPE to seal the pipes bound with FONOCELL.
This will prevent the formation of acoustic bridges due to the possible percolation of the finer parts of the mix through the overlaps of the acoustic insulation.
(*) UNI 9417 standard

Semi-fluid fluid or super-fluid slate

Humid or plastic state

Adhesive tape SIGILTAPE

DETAILS

Expansion joints

One aspect is very important for making tiled floors correctly: the control of the stresses induced by the surface expansion of floors and their coverings.

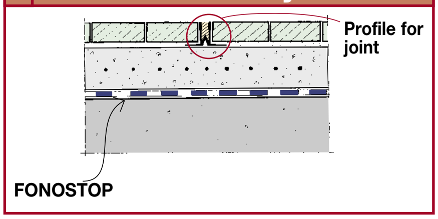
Floors and screeds must be:

- acoustically separated from the fixed elements of the building (walls, columns, door frames, etc);
- subdivided into sectors of suitably limited dimensions: about 4-6 linear metres.

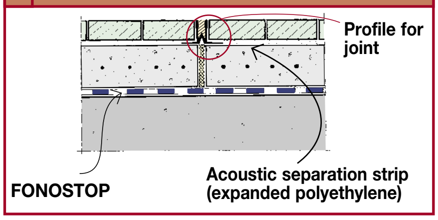
FONOCELL's vertical overlap creates the perimeter joint on walls, columns, and door frames.

In continuous floor zones, the joints normally specified refer to one of the following schemes, according to type of floor, its dimensions, and the composition of the bearing structure.

A Floor only

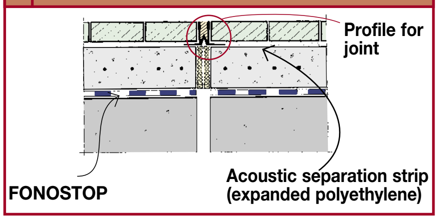


B Screed-floor



Profile for joint

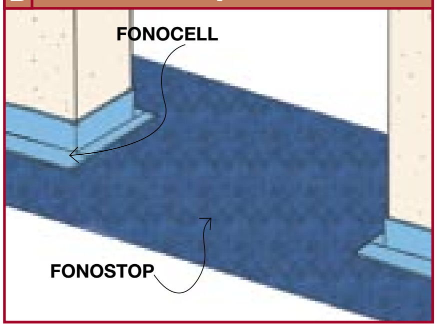
C Floor-screed-structure



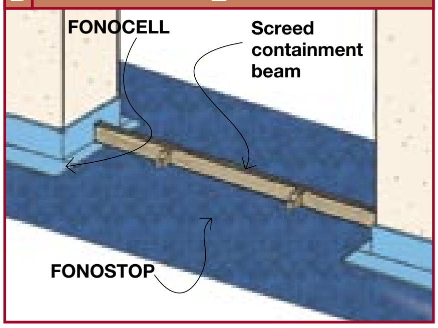
Screed-floor joint on the threshold of a door (type B)

Steps for making a floor-screed joint on the threshold of a door

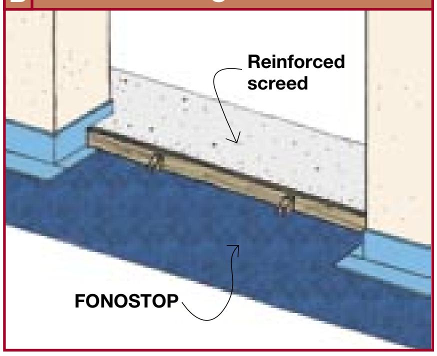
B 1



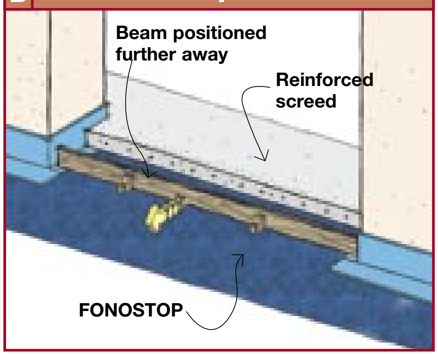
B 2



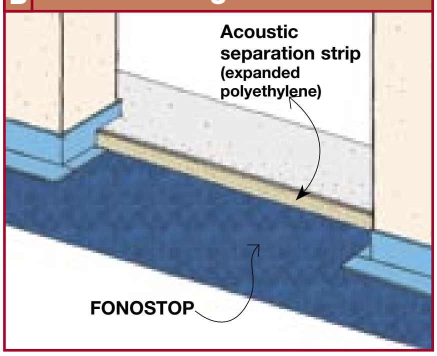
B 3



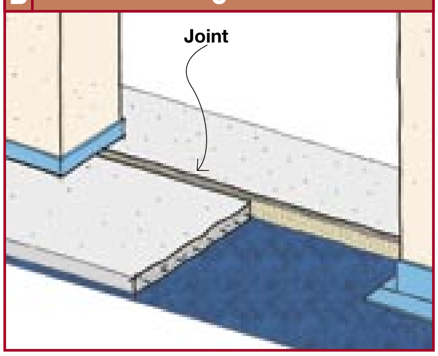
B 4



B 5



B 6



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

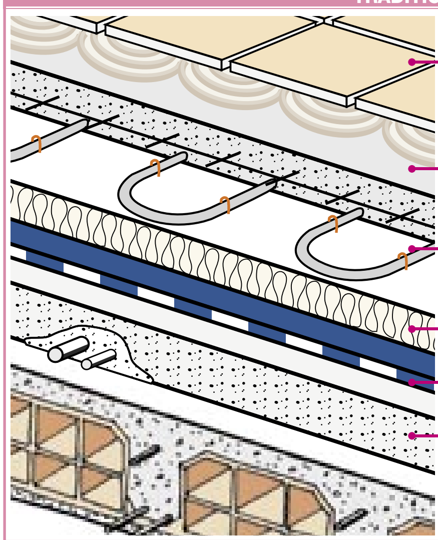
The heating of residential rooms with the "floor heating" system initially came to a stop due to the first applications in the 60s based on recirculation of water at a high temperature, without any regulations, which causes physiological damage to the occupants. However, sales were newly boosted with 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 FONOSTOP DUO integrates perfectly with floor heating technology.
FONOSTOP DUO is widely used also under thermal insulation panels in foamed material over which the heating system with a traditional floor is installed.
FONOSTOP DUO 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.
Now Index has created an innovative laying system, which makes it possible to acoustically insulate the floor even if floor heating is used. There is therefore no need to add shims to the floating system.

PIPES ON MODULAR BARS

In this system, the pipe-holder insulating panels are replaced by modular bars in plastic with compartments for the heating pipes every 5 cm.
The bars are glued extremely quickly directly on FONOSTOP DUO, using a strip of hot glue spread with an electric pistol.
After this, the heating pipes can be positioned and laying will be quicker, easier and safer, thanks to the **"Velcro effect" of FONOSTOP DUO**. When it has been laid, thanks to the fibres on its lower face, it grips the floor foundation so stubbornly that it won't move either when the pipes are installed, or when the screed is laid above.
The new system became a possibility with the advent of the new low water temperature heating technologies, which make the thermal insulation function of the insulating slabs negligible.
This system has a further advantage over the traditional system, because the pipes laid along with the bars remain raised from the laying surface, and can be fully covered by the screed mortar, enabling more efficient heat exchange.
The calculation below, as regard between-storey floors only, shows that both in the case of a heavy floor in clay/cement, and in the case of a light wooden floor, if we compare the laying of the system on plastic bars directly glued on FONOSTOP DUO, to a system which entails the use of a 1 cm thick polystyrene panel, we find that the operation of the heating system is by no means penalised.
The reduction of the energetic efficiency of the heated room amounts to a few percentage points for a floor in clay/cement, and is greater for a wood floor.
The reduction was measured at the temperature of the room below of 16°C and at a temperature of 20°C.
However, in both cases, the warmth is not lost because it is released to the volumes of the building, also using a heating system, and one can say that FONOSTOP DUO does not penalise the building's total energetic efficiency.

Modular bars in plastic are already widely used for heating industrial floors, and various types are available on the market. The thickness of the screed must guarantee uniform distribution of heat on the floor and depends on the diameter of the pipes being used.
For example, with bars that keep the pipes at a height of about 5 mm above the laying surface, the thickness of the screed on FONOSTOP DUO - using14 mm diameter pipes - should be 50 mm, and is increased to 70 mm if using 17-18 mm diameter pipes. There are very many different solutions, and the instructions of heating system manufacturers should always be followed.

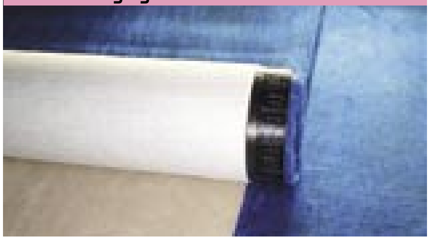
TRADITIONAL SYSTEM



SYSTEM WITH FONOSTOP DUO - INTERVENTION IN HOLLAND

The pictures show a typical example of a floor heating system installed directly over FONOSTOP DUO.
This type of application has become very widespread in Northern Europe, because it easily combines with the screed making techniques, using anhydride, already widely used in these countries.
Production times are very very short, and the preparation and laying of the anhydride screed is fully mechanised.
The anhydride screen is self-levelling and fully covers the heating pipe. It is light, does not require reinforcing, and a team of 3 workers can lay 1,500 m²/day. The average thickness value used is 50 mm.

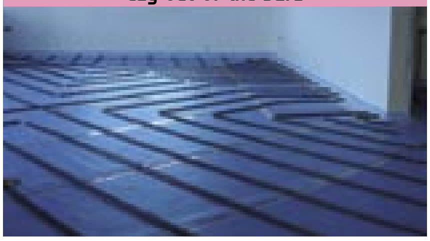
Laying of FONOSTOP DUO



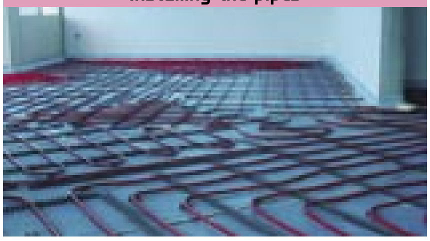
Sealing of overlaps with SIGILTAPE tape

Securing the pipe carrier bars

Lay-out of the bars

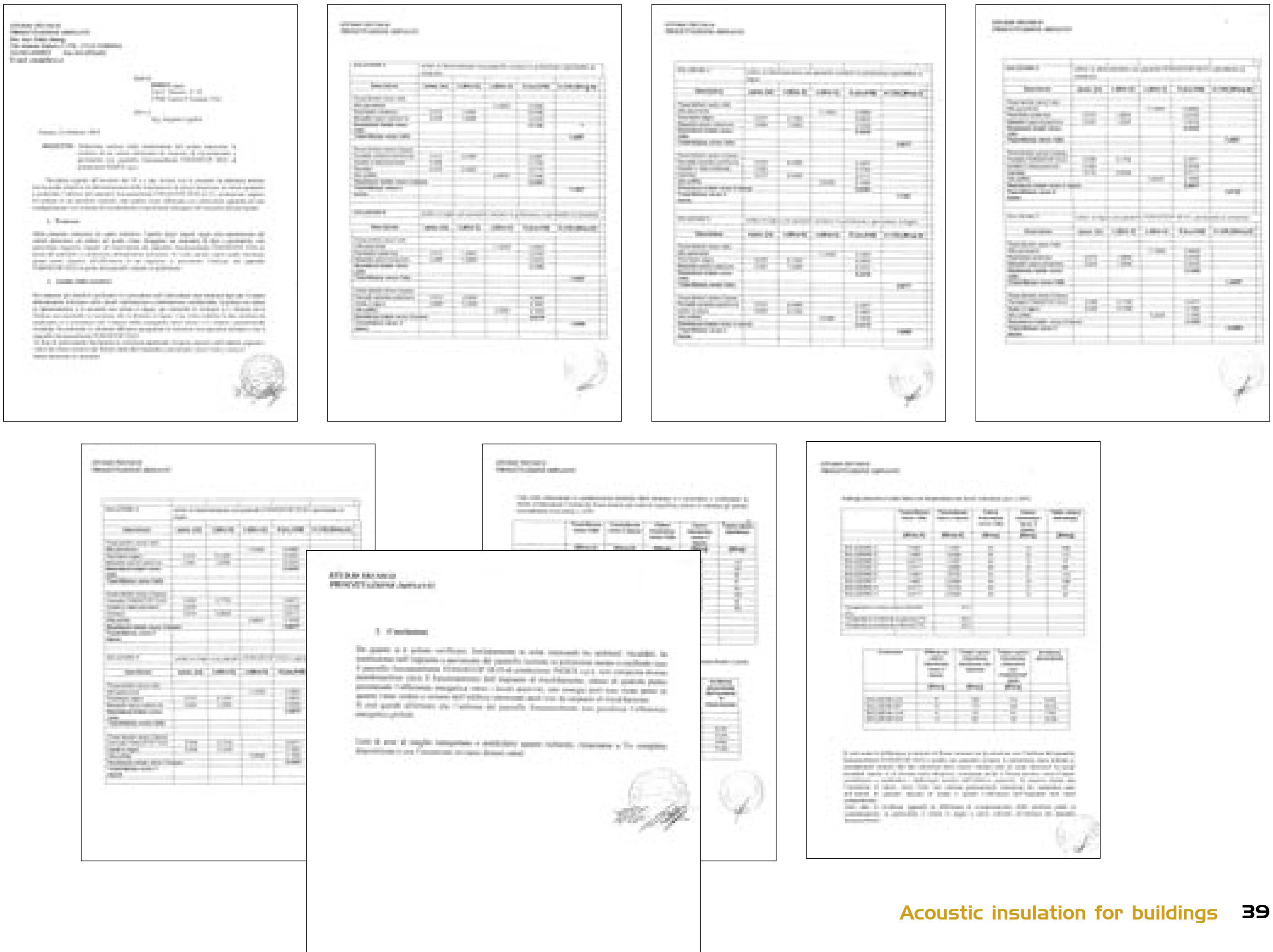


Installing the pipes

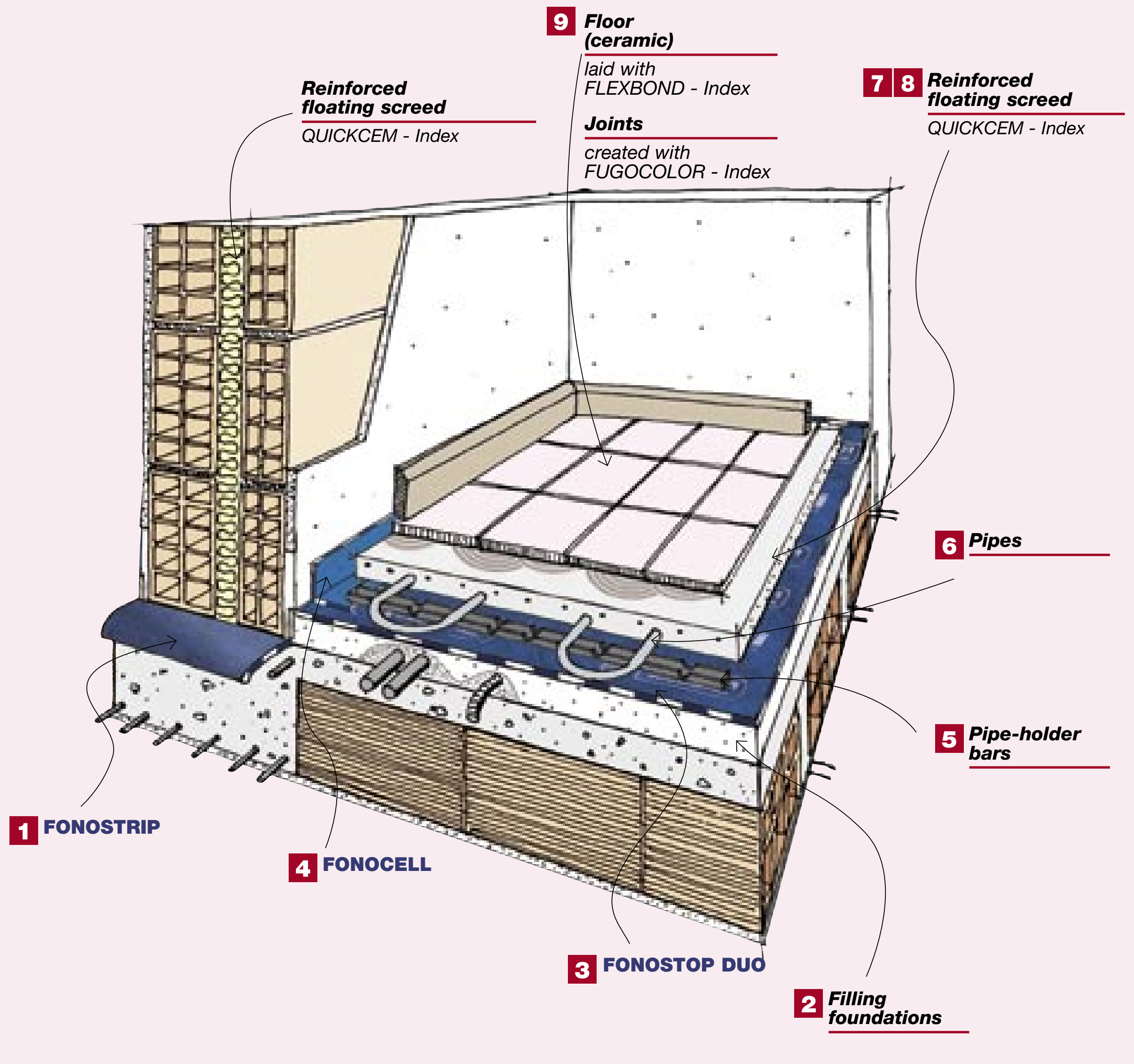


Laying of the anhydrite screed

A technical report on heat transmission through the structure of a floor heated by a floor heating system and using a fonostop duo sound-absorbing panel.



TECHNICAL INTERVENTION SOLUTIONS

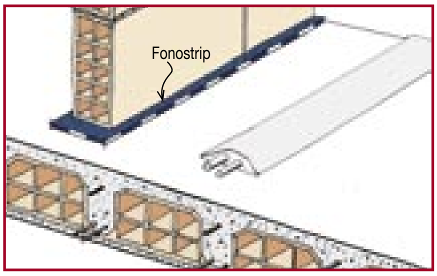


LAYING METHOD

1

Laying FONOSTRIP

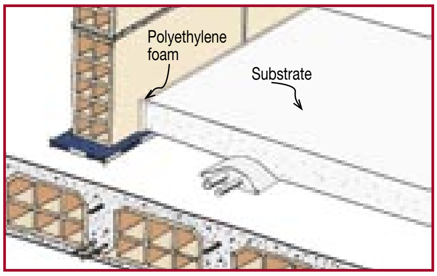
The floor which is the bearing element is generally built in clay/cement mix. The insulating strips are placed over the floor, and the partition walls will be erected over the strips. **FONOSTRIP** is an elastomer insulating material supplied in strips of different width, for dampening wall vibrations.



2

Filling foundations

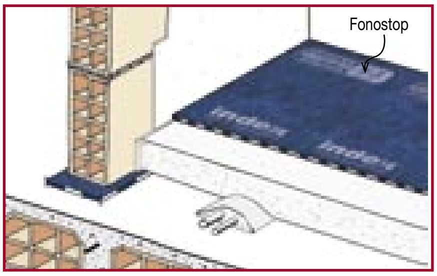
The pipes, which had been laid on the floor and connected with cement mortar, are buried in the filling foundation. Filling can be done with lightened concrete or with sand stabilised with lime or cement (50-100 Kg/m^3) and the filling should preferably be insulated from the walls with strips of expanded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



3

Laying FONOSTOP DUO

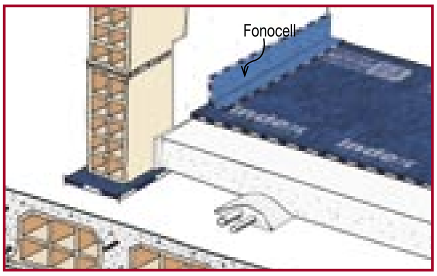
The insulation layer must support yard traffic, and must consist of durable, non-rotting materials.
FONOSTOP DUO is the acoustic insulation material against foot-traffic noise, that satisfies the above requirements. With its limited thickness, it offers high performance. **FONOSTOP DUO** is equipped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



4

Laying FONOCELL

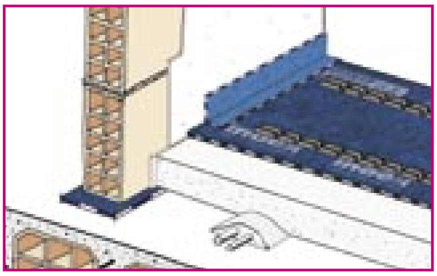
The reinforced floating screed is separated from the projecting walls is obtained by use of a self-adhesive strip in expanded polyethylene with a tab of polyethylene film at the bottom.



5

The pipe-holder bars are secured with hot glue.

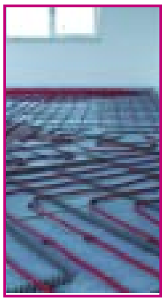
The modular bars in plastic are secured to FONOSTOP DUO with a strip of hot glue extruded by an electric pistol.

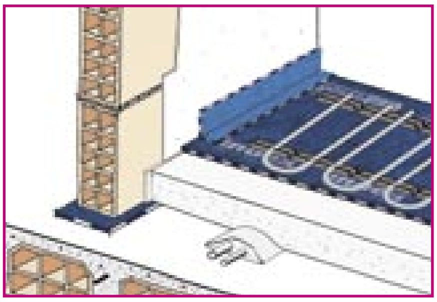


6

Installing the pipes

The pipes are installed in the seats conforming to the heating project

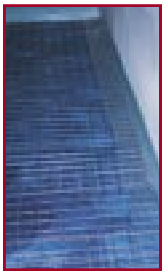


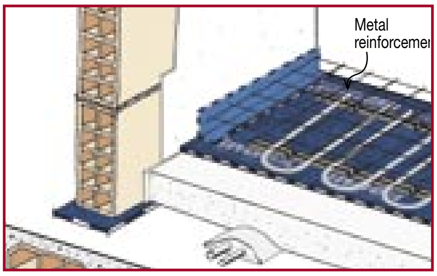


7

Laying the metal reinforcement

The reinforcement of the screed consists of an electro-welded galvanised metal mesh with links of about 5×5 cm.

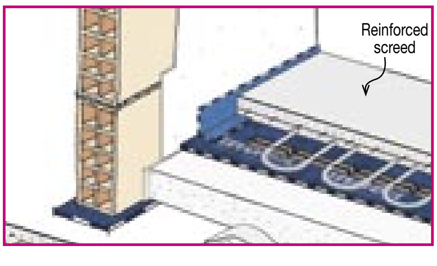




8

Laying the screed

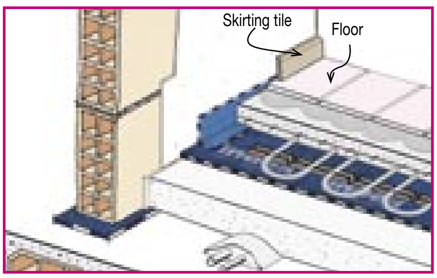
It consists of a bedding screed in reinforced concrete with a thickness of 4 cm (Quickcem - Index).
It must not have any rigid connections with the floor or walls. Even a single rigid connection can reduce the system's acoustic efficiency by half.
Therefore, there must not be any buried pipes which could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



9

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.



ACOUSTIC INSULATION OF WOOD FLOORS AGAINST FOOT-TRAFFIC

This is usually a case of old floors, which have to be restructured. They consist of a bearing structure of beams enclosed by wood boards. This type of floor is almost always too light and has both airborne and foot-traffic noise problems. Moreover, it is often not completely solid, and noise is thus able to pass also through holes, slits, and porous elements. In this case, it is of no use referring to the law of mass. We recommend, case by case, obtaining consultancy from an acoustics expert, who will be able to reconcile the different needs, since, in this case, acoustic insulation solutions often run counter to 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 obtained on cement floors, 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 in a range of frequencies where insulating materials are not very efficient. We can sum up the guidelines for wood floors as follows:

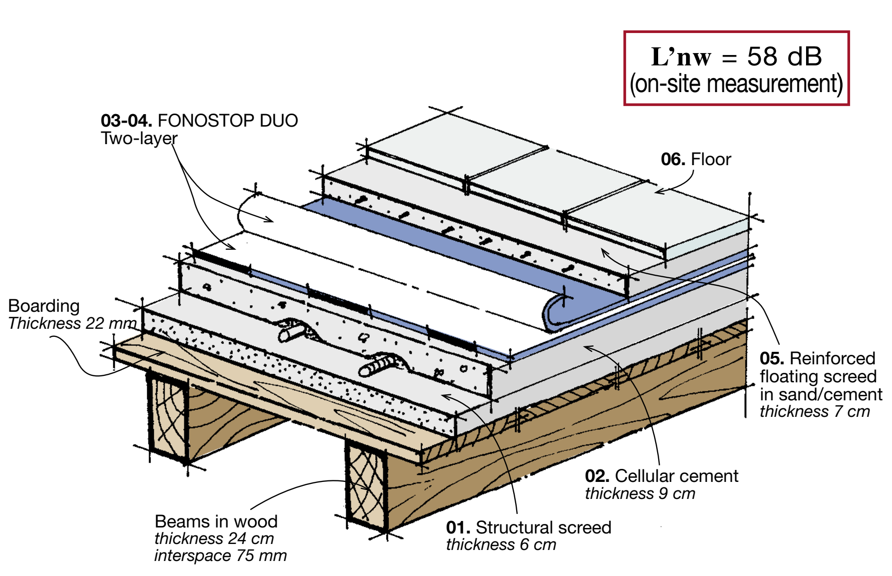
- ensuring floor air is impermeable. Materials such as ECOPOLIPIOMBO and ECOPOLIPIOMBO DUO can satisfy this need.
- increasing the floor's weight and rigidity as much as possible.

Whenever possible, construct a false ceiling. This will be a type providing better performance, with the interspace insulated with mineral or synthetic wools, such as SILENTGLASS or ECOSILENT, and with the hung enclosing element consisting of several layers of covered plaster, preferably in sandwich style with an ECOPOLIPIOMBO sound-impeding foil.

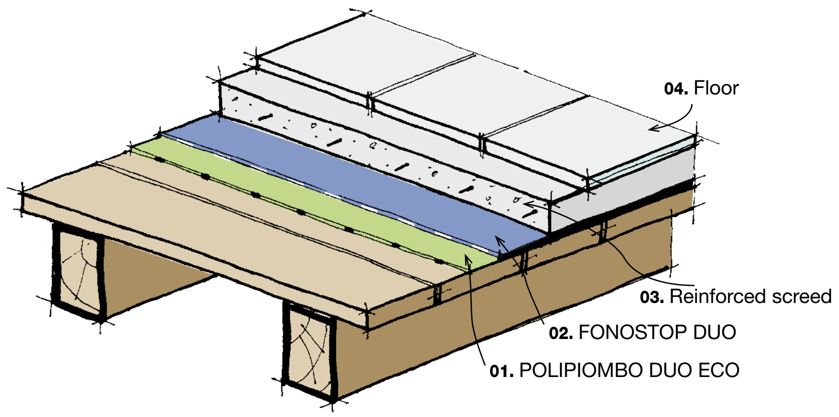
The latter type of intervention will surely also provide good insulation against aerial noise.

The illustration at the side shows a stratigraphy on a wood floor, with insulation provided by solution B: FONOSTOP DUO laid in a double layer with opposing faces. The solution was measured during laying operations and obtained L'_{nw} = 58 dB.

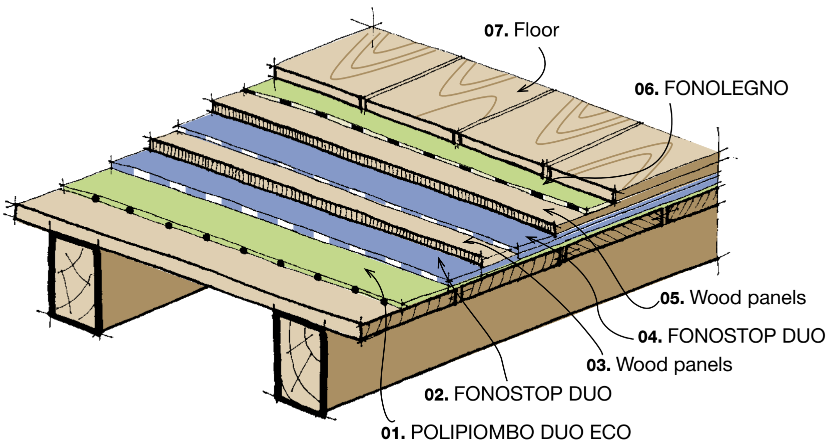
Solution certified by an on-site measurement by "Studio 360" of Rovigo



A cement layer floating on FONOSTOP DUO is a possible solution



When weight cannot be greatly increased, rigidity can be increased with large-sized wood products alternated with damping layers such as FONOSTOP DUO



On-site measurements
Certificate issued by "Studio 360" - Rovigo

1


studio 360

RAPPORTO DI PROVA N. 114/05

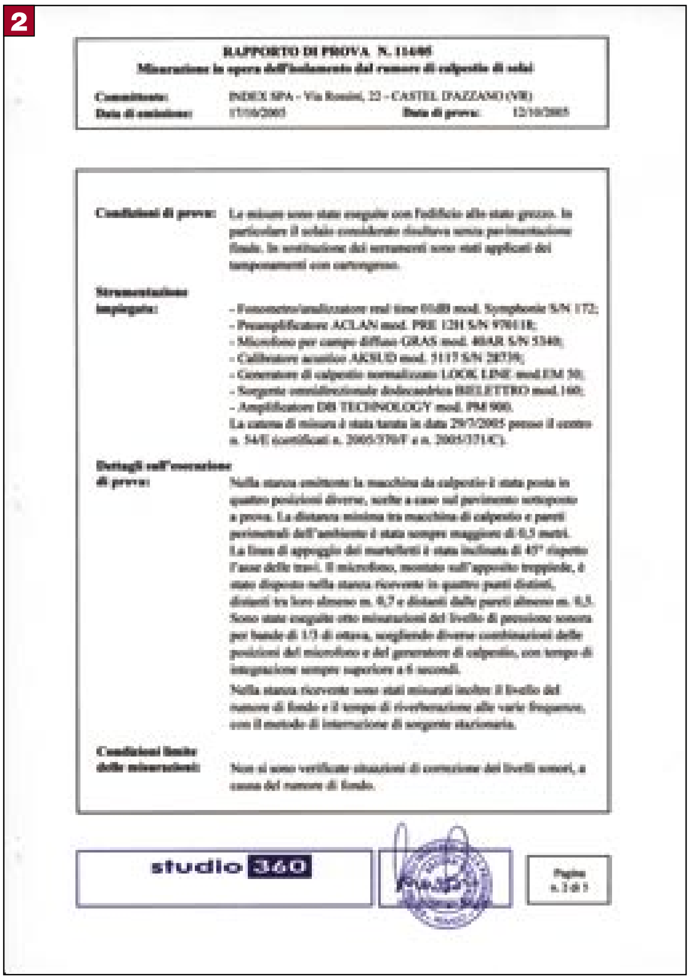
Data di emissione:	17/10/2005
Committente:	INDEX SPA Via Rossini, 22 - CASTEL D'AZZANO (VR)
Tipo di prova:	Misurazione in opera dell'isolamento dal rumore di calpestio di solai secondo la norma tecnica UNI EN ISO 140-7 (2000)
Oggetto della prova:	Solaio tra piano primo e piano terra presso Res. "Corte Cavalli" Ponti sul Mincio - MN
Identificazione della partizione:	Seconda stanza da Sud - Palazzina E
Caratteristiche costruttive:	- travetti in legno; spessore cm 24, interasse cm 75 - assito spessore mm 22 - cappa collaborante in CLS, spessore cm 5 circa - massetto alleggerito in CLS cellulare, spessore cm 9 circa - materiale resiliente - massetto in sabbia/cemento, spessore cm 7 - assenza di rivestimento finale
Strato resiliente:	Index FONOSTOP DUO in doppio strato, con posa speculare
Superficie della partizione comune:	24,8 mq
Volume dell'ambiente ricevente:	89 mc
Data di esecuzione della prova:	12/10/2005

Nota: le caratteristiche costruttive sono state dichiarate dal responsabile di cantiere

Il presente rapporto di prova è composto da n.5 pagine

Pagina n. 1 di 5

2


RAPPORTO DI PROVA N. 114/05
Misurazione in opera dell'isolamento dal rumore di calpestio di solai

Committente: INDEX SPA - Via Rossini, 22 - CASTEL D'AZZANO (VR)
Data di emissione: 17/10/2005 Data di prova: 12/10/2005

Condizioni di prova:	Le misure sono state eseguite con l'edificio allo stato grezzo. In particolare il solaio considerato risultava senza pavimentazione finale. In sostituzione dei serramenti sono stati applicati dei tamponamenti con cartongesso.
Strumentazione impiegata:	- Fonometro/analizzatore real time 01dB mod. Symphonie S/N 172; - Preamplificatore ACLAN mod. PRE 12H S/N 970118; - Microfono per campo diffuso GRAS mod. 40AR S/N 5340; - Calibratore acustico AKSUD mod. 5117 S/N 28739; - Generatore di calpestio normalizzato LOOK LINE mod.EM 50; - Sorgente omnidirezionale dodecaedrica BIELETTRO mod.160; - Amplificatore DB TECHNOLOGY mod. PM 900. La catena di misura è stata tarata in data 29/7/2005 presso il centro n. 54/E (certificati n. 2005/370/F e n. 2005/371/C).
Dettagli sull'esecuzione di prova:	Nella stanza emittente la macchina da calpestio è stata posta in quattro posizioni diverse, scelte a caso sul pavimento sottoposto a prova. La distanza minima tra macchina di calpestio e pareti perimetrali dell'ambiente è stata sempre maggiore di 0,5 metri. La linea di appoggio dei martelletti è stata inclinata di 45° rispetto l'asse delle travi. Il microfono, montato sull'apposito treppiede, è stato disposto nella stanza ricevente in quattro punti distinti, distanti tra loro almeno m. 0,7 e distanti dalle pareti almeno m. 0,5. Sono state eseguite otto misurazioni del livello di pressione sonora per bande di 1/3 di ottava, scegliendo diverse combinazioni delle posizioni del microfono e del generatore di calpestio, con tempo di integrazione sempre superiore a 6 secondi. Nella stanza ricevente sono stati misurati inoltre il livello del rumore di fondo e il tempo di riverberazione alle varie frequenze, con il metodo di interruzione di sorgente stazionaria.
Condizioni limite delle misurazioni:	Non si sono verificate situazioni di correzione dei livelli sonori, a causa del rumore di fondo.

studio 360

Pagina n. 2 di 5

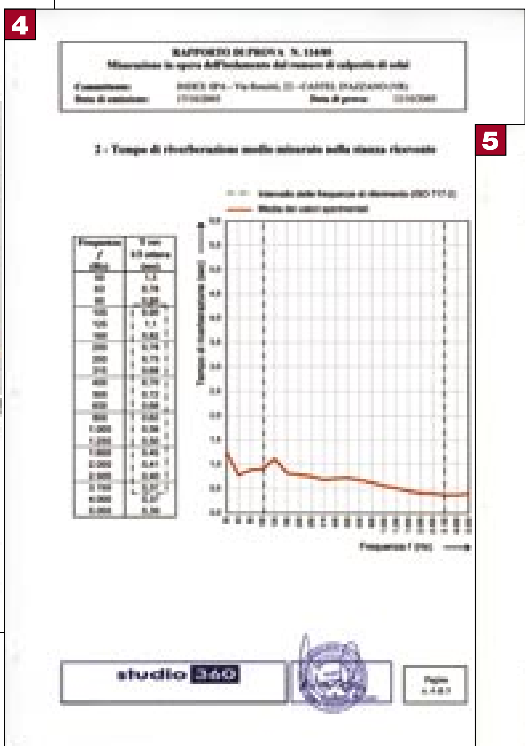
3


RAPPORTO DI PROVA N. 114/05

1 - Livello medio di pressione sonora di calpestio misurato nell'ambiente ricevente (L_i)

studio 360

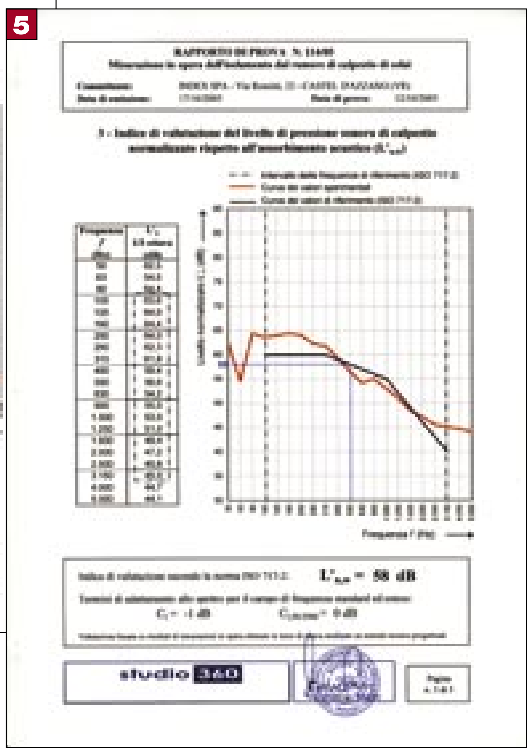
4


RAPPORTO DI PROVA N. 114/05

2 - Tempo di riverberazione medio misurato nella stanza ricevente

studio 360

5


RAPPORTO DI PROVA N. 114/05

3 - Indice di valutazione del livello di pressione sonora di calpestio normalizzato rispetto all'assorbimento acustico ($L'_{n,w}$)

$L'_{n,w}$ = 58 dB

studio 360

ACOUSTIC INSULATION OF FLOATING WOOD FLOORS AGAINST FOOT-TRAFFIC NOISE

A refurbishing remedy

This insulation system is identical to the one we examined previously, with the difference 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 newly built buildings, but it can also be very convenient in restructuring works, where it is laid directly on the old floor, thus avoiding demolition.

As it is not very thick, it can also be used in desperate cases, when no dimensions are available for the screed or, due to design and/or laying errors, the expected result has not been achieved.

FONOSTOP DUO can be used as the insulation material. However, it must be ordered in the version without the overlapping fin. Otherwise, we have designed and built a specific product - FONOLEGNO - suitable for floors in jointed wood. This product provides slightly inferior acoustic performance, but is not as thick and has lower compressibility both to avoid damaging the joining wood beams, and to avoid that unpleasant sensation of excessive yielding when walking over the floor.

FONOLEGNO consists of a 1 mm thick phono-resilient foil coupled to a 4 mm thick non-woven high-density polypropylene fabric.

The insulation material is produced in 10×1 m rolls.

FONOLEGNO has a high friction coefficient referred to cement laying floors, and is sufficiently heavy not to move during the wood floor laying operations, thus ensuring continuous, stable insulation.

FONOLEGNO resists building site traffic and has a high-density non-woven polypropylene fabric, highly resistant to crushing, which maintains its performance long-term.

FONOLEGNO has compression resistance 5 times higher than FONOSTOP DUO.

FONOLEGNO also protects the wood floor above, because the foil of the upper part of the product is impermeable and resists transit of aqueous vapour which could originate from the foundation.

The laying of the insulation material and the floor is carried out completely in dry state, and is less of a problem than laying with a cement screed.

The FONOLEGNO rolls are unwound on a smooth foundation, which should be clean and dry, without any bumps or dips.

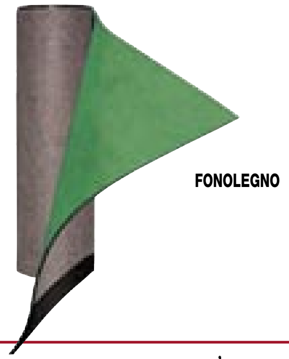
FONOLEGNO should be laid with the face covered with non-woven fabric facing the floor to be insulated, carefully bringing the sheets close to each other, but without overlapping them.

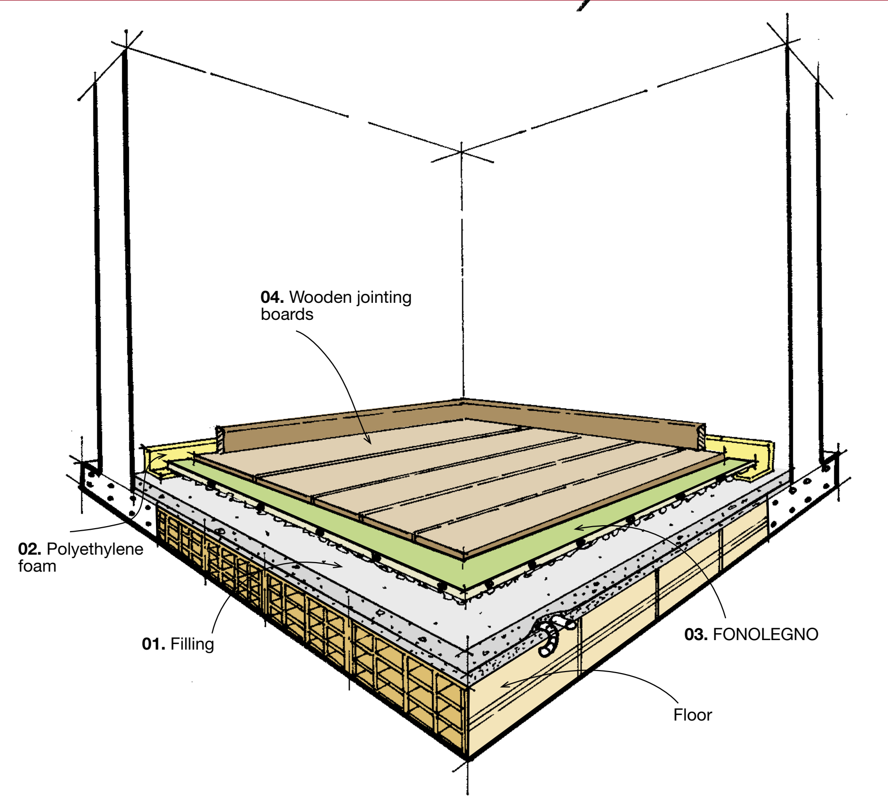
The approach lines should be sealed with adhesive tape stuck across them.

The insulation material should be stopped and trimmed at the foot of the walls and of the bodies projecting from the floor surface.

To avoid acoustic bridges when laying the floor, do not put the floor into contact with the walls. As a precaution, use a strip of self-adhesive polythene foam, and stick it perimetrically only at the foot of the walls. It will ensure that the walls are separated from the floor. The strip is trimmed off when laying is completed.

Care must also be taken when subsequently laying the skirting board. For the same reason, it must be laid slightly separated from the floor.





Comparing solution

FONOLEGNO's degree of insulation against foot traffic noise was evaluated as a first theoretical analysis by comparing it with the performance of FONOSTOP DUO 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 FONOSTOP DUO SYSTEM UNDER A FLOATING SCREED (Index's internal method on 80×40 cm samples)		
FONOSTOP DUO	FONOSTOP DUO	**FONOLEGNO**
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 FONOSTOP DUO		
CRUSHING	1 mm	2 mm
FONOSTOP DUO	0,86 KPa	2,40 KPa
FONOLEGNO	5,87 KPa	62,40 KPa

We next proceeded to obtain in-depth knowledge of on-site performance by testing three different solutions with FONOLEGNO on the same floor in cement-clay mix, and under the same conditions, so that the results could be compared with each other.
The sample floor (with no flooring) was tested under three different conditions:
- condition A: original floor;
- condition B: original floor+addition of glued FONOLEGNO;
- condition C: original floor+addition of non glued FONOLEGNO.

The stratigraphy of the floor element, the subject of the test, is described below, starting with the intrados.

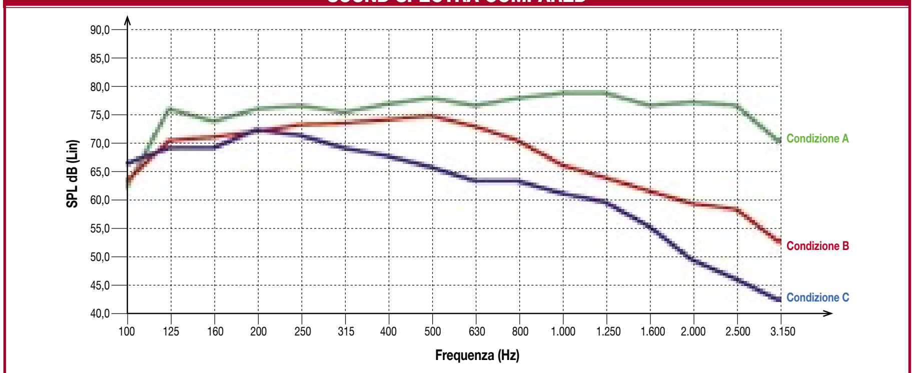
The substantial difference between condition **B** and condition **C**, with respect to condition **A** of the floor, in its original construction, is the installation of the FONOLEGNO mattress.
- in condition **B**, the FONOLEGNO material was glued to the screed and the wood floor was glued to FONOLEGNO. To sum up, FONOLEGNO is squeezed between two layers of glue which, when dried, hardens the floating system.
- in condition **C**, the FONOLEGNO material was not glued to the screed and only the wood floor was glued to FONOLEGNO. In this case, the part of the non-woven fabric which adheres to the screed was not glued and, therefore, is in the conditions to best carry out the floating action of the floor.

The results of the experimental measures are summarised in the following Table.
Following a frequency analysis of the obtained data, the improvement obtained by the insertion of FONOLEGNO can clearly be seen; from the graph - in which the frequency analysis of the sound spectrum is shown in graphic form - it can be seen that reduction of 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.

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

Description	Thickness (cm)	Experimental value (dB)
Condition A		
Gypsum based plaster	1.5	
Slab in cement/tile mix	20+4	
Light cement for levelling (polystyrene + sand)	5.0	
Sand screed and cement for finish	3.5	78.0 dB
Flooring (wood parquet glued to the screed)	1.5	
Total thickness	**about 35.5**	
Condition B		
Gypsum based plaster	1.5	
Slab in cement/tile mix	20+4	
Light cement for levelling (polystyrene + sand)	5.0	
Sand screed and cement for finish	3.5	65.0 dB
Fonolegno panel glued to the screed	0.5	
Flooring (wood parquet glued on Fonolegno)	1.5	
Total thickness	**about 36.0**	
Condition C		
Gypsum based plaster	1.5	
Slab in cement/tile mix	20+4	
Light cement for levelling (polystyrene + sand)	5.0	
Sand screed and cement for finish	3.5	59.0 dB
Fonolegno panel not glued to the screed	0.5	
Flooring (wood parquet glued on Fonolegno)	1.5	
Total thickness	**about 36.0**	

SOUND SPECTRA COMPARED



We always recommend installing FONOLEGNO without using any glues, and on floating wooden floorings laid in dry state; in the previous experiment, the flooring was glued to FONOLEGNO because the building site opted for this method; however, this second possibility is considered feasible.
If FONOLEGNO is to be laid with glue, glue thickness values strictly necessary for requirements must be applied, avoiding applying too much, in order not to impregnate and thus stiffen the textile fibres of the sheet's bottom face.

On-site measurement Certificated by 'Studio di Acustica Applicata' - Verona

ACOUSTIC INSULATION OF TERRACES AGAINST FOOT-TRAFFIC NOISE

The bearing structure of terraces usually consists of floors that are heavy enough to ensure observance of the legal limits specified for acoustic insulation against airborne noises.
The limits for insulation against foot-traffic noises are, instead, satisfied by appropriate insulating stratigraphies. 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 Perlite foam and cellulose fibres, and high density mineral fibre panels. Solution 2: by laying the terrace floor on a floating screed insulated from the waterproofing coat with FONOSTOP DUO, the same material used for the interiors, which, in many cases, can be advantageously replaced by a layer of ISOLSTRATO DUO, offering waterproofing mechanical protection.
By separating the floor layers, the floating system further increases its sound insulating power **R'w**.

ISOLSTRATO DUO

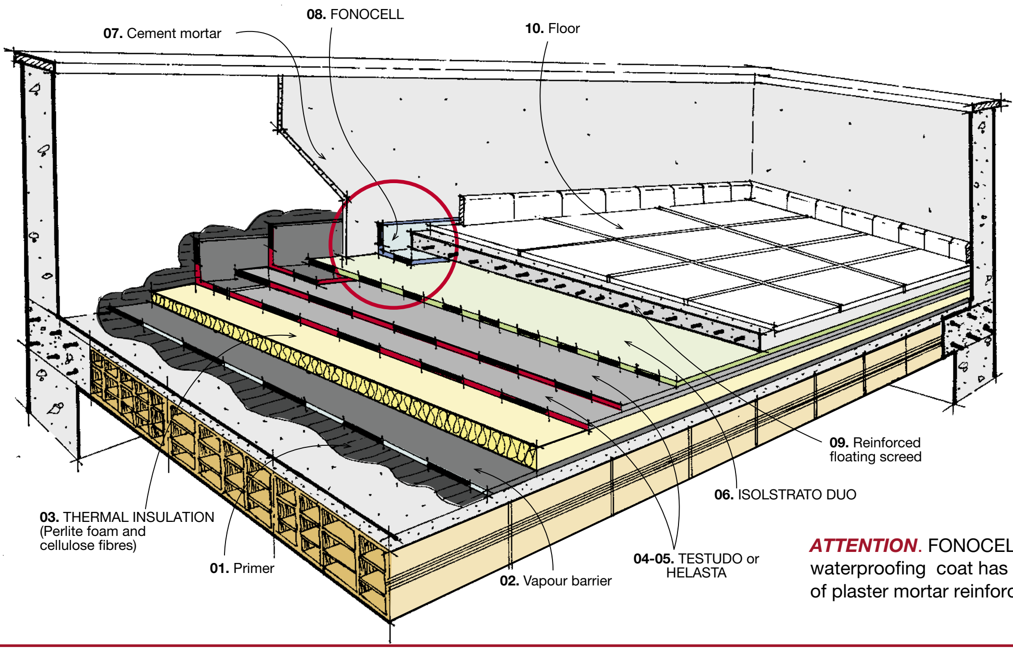
ISOLSTRATO DUO is a multi-purpose ready-to-use separation layer. It is laid to protect the waterproof coat which has to be floored. It consists of a non-woven polyester fabric, pre-coupled to a polyethylene film which projects by about 10 cm from one side.
The polyethylene film covering the top face prevents the cement grout, when poured, from assimilating the fabric's fibres, thus eliminating its insulating properties. The non-woven fabric resists perforations and is sufficiently thick to reduce friction between the screed and the waterproofing coat thus preventing transmission of cracks.
The special "elastic needling", an exclusive INDEX project for the non-woven fabric, allied to correct laying of ISOLSTRATO DUO, conforming to the "floating screed" principle, satisfies also the other important function, acoustic insulation, thus contributing to the respect of the passive acoustic requirements of buildings.
The laying methods of ISOLSTRATO DUO are the same as those used for interior floors on FONOSTOP DUO. To ensure correct acoustic behaviour of the 'floating screed', one must plan at the design stage, thorough separation of the screed from the floor, from the perimeter walls and from any body or pipe which vertically crosses the terrace, after which meticulously executing the details.
The screed, which has a minimum thickness of 4 cm, and is reinforced with an electro-welded metal net, must be free of any rigid constraint which reduces its capacity to oscillate on the insulating mattress, and, therefore, no pipes must be buried inside it.
The ISOLSTRATO DUO rolls should be unwound and laid dry on the waterproof coat, overlapping the polyethylene fin which projects from the fabric on the nearest sheet. Instead, the sheets should not be overlapped at their front end but should be accurately brought near to each other. The sheets should cover all the flat part of the terrace and are trimmed off at the foot of the vertical parts.
Both the longitudinal overlaps and the cross-wise approach lines are accurately sealed with adhesive tape SIGILTAPE spread across them.
To enable the screed to separate from the vertical parts, after the waterproof coat has been protected by a layer of mortar reinforced with a metal net, the vertical parts should be covered with FONOCELL, angular self-adhesive elements in polyethylene foam, also available in rolls. These elements descend to cover ISOLSTRATO DUO, already laid over the floor (*see drawing*). Si dovrà porre attenzione che FONOCELL venga posato solo dopo che il manto impermeabile è stato protetto da no strato di malta da intonaco armato con rete metallica. 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 ISOLSTRATO DUO is below that of FONOSTOP DUO, but it can be said in favour of the former, that it is almost always associated with thermal insulation. If this insulation is suitably selected, it can contribute to the system's acoustic insulation, and comes at a lower product price.
Below, we present a comparative test of the acoustic performance of the two materials.

Test of acoustic insulation against foot traffic of ISOLSTRATO DUO compared to the FONOSTOP DUO system under floating screed (Index* internal method on samples of 80×40 cm with a thickness of 5 cm)

Floor	L'nw = 72 dB	
Floor + Plate over FONOSTOP DUO	L'nw = 44 dB	ΔLw = 28 dB
Floor + Plate over **ISOLSTRATO DUO**	L'nw = 50 dB	ΔLw = 22 dB

Note: the results of the acoustic insulation tests carried out with the internal method are significant for comparing different materials measured in the same context, but cannot be used for forecast calculations.

Acoustic insulation of a terrace

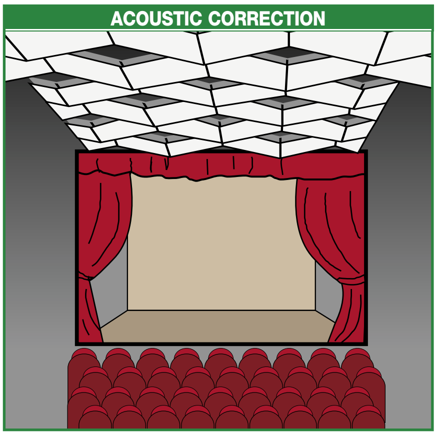


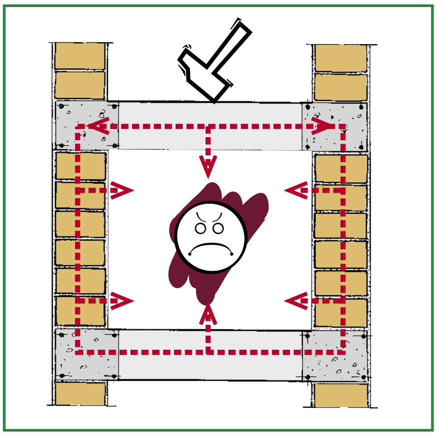
ATTENTION. FONOCELL can be laid only after the waterproofing coat has been protected by a layer of plaster mortar reinforced with metal netting.

ACOUSTIC INSULATION OF CEILINGS AGAINST AIRBORNE AND FOOT-TRAFFIC NOISE

An insulating system based on the same principle applied to lined plaster walls already used for airborne noise.
As in the case of walls, it offers insulation against both airborne noise and percussive noise, although it is not as efficient against percussive noise as the "floating floor", unless such efficiency is obtained with the negative side-effects produced by a considerable reduction in volume of the disturbed room in order to fill the resulting space with insulating material - something that is rarely possible in practice. In addition to this, one should not confuse the materials for false ceiling used to acoustically correct public halls, offices, etc, with materials used for sound insulation. The former are too light and are not solid, and, on the contrary, are often perforated. Conversely, the same action directed at walls is needed for a false-ceiling too: a false-wall must be built - horizontal in this case - completely impermeable to sound waves, and of substantial weight. The system whereby slabs of lined plaster already coupled to mineral wools are secured to the ceiling, is not as efficient as it is for walls where a prefabricated panel is only glued on, because the ceiling contains the inevitable securing screws producing a rigid link which cuts down the acoustic benefit to a mere 3÷4 dB.
As in the case of walls, the best results are obtained with lined plaster slabs fitted on a metal frame. The frame can be installed on the ceiling to minimize the lowered geometry or it can be fitted away from the ceiling, supported by suspended metal hooks - the second is the more efficient system. Suppliers of plasterboard slabs provide a complete range of hooks and metal frames.

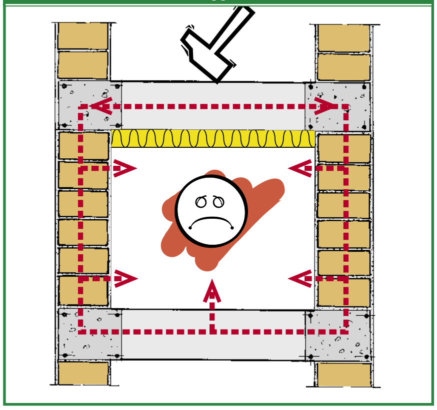
ACOUSTIC CORRECTION





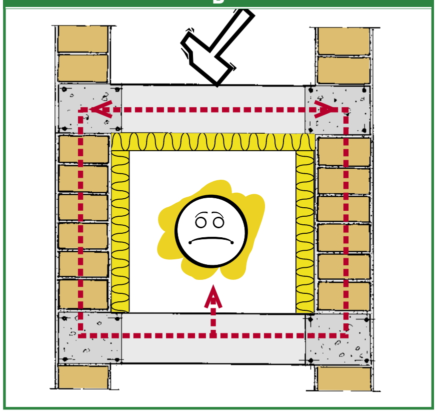
Generally (A) is a type of action suitable only for inhabited rooms in an existing building with insufficient insulation.

A

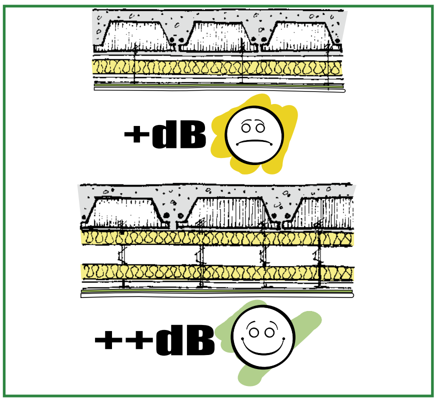


It is often combined with insulation of walls (B) lined with the same technique, otherwise lateral transmission of tread noise would be significant enough to make ceiling-only insulation an ineffective measure. As this is an invasive type of action, which reduces living space, it is use only for some rooms in the dwelling, usually bedrooms.

B

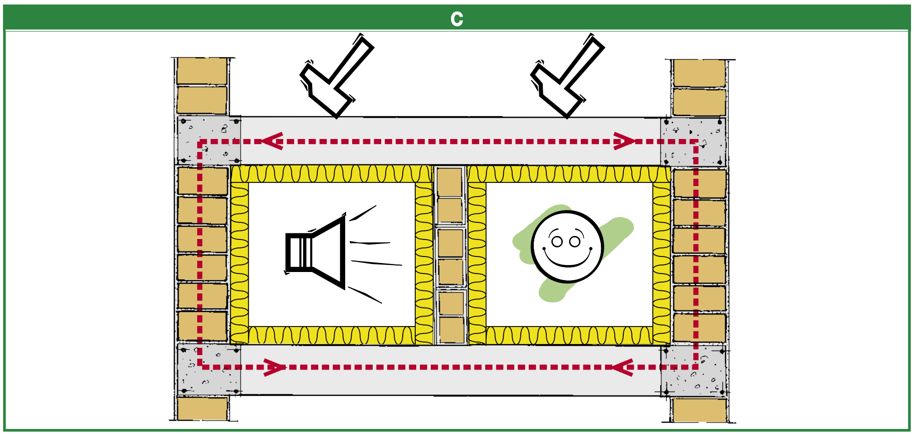


In practice, efficient action means building a room inside a room. In the most serious cases, even the floor is insulated. This type of solution is efficient also for insulating the noises produced inside the room itself. In fact, this technique is used for insulating discotheques and show venues (C).



An increase in weight of the false-wall provides acoustic benefits also for the false ceiling, and, therefore, as in the case of walls, it is important to double the plasterboard slabs of the false-ceiling. If an ECOPOLIPIOMBO foil is fitted between the two slabs, this will further improve acoustic performance. Alternatively, EP GIPS can be used - this is the slab precoupled to ECOPOLIPOMBO, which reduces laying operations, and its ease of laying is useful when laying the false-ceiling.
For a floor of about 300 kg/m² of 20+4 or 16+4 clay/cement mix, the increase in insulation ΔL_{nw} expected with the suggested systems, is about 12 dB, for the false-ceiling with adhering frame, with interspace filled with 40-45 mm of mineral or synthetic wool and double plasterboard slab of 12.5 mm each laid sandwich-wise over a 5 kg/m² foil of ECOPOLIPIOMBO or ECO POLIPIOMBO DUO. The benefit is worthwhile only if combined also with insulation of the walls, otherwise lateral transmissions frustrate the result.
Sometimes, the possible lowering of the ceiling is greater, e.g. when old buildings are being restructured. This makes it possible to insulate more efficiently, where the interspace created by lowering the ceiling by about 20 cm, as ever delimited by two plasterboard slabs including the ECOPOLIPIOMBO or ECOPOLIPIOMBO DUO foil, screwed onto the metal frame, is double-insulated with 40÷45 mm thick mineral or synthetic wool, laid over the slabs, and fastened to the ceiling. The system we have described, with a double-insulated interspace, can even insulate by about 18 dB, but must be combined with wall insulation.

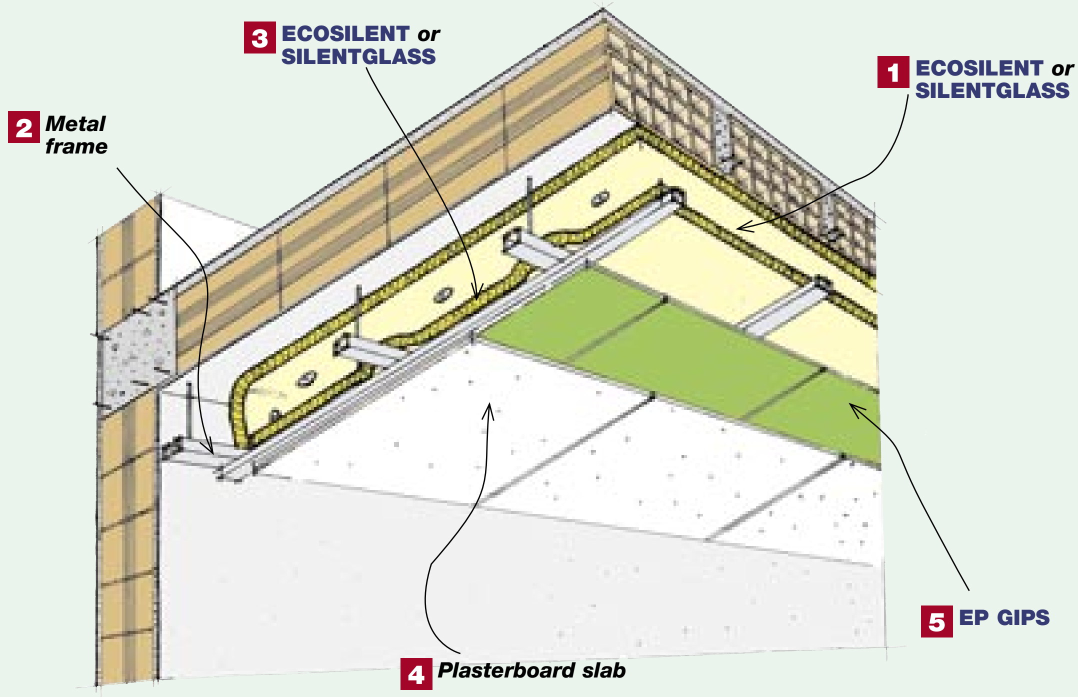
C



TECHNICAL INTERVENTION SOLUTIONS

FALSE-CEILINGS ON A SUSPENDED METAL FRAME

Acoustic insulation obtained with a false-ceiling on a suspended metal frame

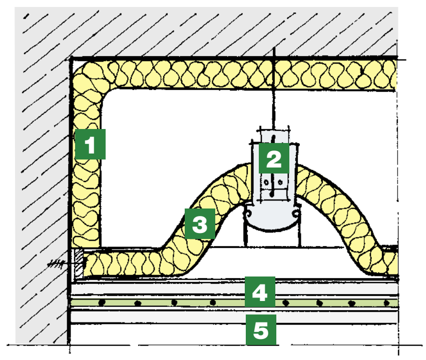


The specification items are on page 53

DETAILS

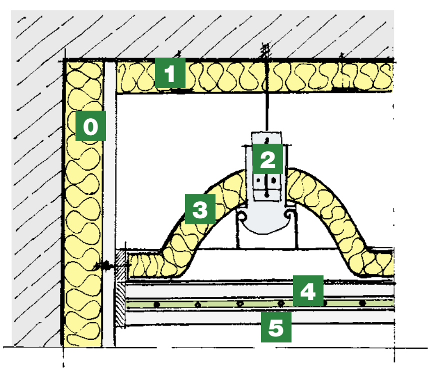
Wall joint with false-wall

1 ECOSILENT or SILENTGLASS
2 Metal frame
3 ECOSILENT or SILENTGLASS
4 EP GIPS
5 Plasterboard



Wall joint without false-wall

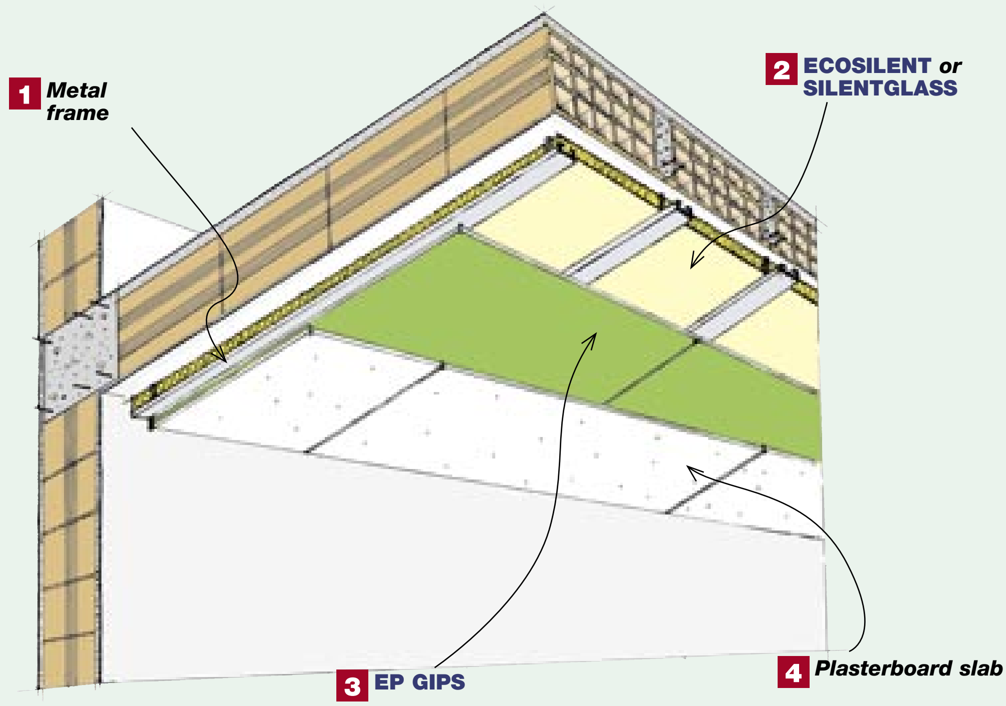
0 Wall insulation
1 ECOSILENT or SILENTGLASS
2 Metal frame
3 ECOSILENT or SILENTGLASS
4 EP GIPS
5 Plasterboard slab



TECHNICAL INTERVENTION SOLUTIONS

FALSE-CEILINGS ON AN ADHERING METAL FRAME

Acoustic insulation obtained with a false-ceiling on an adhering metal frame



The specification items are on page 53

DETAILS

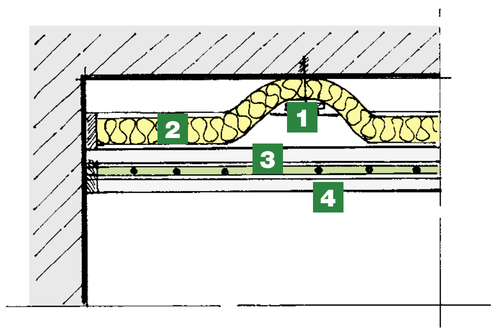
Wall joint with false-wall

1 Metal frame

2 ECOSILENT or SILENTGLASS

3 EP GIPS

4 Plasterboard slab



Wall joint without false-wall

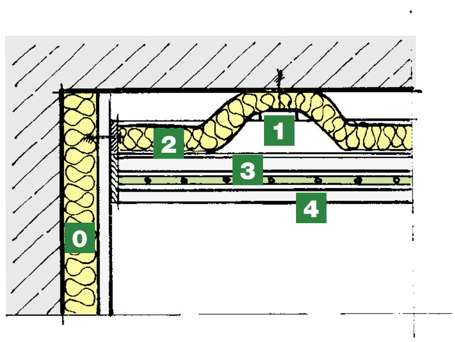
0 Wall insulation

1 Metal frame

2 ECOSILENT or SILENTGLASS

3 EP GIPS

4 Plasterboard slab



ACOUSTIC INSULATION OF WALLS IN NEWLY CONSTRUCTED BUILDINGS

New external double-walls in masonry

Acoustic insulation of external perimeter double-walls separated by an interspace with thickness of not less than 4 cm will be obtained by filling in the space between the two walls with thermal-acoustic insulation material:

- in self-supporting panels of rock wool with resistivity to air flow r=32 KPa s/m^2 and thermal conductivity λ 0.034 W/mK, type SILENTROCK with thickness s=… cm.

which will be lined with plaster insulated against sound waves and aqueous vapour made 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 and aqueous vapour diffusion coefficient μ=100,000, type **ECOPOLIPIOMBO**.

Or alternatively

- in self-supporting panels of rock wool in a polyethylene 'envelope', with one airtight and vapour-proof face consisting of a high density foil which will face inside. The **SILENTROCK EP** insulation will have resistivity to air flow r=32 KPa s/m^2 and thermal conductivity λ 0.034 W/mK, with thickness s=… cm.

The internal wall will be built over a sound dampening elastomeric strip, with a thickness of s=4 mm, and with a width greater by at least 4 cm with respect to the elevated wall, with dynamic rigidity under a load of 400 Kg/m^2 = 937 MN/m^3.

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 rigidity 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 **ECOPOLIPIOMBO**.

Or alternatively:

- with a high-density phono-resistant foil, with thickness of s=4 mm, coupled to a non-woven fabric in polyester with thickness of s=5 mm, with dynamic rigidity (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 **ECOPOLIPIOMBO DUO**, 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 self-supporting panels of rock wool, with resistivity to air flow r=32 KPa s/m^2 and thermal conductivity λ 0.034 W/mK, type SILENTROCK with thickness s=… cm.

Or alternatively:

- with thermal-acoustic insulation material in panels containing thermo-alloyed polyester fibre, glue-free and non-toxic, with apparent dynamic rigidity of over 30 MN/m^3, density of 33 Kg/m^3, and thickness of s=… cm, type ECOSILENT

Or alternatively

- in self-supporting panels of rock wool in a polyethylene 'envelope', with one airtight and vapour-proof face consisting of a high density foil which will face inside. The **SILENTROCK EP** insulation will have resistivity to air flow r=32 KPa s/m^2 and thermal conductivity λ 0.034 W/mK, with thickness s=… cm.

Or alternatively

- in self-supporting panels in a polyethylene 'envelope' consisting of non-toxic thermo-alloyed polyester fibre without any glues, with airtight and vapour-proof face, consisting of a high density foil. The **ECOSILENT EP** insulation with a thickness of s=… cm will have air flow resistivity of r=22 KPa s/m^2.

ACOUSTIC INSULATION OF WALLS IN EXISTING BUILDINGS

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, 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 **SILENTGIPS ALU**. 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 perimeter walls with glued insulation

The internal perimeter walls dividing different residential units, will be acoustically insulated by cladding them with prefabricated slabs with a thickness of s=… cm, consisting of plasterboard with thickness of s=9.5 mm coupled to fibreglass with thickness of 85 Kg/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.

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:

- with a semi-rigid fibreglass-based thermo-acoustic insulation material in rolls coupled to a film of glass with air flow resistivity r=6÷8 KPa s/m^2 and thickness of s=… cm, type **SILENTGLASS**.

Or alternatively

- with insulation material in panels containing thermo-alloyed polyester fibre, glue-free and non-toxic, with apparent dynamic rigidity of over 30 MN/m^3, density of 33 Kg/m^3 and thickness of s=… cm, type **ECOSILENT**.

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:

- 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 and aqueous vapour diffusion coefficient of μ=100,000 type **ECOPOLIPIOMBO**.

Or alternatively:

- a high-density phono-resistant foil , with thickness of s=4 mm, coupled to a non-woven fabric in polyester with thickness of s=5 mm, with dynamic rigidity (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 and aqueous vapour diffusion coefficient of μ=100,000 type **ECOPOLIPIOMBO DUO**, laid with the face covered with the non-woven fabric directed toward the external slab.

Or alternatively

Il tamponamento della controparete sarà realizzato:

- The fill-in of the false-wall will consist of a first slab in lined plaster, pre-coupled to a phono-resistant foil containing high density polymer lead and with extremely high critical frequency, with a thickness of s=15 mm, type **EP GIPS**. Next, the second slab will be laid. It is in lined plaster with a thickness of >12 mm; both will be screwed on vertical metal uprights at distances

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 FLOORS AGAINST FOOT-TRAFFIC NOISE

Insulation under floating screed

FONOSTOP DUO single-layer (method A)

Acoustic insulation of floors against foot-traffic noise will be obtained with the 'floating floor' technique over acoustic insulation material providing protection against foot-traffic noise, with a thickness not exceeding 8 mm.

This insulation consists of a 1.5 mm thick phono-resilient foil, coupled to **FONOSTOP DUO** a non-woven fabric in polyester with a thickness of 6.5 mm. This fabric has a dynamic rigidity of **s'**=21 MN/m³ with measurements conforming to standard UNI-EN 29052 part 1 and certified by ITC-CNR (formerly ICITE). The insulating material will be supplied in rolls with a height of 105 cm, including a 5 cm overlapping tab. The insulating sheets will be laid on a smooth laying surface with a 5 cm overlap between sheets. The overlaps will be sealed with an appropriate adhesive tape.

The sheet ends will not be removed but will be placed to face 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 expanded polyethylene named **FONOCELL**.

Next, a screed will be cast onto the insulating material. This screed must be reinforced with an electro-welded mesh and the specified flooring will then be laid over the screed. The excess insulating material projecting from the perimeter will be trimmed and the skirting will be laid. The skirting must be detached from the floor in order to avoid "acoustic bridges". The partition walls will be insulated from the floor by **FONOSTRIP**, a sound dampening elastomer material with a thickness of 4 mm, and at least 4 cm wider than the thickness of the walls, to be inserted between floor and wall.

For a higher degree of insulation:

FONOSTOP DUO double layer (method B)

The acoustic insulation of floors against foot-traffic noise will be obtained with the 'floating floor' technique over a foot-traffic acoustic insulation system with dynamic rigidity of **s'**=11 MN/m³ measured in conformity with standard UNI-EN 29052 part 1 and certified by ITC-CNR (formerly ICITE). It consists of a phono resilient foil, with a thickness of 1.5 mm, coupled to a non-woven polyester fabric, with a thickness of 6.5 mm, type **FONOSTOP DUO** laid in a double opposing layer. The insulation will be supplied in rolls with a height of 105 cm, including a 5 cm overlapping tab. The sheets of the first layer will be laid over a laying surface free of any roughness, making them overlap by 5 cm, with the face covered with polyester fibre facing up. The second layer, laid parallel to the first will be laid across the joining lines of the first layer, with the face covered with polyester fibre facing down, with 5 cm overlaps sealed with the appropriate adhesive tape. The sheet ends will not be made to overlap but will be placed to face each other and sealed with the same adhesive tape. The floating, reinforced screed will be separated from the in-relief walls by means of a self-adhesive strip of polyethylene foam named **FONOCELL**.

Next, pour screed on the insulation material. The screed must be reinforced with an electro-welded net. The flooring will be laid over the net. Trim any excess insulation material projecting from the perimeter. Next, lay the skirting board, which must be separated from the floor to prevent causing any 'acoustic bridges'. The partitions will be insulated from the floor by strips of a sound dampening elastomeric material named **FONOSTRIP**, with a thickness of 4 mm and at least 4 cm wider than the thickness of the walls - it will be laid in between the floor and walls.

FONOSTOP DUO + FONOSTOP TRIO (method C)

The acoustic insulation of floors against foot-traffic noise will be obtained with the 'floating floor' technique over a foot-traffic double layer acoustic insulation system with dynamic rigidity of **s'**=9 MN/m³ measured in conformity with standard UNI-EN 29052 part 1 and certified by ITC-CNR (formerly ICITE). It consists of a phono resilient foil, with a thickness of 1.5 mm, coupled on both faces to two non-woven polyester fabrics, with a thickness of 6.5 mm, type **FONOSTOP TRIO** and by a further phono-resilient foil, with a thickness of 1.5 mm, coupled to a non-woven polyester fabric with a thickness of 6.5 mm type **FONOSTOP DUO**. The first layer consisting of **FONOSTOP TRIO** will be laid on a laying surface free of any roughness and foreign bodies, making the sheets overlap for 5 cm along the two opposing selvedges arranged on the sheet. At their ends, the sheets will not be made to overlap but will only be brought near to each other. After this, the second layer will be laid. It consists of **FONOSTOP DUO** laid parallel with respect to the first layer and across its overlaps. The sheets will be made to overlap for 5 cm along the overlap tab arranged on the sheet, whereas the ends will only be accurately brought together. Finally, both the longitudinal overlaps and the transverse approach lines will be sealed with adhesive tape. The floating, reinforced screed will be separated from the in-relief walls by means of a self-adhesive strip of polyethylene foam named **FONOCELL**.

Next, pour screed on the insulation material. The screed must be reinforced with an electro-welded net. The flooring will be laid over the net. Trim any excess insulation material projecting from the perimeter. Next, lay the skirting board, which must be separated from the floor to prevent causing any 'acoustic bridges'. The partitions will be insulated from the floor by strips of a sound dampening elastomeric material named **FONOSTRIP**, with a thickness of 4 mm and at least 4 cm wider than the thickness of the walls - it will be laid in between the floor and walls.

Insulation under floating wood floors

Acoustic insulation of floating fixed wood floors will be obtained with 5 mm thick acoustic insulation against foot-traffic, type **FONOLEGNO**. It consists of a phono resilient foil coupled to a non-woven high density polypropylene fabric, with resistance to crushing at constant load of 2 Kpa for 122 days, conforming to EN 1606, of less than 0.2 mm.

The pieces of fabric will be unwound in dry state on the smooth dry foundation, with the face covered with the non-woven fabric facing the floor, carefully bringing the pieces of fabric together but without overlapping them.

The sheets will be stopped and trimmed at the foot of the walls and of the bodies emerging from the floor level, and the approach lines of the sheets will be sealed with adhesive tape. The wood flooring above will then be laid in dry state on the acoustic insulation, taking care to keep it slightly detached from the walls. Take this precaution when laying the skirting board, which must not touch the floor.

Insulation of terraces under a floating screed

The acoustic insulation of terraces against foot traffic noise will be achieved with the "floating floor" technique over 4 mm thick acoustic insulation type **ISOLSTRATO DUO**. It consists of a polyethylene film coupled to a non-woven polyester fabric with 'elastic needling', with ultimate tensile stress of L/T=550/350 N/50 mm and ultimate elongation stress of L/T=100/200%.

The fabrics will be laid on the waterproof coat, making the polyethylene 'wing' which projects from the fabric on the nearby sheet overlap, whereas the ends will only be accurately brought together. The sheets will be restrained and trimmed at the foot of the perimeter walls and of all the bodies issuing from floor level. All the overlaps and approach lines will be sealed with adhesive tape.

After creating protective elements for the vertical parts of the waterproof coat, the insulation strip in polyethylene foam named **FONOCELL** will be glued over these parts. **FONOCELL** will then come down to line the pieces of fabric of **ISOLSTRATO DUO** which had been laid on the flat part.

Next, a cement screed reinforced with an electrically welded net, with thickness of over 4 cm, will be poured on the insulation layer.

After the floor is laid, the **FONOCELL** strip will be trimmed, will project from the floor and the skirting board will be laid and must be detached from the floor.

ACOUSTIC INSULATION OF CEILINGS

Existing floor with false-ceiling 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:

- with semi-rigid fibreglass-based thermo-acoustic insulation material in rolls, coupled to a film of glass with air flow resistivity r=6÷8 KPa s/m^2, with a thickness of s =….cm, type **SILENTGLASS**.

Or alternatively:

- with insulation material in thermo-alloyed polyester fibre panels, glue-free and non-toxic, with apparent dynamic rigidity of over 30 MN/m^3, density of 33 kg/m^3, and thickness of s=… cm, type **ECOSILENT**.

The false-ceiling will be enclosed with a double layer of lined plaster slabs , and will include a damping layer screwed onto metal profiles of a frame adjoining the ceiling, but insulated from it by an adhesive seal in foamed polymer.

- The fill-in will consist of a first slab in lined plaster, pre-coupled to a phono-resistant foil containing high density polymer lead and with extremely high critical frequency, with a thickness of s=15 mm, type **EP GIPS**. Next, the second slab will be laid. It is in lined plaster with a thickness of >12 mm.

Existing floor with false-ceiling 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:

- a semi-rigid fibreglass-based thermo-acoustic insulation material in rolls, coupled to a film of glass with air flow resistivity r=6÷8 KPa s/m^2, with a thickness of s =….cm, type **SILENTGLASS**.

Or alternatively:

- an insulation material in thermo-alloyed polyester fibre panels, glue-free and non-toxic, with apparent dynamic rigidity of over 30 MN/m^3, density of 33 kg/m^3, and thickness of s=… cm, type **ECOSILENT**.

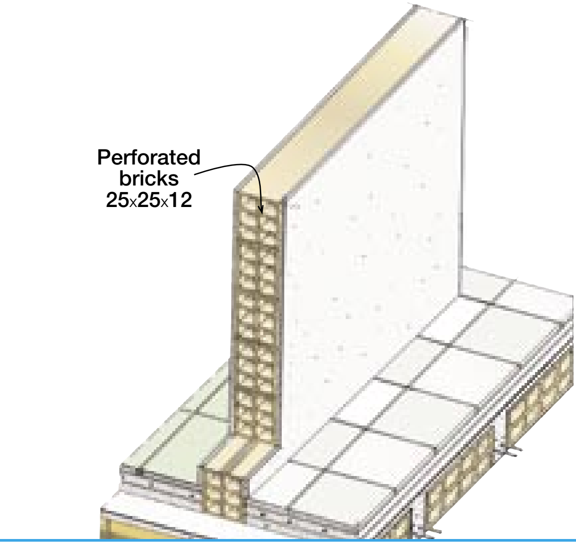
The first layer of … cm thickness will be glued or mechanically secured to the ceiling, while the second layer of … cm thickness will be laid on the lined plaster slabs which enclose the false-ceiling. The false-ceiling will be made with a double layer of lined plaster slabs, and will include a damping layer of screwed onto profiles of a metal frame hung on suspension hooks to provide acoustic insulation.

- The fill-in will consist of a first slab in lined plaster, pre-coupled to a phono-resistant foil containing high density polymer lead and with extremely high critical frequency, with a thickness of s=15 mm, type **EP GIPS**. Next, the second slab will be laid. It is in lined plaster with a thickness of >12 mm.

A joint-covering mesh type **NASTROGIPS** will be laid across the slab approach lines. It is used to strengthen the joints sealing, which will be effected with a stucco type **STUCCOJOINT**.

ACOUSTIC INSULATION OF WALLS CERTIFIED BY "IEN G. FERRARIS" - TORINO

SINGLE WALL 12



CHARACTERISTICS OF WALL

- Total thickness 15 cm
- Weight 153 kg/m²

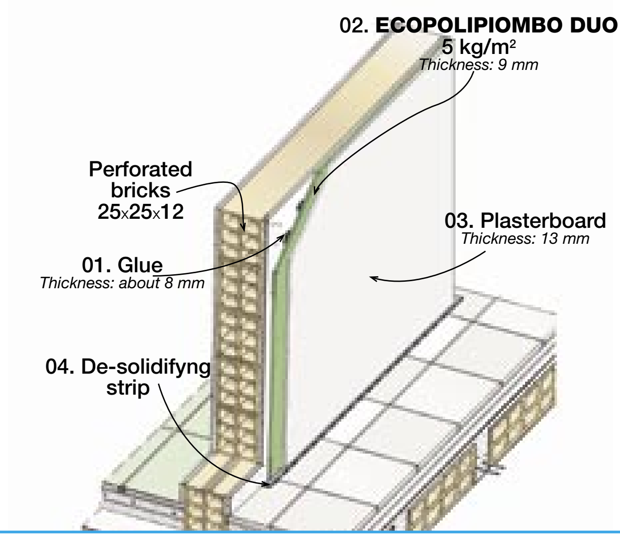
SOUNDPROOFING POWER

R_W = 44.9 dB

CERTIFICATION

"IEN G. Ferraris"
n. 35561/04

THIN FALSE-WALL IN GLUED PLASTERBOARD



CHARACTERISTICS OF WALL

- Total thickness 18 cm
- Weight 167 kg/m²

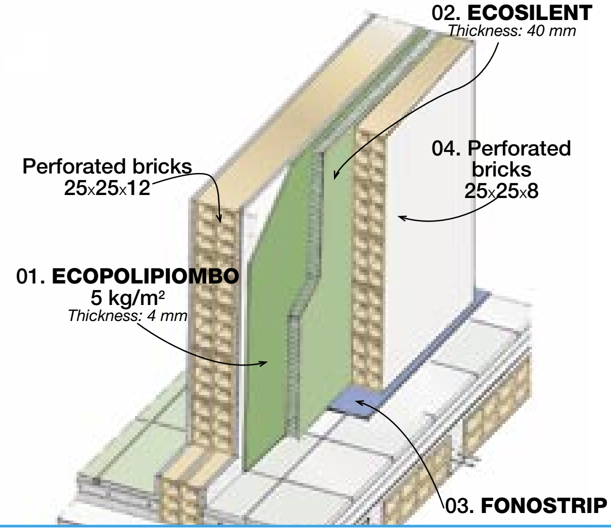
SOUNDPROOFING POWER

R_W = 51.9 dB

CERTIFICATION

"IEN G. Ferraris"
n. 35561/08

DOUBLE INSULATED WALL 12÷8



CHARACTERISTICS OF WALL

- Total thickness 29 cm
- Weight 260 kg/m²

SOUNDPROOFING POWER

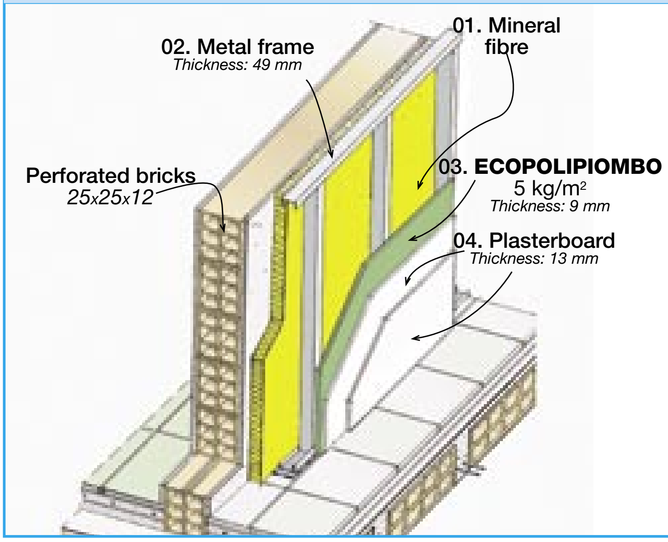
R_W = 52.3 dB

Alternatively:
ECOSILENT+ECOPOLIPIOMBO = ECOSILENT EP

CERTIFICATION

"IEN G. Ferraris"
n. 35561/09

SEPARATE FALSE-WALL IN PLASTERBOARD ON METAL FRAME



CHARACTERISTICS OF WALL

- Total thickness 26 cm
- Weight 180 kg/m²

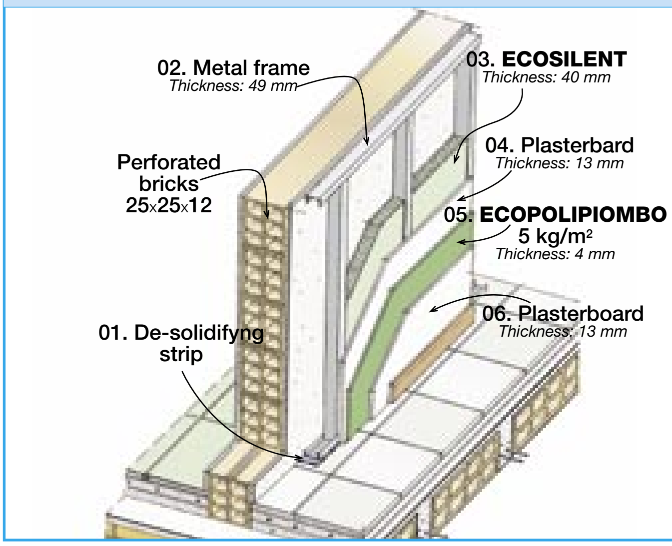
SOUNDPROOFING POWER
R_w = 61.1 dB

Alternatively:
ECOPOLIPIOMBO+Plasterboard = **EP GIPS**

CERTIFICATION

"IEN G. Ferraris"
n. 35561/05

LEAN-TO FALSE-WALL IN PLASTERBOARD ON METAL FRAME (ECOPOLIPIOMBO)



CHARACTERISTICS OF WALL

- Total thickness 23 cm
- Weight 178 kg/m²

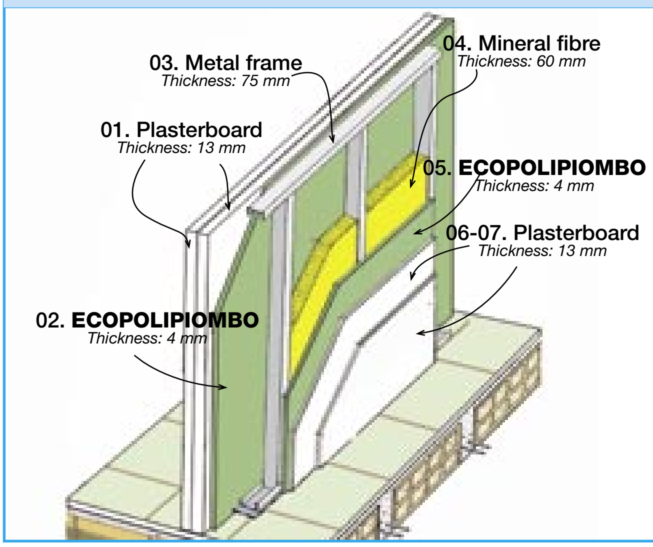
SOUNDPROOFING POWER
R_w = 61.3 dB

Alternatively:
ECOPOLIPIOMBO+Plasterboard = **EP GIPS**

CERTIFICATION

"IEN G. Ferraris"
n. 35561/07

PLASTERBOARD WALL ON METAL FRAME



CHARACTERISTICS OF WALL

- Total thickness 13,5 cm
- Weight 54 kg/m²

SOUNDPROOFING POWER
R_w = 59.2 dB

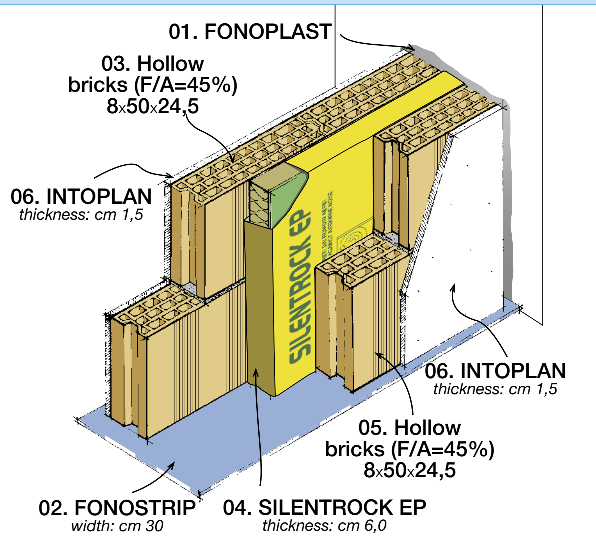
Alternatively:
ECOPOLIPIOMBO+Plasterboard = **EP GIPS**

CERTIFICATION

"IEN G. Ferraris"
n. 35561/03

INDEX MEASUREMENT
ACOUSTIC INSULATION OF WALLS CERTIFIED BY "ITC-CNR" - MILANO

DOUBLE WALL 8



CHARACTERISTICS OF WALL

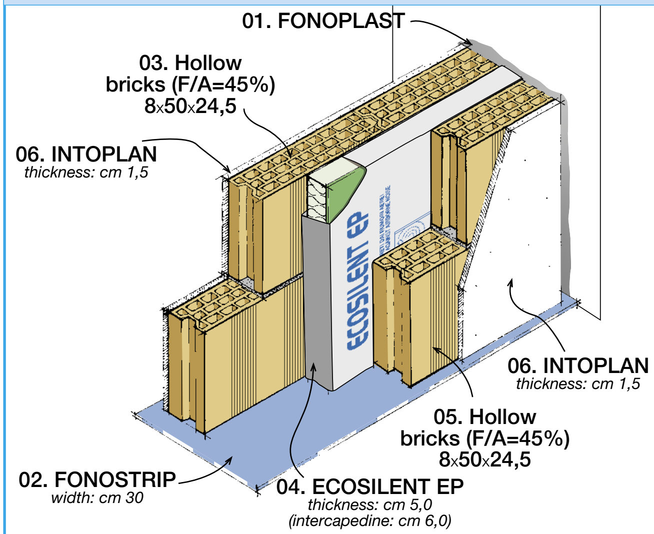
- Total thickness 25 cm
- Weight 245 kg/m²

SOUNDPROOFING POWER
R_W = 55.0 dB

CERTIFICATION

"ITC-CNR"
n. 4165RP06

DOUBLE WALL 8



CHARACTERISTICS OF WALL

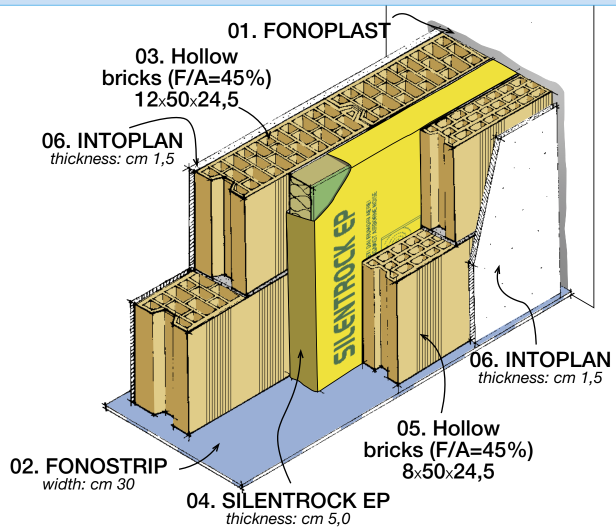
- Total thickness 25 cm
- Weight 243 kg/m²

SOUNDPROOFING POWER
R_W = 56.0 dB

CERTIFICATION

"ITC-CNR"
n. 4166RP06

DOUBLE WALL 12÷8



CHARACTERISTICS OF WALL

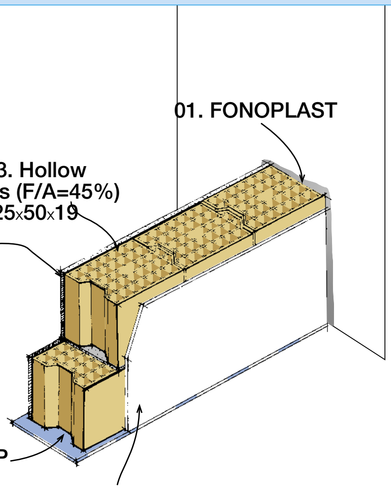
- Total thickness 28 cm
- Weight 288 kg/m²

SOUNDPROOFING POWER
R_W = 57.0 dB

CERTIFICATION

"ITC-CNR"
n. 4167RP06

SINGLE WALL 25



CHARACTERISTICS OF WALL

• Total thickness	28 cm
• Weight	202 kg/m²

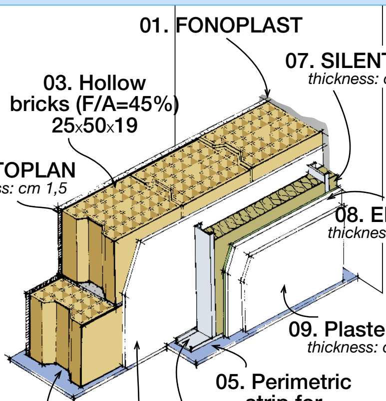
SOUNDPROOFING POWER

R_W = 53.0 dB

CERTIFICATION

"ITC-CNR"
n. 4215RP06

DETACHED FALSE-CEILING IN PLASTERBOARD ON METALLIC FRAME ON A 25 BLOCK



CHARACTERISTICS OF WALL

• Total thickness	37 cm
• Weight	228 kg/m²

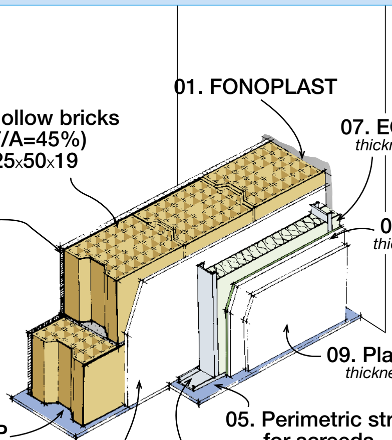
SOUNDPROOFING POWER

R_W = 69.0 dB

CERTIFICATION

"ITC-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-CNR"
n. 4214RP06

ANDIL MEASUREMENT

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 Rw 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

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

INDEX PRODUCT RANGE

FONOSTOP DUO

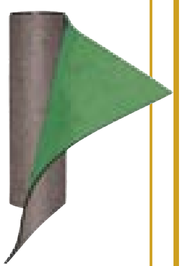
Double-layer acoustic insulation against foot traffic noise made of a phono-resistant foil, covered with a film of polypropylene fibre combined with a non woven fabric in phono-resilient polyester for acoustic insulation of floors with floating flooring

FONOSTOP TRIO

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 acoustic insulation of floors with floating flooring

FONOLEGNO

Double-layer acoustic insulation against foot traffic noise made of a phono-resilient foil, combined with a high density non woven fabric in polypropylene for acoustic insulation of jointed floating wood floors



FONOBARRIER

A multi-functional layer for acoustic insulation against foot traffic noise, separation and protection with high mechanical resistance

ISOLSTRATO DUO

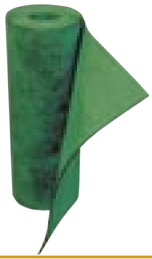
A multi-functional separation layer for acoustic insulation against foot traffic noise and for protecting waterproof coats of walkable terraces under floating screed. It is made of high density non woven elastic needling fabric coupled to a polyethylene film

ECOPOLIPIOMBO DUO

A phono-resistant foil containing high density polymer lead with ultra high critical frequency. It is used for 'acoustically-tight' plastering of interspaces of brick walls and acoustic improvement of plasterboard walls, with one face coupled to thick felt in non-woven polyester fabric and the other lined with a textile finish in polypropylene

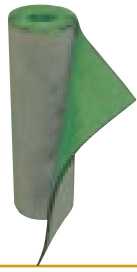
ECOPOLIPIOMBO

A phono-resistant foil containing high density polymer lead with ultra high critical frequency. It is used for 'acoustically-tight' plastering of interspaces of brick walls and acoustic improvement of plasterboard walls, with both faces lined with a finish in polypropylene fabric



ECOPOLIPIOMBO AUTOADESIVO

A phono-resistant foil containing high density polymer lead with ultra high critical frequency. It is used for 'acoustically-tight' plastering of interspaces of brick walls and acoustic improvement of plasterboard walls and for the anti-vibration lining of metal sheets with the self-adhesive face protected by a silicon film and the other lined with a textile finish in polypropylene



SILENTROCK

Self-bearing insulation panel in rock wool for thermo-acoustic insulation of interspaces of traditional double walls and of walls and false-walls on a metal frame lined with plaster.

ECOSILENT

Thermo-acoustic insulation in panels, containing thermally bound polyester fibre. Contains no glues, non-toxic. Used for filling and reducing resonance in the interspaces of double walls in brick or of false-walls and false-ceilings on a metal frame lined with plaster

SILENTROCK EP

Self-bearing insulation panel in rock wool pre-coupled to an air and vapour tight high-density phono-resistant foil; in polyethylene bag. Designed for thermo-acoustic insulation of the interspaces of traditional double walls, and of walls and false-walls on a metal frame lined with plaster

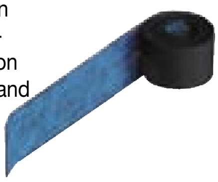
ECOSILENT EP

Self-bearing insulation panel in thermally bound non-toxic polyester fibre. Glue free, pre-coupled to an air and vapour tight high-density phono-resistant foil; in polyethylene bag. Designed for thermo-acoustic insulation of traditional double walls, and of walls and false-walls on a metal frame lined with plaster

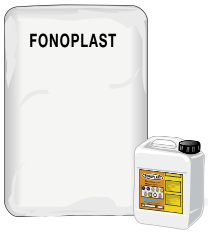
EP GIPS
A slab in lined plaster for higher grade sound proofing walls and false-ceilings. It is pre-coupled to the ECOPOLIPIOMBO phono-resistant foil containing high density, extremely high critical frequency polymer lead

SILENTGLASS
Thermo-acoustic semi-rigid insulation in rolls. Contains fibreglass and is used for filling and reducing resonance in the interspace of double false-walls in brick or in false-walls and false-ceilings in lined plaster

FONOSTRIP
A phono-damping elastomer strip lined on both sides with a film of 4 mm thick poly-propylene fibres. When laid under partition walls, it prevents transmission of impact and vibrations to the floor

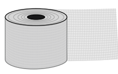


FONOPLAST
Elastic bi-component cement mortar, vibration dampening, with high adhesion, for separation of walls



GIPSCOLL
Special adhesive plaster for counter-cladding walls with SLENTGIPS slabs

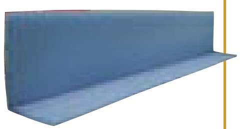
NASTROGIPS
Tape for sealing SILENTGIPS slabs



SILENTGIPS/ALU
A slab in lined plaster pre-coupled to glass wool, with vapour barrier in aluminium foil for the thermo-acoustic insulation of false-walls of external perimetric walls

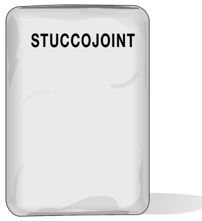
SILENTGIPS
A plasterboard slab pre-coupled to glass wool, for use on thermo-acoustic insulation false-walls of internal partitions

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

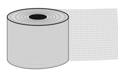


FONOCOLL
Water adhesive for glueing ECOPOLIPIOMBO on plasterboard or wood panels

STUCCOJOINT
Stucco for finishing joints between SILENTGIPS slabs



SIGILTAPE
Fabric-lined super adhesive tape for sealing overlaps and approach lines of FONOSTOP DUO, FONOCELL, ISOLSTRATO DUO, and FONOLEGNO



For further information, please consult the relevant technical data-sheets.

TECHNICAL DATA-SHEETS

TECHNICAL CHARACTERISTICS	FONOSTOP DUO	FONOSTOP TRIO
Thickness of components before coupling • Phonoresilient foil • Non-woven fabric	 1,5 mm ca. 6,5 mm ca.	 1,5 mm ca. 10,5 mm ca.
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)
Aeric mass	1,6 kg/m^2	2,2 kg/m^2
Impermeability	Waterproof	–
Aqueous vapour diffusion coefficient (phonoresilient foil)	μ 100.000	μ 100.000
Thermal conductivity coefficient λ • Phonoresilient foil • Non-woven fabric	 0,170 W/mK 0,045 W/mK	 – –
Acoustic insln.against foot-traffic noise (ISO717/82, UNI8270/7)		
ISO evaluation index at 500 Hz, bare floor (thickness: 240 mm)	I:74.0 dB	–
ISO evaluation index at 500 Hz, floor with “floating flooring”	I_i:40.5 dB	–
Improvement as a difference between the two indices (6)	ΔI_r:33.5 dB	–
Dynamic rigidity (ITC certificate conforming to UNIEN29052 p. 1st) load 200 kg/m^2 • FONOSTOP DUO single layer • FONOSTOP DUO double layer (4) • FONOSTOP TRIO+FONOSTOP DUO	Apparent dynamic rigidity: s'_t = 4 MN/m^3; s'_t = 2 MN/m^3 Dynamic rigidity: s' = 21 MN/m^3 (1); s' = 11 MN/m^3 (2)	Apparent dynamic rigidity: s'_t = 2 MN/m^3 Dynamic rigidity: s' = 9 MN/m^3 (3)
Compression tests under constant load of 200 kg/m^2 (EN 1606) • FONOSTOP DUO single layer • FONOSTOP DUO double layer (4) • FONOSTOP TRIO+FONOSTOP DUO	Reduction of thickness ≤1 mm ≤1 mm –	Reduction of thickness ≤1 mm
Compression capability (EN 12431:2000 - Determination of thickness) • FONOSTOP DUO single layer • FONOSTOP DUO double layer (4)	 ≤2 mm ≤3 mm	 – –
Fire reaction class	Class 1 (5)	–
Certifications	ITC-CNR, CSI, Istituto Giordano	ITC-CNR

(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) FONOSTOP DUO laid in double layer with opposing white faces. (5) Approval of the Ministry of Interior No. VR2172B41C100002.
(6) Certificate CSI n. ME06/060/98.
WARNING: only the dynamic rigidity values **s'**, ringed in red, are values useful for an estimate calculation conforming to standard EN 12354-2.

TECHNICAL CHARACTERISTICS	ISOLSTRATO DUO
Total thickness	4,0 mm ca.
Aeric mass	0,25 kg/m^2
Roll size	1,20×50 m
Width of polyethylene sheet	130 cm
Width of non-woven fabric	120 cm
Resistance to tensile stress • ultimate tensile stress L/T • ultimate elongation L/T	 550/350 N/50 mm 100/200%

TECHNICAL CHARACTERISTICS

	FONOLEGNO
Aeric mass	**2,0 kg/m²**
Roll size	1,00×10 m
Total thickness	5,0 mm ca.
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 λ • phonoresilient foil • non-woven fabric	 0,170 W/m°K 0,045 W/m°K
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

TECHNICAL CHARACTERISTICS

	ECOPOLIPIOMBO DUO	ECOPOLIPIOMBO		ECOPOLIPIOMBO AUTOADESIVO
Aeric mass	**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/Kg	1,70 KJ/Kg	1,70 KJ/Kg	1,70 KJ/Kg
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 of polymer lead compound (thickness 10 mm, dens. 1.250 kg/m³)	>85.000 Hz	>85.000 Hz	>85.000 Hz	>85.000 Hz
Dynamic rigidity (UNI EN 29052/1)	s' = 21 MN/m³	–	–	–
Phono-insulating power	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) Certificate Istituto Giordano n. 171105/RF3601. Approval of the Ministry of Interior No. VR2172B10D100003.
(2) Certificate Istituto Giordano n. 171105/RF3602. Approval of the Ministry of Interior No. VR2172B10D100003.

TECHNICAL CHARACTERISTICS

	SILENTROCK		
Total thickness	**40 mm**	**50 mm**	**60 mm**
Panel size	0,60×1,20 m	0,60×1,20 m	0,60×1,20 m
Density	70 kg/m²	70 kg/m²	70 kg/m²
Resistivity to air flow **r**	32 KPa s/m²	32 KPa s/m²	32 KPa s/m²
Specific heat	0,837 KJ/kg K	0,837 KJ/kg K	0,837 KJ/kg K
Thermal conductivity coefficient λ	0,034 W/mK	0,034 W/mK	0,034 W/mK
Thermal resistance	1,15 mq K/W	1,45 mq K/W	1,75 mq K/W
Fire reaction class	Euroclass 1	Euroclass 1	Euroclass 1
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-CNR		

TECHNICAL CHARACTERISTICS

	ECOSILENT
Total thickness	**40 mm**
Panel size	0,60×1,20 m
Density	33 kg/m²
Fibre diameter	17,9÷28 μm
Apparent dynamic rigidity	$s'_t \leq 30$ MN/m³
Specific heat	0,240 KJ/kg K
Use temperature range	–40°C ÷ +110°C
Thermal conductivity λ	0,0363 K/W
Lower heat value	21.600 KJ/Kg
Fire reaction class	Class 1 (does not drip)
Certifications	icn

TECHNICAL CHARACTERISTICS

	SILENTROCK EP		
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
Rock wook density	70 kg/m²	70 kg/m²	70 kg/m²
Aeric mass soundproofing foil	5 kg/m²	5 kg/m²	5 kg/m²
Resistivity to air flow **r**	32 KPa s/m²	32 KPa s/m²	32 KPa s/m²
Specific heat • rook wool • soundproofing foil	 0,837 KJ/kg K 1,700 KJ/kg K	 0,837 KJ/kg K 1,700 KJ/kg K	 0,837 KJ/kg K 1,700 KJ/kg K
Aqueous vapour diffusion coefficient (phono-resilient foil)	μ 100.000	μ 100.000	μ 100.000
Thermal conductivity coefficient λ • rook wool • phono-resilient foil	 0,034 W/mK 0,170 W/mK	 0,034 W/mK 0,170 W/mK	 0,034 W/mK 0,170 W/mK
Thermal resistance	1,15 mq K/W	1,45 mq K/W	1,75 mq K/W
Fire reaction class	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	ITC-CNR		

TECHNICAL CHARACTERISTICS

	ECOSILENT EP	
Total thickness	**40 mm**	**50 mm**
Panel size	0,60×1,00 m	0,60×1,00 m
Density of polyester wool	25 kg/m²	25 kg/m²
Aeric mass of sound-proofing foil	5 kg/m²	5 kg/m²
Resistivity to air flow **r**	22 KPa s/m²	22 KPa s/m²
Specific heat • polyester wool • sound-proofing foil	 0,240 KJ/kg K 1,700 KJ/kg K	 0,240 KJ/kg K 1,700 KJ/kg K
Diffusion coefficient of acqueous vapour (phono-resilient foil)	μ 100.000	μ 100.000
Thermal conductivity coefficient λ • polyester wool • sound-proofing foil	 0,037 W/mK 0,170 W/mK	 0,037 W/mK 0,170 W/mK
Thermal resistance	1,08 mq K/W	1,35 mq K/W
Fire reaction class	Class 1	Class 1
Certifications	ITC-CNR	

TECHNICAL CHARACTERISTICS

	EP GIPS
Total thickness	16,5 mm
Panel size	1,20×2,50 m
Aeric mass of sound-proofing foil	5 kg/m²
Specific height • plasterboard slab • soundproofing foil	 0,837 KJ/kg K 1,700 KJ/kg K
Diffusion coefficient of acqueous vapour (phono-resilient foil)	μ = 100.000
Fire reaction class	Class 1
Certifications	ITC-CNR

TECHNICAL CHARACTERISTICS

	SILENTGLASS	
Total thickness	**45 mm**	**75 mm**
Roll size	0,60×20 m	0,60×20 m
Density	13 kg/m²±10%	11,5 kg/m²±10%
Resistivity to air flow **r**	6÷8 KPa s/m²	6÷8 KPa s/m²
Specific heat	0,850 KJ/kg K	0,850 KJ/kg K
Thermal conductivity coefficient λ	0,034 W/mK	0,034 W/mK
Fire reaction class (PV CSTB)	Classe M0	Classe M0

TECHNICAL CHARACTERISTICS

	SILENTGIPS/ALU		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 –
Density of glass wool	85 kg/m^3	85 kg/m^3	85 kg/m^3	85 kg/m^3	85 kg/m^3
Specific heat • plasterboard slab • glass wool	 0,837 KJ/kg K 0,850 KJ/kg K	 0,837 KJ/kg K 0,850 KJ/kg K	 0,837 KJ/kg K 0,850 KJ/kg K	 0,837 KJ/kg K 0,850 KJ/kg K	 0,837 KJ/kg K 0,850 KJ/kg K
Aqueous vapour diffusion coefficient • 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 of glass wool	0,571 m^2 K/W	0,834 m^2 K/W	0,571 m^2 K/W	0,834 m^2 K/W	1,097 m^2 K/W

TECHNICAL CHARACTERISTICS

	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**
Width of phonoresilient foil	14 cm	20 cm	25 cm	30 cm
Impermeability	Waterproof	Waterproof	Waterproof	Waterproof
Aqueous vapour diffusion coefficient (phonoresilient foil)	100.000 μ	100.000 μ	100.000 μ	100.000 μ
Coefficiente di conducibilità termica • phonoresilient foil λ	0,170 W/m°K	0,170 W/m°K	0,170 W/m°K	0,170 W/m°K
Dynamic rigidity (ITC certificate conforming to UNIEN29052 p. 1st) (1) • load 200 kg/m^2 • load 400 kg/m^2	 $s'_t = s' = 449$ MN/m^3 $s'_t = s' = 937$ MN/m^3	 $s'_t = s' = 449$ MN/m^3 $s'_t = s' = 937$ MN/m^3	 $s'_t = s' = 449$ MN/m^3 $s'_t = s' = 937$ MN/m^3	 $s'_t = s' = 449$ MN/m^3 $s'_t = s' = 937$ MN/m^3
Certifications	ITC-CNR			

TECHNICAL CHARACTERISTICS

	FONOCELL
Thickness	5,0 mm ca.
Dimensions of pre-formed “L” shape • Height of vertical part • Widht of vertical part • Length	0,15×2,0 m 10 cm 5 cm 200 cm

TECHNICAL CHARACTERISTICS

	SIGILTAPE
Tape width	50 mm
Tape length	25 m

TECHNICAL CHARACTERISTICS

FONOPLAST

	Component A	Component B
Appearance	Powder	Milky liquid
Specific weight	1,48 kg/dm³	1,05 kg/dm³
Inflammability	None .	None .
Storage	12 months	12 months
FONOPLAST mix Ratio 25:6.		
Specific weight	1,58±0,05 kg/dm³	
Application temperature	+5°C÷+35°C	
Workability time	30 minuts	
Cold state flexibility	–30°C	
Ultimate elongation	>1 N/mm²	
Impermeability (1 m of water column)	Waterproof	
Vapour diffusion resistance	µ>1.500	
Dynamic rigidity under load of 200 kg/m²	900 MN/m³	

TECHNICAL CHARACTERISTICS

FONOCOLL

Aspect	milky liquid
Packaging	Buckets 5 kg and 10 kg
Specific weight	1,04±0,05 kg/liter
Dry residue (5 hours @ 165°C)	50%±1%
Brookfield Viscosity (RVT5 - speed 20 @ 25°C)	5.000-10.000 cps
Flammability	not flammable
Shelf life in the original containers	12 months

For further information, please consult the relevant technical data-sheets.


FONOSTOP


FONOSILENT


FONOBARRIER


FONOLEGNO


ISOLSTRATO DUO


ECOPOLIPIOMBO


SILENTROCK


ECOSILENT


SILENTROCK EP


ECOSILENT EP


EP GIPS


SILENTGLASS


SILENTGIPS


FONOSTRIP


FONOPLAST

CERTIFICATIONS OF PRODUCTS FOR ACOUSTIC INSULATION OF FLOOR AGAINST FOOT-TRAFFIC NOISE

FONOSTOP DUO

ITC-CNR

Certification "ITC" n. 3402/RP/01.
Determination of dynamic rigidity of FONOSTOP DUO UNI EN 29052 for calculating the insulation of a floor covered with "floating flooring material"

CSI

Certificatio "CSI" n. ME06/060/98 for acoustic insulation against foot-traffic of FONOSTOP DUO
ISO 717/82 UNI 8270/7.

Certification "ISTITUTO GIORDANO" n. 171472/RF3612 for determining the fire reaction class

Approval of "Ministry of Interior" n. VR2172B41C100002
Determinatin fire reaction class

Sistem: FONOSTOP DUO + FONOSTOP DUO

ITC-CNR

Certification "ITC" n. 3403/RP/01. Determination of dynamic rigidity of FONOSTOP DUO double-layer UNI EN 29052 for calculating the insulation of a floor covered with "floating flooring material"

Sistem: FONOSTOP DUO + FONOSTOP TRIO

ITC-CNR

Certification "ITC" n. 3404/RP/01. Determination of dynamic rigidity of FONOSTOP DUO with FONOSTOP TRIO UNI EN 29052 for calculating the insulation of a floor covered with "floating flooring material"

FONOSTRIP

ITC-CNR

Certification "ITC" n. 3453/RT/02.
Determination of dynamic rigidity of FONOSTRIP for calculating the insulation of a floor covered with "floating flooring material"

On-site measurement

studio 360

Studio 360

CISDA

Politecnico di Torino

LABORATORIO DI ACUSTICA APPLICATA

Studio di Acustica Applicata

CERTIFICATIONS OF PRODUCTS FOR ACOUSTIC INSULATION AGAINST AIRBORNE NOISE

ECOPOLIPIOMBO DUO

Certification "IEN G. FERRARIS" n. 35561/03 - n. 35561/08	Certification "ISTITUTO GIORDANO" - n. 171105/RF3601 Determination fire reaction class	Approval of "Ministry of Interior - n. VR2172B10D100003 Determinatin fire reaction class

ECOPOLIPIOMBO

Certification "IEN G. FERRARIS" n. 35561/05 - n. 35561/07 - n. 35561/09	Certification "ISTITUTO GIORDANO" - n. 171105/RF3602 Determination fire reaction class	Approval of "Ministry of Interior" - n. VR2172B10D100001 Determinatin fire reaction class

ECOSILENT

ITC-CNR Certification "ITC-CNR" n. 4214PR06	Certification "IEN G. FERRARIS" n. 35561/07 - n. 35561/09

SILENTROCK

ITC-CNR

Certification "ITC-CNR"
n. 4213PR06

SILENTROCK EP

ITC-CNR

Certification "ITC-CNR"
n. 4165PR06 - n. 4167PR06

ECOSILENT EP

ITC-CNR

Certification "ITC-CNR"
n. 4166PR06

EP GIPS

ITC-CNR

Certification "ITC-CNR"
n. 4213PR06 - n. 4214RP06

INDEX MATERIALS ARE CONSTANTLY CONTROLLED IN OUR LABORATORIES AND HAVE BEEN CERTIFIED IN THE MAIN COUNTRIES OF THE WORLD

ITC-CNR
BUREAU VERITAS 1828
AGREMENT SOUTH AFRICA
tecnotest ag
UNIVERZA V MARIBORU
INSTITUT GRADEVINARSTVA HRVATSKE d.d.

BBA BRITISH BOARD OF AGRÉMENT CERTIFICATE No. 90/2497/c CERTIFICATE No. 90/2519
BYGGFORSK
CSTB
C.S.T.C. W.T.C.B.
RINA 1861

SFV
TSE
atg
LABORATORI DI INGEGNERIA ASSOCIAZIONE
INCER TRANS S.A. BUCURESTI
UKAS TESTING

dakadvies
VTT
ISTITUTO GIORDANO
cete méditerranée
FMPA

izolacja
UMC IMS
L P M
CSTBat
РЕПУБЛИКА БЪЛГАРИЯ
SGS

AUSTRALIAN WATER QUALITY CENTRE
AUTORIZOVANÁ OSOBA 246 ÚNMZ
SPSC
PSB SINGAPORE
PCBC
ZÚS

CSI
CENTRO CERAMICO
SNCF EQUIPEMENT
UL
SISIR
SECO

STATE OF KUWAIT
SITAC
SOCOTEC
SP
NATIONAL ROOFING CONTRACTORS ASSOCIATION MEMBER

DIN
ten
ti
ISTEDIL

SETRA
TECNOLAB
wq
Warrington FIRE research

AWARDS AND RECOGNITIONS RECEIVED BY INDEX


D&B

D&B attesta che in
data 24-06-2004
la Società INDEX SPA
D-U-N-S® Number 428749709
ha ottenuto il
D&B RATING 1
"Indice di Massima Affidabilità"
che per sua stessa natura è un valore dinamico rapportato alla situazione generale dell'Azienda

Il Presidente

INDEX has been awarded with "RATING 1" – Basel II "Index of Maximum Reliability"


ASSOCIAZIONE DEGLI INDUSTRIALI
DELLA PROVINCIA DI VERONA

Premio Impresa Formativa 2003
A
INDEX SPA

To confirm the mission of INDEX in the role of instructive company, we are illustrating herein the exact copy of the "Award" received on behalf of the Industrial Association for "Instructive Business"


Premio
COSTRUIRE
per la proposta più interessante del 2000
alla società
Index
per il prodotto
Fonostop Duo
Bologna, 19 ottobre 2001

FONOSTOP DUO achieved an important award

CERTIFICATION OF THE CORPORATE MANAGEMENT SYSTEM

INDEX UNI-EN-ISO 9001 QUALITY MANAGEMENT SYSTEM CERTIFICATION - ed. 2000 - VISION

In 1993, INDEX obtained fullest certification guaranteeing the quality of its products and services. It was the first to do so among its world-wide competitors.
In 2003 it obtained the renewal of certification UNI-EN ISO 9001 - 2000 ed. - Vision.
The ISO 9001certification is not limited to supplying a Quality guarantee for the controls and final tests of the product, but also extends to design and after-sales service to the customer.
Design is not intended as just research and development of new products, but also covers on-going improvement of existing products.
ISO 9001 is an important milestone for INDEX, but it also means that operators have the certainty and guarantee enabling them to always count on products and services of absolute Quality.

INDEX ENVIRONMENTAL MANAGEMENT SYSTEM CONFORM TO UNI EN ISO 14001 STANDARDS

In March 2001, INDEX obtained certification for its Environmental Management System according to standard UNI EN ISO 14001.
In March 2004, it obtained renewal of the certificaion on the principle of the continuity of and high, sensitive attention to the protection of the environment, showing the validity of its commitment.
This new goal reached by the company guarantees that, inside the company, all the possible impacts of its activity are controlled and managed according to an environmental protection programme, which establishes the objectives and plans for on-going improvement, aiming at ever more advanced environmental standards.

• ENVIRONMENTAL MANAGEMENT SYSTEMS INDEX

INDEX knows that respecting the Environment is an unquestionable condition if a company wants to put its products on the market in a correct and responsible way. The respect of the environment is one of the main criterion on the basis of which Customers and the public judge us. The key element of INDEX's Environmental Policy is to minimize the impact of the company's activity on the Environment, by taking all of the measures envisaged by the established Environmental Objectives.

INDEX is committed to operating in full conformity with the legislation and regulations in force, while always aiming at improving the results obtained:

- Adopting an Environmental Management System that reduces or stops the impact of the company's business activities on the environment, aiming at continuous improvement in this field.
- Investing in research and development to produce products and technologies that are environmentally friendly for the entire life cycle of the product.
- Assessing the economic feasibility of using the best technologies available on the market.
- Guaranteeing that none of INDEX's business activities can create risks for the health and safety of the people collaborating with the company, or for people living in the area.
- Letting everyone of the company staff participate in the choices taken on environmental questions.
- Guaranteeing collaboration with the local authorities and community, in a philosophy based on industrial production which is open, and fully aware of the responsibility involved.
- Introducing the certainty of natural growth

Since 1993 the most comprehensive certification and quality guarantee of INDEX products and services

Since 2001 the most comprehensive certification to guarantee quality and respect for environment

SOME REFERENCES OF WORKS EFFECTED THROUGHOUT THE WORLD WITH INDEX PRODUCTS


Petronas Towers - Kuala Lumpur
Malesia


Sede TOYOTA Italia Motors - Roma


Champs Elises - Parigi - Francia


Palazzo Guglienzi Brognolino
Verona


Auditorium della Musica - Roma

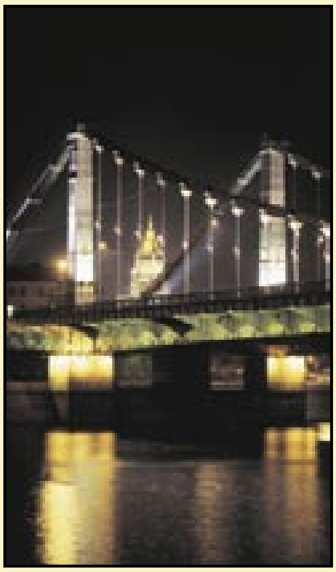

MART - Museo Arte Moderna di
Rovereto e Trento


Empire State Building - New York


Reggia di Caserta


Asili Portiani - Verona


Hotel SOFITEL - Villasimius -
Cagliari


PONTE "KRIMSKY" - Mosca
Russia

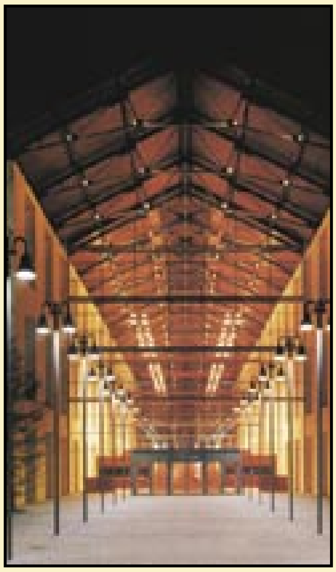

Dubai Marina - Emirati Arabi Uniti


HOTEL "HILTON" - Malta


Ponte Pietra - Bordeaux - Francia


Fiera del Marmo - Carrara


SIBAYA HOTEL CASINO - Uhmlanga
Durbans


Auditorium - Parma


STADIO - Joannesburg
Sud Africa


VIADOTTO "HEMUS"
Bulgaria


Place Vandom - Parigi
Francia

Other constantly updated references can be consulted on Internet site www.indexspa.com

INDEX COMMUNICATION AND ADVERTISING

There's something about Index products and services that makes them different and exclusive: it's the company's dimensions and technology, our research and commitment to offering solutions to problems, and our respect for the needs of specifiers, installers, retailers, and end users.
This is why over the years Index has always placed the utmost importance on communication, with corporate and product advertising in the most authoritative and widely circulated trade publications.
Images that pursue two objectives: to inform and to confirm.
To inform of the existence of exclusive products, systems, and solutions.
To actively confirm Index's leadership.

Updated: December 2006

The document herein annuls and replaces the previous one.
The document provides descriptions of the products.
It is therefore up to the user to make sure the product and relative laying complies with current laws and European, national and regional standards, for which the user is then also responsible.
INDEX S.p.A. reserves the right to modify the characteristics of its products at any time and without notice.

This publication, which was written by Index's Technical Department, was revised by ANIT (Italian acronym for National Association for thermal and acoustic insulation) of which our Company is a member.

The data supplied in this publication, obtained through laboratory tests and on-site measurement, do not guarantee repeatability of results for equivalent systems

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.

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.

INDEX's exclusive production systems are covered by registered patents.

• 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

index
Construction Systems and Products
INTERNET: **www.indexspa.it**
E-MAIL: index.export@indexspa.it
Via G. Rossini, 22 - 37060 Castel D'Azzano (VR) - Italy - C.P.67 - Tel. 045.8546201 - Fax 045.512444

TOTAL QUALITY index UNI EN ISO 9001 ed. 2000 - Vision

Environmental Management Systems index UNI EN ISO 14001

Cg. - 800 - 02/2007inglD+2