silensis

02

Silensis: high performance acoustic insulating ceramic brick walls system

Acoustic performance and compliance with sound insulation requirements.

HISPALYT
CERÁMICA PARA CONSTRUIR

02. Silensis: high performance acoustic insulating ceramic brick walls system. Acoustic performance and compliance the requirements of the CTE.

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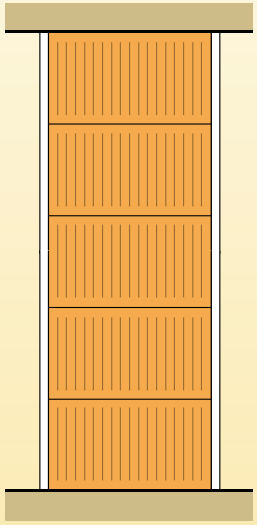
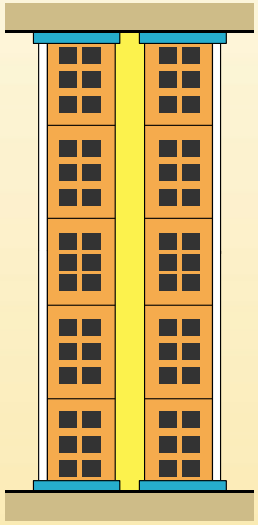
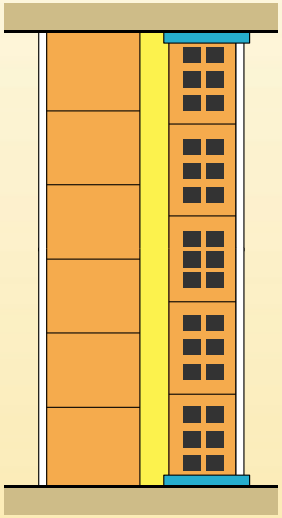
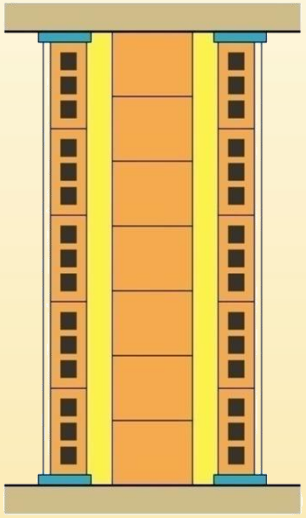
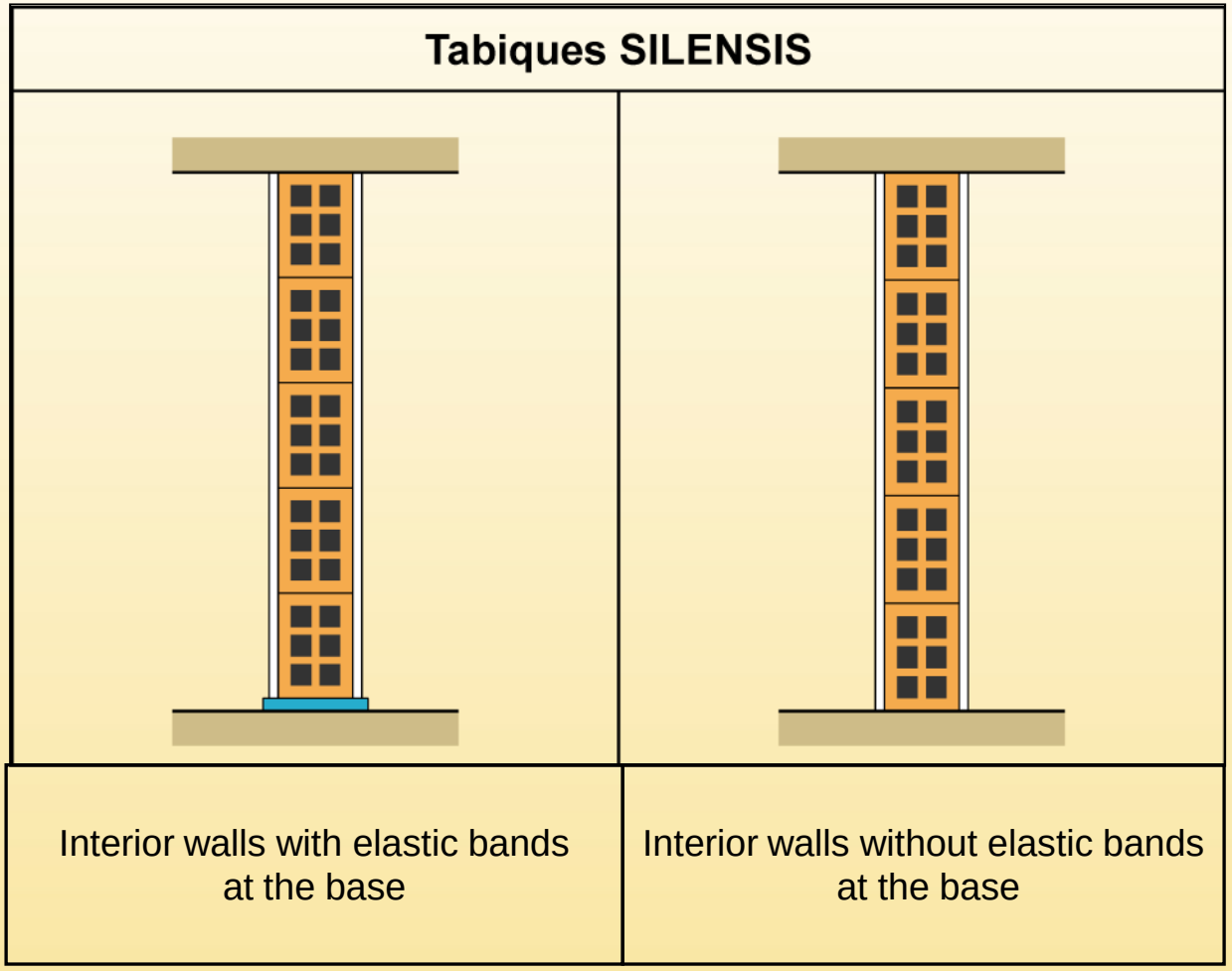
02. Silensis: high performance acoustic insulating ceramic brick walls system.
02.1. Types of Silensis solutions. Silensis party walls.

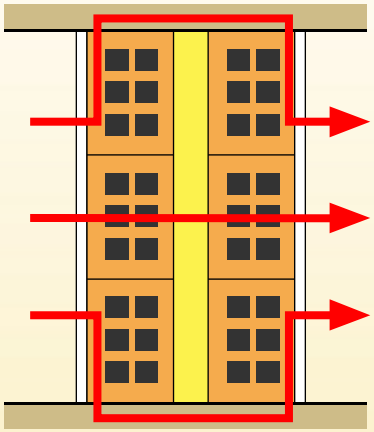
Party walls in compliance with the DB HR of the CTE			
Single wall	Double wall		Triple wall
Silensis Type 1A	**Silensis Type 2A**	**Silensis Type 2B**	**Silensis Type 1B**
			
Single wall composed of a heavy wall without elastic bands	Double wall composed of 2 lightweight walls with perimeter elastic bands and absorbing material in the air chamber	Double wall composed of 1 supporting heavy wall and 1 lightweight wall with perimeter elastic bands and absorbing material in the air chamber	Triple wall composed of 1 supporting heavy wall and 2 lightweight walls with perimeter elastic bands on both sides and absorbing material in the air chambers
Type 1 of the CTE DB HR	Type 2 of the CTE DB HR	Type 2 of the CTE DB HR	Type 1 or 2 of the CTE DB HR
SILENSIS SOLUTIONS			

02. Silensis: high performance acoustic insulating ceramic brick walls system.
02.1. Types of Silensis walls. Silensis interior walls.

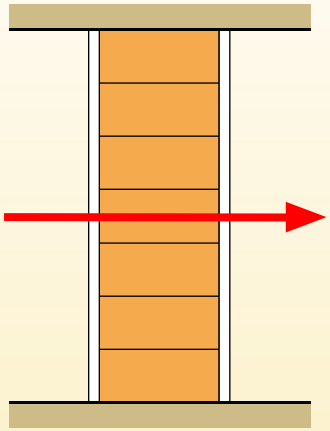


02 Silensis: high performance acoustic insulating ceramic brick walls system.
02.2. A. Acoustic insulation. Laboratory measurement of sound insulation.

Party walls in compliance with the NBE CA 88

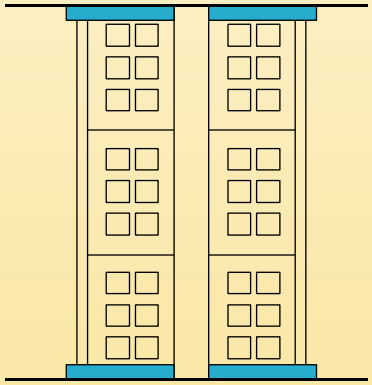


Double wall composed of two lightweight walls, traditionally built, without elastic bands

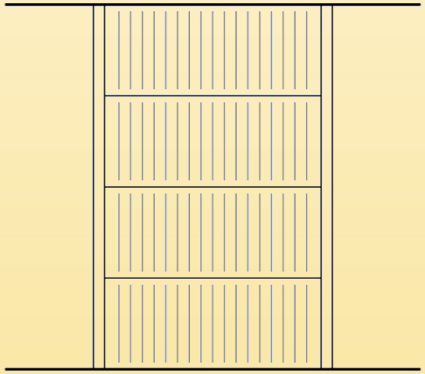


Single wall composed of a heavy wall

Party walls in compliance with the DB HR of the CTE



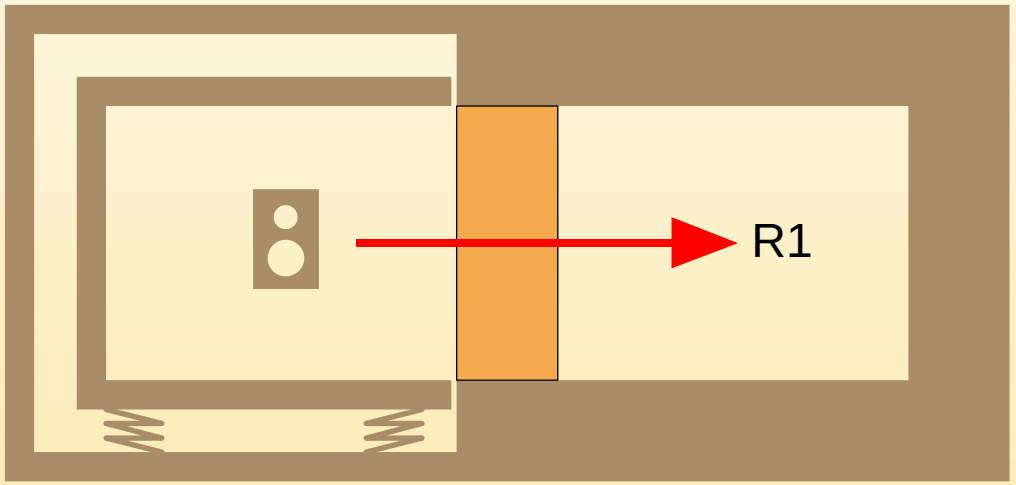
Double wall composed of two lightweight walls with perimeter elastic bands



Single wall composed of a much more heavy wall than the walls built until now for compliance with the NBE CA 88

Laboratory measurement of sound insulation of a single wall

R direct = R laboratory = R1

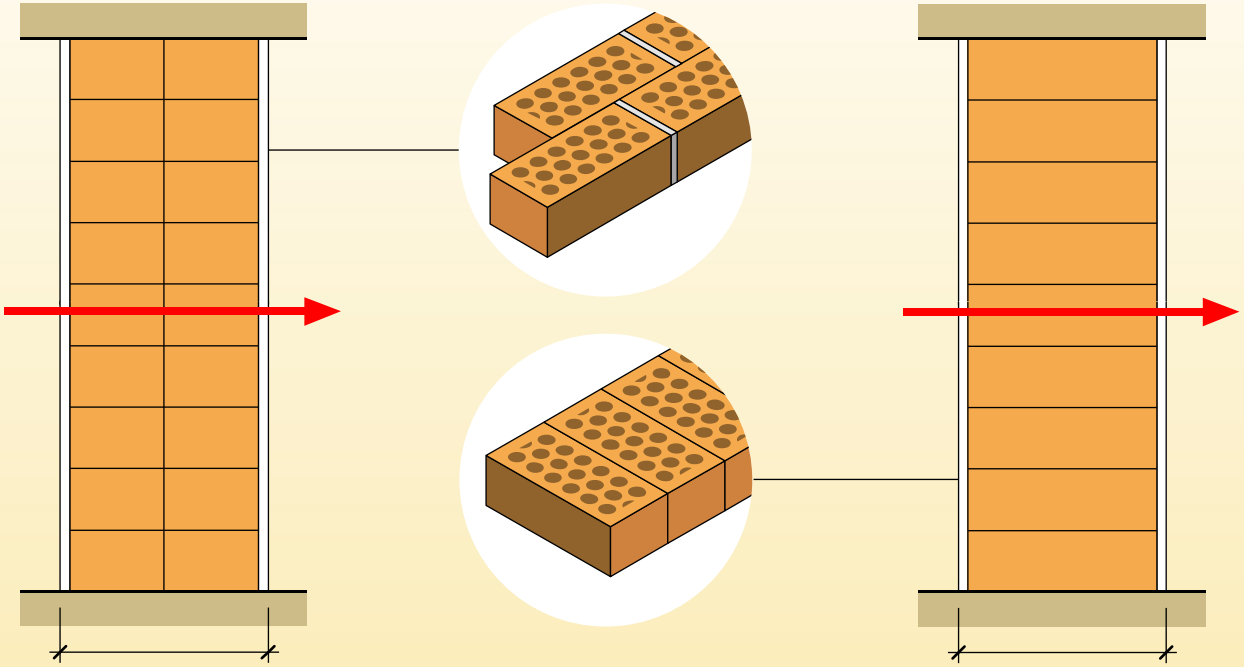


The noise transmission path R1 is the one which characterizes the sound insulation of the single wall

To improve acoustic insulation of single walls it is necessary to use high masses, and consequently, higher thicknesses

02 Silensis: high performance acoustic insulating ceramic brick walls system.
02.2. A. Acoustic insulation. Laboratory measurement of sound insulation.

Silensis Solution Type 1



thickness: 27 cm
mass: 317,5 Kg/m2

R_A = 54,3 dBA

Gypsum plaster 1 cm
2 attached walls of half-foot perforated brick wall
280x125x90 mm
Gypsum plaster 1 cm

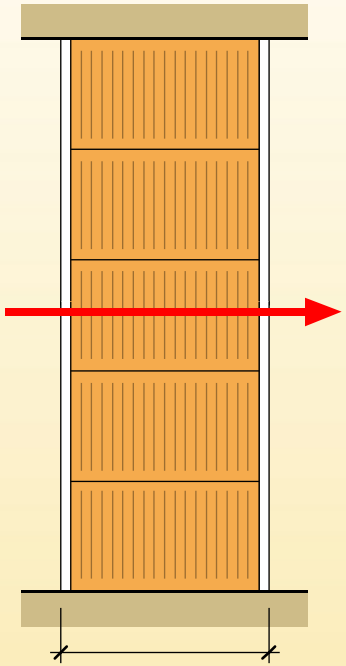
thickness: 26,5 cm
mass: 380 Kg/m2

R_A = 54,3 dBA

Gypsum plaster 1,5 cm
One-foot perforated brick wall
235x110x100 mm
Gypsum plaster 1,5 cm

02 Silensis: high performance acoustic insulating ceramic brick walls system.
02.2. A. Acoustic insulation. Laboratory measurement of sound insulation.

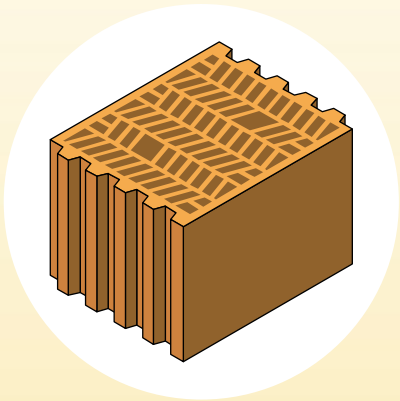
Silensis Solution Type 1

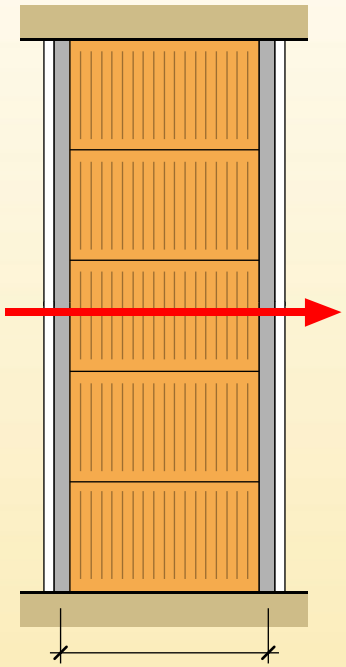


thickness: 32 cm
mass: 289 Kg/m2

R_A = 52 dBA

Gypsum plaster 1,5 cm
Ceramic block 300x290x190 mm
Gypsum plaster 1,5 cm





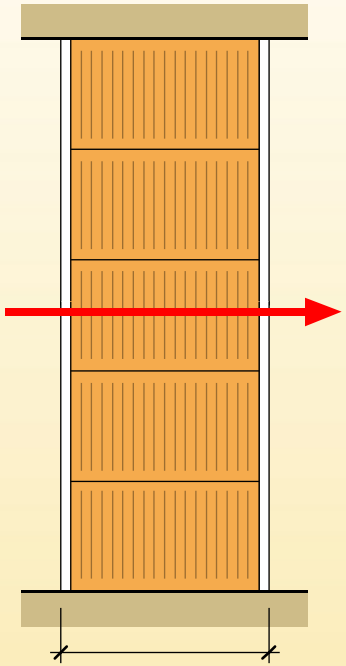
thickness: 26,6 cm
mass: 261 Kg/m2

R_A = 54,3 dBA

Gypsum plaster 0,3 cm
Cement mortar lining 1 cm
Ceramic block 300x240x190 mm
Cement mortar lining 1 cm
Gypsum plaster 0,3 cm

02 Silensis: high performance acoustic insulating ceramic brick walls system.
02.2. A. Acoustic insulation. Laboratory measurement of sound insulation.

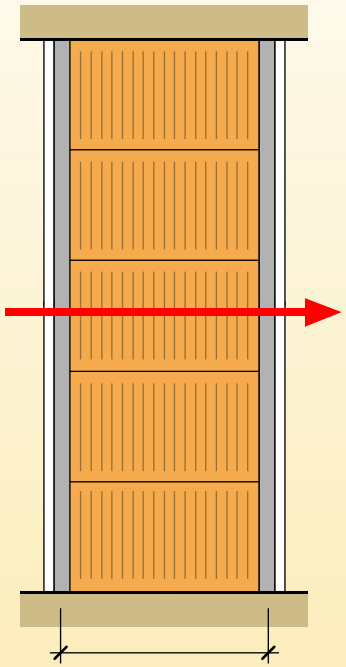
Silensis Solution Type 1



thickness: 20 cm
mass: 333 Kg/m2

R_A = 54,4 dBA

Gypsum plaster 1 cm
Ceramic block 280x180x75 mm
Gypsum plaster 1 cm



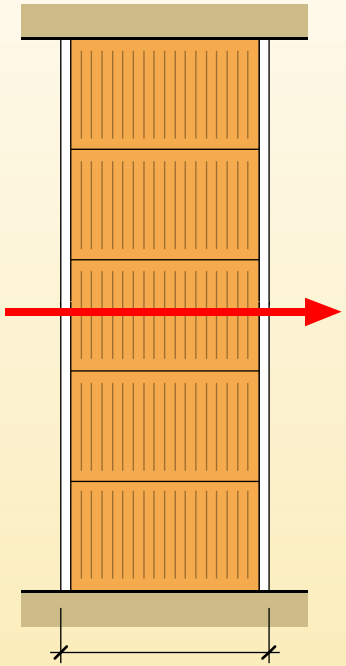
thickness: 20,6 cm
mass: 377 Kg/m2

R_A = 55,4 dBA

Gypsum plaster 0,3 cm
Cement mortar lining 1 cm
Ceramic block 280x180x75 mm
Cement mortar lining 1 cm
Gypsum plaster 0,3 cm

02 Silensis: high performance acoustic insulating ceramic brick walls system.
02.2. A. Acoustic insulation. Laboratory measurement of sound insulation.

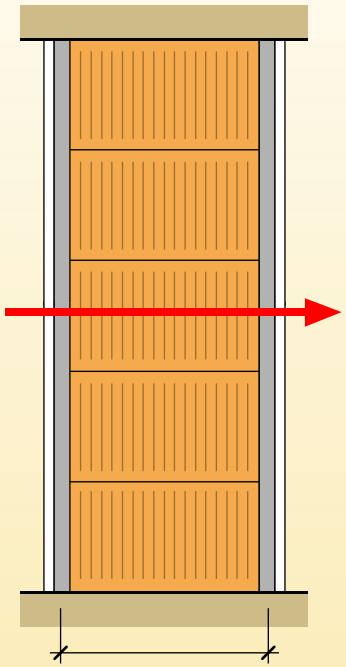
Silensis SolutionType 1



thickness: 19 cm
mass: 314 Kg/m2

R_A = 54,5 dBA

Gypsum plaster 1,5 cm
Ceramic block 250x160x65 mm
Gypsum plaster 1,5 cm



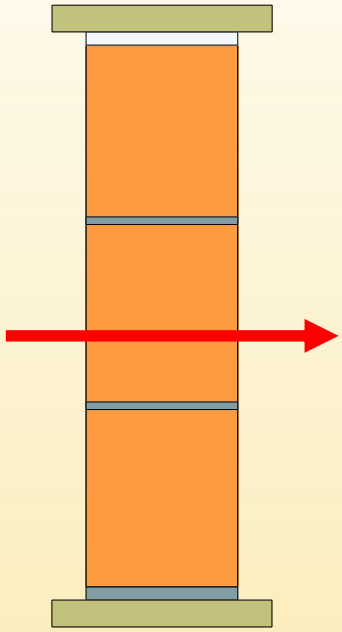
thickness: 19,6 cm
mass: 332 Kg/m2

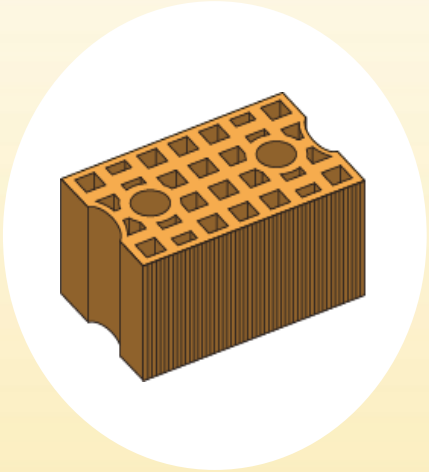
R_A = 55,2 dBA

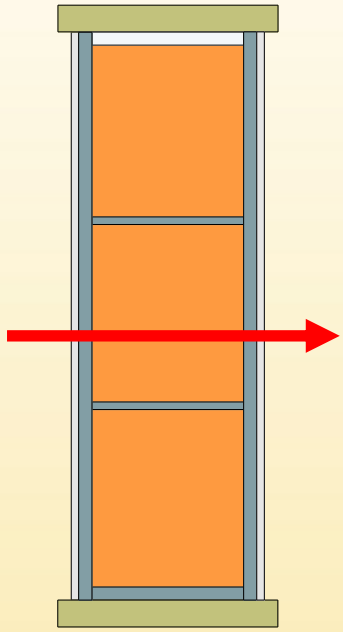
Gypsum plaster 0,3 cm
Cement mortar lining 1,5 cm
Ceramic block 250x160x65 mm
Cement mortar lining 1,5 cm
Gypsum plaster 0,3 cm

02 Silensis: high performance acoustic insulating ceramic brick walls system.
02.2. A. Acoustic insulation. Laboratory measurement of sound insulation.

Silensis SolutionType 1







thickness: 18 cm
mass: 232 Kg/m^2

R_A = 51,3 dBA

Ceramic block 280x190x180 mm

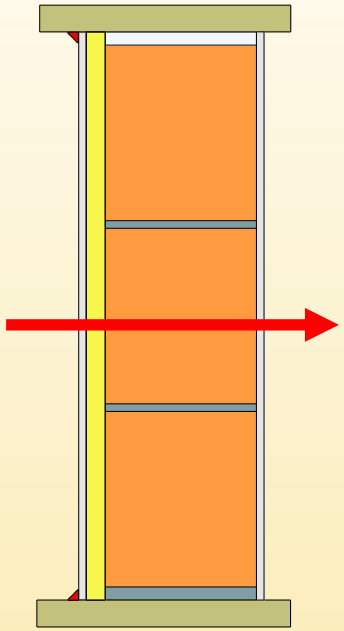
thickness: 23,5 cm
mass: 277 Kg/m^2

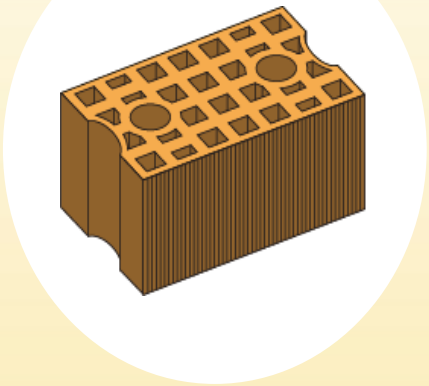
R_A = 55,6 dBA

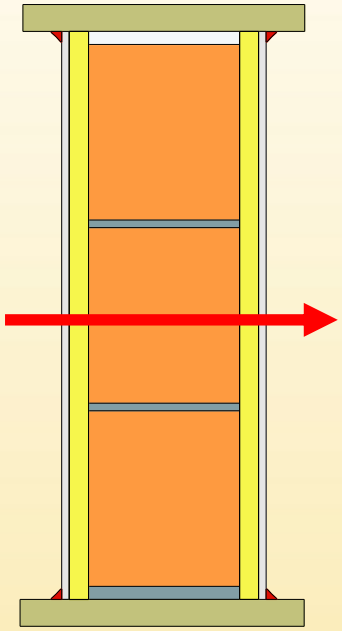
Gypsum plaster 3 mm + Fonotech (Plaster mix with recycled rubber and other additives) 20 mm
Ceramic block 280x190x180 mm
Fonotech (Plaster mix with recycled rubber and other additives) 20 mm + Gypsum plaster 3 mm

02 Silensis: high performance acoustic insulating ceramic brick walls system.
02.2. A. Acoustic insulation. Laboratory measurement of sound insulation.

Silensis SolutionType 1







thickness: 25,5 cm
mass: 253 Kg/m^2

R_A = 58,1 dBA

Cladding of agloacoustic material (PYL + Flexible Polyurethane) 33 mm
Ceramic block 280x190x180 mm
Gypsum plaster 12 mm

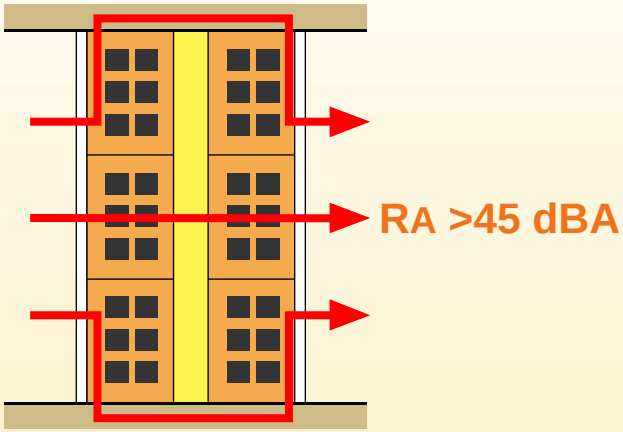
thickness: 24,6 cm
mass: 256 Kg/m^2

R_A = 59,4 dBA

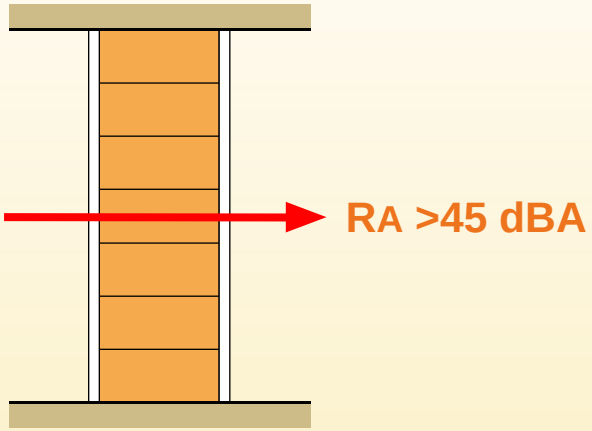
Cladding of agloacoustic material (PYL + Flexible Polyurethane) 33 mm
Ceramic block 280x190x180 mm
Cladding of agloacoustic material (PYL + Flexible Polyurethane) 33 mm

02 Silensis: high performance acoustic insulating ceramic brick walls system.
02.2. A. Acoustic insulation. Laboratory measurement of sound insulation.

Party walls in compliance with the NBE CA 88

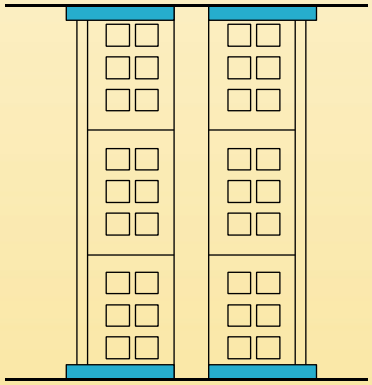


Double wall composed of two lightweight walls, traditionally built, without elastic band

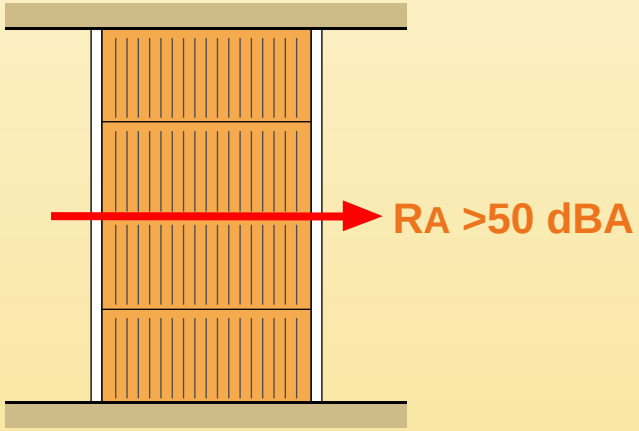


Single wall composed of a heavy wall

Party walls in compliance with the DB HR of the CTE



Double wall composed of two lightweight walls with perimeter elastic bands



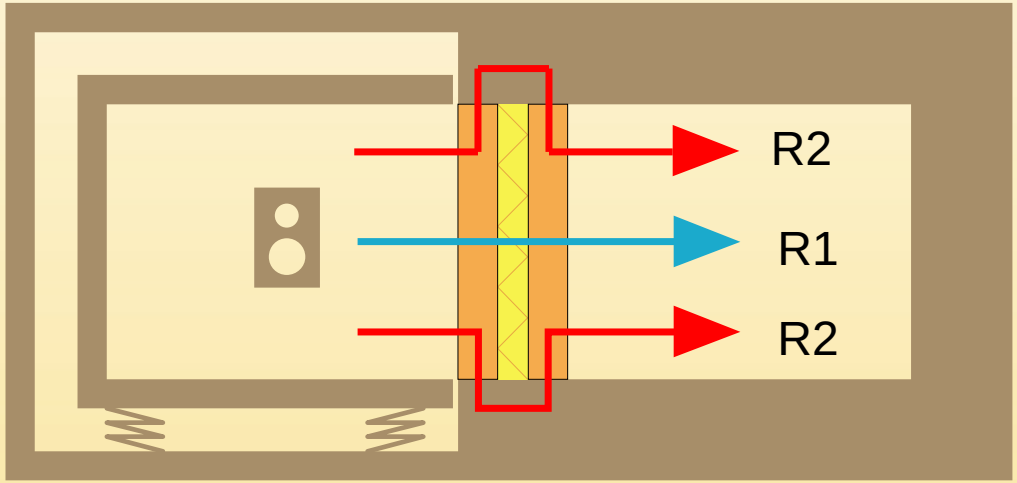
Single wall composed of a much more heavy wall than the walls built until now for compliance with the NBE CA 88

The direct transmission of noise (R_{direct} or R_{Dd}) in a double wall is composed of two paths

Path 1 (R1): brick-air chamber-brick (■)

Path 2 (R2): brick-flank-brick (■)

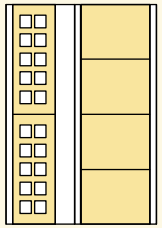
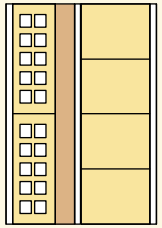
R direct = R laboratory = R1 + R2



The noise transmission path R2 is the one that limits the acoustic insulation of the double wall

02 Silensis: high performance acoustic insulating ceramic brick walls system.
02.2. A. Acoustic insulation. Laboratory measurement of sound insulation.

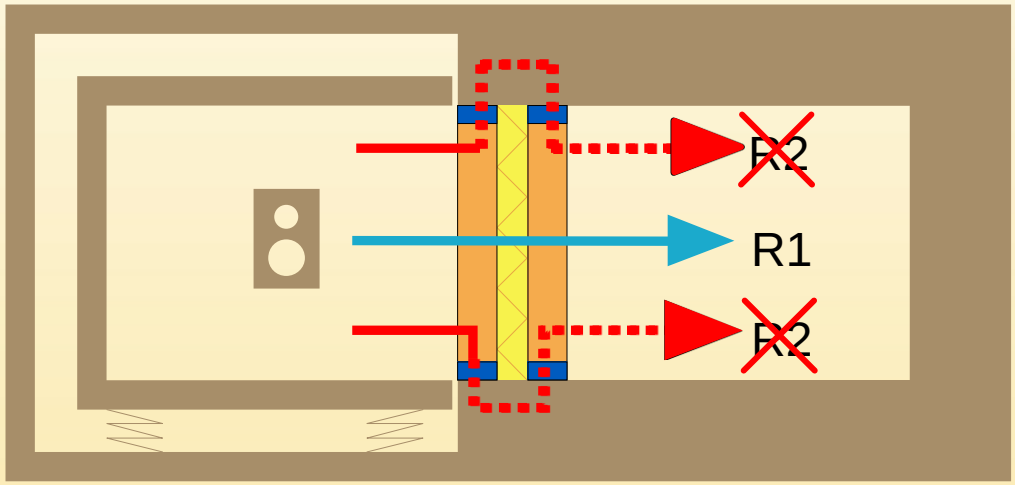
The structural acoustic bridge is the reason why, although we change the absorbing material of the air chamber, or use heavier bricks or increase the thickness of the air chamber, the sound insulation of the double wall doesn't improve substantially

Tipo de pared	Masa (kg/m^2)	R_w (dB)
	260	48,0
	270	48,5

Due to increasement of acoustic requirements
(RA > 45 dBA in laboratory became DnT, A > 50 dBA on site)
These solutions normally used for compliance with the NBE CA 88 are no longer valid to ensure compliance with the CTE DB HR

Laboratory measurement of sound insulation in
a double wall with perimeter elastic bands in both walls
Elimination of the structural acoustic bridge

R direct = R laboratory = R 1



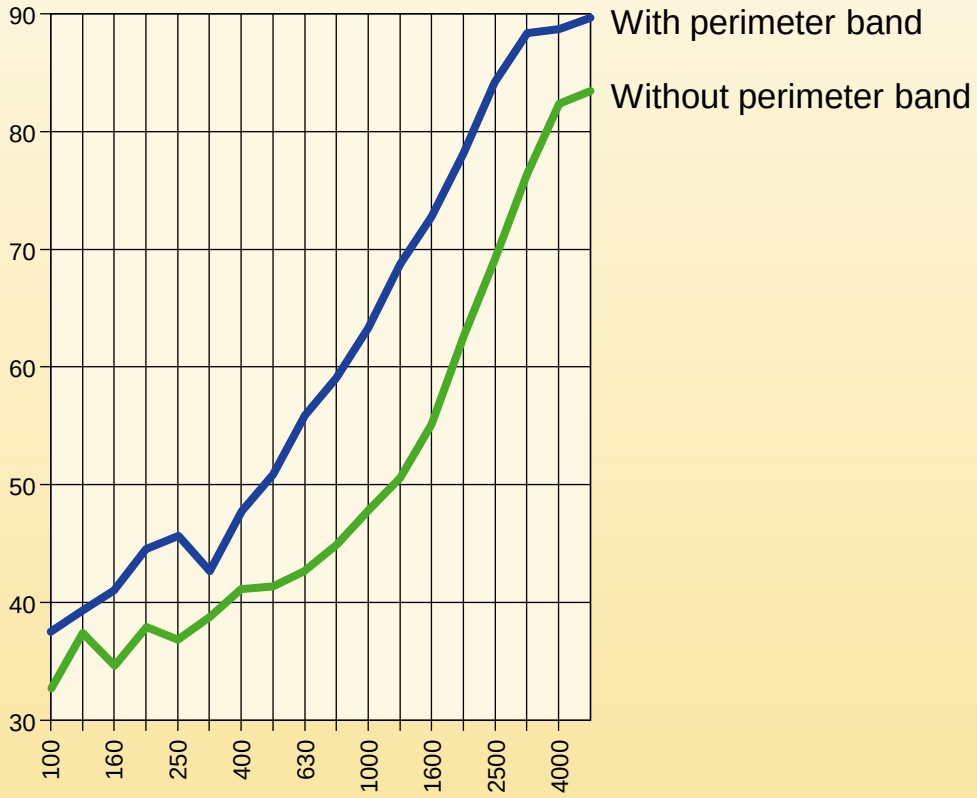
The placement of the elastic bands in the perimeter of the walls eliminates
the structural acoustic bridge

In the laboratory, the structural acoustic brigde between the two walls is formed by the union of the walls in all their edges with the concrete frame of the laboratory

Therefore, the elastic band must be put around the perimeter of the walls

02 Silensis: high performance acoustic insulating ceramic brick walls system.
02.2. A. Acoustic insulation. Laboratory measurement of sound insulation.

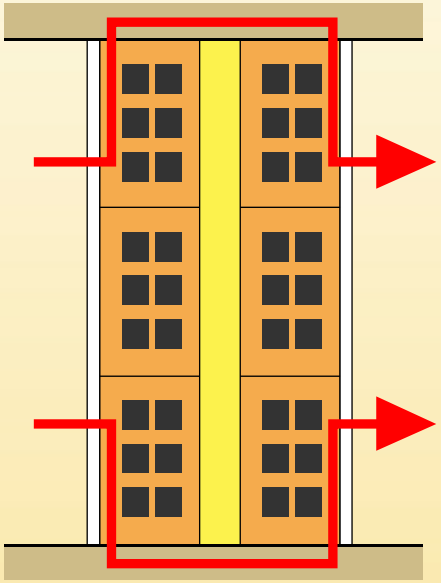
For a given ceramic double wall solution the **difference of acoustic insulation in laboratory** using the new assembly system WITH elastic bands compared to the traditional assembly system WITHOUT elastic bands **may range between 10 and 15 dB higher**



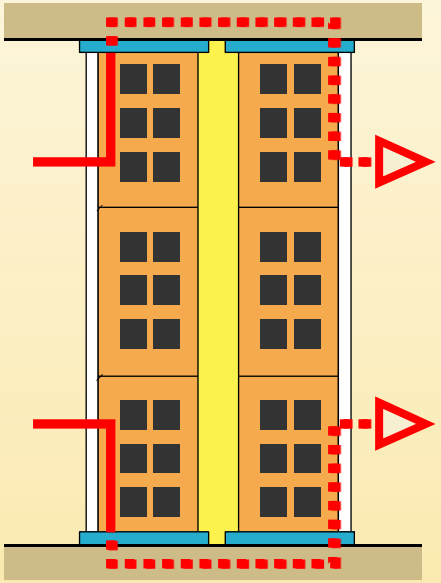
On site, the structural acoustic bridge is caused by the joints of the leaves of the double wall with all the bordering elements

(outer leaf of facade, upper structural floor, lower structural floor, pillars, etc.)

Therefore it is necessary to place elastic bands in all the perimeter of the leaves



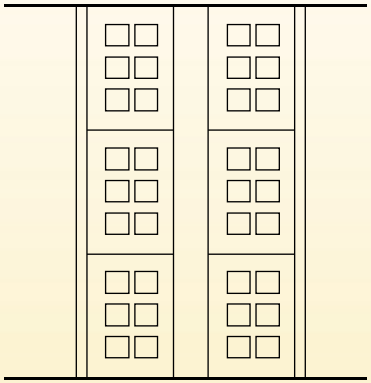
Formation of the structural acoustic bridge in a double wall built according with the traditional assembly system, without elastic bands



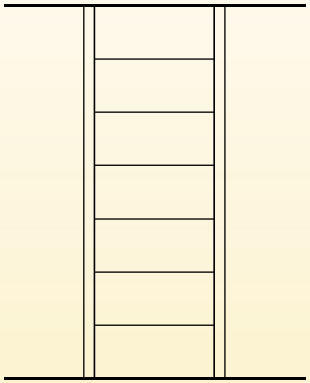
Interruption of the structural acoustic bridge in a double wall built with perimeter elastic bands

02 Silensis: high performance acoustic insulating ceramic brick walls system.
02.2. A. Acoustic insulation. Laboratory measurement of sound insulation.

Party walls in compliance with the NBE CA 88

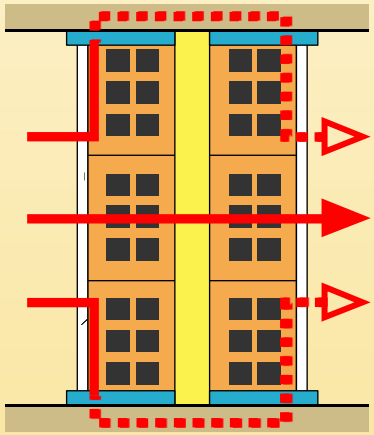


Double wall composed of two lightweight walls, traditionally built, without elastic bands

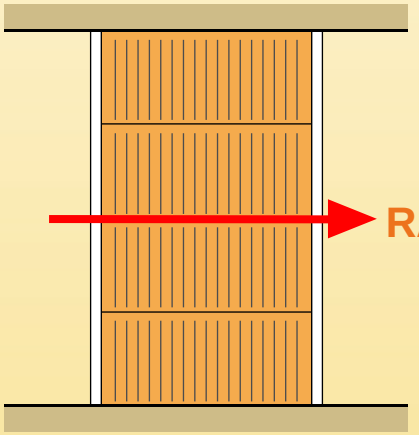


Single wall composed of a heavy wall

Party walls in compliance with the DB HR of the CTE



Double wall composed of two lightweight walls with perimeter elastic bands



Single wall composed of a much more heavy wall than the walls built until now for compliance with the NBE CA 88

SILENSIS SOLUTIONS

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02.2. A. Acoustic insulation. Laboratory measurement of sound insulation.

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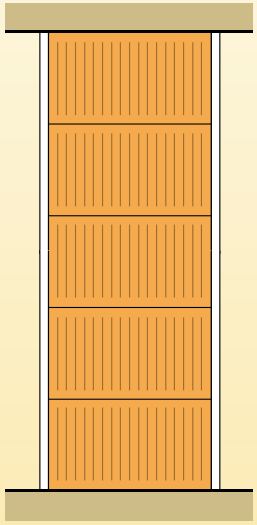
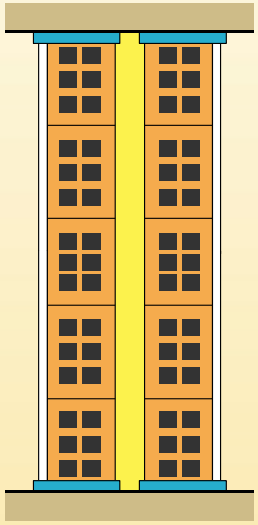
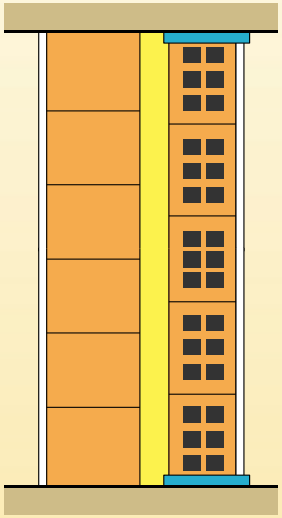
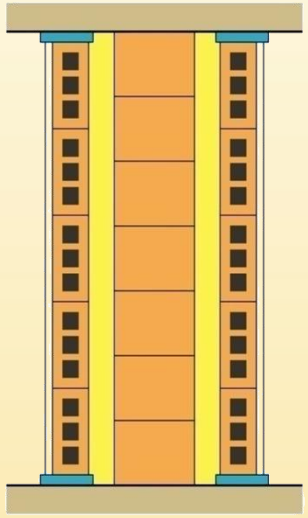
			
Single wall composed of a heavy wall without elastic bands	Double wall composed of 2 lightweight walls with perimeter elastic bands and absorbing material in the air chamber	Double wall composed of 1 supporting heavy wall and 1 lightweight wall with perimeter elastic bands and absorbing material in the air chamber	Triple wall composed of 1 supporting heavy wall and 2 lightweight wall with perimeter elastic bands on both sides and absorbing material in the air chambers
Type 1 of the CTE DB HR	Type 2 of the CTE DB HR	Type 2 of the CTE DB HR	Type 1 ó 2 of the CTE DB HR

SILENSIS SOLUTIONS

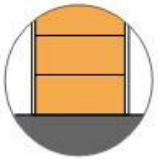
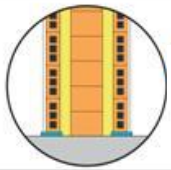
02 Silensis: high performance acoustic insulating ceramic brick walls system.
02.2. A. Acoustic insulation. Laboratory measurement of sound insulation.

Laboratory measurement of sound insulation. Silensis party walls solutions in compliance with the requirements of the CTE DB HR

Hispalyt has carried out several tests in different laboratories with results between

52 to 63 dBA of acoustic insulation, depending on the thickness of the air chamber, absorbing material, etc.

02 Silensis: high performance acoustic insulating ceramic brick walls system.
02.2. A. Acoustic insulation. Laboratory measurement of sound insulation.

Party walls		m	R_A
 Silensis Type 1A	BC 300 x 290 x190 mm Gypsum plaster 1,5 cm, on both sides	289 Kg/m²	52 dBA
	BC 300 x 240 x190 mm Gypsum plaster 0,3 cm + Cement mortar lining 1 cm, on both sides	261 Kg/m²	54 dBA
	2 half-foot LP attached walls Gypsum plaster 0,3 cm + Cement mortar lining 1 cm, on both sides	318 Kg/m²	54 dBA
	BC 280 x 180 x 75 mm Gypsum plaster 1,5 cm, on both sides	333 Kg/m²	54 dBA
	BC 280 x 180 x 75 mm Gypsum plaster 0,3 cm + Cement mortar lining 1 cm, on both sides	377 Kg/m²	55,4 dBA
 Silensis Type 2A	LHGF 7 cm + LM 4 cm + LHGF 5 cm perimeter elastic bands and gypsum plaster 1 cm, on both sides	111 Kg/m²	53 dBA
	LHGF 7 cm + LM 4 cm + LHGF 7 cm perimeter elastic bands and gypsum plaster 1 cm, on both sides	123 Kg/m²	56 dBA
	LHD 7 cm + LM 4 cm + LHD 7 cm perimeter elastic bands and gypsum plaster 1 cm, on both sides	171 Kg/m²	54 dBA
	LHD 8 cm + LM 4 cm + LHD 8 cm perimeter elastic bands and gypsum plaster 1 cm, on both sides	164 Kg/m²	56 dBA
	LHGF 9 cm + LM 4 cm + LHGF 9 cm perimeter elastic bands and gypsum plaster 1 cm, on both sides	170 Kg/m²	56 dBA
	PCY 6 cm + LM 4 cm + PCY 6 cm perimeter elastic bands and gypsum plaster 1 cm, on both sides	133 Kg/m²	56 dBA
 Silensis Type 2B	½ foot LP + LM 4 cm + LHS 5 cm perimeter elastic bands Gypsum plaster 1 cm, on both sides	230 Kg/m²	62 dBA
	BC 300 x 240 x 140 mm + LM 4 cm + LHS 5 cm perimeter elastic bands Gypsum plaster 1 cm, on both sides	237 Kg/m²	63 dBA
 Silensis Type 1B	LHGF 5 cm perimeter elastic bands + LM 4 cm + ½ foot LP + LM 4 cm + LHS 5 cm perimeter elastic bands Gypsum plaster 1 cm, on both sides	220 Kg/m²	70 dBA

LHD: Double hollow brick; LHGF: Large format double hollow brick ; LHS: Simple hollow brick ; PCY: Prefabricated ceramic and plaster panel; BC: Ceramic block; LP Perforated brick; LM : absorbing material ; EEPS: elasticized expanded polystyrene

02 Silensis: high performance acoustic insulating ceramic brick walls system.
02.2. A. Acoustic insulation. Laboratory measurement of sound insulation.

Influence of the slots in separation wall insulation

Measurement without slots on the wall for facilities

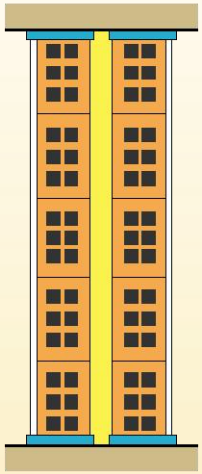
R_A = 56 dBA

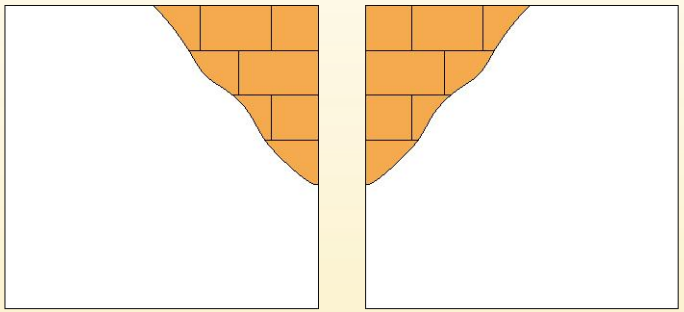
Gypsum plaster 10mm
+
LHDGF 7cm
+
Mineral wool insulation 40mm
+
LHDGF 7cm
+
Gypsum plaster 10mm

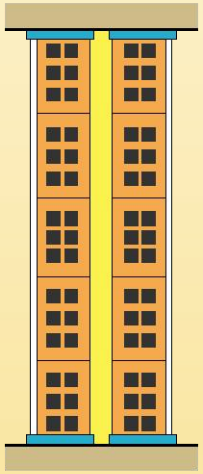
perimeter elastic bands EEPS 1,5cm

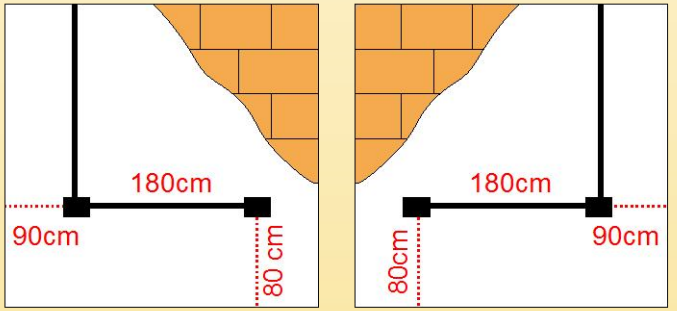
R_A = 57 dBA

Measurement with slots on the wall for facilities









LHGF: Large format double hollow brick; EEPS: elasticized expanded polystyrene

The slots on the walls don't reduced the acoustic insulation of the ceramic wall

02 Silensis: high performance acoustic insulating ceramic brick walls system.
02.2. A. Acoustic insulation. Laboratory measurement of sound insulation.

Influence of the grooves in the insulation of the party wall

Measurement without slots

R_A = 56 dBA

EUSKO JAURLARITZA GOBIERNO VASCO
ETXEBIZITZA ETA GIZARTE GAIETAKO SAILA
DEPARTAMENTO DE VIVIENDA Y ASUNTOS SOCIALES
Ebaluazio, Berrikuntza eta Kontrol Zuzendaritza — Dirección de Vivienda, Innovación y Control
Erakuntzaren Kalitate Kontrolerako Laborategia — Laboratorio de Control de Calidad de la Edificación

Aislamiento a Ruido Aéreo según UNE-EN ISO 140-3:1995
Medidas en Laboratorio

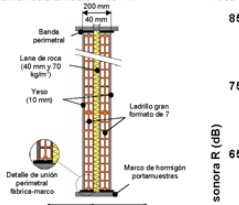
Cliente: HISPALYT, Asociación de Tabiques y Muros Cerámicos. **Fecha Ensayo:** 07/09/06

Muestra: Doble fábrica de ladrillo gran formato de 7, con lana de roca.

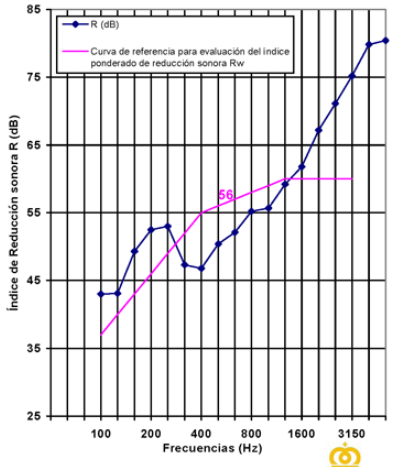
Descripción de la muestra:

La muestra bajo ensayo consiste en un cerramiento vertical compuesto por dos fábricas de ladrillo gran formato de 7 (705x520x70 mm y 48,2 kg/m^3), con 1 cm de yeso por sus caras exteriores y cámara intermedia de 40 mm con lana de roca. Las dos fábricas se han construido sobre banda perimetral de poliestireno expandido elastificado de 15 mm de espesor. La muestra ha sido construida en una abertura de ensayo de 2,8 m x 3,6 m de un marco prefabricado de hormigón.

Volumen sala receptora: 55 m^3 — Masa superficial estimada: 123 kg/m^2 — Temperatura: 22,3 ºC
Volumen sala emisora: 65 m^3 — Área de la muestra: 10,08 m^2 — Humedad relativa: 69 %



f (Hz)	R (dB)
100	43,0
125	43,1
160	49,3
200	52,5
250	53,0
315	47,3
400	46,8
500	50,4
630	52,1
800	55,2
1000	55,7
1250	59,2
1600	61,8
2000	67,2
2500	71,1
3150	75,2
4000	79,8
5000	80,4



Indices de aislamiento: UNE-EN ISO 717-1:1997 $R_w(C;C_{tr})$: 56 (-1 ; -3) dB
NBE-CA 88 R(A): 56,1 dB(A)
Evaluación basada en medidas de laboratorio mediante método de ingeniería

ENAC ENSAYOS Nº 4/LE456

Nº de resultado: B0141 – 04 – M216 Firma: Area de Acústica Gestionada por labein tecnalia
Fecha informe: 15 de septiembre de 2.006

Anexo al informe B0141-IN-CT-04 II pág. 1 de 1

Measurement with slots

R_A = 57 dBA

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Ebaluazio, Berrikuntza eta Kontrol Zuzendaritza — Dirección de Vivienda, Innovación y Control
Erakuntzaren Kalitate Kontrolerako Laborategia — Laboratorio de Control de Calidad de la Edificación

Aislamiento a Ruido Aéreo según UNE-EN ISO 140-3:1995
Medidas en Laboratorio

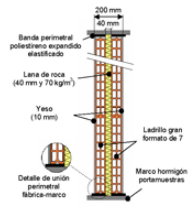
Cliente: HISPALYT, Asociación de Tabiques y Muros Cerámicos. **Fecha Ensayo:** 09/10/06

Muestra: Doble fábrica de ladrillo gran formato de 7, con lana de roca y rozas.

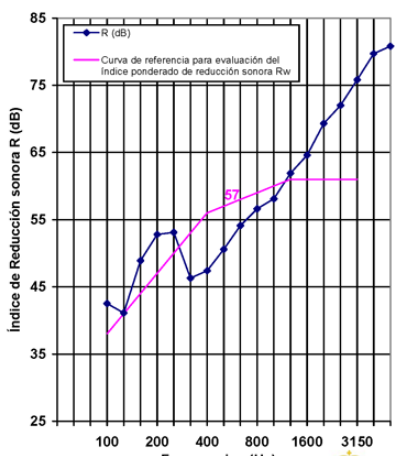
Descripción de la muestra:

La muestra bajo ensayo consiste en un cerramiento vertical compuesto por dos fábricas de ladrillo gran formato de 7 (705x520x70 mm y 48,2 kg/m^3) revestidas con 1 cm de yeso, cámara intermedia de 40 mm con lana de roca y rozas enfrentadas por ambas caras. Las dos fábricas se han construido sobre banda perimetral de poliestireno expandido elastificado de 15 mm de espesor. La muestra ha sido construida en una abertura de ensayo de 2,8 m x 3,6 m de un marco prefabricado de hormigón.

Volumen sala receptora: 55 m^3 — Masa superficial estimada: 123 kg/m^2 — Temperatura: 19,6 ºC
Volumen sala emisora: 65 m^3 — Área de la muestra: 10,08 m^2 — Humedad relativa: 69 %



f (Hz)	R (dB)
100	42,5
125	41,1
160	48,9
200	52,8
250	53,1
315	46,3
400	47,4
500	50,6
630	54,1
800	56,6
1000	58,1
1250	61,9
1600	64,6
2000	69,3
2500	72,0
3150	75,8
4000	79,7
5000	80,8



Indices de aislamiento: UNE-EN ISO 717-1:1997 $R_w(C;C_{tr})$: 57 (-1 ; -4) dB
NBE-CA 88 R(A): 56,7 dB(A)
Evaluación basada en medidas de laboratorio mediante método de ingeniería

ENAC ENSAYOS Nº 4/LE456

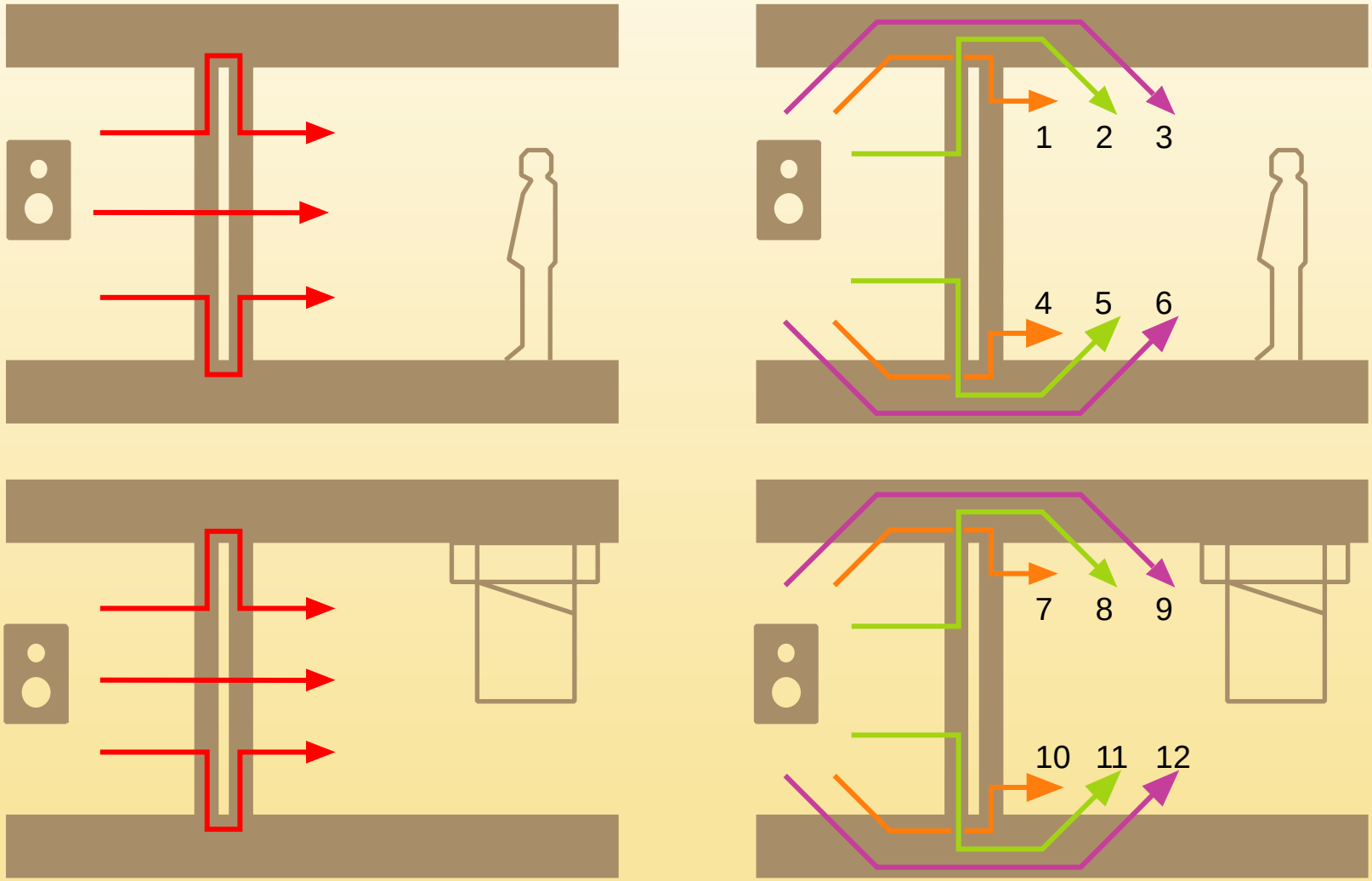
Nº de resultado: B0141 – 04 – M241 Firma: Area de Acústica Gestionada por labein tecnalia
Fecha informe: 10 de octubre de 2.006

Anexo al informe B0141-IN-CT-04 III pág. 1 de 1

The slots on the walls don't reduced the acoustic insulation of the ceramic wall

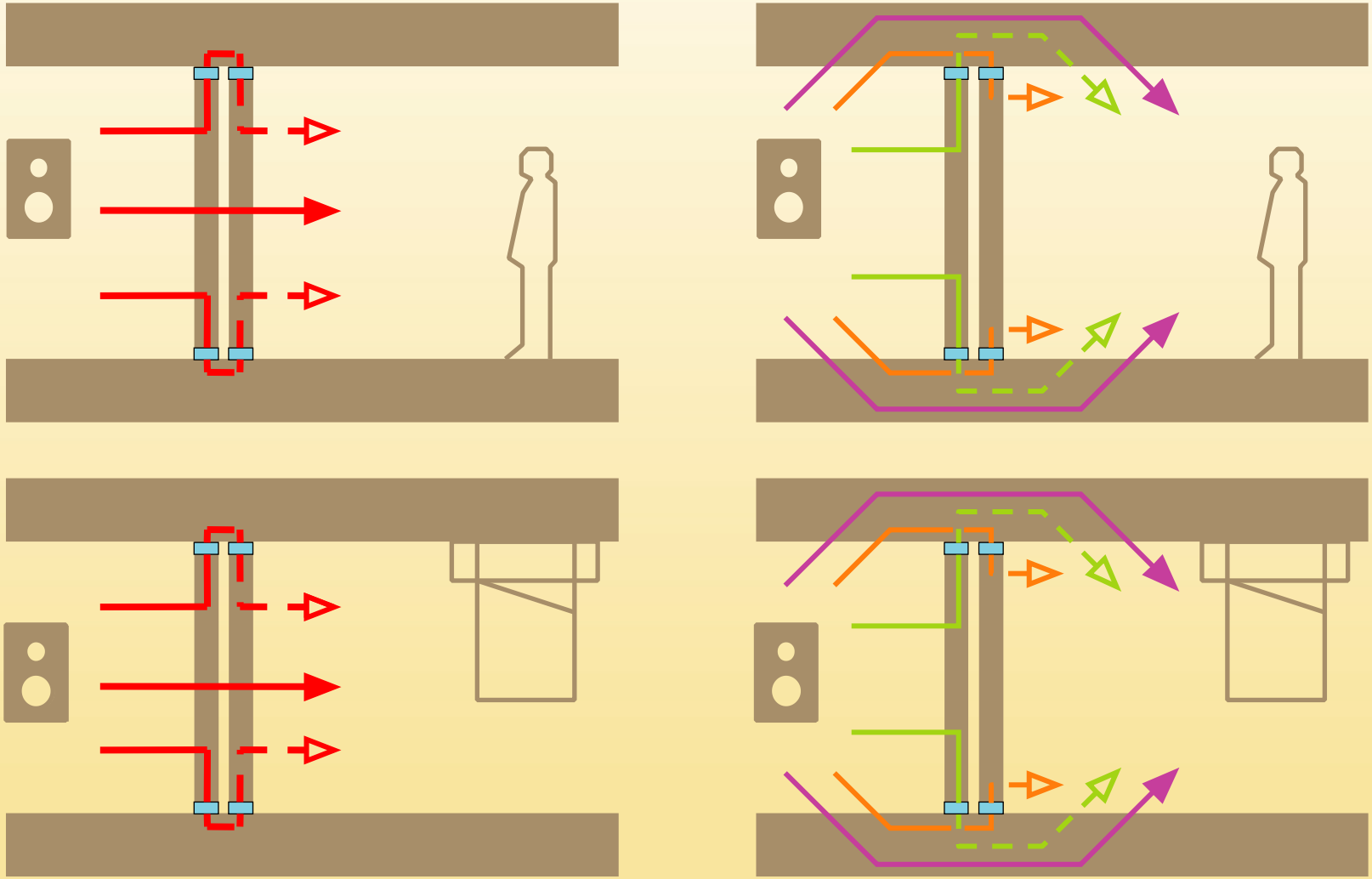
The horizontal noise transmission paths on site

Between two enclosures there is one direct transmission (■)
but there are also twelve indirect noise transmission paths (■ ■ ■)



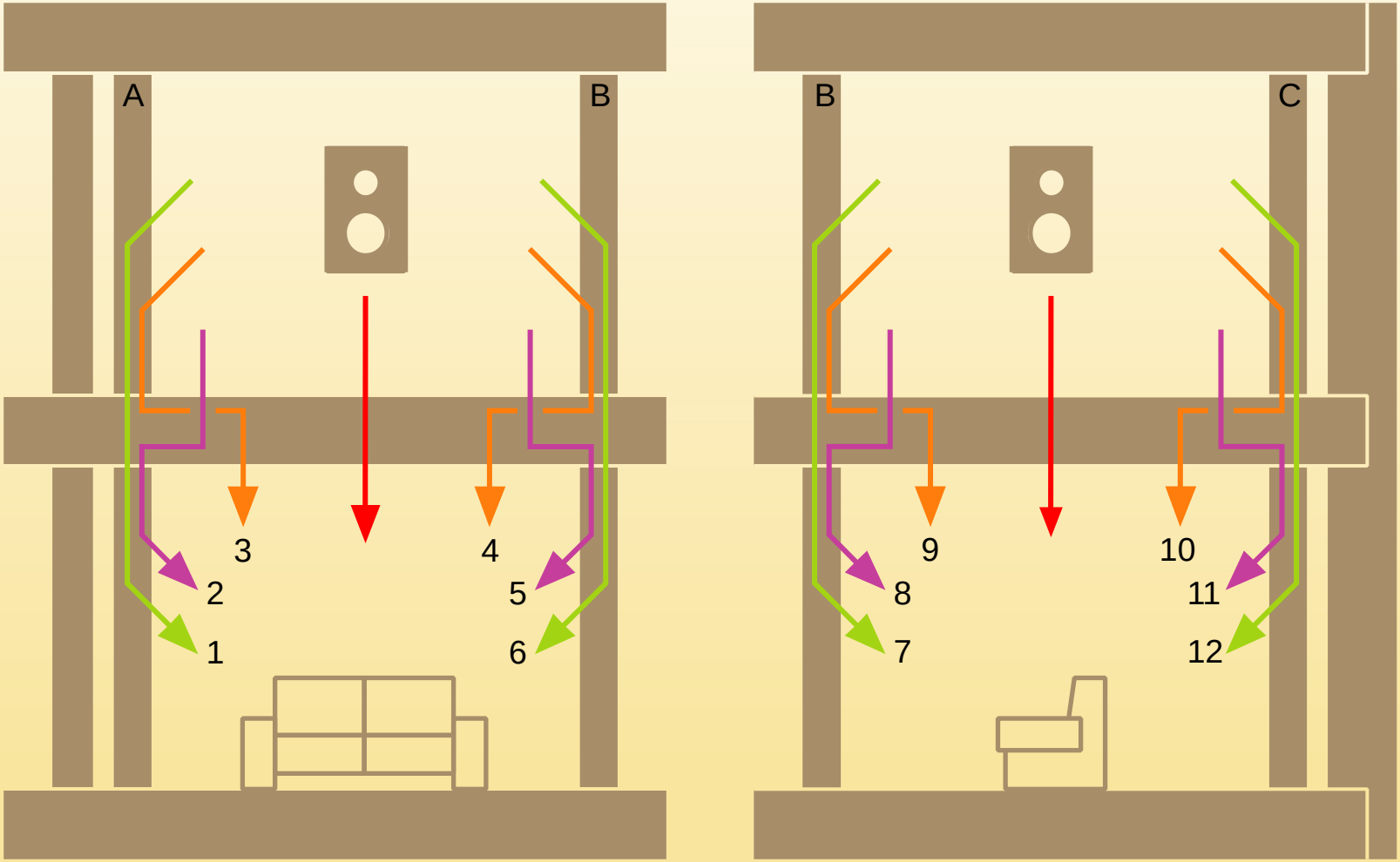
Horizontal acoustic insulation improvement using elastic bands

The perimeter elastic bands of the party wall (■)
Improve the acoustic insulation between adjacent horizontally because
the elastics bands interrupt the structural acoustic bridge (■)
and some noise transmission indirect paths of (■ ■)



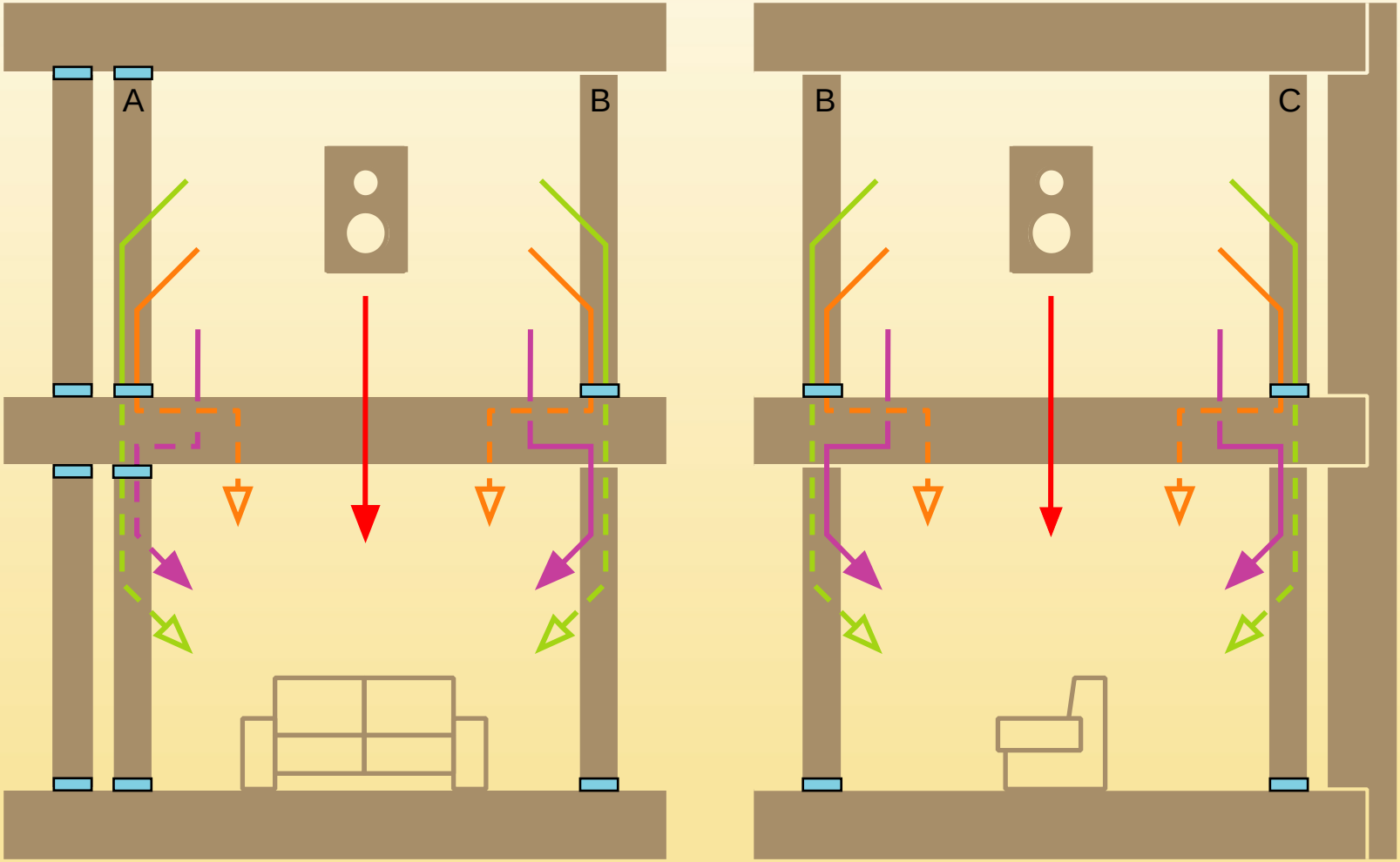
The vertical noise transmission paths on site

Between two horizontally adjacents enclosures there is
one direct noise transmission path through the floor structure (■)
and there are also 12 indirect noise transmission paths (■ ■ ■)
through the party wall (A) interior walls (B) and inner walls of the facade (C)



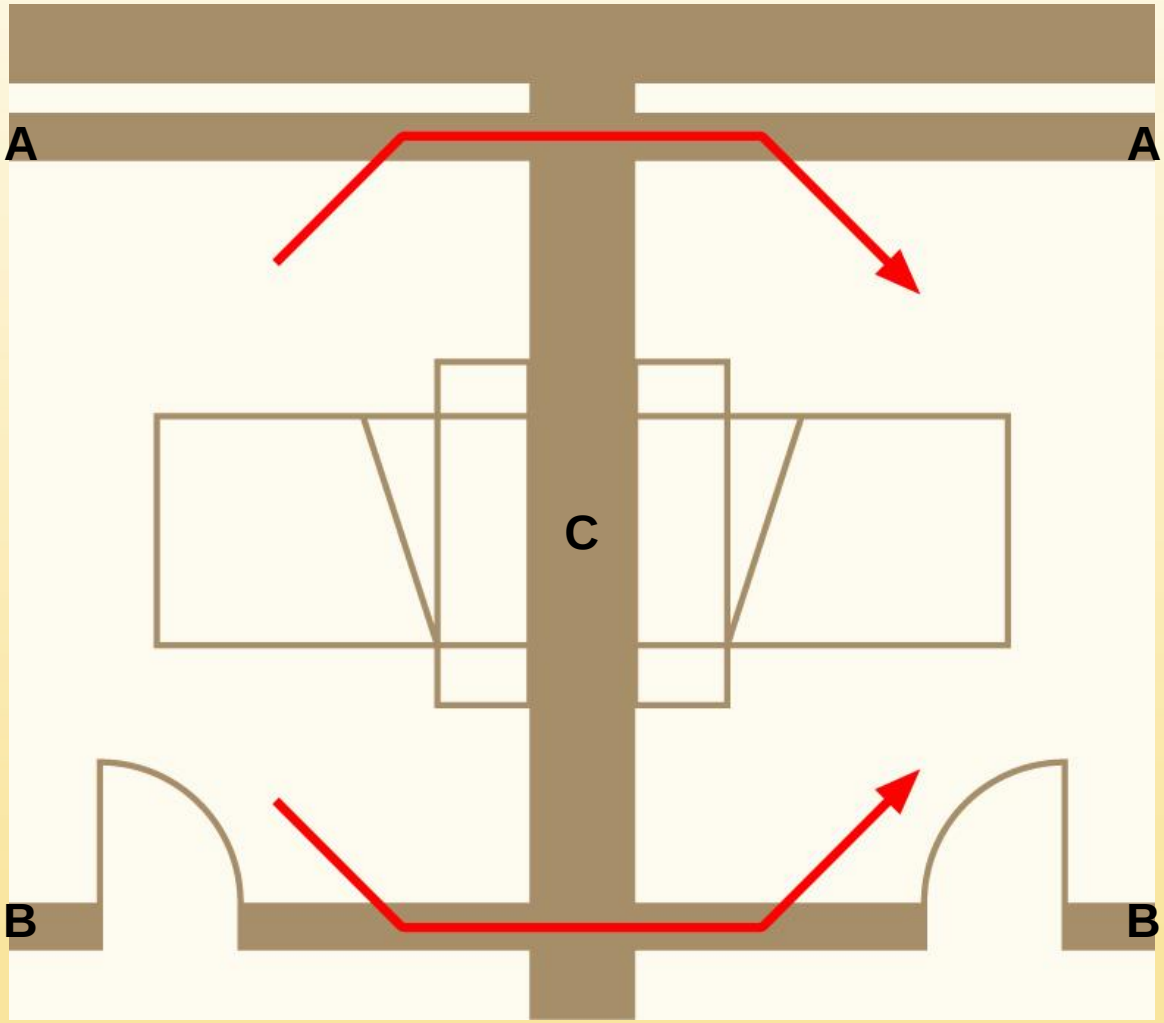
Vertical acoustic insulation improvement using elastic bands

The placement of the elastic bands (■)
in the base of party walls (A) interior walls (B) and inner walls of the facade (C)
improves the acoustic insulation vertically
because the elastic bands interrupt the indirect noise transmission paths (■ ■)



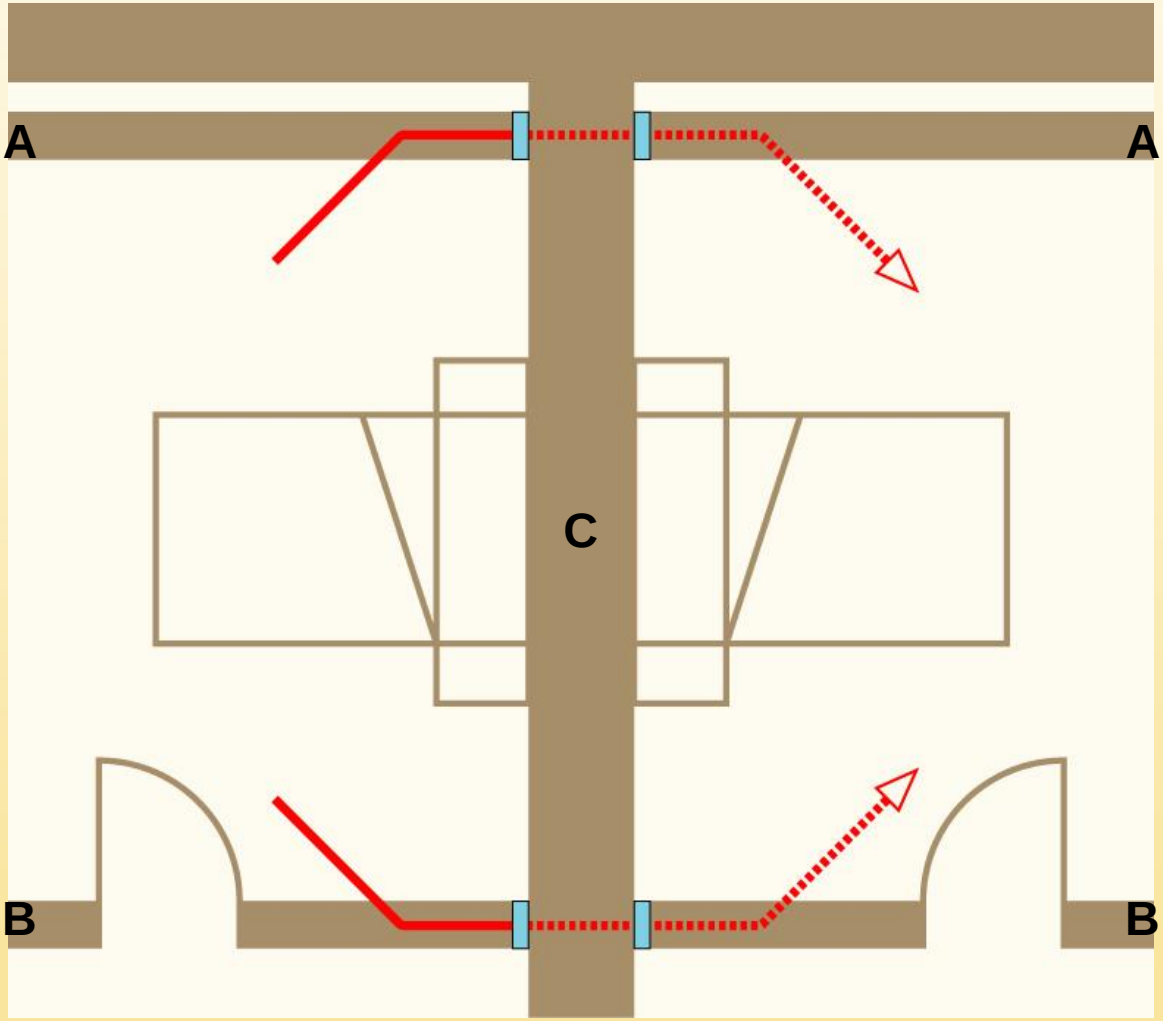
Horizontal transmissions of noise in one leaf party walls

When the interior walls (B) and inner walls of the facade (A) join a one leaf party wall (C), the interior wall transmission path - interior wall (B-B) and inner wall of the facade - inner wall of the facade (A-A) could be critic.



Improvement of the acoustic insulation horizontally using vertical elastic bands

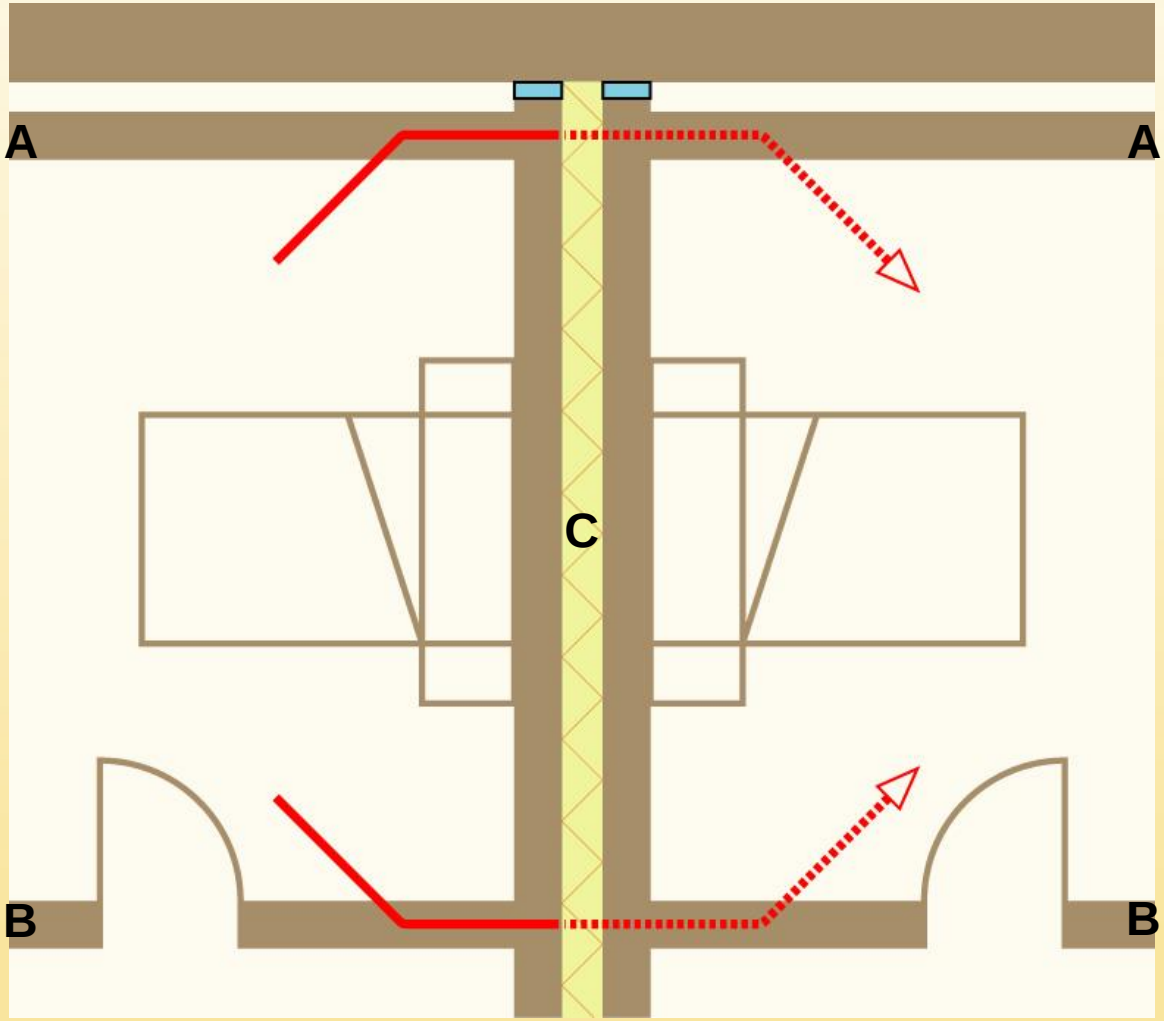
The interruption of the interior wall noise transmission paths– interior wall (B-B) and the inner wall of the facade – inner wall of the facade (A-A) by placing the elastics bands in the union of the interior walls (B) and the inner wall of the facade (A) with a one leaf party wall (C).



Improvement of the acoustic insulation horizontally using vertical elastic bands

It is not necessary the use of vertical elastic bands in two leaf party walls

The union of the interior walls (B) and inner facade walls (C) with a two leaf party wall is rigid. The interruption of the interior wall noise transmission paths - interior wall (B-B) and inner wall of the facade - inner wall of the facade (A-A) is made by the air chamber of the double wall (C)

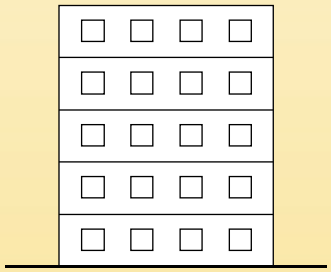
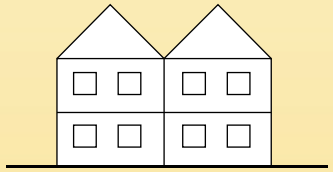


IN SUMARY:

The use of elastic bands improves the acoustic insulation in VERTICAL and/or HORIZONTAL depending on the union where we place it.

BUT...

The acoustic insulation requirements are different depending on the type of building:

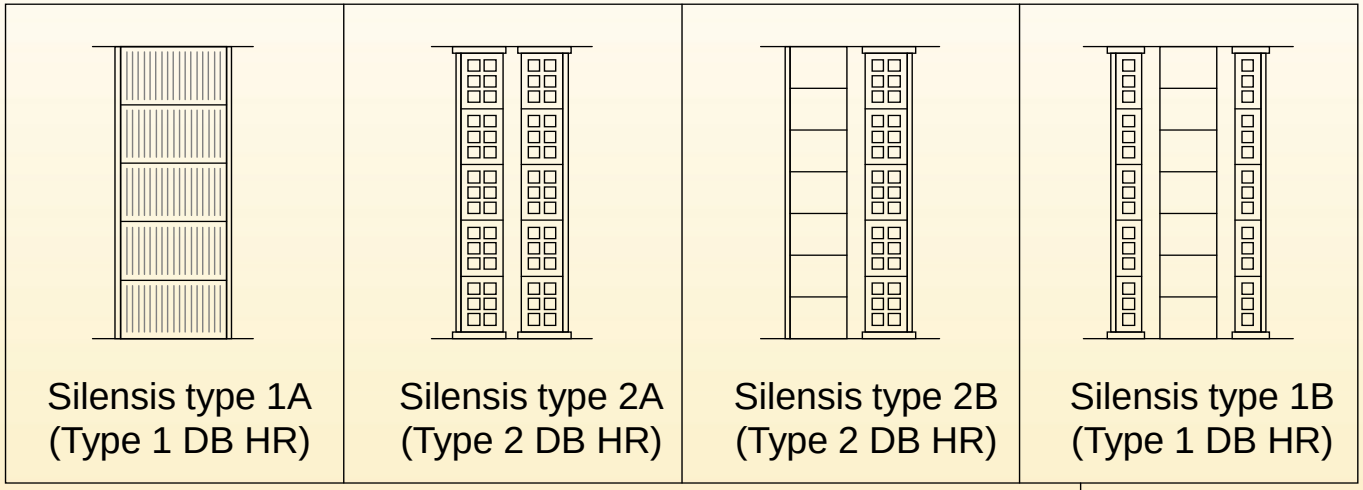
Buildings **WITH** acoustic insulation requirements in vertical	Buildings **WITHOUT** acoustic insulation requirements in vertical
	
Enclosures adjacent vertically belonging to different users	Enclosures adjacent vertically belonging to the same user

Then... Where and when must we place elastic bands in the interior walls and inner walls of the facade?

02 Silensis: high performance acoustic insulating ceramic brick walls system.
02.2. B. Acoustic insulation. Acoustic transmissions on site.

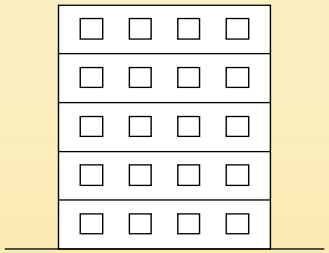
Placement of the elastic bands ■ in interior walls and inner walls of the facade

Depending on the type of party wall

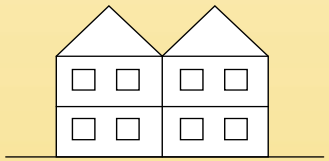


Silensis type 1A (Type 1 DB HR) | Silensis type 2A (Type 2 DB HR) | Silensis type 2B (Type 2 DB HR) | Silensis type 1B (Type 1 DB HR)

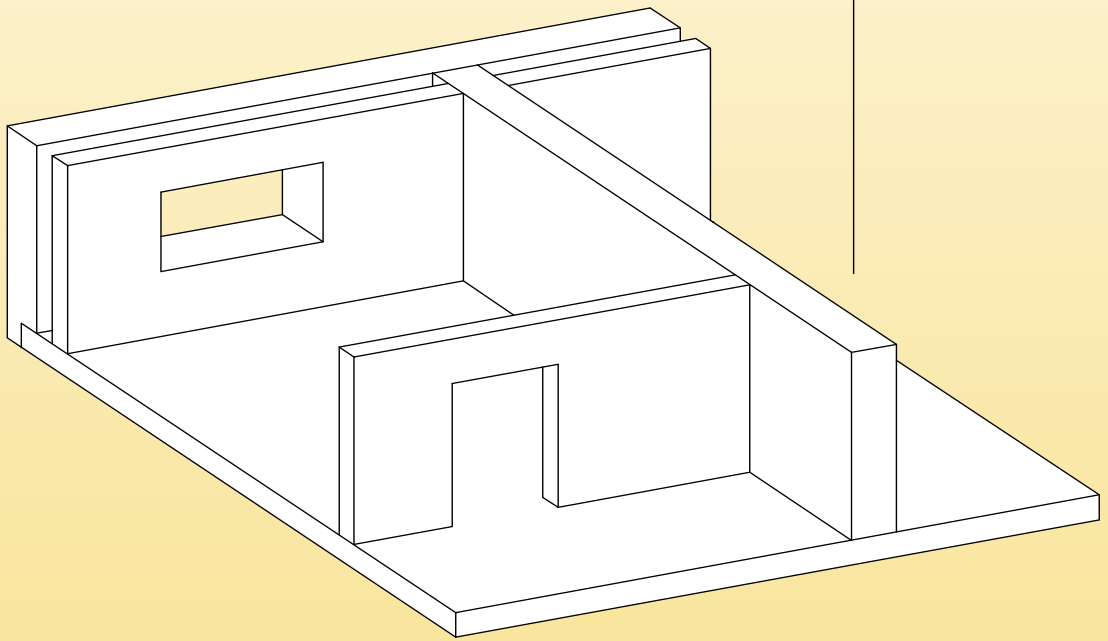
Depending on the type of the building



Buildings with acoustic insulation requirements in vertical



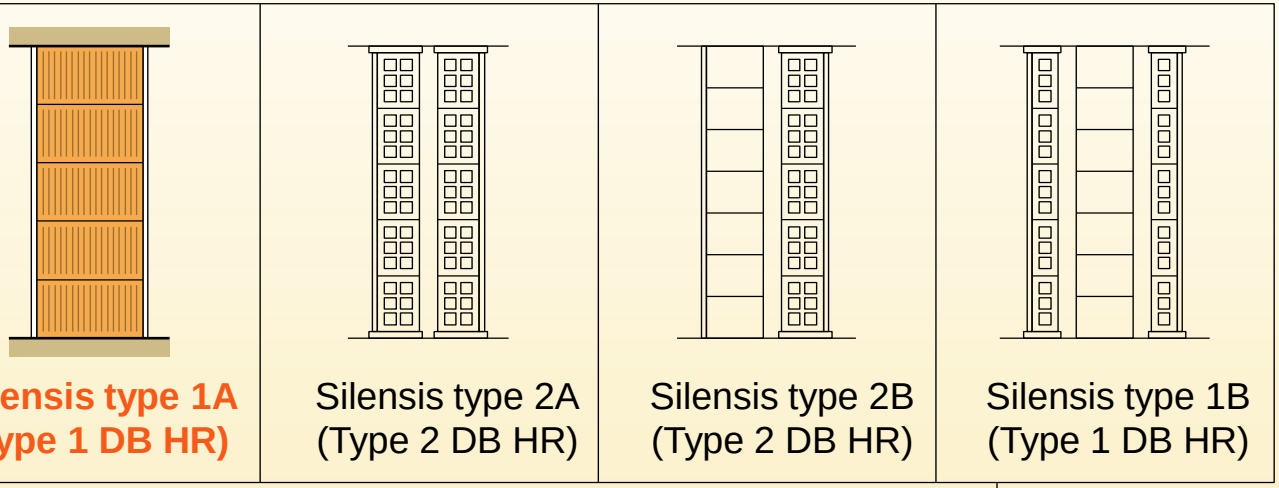
Buildings without acoustic insulation requirements in vertical



02 Silensis: high performance acoustic insulating ceramic brick walls system.
02.2. B. Acoustic insulation. Acoustic transmissions on site.

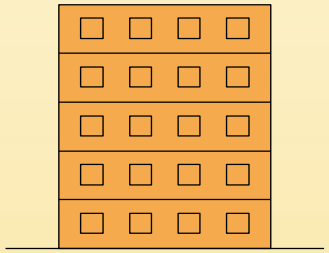
Placement of the elastic bands in interior walls and inner walls of the facade

Depending on the type of party wall

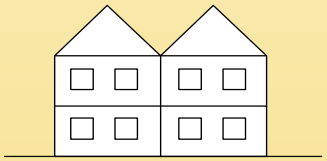


Silensis type 1A (Type 1 DB HR)	Silensis type 2A (Type 2 DB HR)	Silensis type 2B (Type 2 DB HR)	Silensis type 1B (Type 1 DB HR)

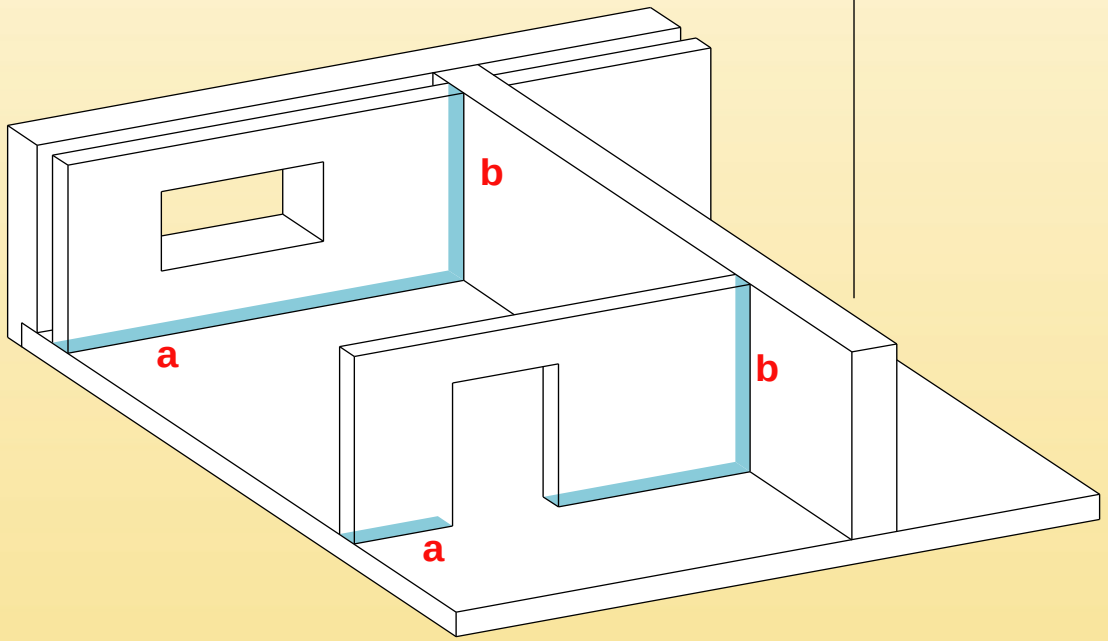
Depending on the type of building



Buildings with acoustic insulation requirements in vertical



Buildings without acoustic insulation requirements in vertical

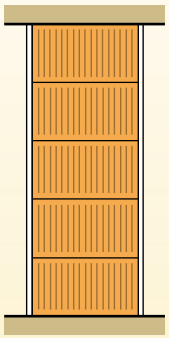


Joints with the floor structure: with elastic bands in the base (a)
Joints with the party wall: with elastic bands in vertical (b)
(Except if the wall is very heavy)

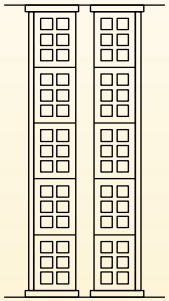
02 Silensis: high performance acoustic insulating ceramic brick walls system.
02.2. B. Acoustic insulation. Acoustic transmissions on site.

Placement of the elastic bands in interior walls and inner walls of the facade

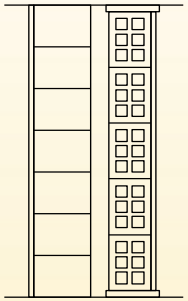
Depending on the type of party wall



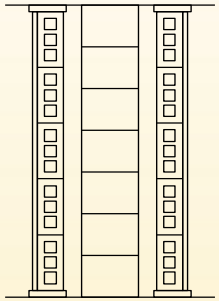
Silensis type 1A (Type 1 DB HR)



Silensis type 2A (Type 2 DB HR)

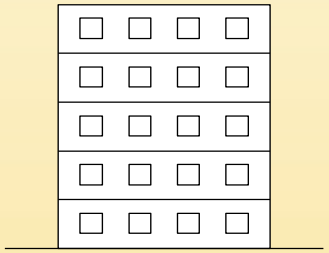


Silensis type 2B (Type 2 DB HR)

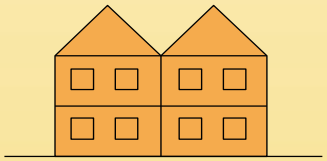


Silensis type 1B (Type 1 DB HR)

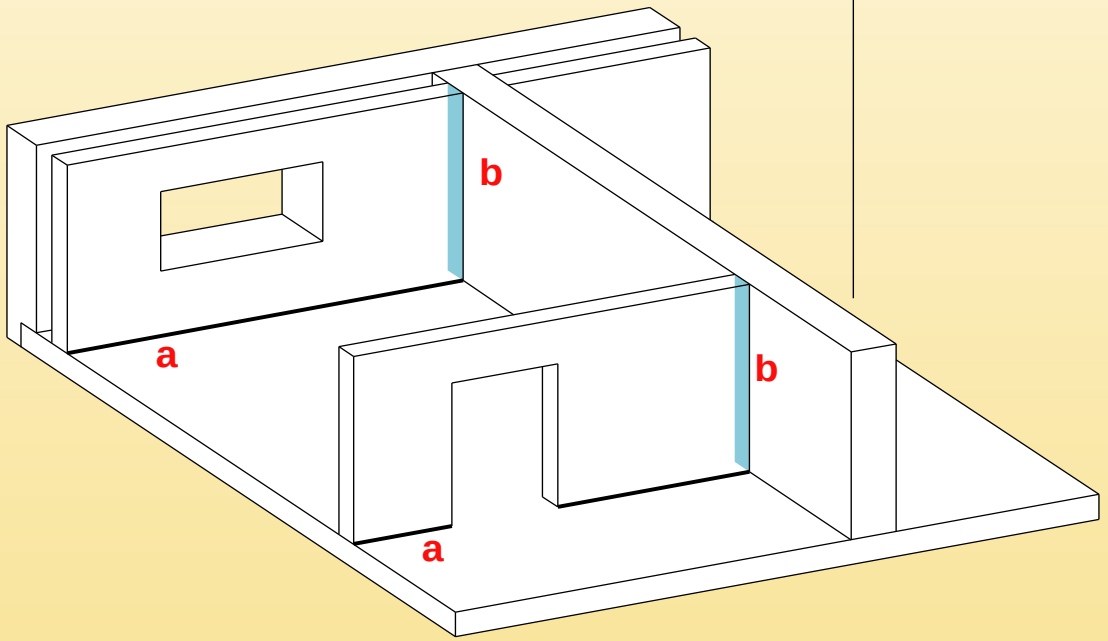
Depending on the type of building



Buildings with acoustic insulation requirements in vertical



Buildings without acoustic insulation requirements in vertical

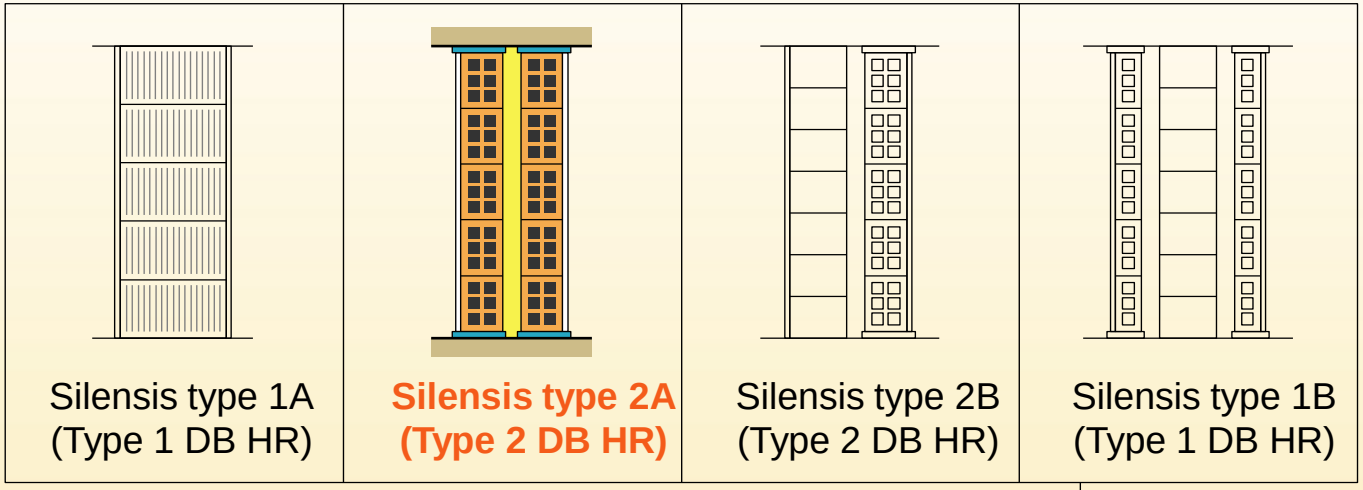


Joints with the floor structure : without elastic bands in the base (a)
Joints with the party wall: with elastic bands in vertical (b)
(Except if the wall is very heavy)

02 Silensis: high performance acoustic insulating ceramic brick walls system.
02.2. B. Acoustic insulation. Acoustic transmissions on site.

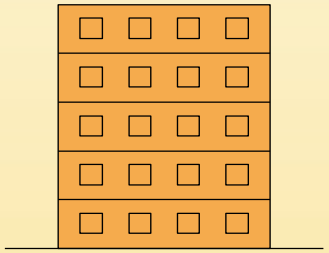
Placement of the elastic bands in interior walls and inner walls of the facade

Depending on the type of party wall

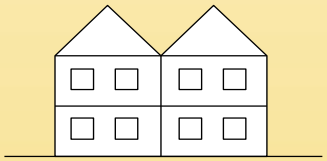


Silensis type 1A (Type 1 DB HR)	**Silensis type 2A (Type 2 DB HR)**	Silensis type 2B (Type 2 DB HR)	Silensis type 1B (Type 1 DB HR)

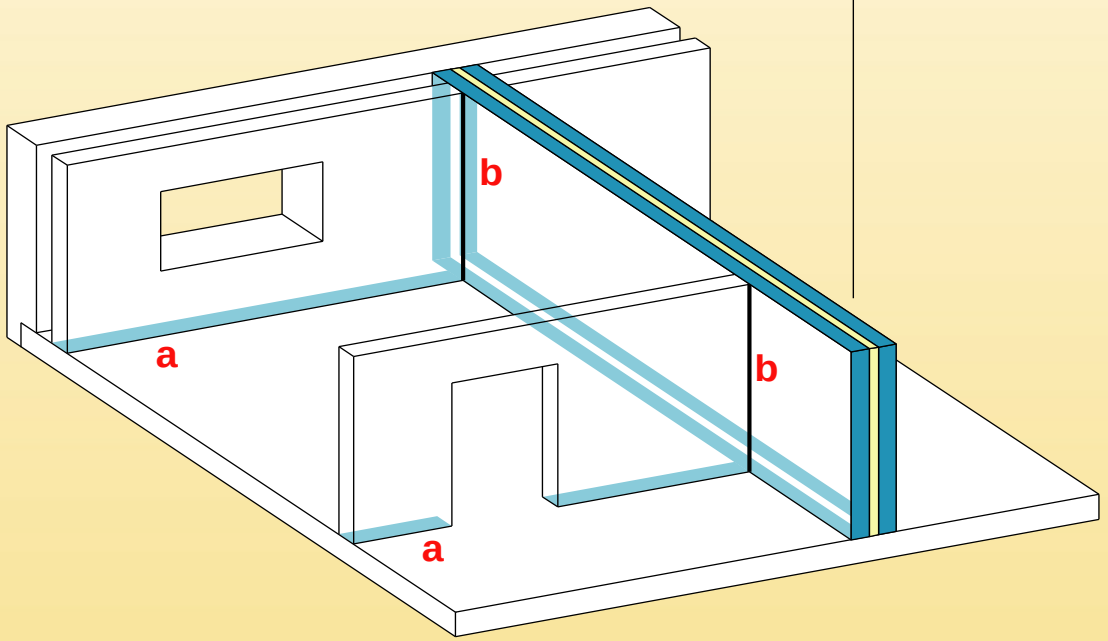
Depending on the type of building



Buildings with acoustic insulation requirements in vertical



Buildings without acoustic insulation requirements in vertical

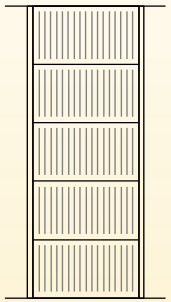
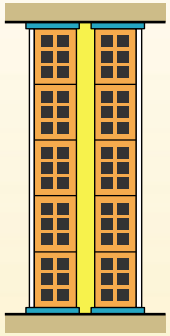
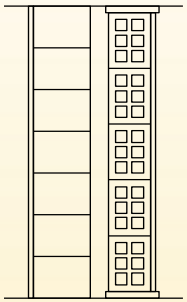
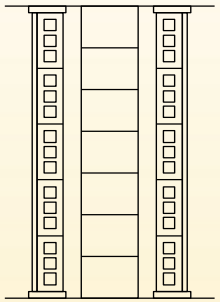


Joints with the floor structure : with elastic bands in the base (a)
Joints with the party wall: rigid union, without elastic bands in vertical (b)

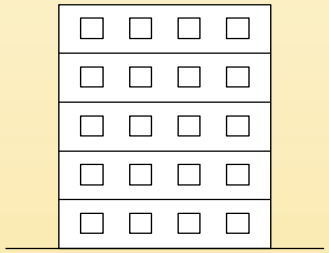
02 Silensis: high performance acoustic insulating ceramic brick walls system.
02.2. B. Acoustic insulation. Acoustic transmissions on site.

Placement of the elastic bands in interior walls and inner walls of the facade

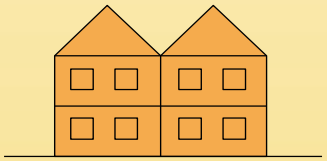
Depending on the type of party wall

			
Silensis type 1A (Type 1 DB HR)	**Silensis type 2A (Type 2 DB HR)**	Silensis type 2B (Type 2 DB HR)	Silensis type 1B (Type 1 DB HR)

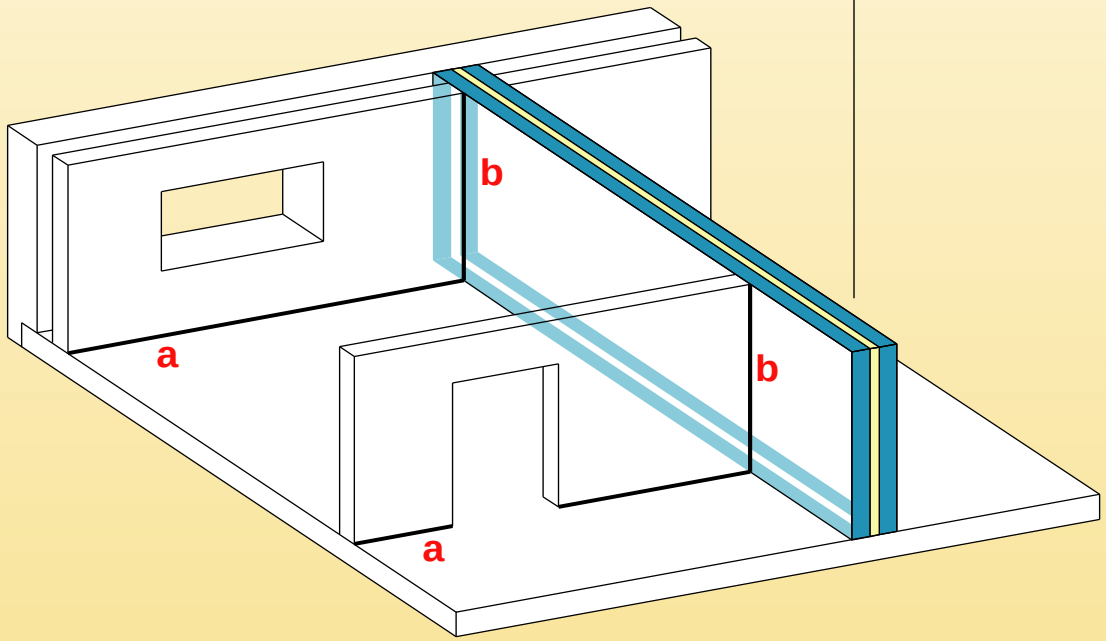
Depending on the type of building



Buildings with acoustic insulation requirements in vertical



Buildings without acoustic insulation requirements in vertical

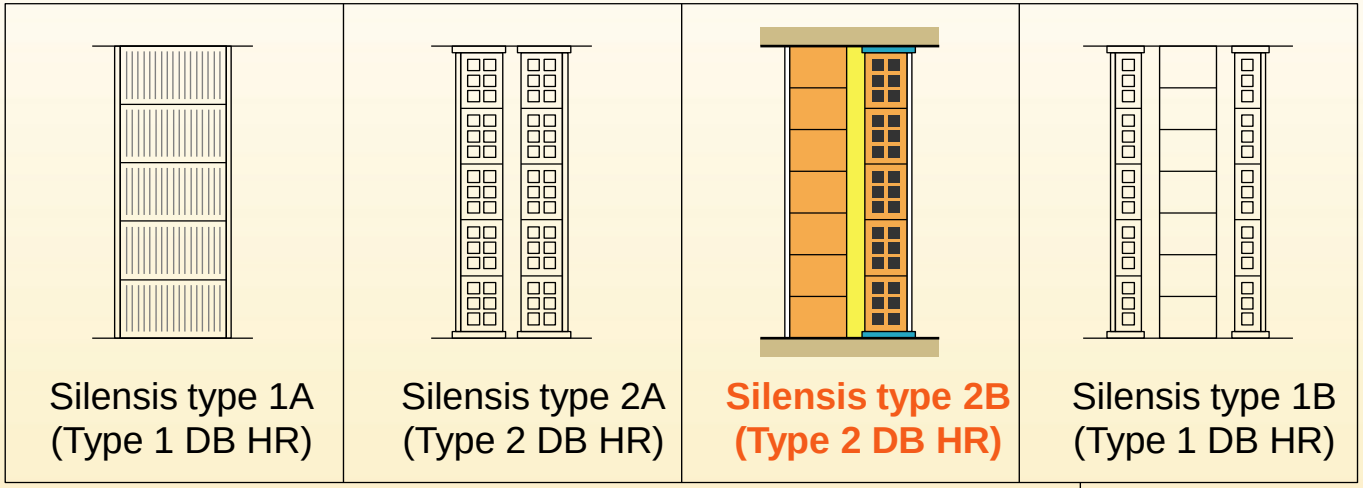


Joints with the floor structure : without elastic bands in the base (a)
Joints with the party wall: rigid union, without elastic bands in vertical (b)

02 Silensis: high performance acoustic insulating ceramic brick walls system.
02.2. B. Acoustic insulation. Acoustic transmissions on site.

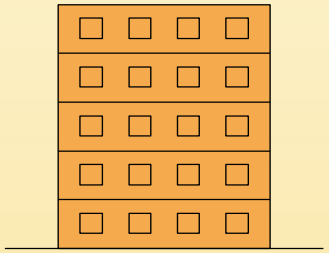
Placement of the elastic bands in interior walls and inner walls of the facade

Depending on the type of party wall

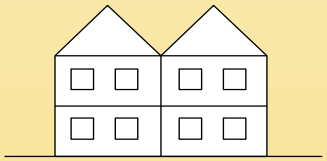


Silensis type 1A (Type 1 DB HR)	Silensis type 2A (Type 2 DB HR)	**Silensis type 2B (Type 2 DB HR)**	Silensis type 1B (Type 1 DB HR)

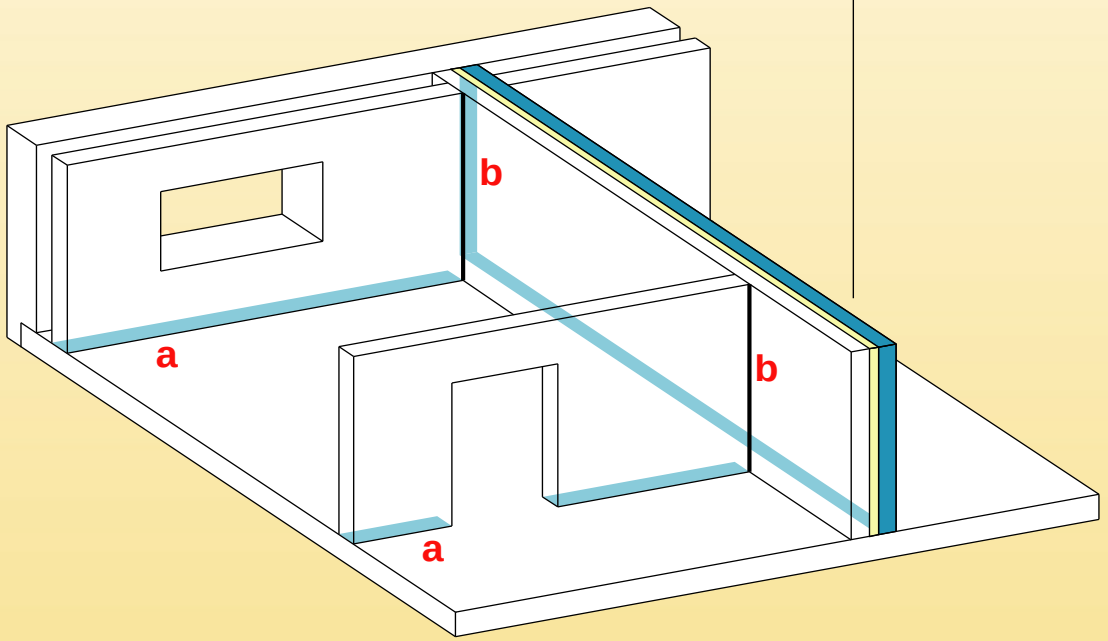
Depending on the type of building



Buildings with acoustic insulation requirements in vertical



Buildings without acoustic insulation requirements in vertical

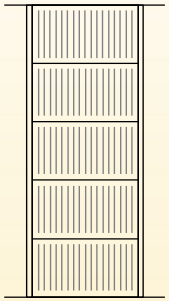
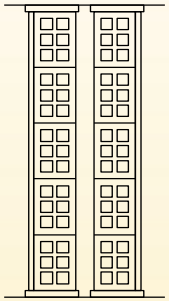
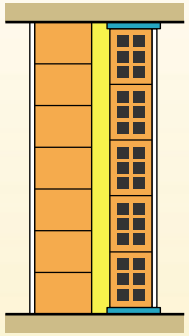
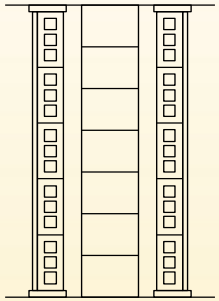


Joints with the floor structure : with elastic bands in the base (a)
Joints with the party wall: rigid union, without elastic bands in vertical (b)

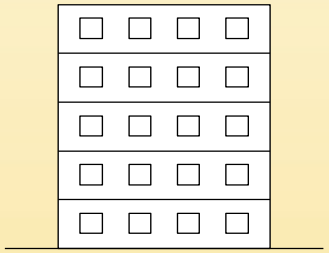
02 Silensis: high performance acoustic insulating ceramic brick walls system.
02.2. B. Acoustic insulation. Acoustic transmissions on site.

Placement of the elastic bands in interior walls and inner walls of the facade

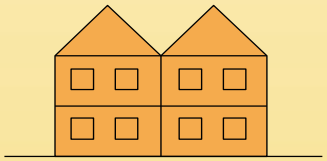
Depending on the type of party wall

Silensis type 1A (Type 1 DB HR)	Silensis type 2A (Type 2 DB HR)	**Silensis type 2B (Type 2 DB HR)**	Silensis type 1B (Type 1 DB HR)
			

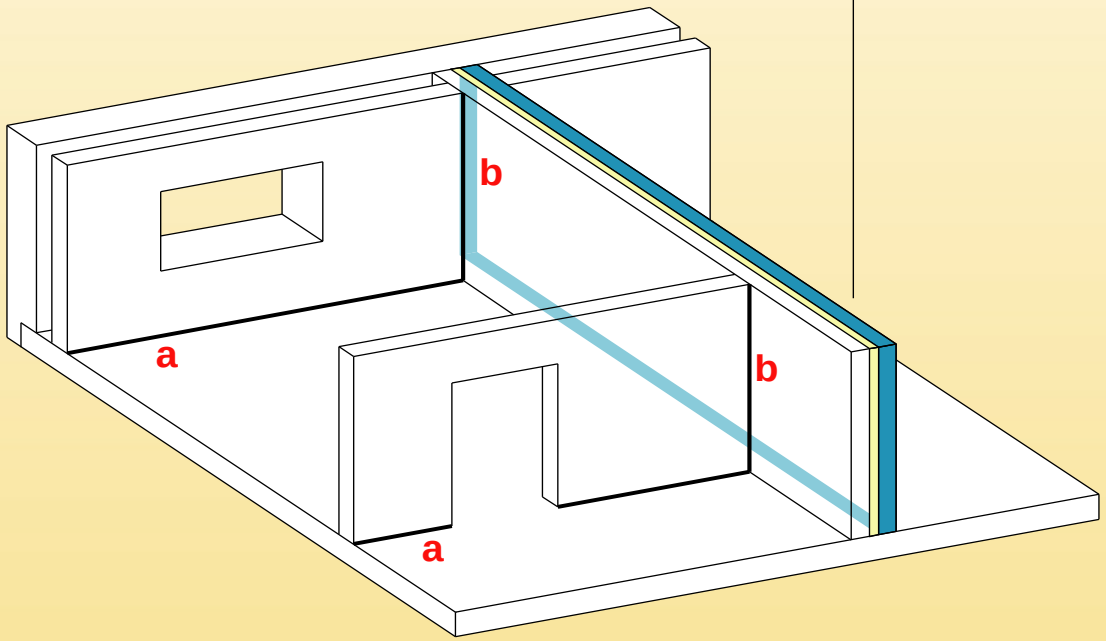
Depending on the type of building



Buildings with acoustic insulation requirements in vertical



Buildings without acoustic insulation requirements in vertical

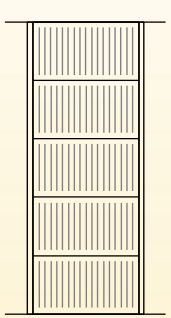


Joints with the floor structure : without elastic bands in the base (a)
Joints with the party wall: rigid union, without elastic bands in vertical (b)

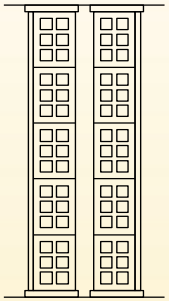
02 Silensis: high performance acoustic insulating ceramic brick walls system.
02.2. B. Acoustic insulation. Acoustic transmissions on site.

Placement of the elastic bands in interior walls and inner walls of the facade

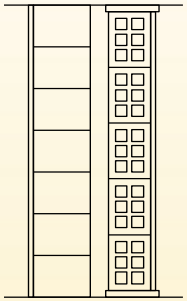
Depending on the type of party wall



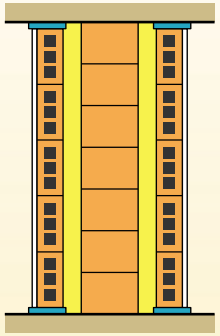
Silensis type 1A
(Type 1 DB HR)



Silensis type 2A
(Type 2 DB HR)

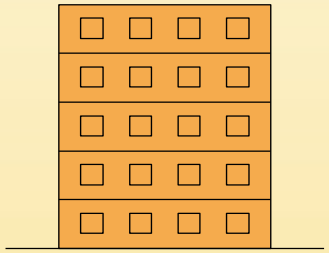


Silensis type 2B
(Type 2 DB HR)

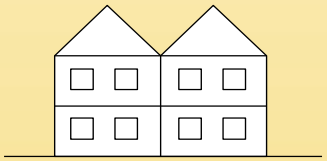


Silensis type 1B
(Type 1 DB HR)

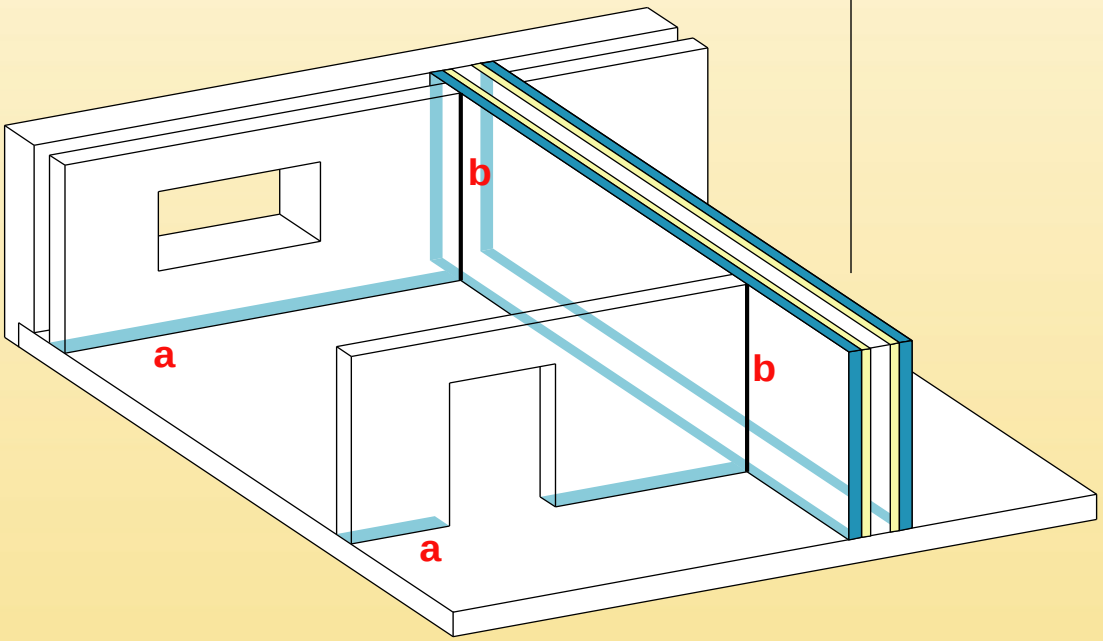
Depending on the type of building



Buildings with acoustic insulation requirements in vertical



Buildings without acoustic insulation requirements in vertical

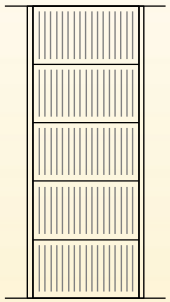
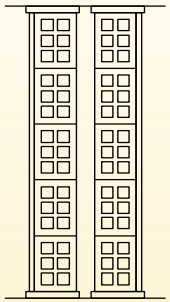
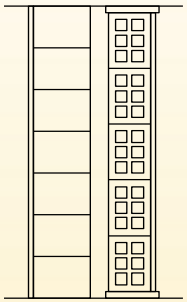
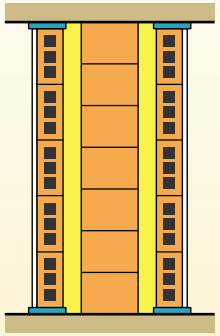


Joints with the floor structure : with elastic bands in the base (a)
Joints with the party wall: rigid union, without elastic bands in vertical (b)

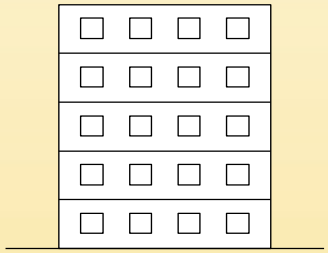
02 Silensis: high performance acoustic insulating ceramic brick walls system.
02.2. B. Acoustic insulation. Acoustic transmissions on site.

Placement of the elastic bands in interior walls and inner walls of the facade

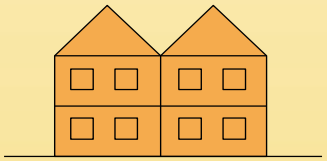
Depending on the type of party wall

Silensis type 1A (Type 1 DB HR)	Silensis type 2A (Type 2 DB HR)	Silensis type 2B (Type 2 DB HR)	**Silensis type 1B (Type 1 DB HR)**
			

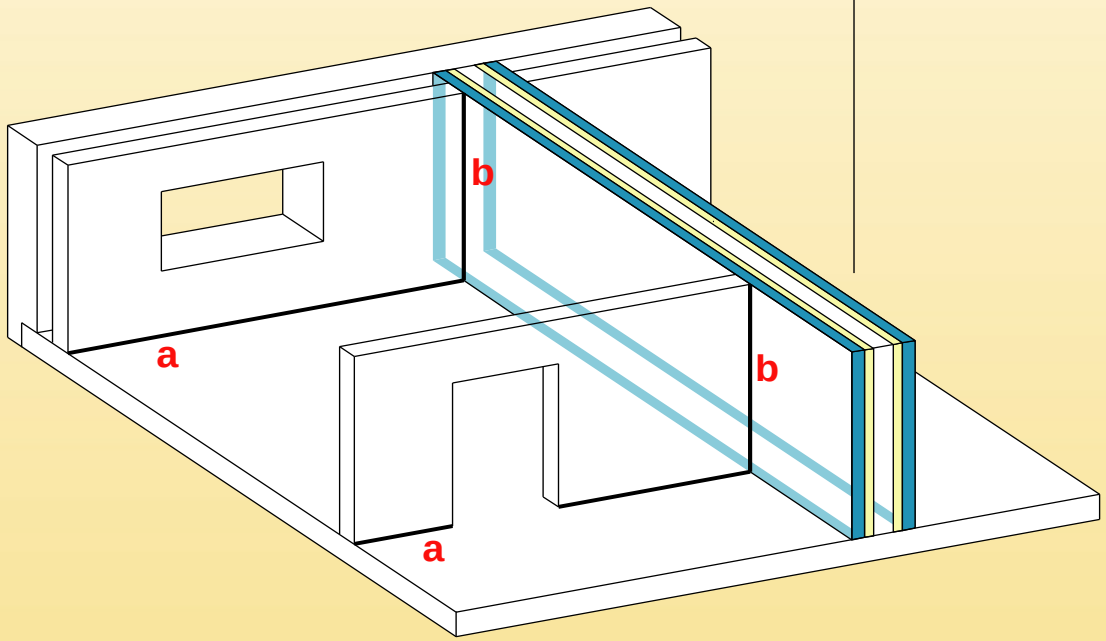
Depending on the type of building



Buildings with acoustic insulation requirements in vertical



Buildings without acoustic insulation requirements in vertical



Joints with the floor structure : without elastic bands in the base (a)
Joints with the party wall: rigid union, without elastic bands in vertical (b)

Validation of the Silensis System on site. Measurement of sound insulation on site

Methodology used in the measurement

In project stage:

1- Selection of the enclosure with the worst geometry

2- Evaluation of the noise transmission paths, identification of the most critic paths

3- Definition of the optimum combination of constructive elements to use in these cases:

Criteria:

- Cause the least possible alteration to the original building project
- Compliance with all requirements of the DB HR of the CTE
  (Acoustic insulation to airborne noise in horizontal, in vertical, and impact noise)

In construction:

1- Monitoring and consulting on the implementation

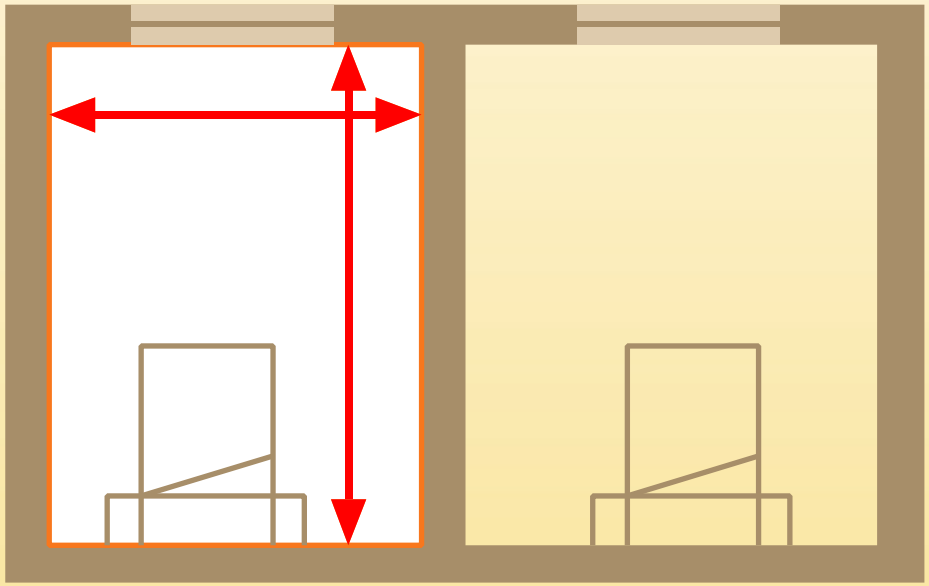
2- Measurement of sound insulation on site, according to UNE-EN ISO 140
and under ENAC acreditation

Validation of the Silensis System on site. Measurement of sound insulation on site

Conditions that were sought in the measurements

Choosing the enclosure with the most unfavorable geometry
(usually bedrooms)

Small depth enclosure



Big surface of the party wall

Validation of the Silensis System on site. Measurement of sound insulation on site

Conditions that were sought in the measurements

Different combinations of constructives elements (facades, floor structure…)

Validation of the Silensis System on site. Measurement of sound insulation on site

Conditions that were sought in the measurements

Party walls with different type of bricks
(hollow brick, hollow brick large format, panel prefabricated ceramic and plaster …)

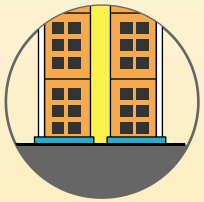
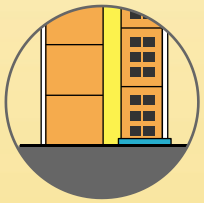
Validation of the Silensis System on site. Measurement of sound insulation on site

Conditions that were sought in the measurements

Elastic bands of:
EEPS (Elasticized expanded polystyrene)

Validation of the Silensis System on site. Measurement of sound insulation on site

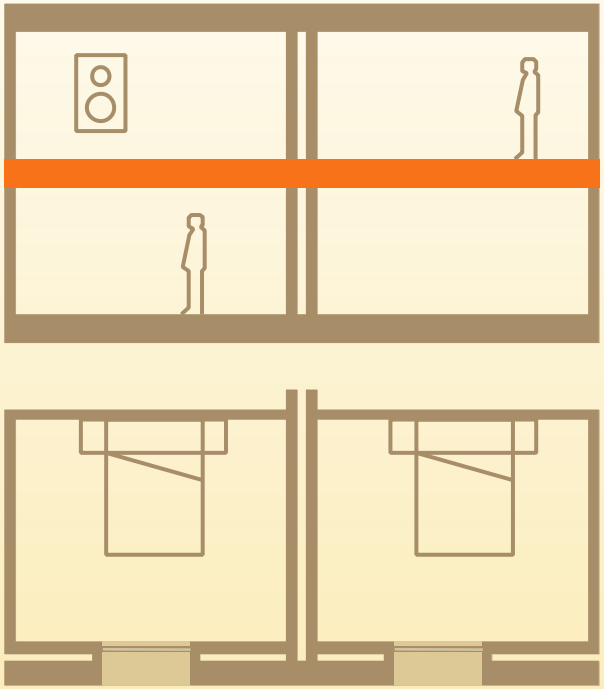
Some results of the measurements in buildings, according to UNE-EN ISO 140 and under ENAC accreditation

	SEPARATING ELEMENT	LOCATION	DATE	$D_{nT,w}+C_{100-5k}$
 **Silensis Tipo 2A**	LGF 7cm + LM 4cm + LGF 5cm Elastic Bands EEPS 1,5cm	Álava	Feb-04	50
	LHD 8cm + LM 4cm + LHD 8cm Elastic Bands EEPS 1,5cm	Mérida	Ene-06	54
	LGF 8cm + LM 4cm + LGF 8cm Elastic Bands EEPS 1,5cm	Vigo	Ago-06	51 / 55
	LGF 7cm + Tecnosound 3cm + LGF 7cm Elastic Bands EEPS 1,5cm	Soria	Sep-06	50
	PPCY 6cm + LM 6cm + PPCY 6cm Elastic Bands EEPS 1,5cm	Logroño	May-06	51 / 52
	LGF 7cm + LM 5cm + LGF 10cm Elastic Bands EEPS 1cm	Valencia	Ene-07	53 / 55
	LGF 7cm +LM 4cm + LGF 7cm Elastic Bands EEPS 1cm	Guipúzcoa	Feb-07	53
 **Silensis Tipo 2B**	1/2 foot LP 11,5cm + LM 4cm+ LHS 5cm. Elastic Bands EEPS 1,5cm	Vigo	Ago-06	54 / 55
	LP 11,5cm + LM 4cm+ LHS 5cm. Elastic Bands EEPS 1,5cm	La Coruña	Ago-06	56 / 56

LHD: Double horizontally perforated brick; LHGF: Large format double hollow brick ; LHS: Simple hollow brick ; PCY: Panel prefabricated ceramic and plaster; BC: Ceramic block; LP Perforated brick; LM : absorbing material ; EEPS: elasticized expanded polystyrene

These results of the measurements in buildings are not directly comparable because they depend not only on the party wall, but also on the rest of the constructive elements and geometry

Validation of the Silensis System on site. Measurement of sound insulation on site



Construction in Mérida

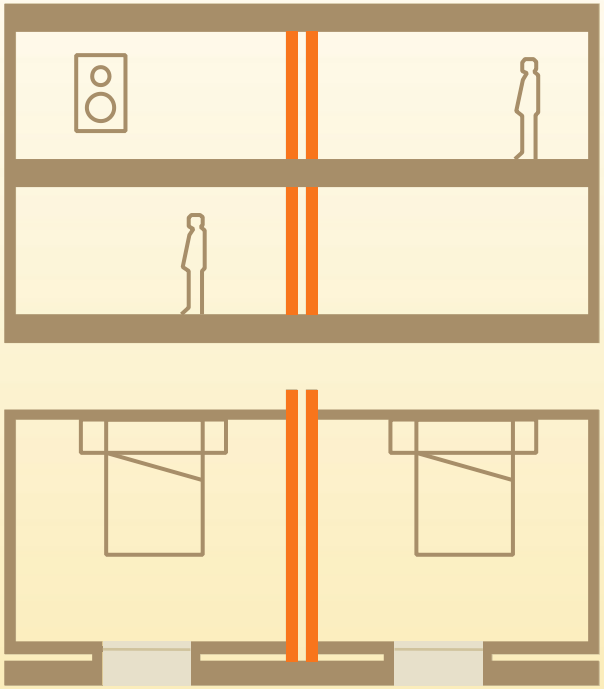
Floor structure
- Concrete block grid(25+5cm)
- Anti-impact material: 2cm EEPS

Party wall between dwellings
- Double hollow brick (24x11,2x8 cm) with perimeter elastic bands EEPS 1,5 cm
- Mineral wool insulation 4cm
- Double hollow brick (24x11,2x8 cm) with perimeter elastic bands EEPS 1,5 cm

Interior wall
- Double hollow brick (40x20x7 cm) with elastic bands EEPS 1,5 cm in the base

Facade
- 1/2 foot perforated brick (24x11,2x10 cm)
- Projected polyurethane
- Double hollow brick (40x20x7 cm) with elastic bands EEPS 1,5 cm in the base

Validation of the Silensis System on site. Measurement of sound insulation on site



Construction in Mérida

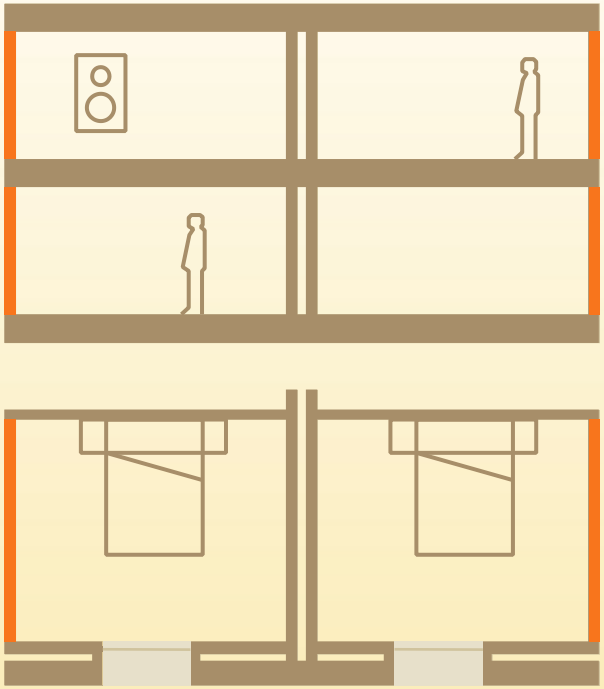
Floor structure
- Concrete block grid(25+5cm)
- Anti-impact material: 2cm EEPS

Party wall between dwellings
- Double hollow brick (24x11,2x8 cm) with perimeter elastic bands EEPS 1,5 cm
- Mineral wool insulation 4cm
- Double hollow brick (24x11,2x8 cm) with perimeter elastic bands EEPS 1,5 cm

Interior wall
- Double hollow brick (40x20x7 cm) with elastic bands EEPS 1,5 cm in the base

Facade
- 1/2 foot perforated brick (24x11,2x10 cm)
- Projected polyurethane
- Double hollow brick (40x20x7 cm) with elastic bands EEPS 1,5 cm in the base

Validation of the Silensis System on site. Measurement of sound insulation on site



Construction in Mérida

Floor structure
- Concrete block grid(25+5cm)
- Anti-impact material: 2cm EEPS

Party wall between dwellings
- Double hollow brick (24x11,2x8 cm) with perimeter elastic bands EEPS 1,5 cm
- Mineral wool insulation 4cm
- Double hollow brick (24x11,2x8 cm) with perimeter elastic bands EEPS 1,5 cm

Interior wall
- Double hollow brick (40x20x7 cm) with elastic bands EEPS 1,5 cm in the base

Facade
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- Projected polyurethane
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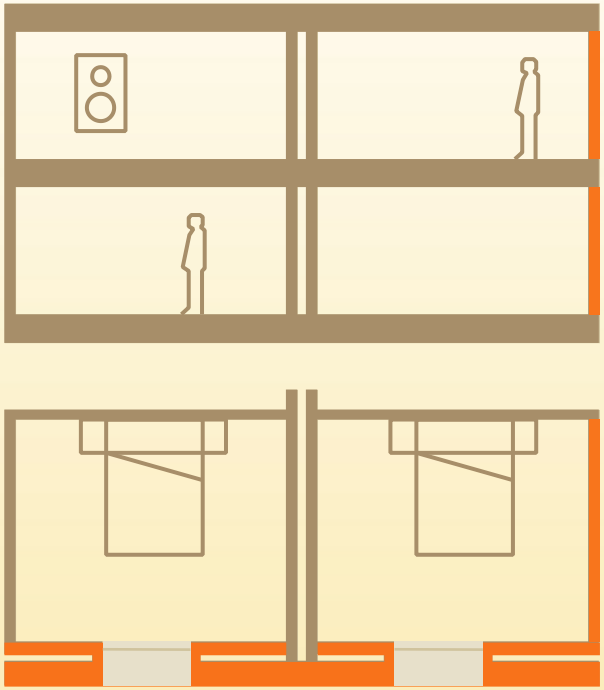
Validation of the Silensis System on site. Measurement of sound insulation on site



Construction in Mérida

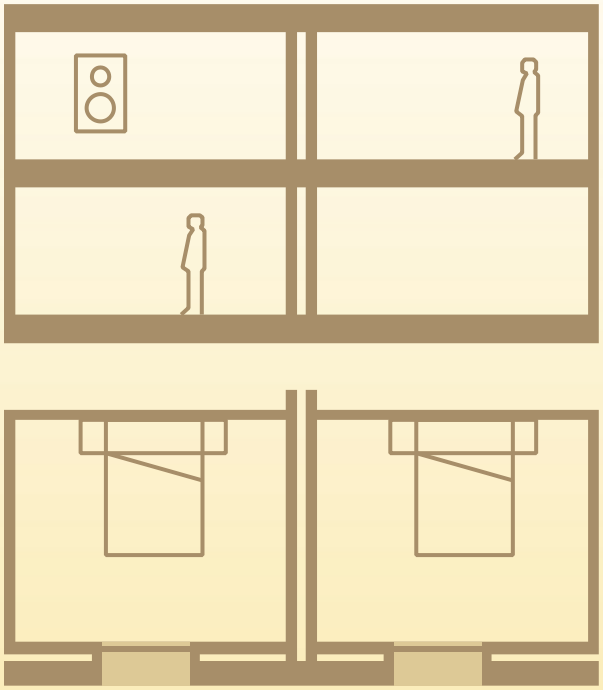
Floor structure
- Concrete block grid(25+5cm)
- Anti-impact material: 2cm EEPS

Party wall between dwellings
- Double hollow brick (24x11,2x8 cm) with perimeter elastic bands EEPS 1,5 cm
- Mineral wool insulation 4cm
- Double hollow brick (24x11,2x8 cm) with perimeter elastic bands EEPS 1,5 cm

Interior wall
- Double hollow brick (40x20x7 cm) with elastic bands EEPS 1,5 cm in the base

Facade
- 1/2 foot perforated brick (24x11,2x10 cm)
- Projected polyurethane
- Double hollow brick (40x20x7 cm) with elastic bands EEPS 1,5 cm in the base

Validation of the Silensis System on site. Measurement of sound insulation on site



Construction in Mérida

DIFERENCIA DE NIVELES ESTANDARIZADA
NORMA UNE-EN ISO 140-4:1999
MEDIDAS *IN SITU* DEL AISLAMIENTO AL RUIDO AÉREO ENTRE RECINTOS

labein tecnalia

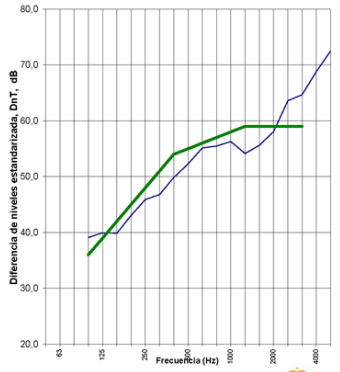
Cliente: HISPALYT **Fecha del ensayo:** 17.01.2006

Descripción e identificación del elemento de construcción y disposición del ensayo :
CONSTRUCTORA: Trajano Inmobiliaria, 27 viviendas en Mérida (Badajoz)
EMISOR: Planta 2ª, Dormitorio 2. Fuente omnidireccional situada en dos posiciones del Dormitorio. Promedio de diez posiciones de micrófono. - RECEPTOR: Planta 2ª, Dormitorio 3. Promedio de diez posiciones de micrófono. Tiempo de reverberación medido con dos posiciones de la fuente y seis posiciones de microfono. ELEMENTO SEPARADOR: Medianera de la vivienda.
ELEMENTOS CONSTRUCTIVOS UTILIZADOS: Forjado: Reticular de bovedilla de hormigón (25+5). Elemento anti-impacto: 2cm de EPS elastificado. Fachada: Doble hoja compuesta por ladrillo perforado, poliuretano proyectado y hoja interior de LHD (apoyado sobre banda EPS). Medianera: LHD 8cm + 4cm LR + LHD 8cm (ambas hojas con bandas de EPS en su perimetro). Tabiquería interior: LHD 6.5 cm (apoyado sobre banda EPS).

Volumen del recinto emisor : 34,2 m^3
Volumen del recinto receptor : 29,04 m^3

Rango de frecuencias según los valores de la curva de referencia (UNE-EN ISO 717-1)

Frecuencia Hz	D_{nT} (1/3 oct) dB
50	
63	
80	
100	39,1
125	40,0
160	39,9
200	43,1
250	45,9
315	46,8
400	49,8
500	52,3
630	55,1
800	55,5
1000	56,3
1250	54,1
1600	55,6
2000	58,0
2500	63,6
3150	64,7
4000	68,8
5000	72,5



Valoración según la Norma UNE-EN ISO 717-1 :1997
$D_{nT,w}(C;C_{tr})$= 55 (-2 ; -5) dB $C_{100-5000}$ = -1 dB $C_{tr100-5000}$ = -5 dB
Evaluación basada en medidas in situ obtenidas mediante un método de ingeniería

ENAC ENSAYOS Nº 4 / LE286

Nº. de informe: PRZE1674-IN-CT-05 **Laboratorio:** CENTRO TECNOLÓGICO LABEIN
Fecha: 01.03.06 **Firma:**

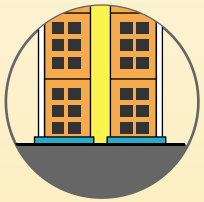
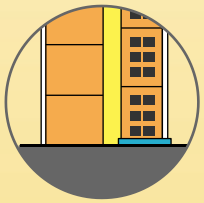
Horizontal airbone insulation	$D_{nT,w}$ (C100-5k)= 54dBA
Vertical airbone insulation	$D_{nT,w}$ (C100-5k)= 54dBA
Horizontal impact	$L'_{nT,w}$= 55 dBA
Vertical impact	$L'_{nT,w}$= 57 dBA

It complies the CTE DB HR

Compliance with all the requirements of the CTE DB HR (airborne noise and impact)
Measured in unfavorable building enclosures

Validation of the Silensis System on site. Measurement of sound insulation on site

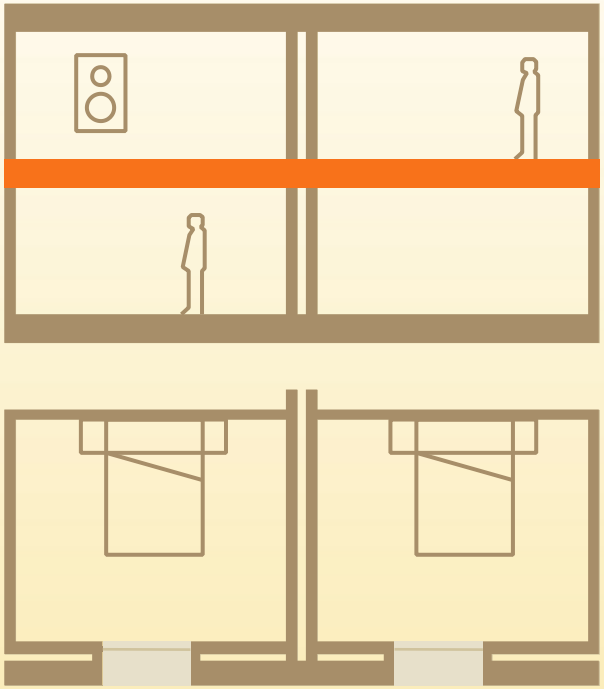
Some results of the measurements in buildings, according to UNE-EN ISO 140 and under ENAC accreditation

	SEPARATING ELEMENT	LOCATION	DATE	$D_{nT,w}+C_{100-5k}$
 **Silensis Tipo 2A**	LGF 7cm + LM 4cm + LGF 5cm Elastic Bands EEPS 1,5cm	Álava	Feb-04	50
	LHD 8cm + LM 4cm + LHD 8cm Elastic Bands EEPS 1,5cm	Mérida	Ene-06	54
	LGF 8cm + LM 4cm + LGF 8cm Elastic Bands EEPS 1,5cm	Vigo	Ago-06	51 / 55
	LGF 7cm + Tecnosound 3cm + LGF 7cm Elastic Bands EEPS 1,5cm	Soria	Sep-06	50
	PPCY 6cm + LM 6cm + PPCY 6cm Elastic Bands EEPS 1,5cm	Logroño	May-06	51 / 52
	LGF 7cm + LM 5cm + LGF 10cm Elastic Bands EEPS 1cm	Valencia	Ene-07	53 / 55
	LGF 7cm +LM 4cm + LGF 7cm Elastic Bands EEPS 1cm	Guipúzcoa	Feb-07	53
 **Silensis Tipo 2B**	1/2 foot LP 11,5cm + LM 4cm+ LHS 5cm. Elastic Bands EEPS 1,5cm	Vigo	Ago-06	54 / 55
	LP 11,5cm + LM 4cm+ LHS 5cm. Elastic Bands EEPS 1,5cm	La Coruña	Ago-06	56 / 56

LHD: Double horizontally perforated brick; LHGF: Large format double hollow brick ; LHS: Simple hollow brick ; PCY: Panel prefabricated ceramic and plaster; BC: Ceramic block; LP Perforated brick; LM : absorbing material ; EEPS: elasticized expanded polystyrene

These results of the measurements in buildings are not directly comparable because they depend not only on the party wall, but also on the rest of the constructive elements and geometry

Validation of the Silensis System on site. Measurement of sound insulation on site



Construction in Vigo

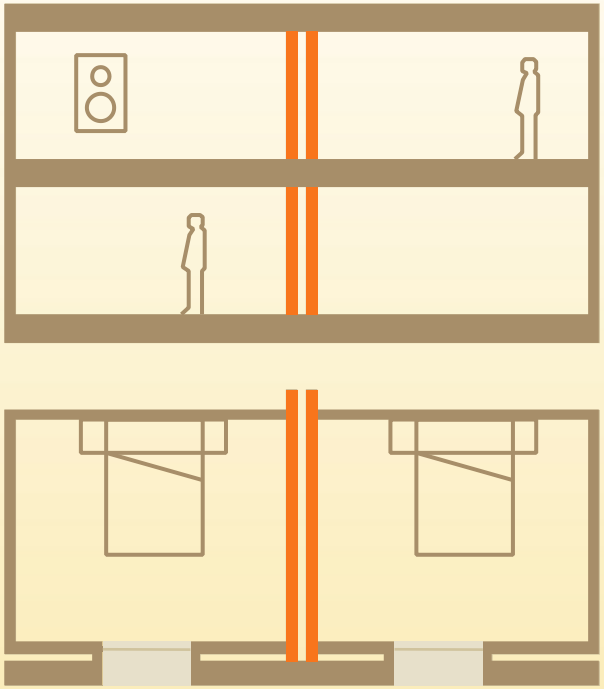
Floor structure
-One-way floor with concrete prefabricated beams and lightweight concrete (30+5cm)
-Anti-impact material : 2cm de EEPS

Party wall between dwellings
- 1/2 foot LP
- Mineral wool insulation 4cm
- Simple hollow brick 5 cm with perimeter elastic bands EEPS 1,5 cm

Interior wall
- Hollow brick large format 8 cm elastic bands EEPS 1,5 cm

Facade
- Face brick + slate
- Extruded polyurethane insulation
- Hollow brick large format 8 cm with perimeter elastic bands EEPS 1,5 cm

Validation of the Silensis System on site. Measurement of sound insulation on site



Construction in Vigo

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Facade
- Face brick + slate
- Extruded polyurethane insulation
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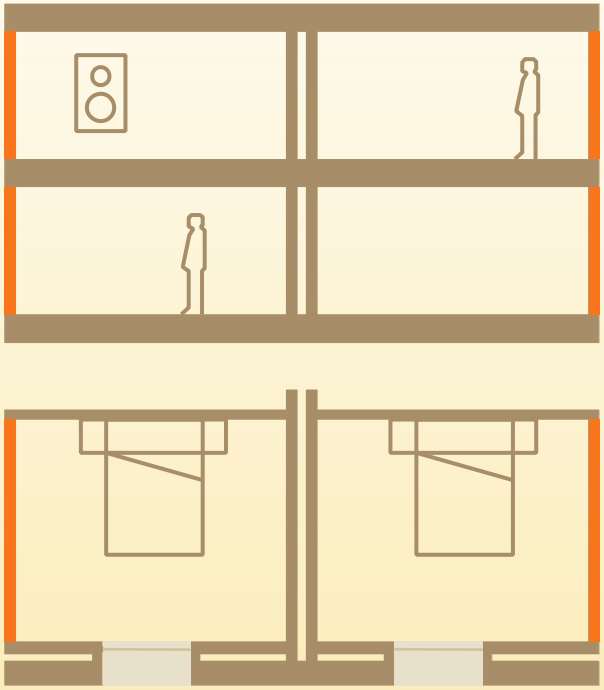
Validation of the Silensis System on site. Measurement of sound insulation on site



Construction in Vigo

Floor structure
-One-way floor with concrete prefabricated beams and lightweight concrete (30+5cm)
-Anti-impact material : 2cm de EEPS

Party wall between dwellings
- 1/2 foot LP
- Mineral wool insulation 4cm
- Simple hollow brick 5 cm with perimeter elastic bands EEPS 1,5 cm

Interior wall
- Hollow brick large format 8 cm elastic bands EEPS 1,5 cm

Facade
- Face brick + slate
- Extruded polyurethane insulation
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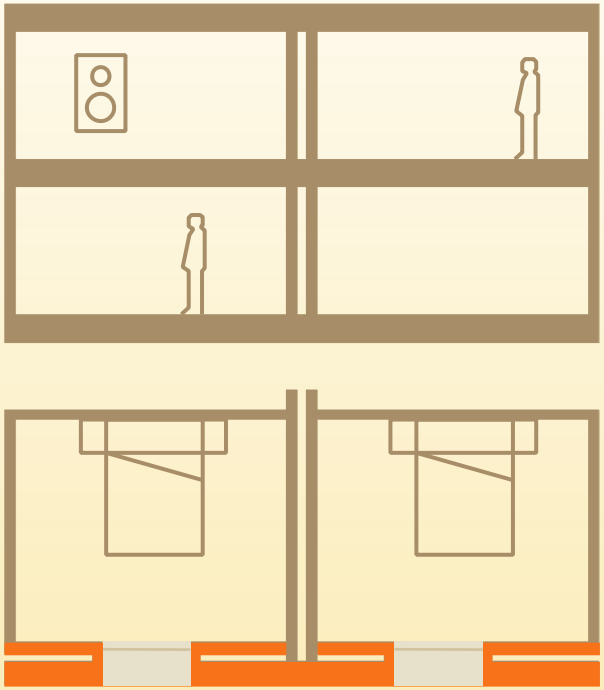
Validation of the Silensis System on site. Measurement of sound insulation on site



Construction in Vigo

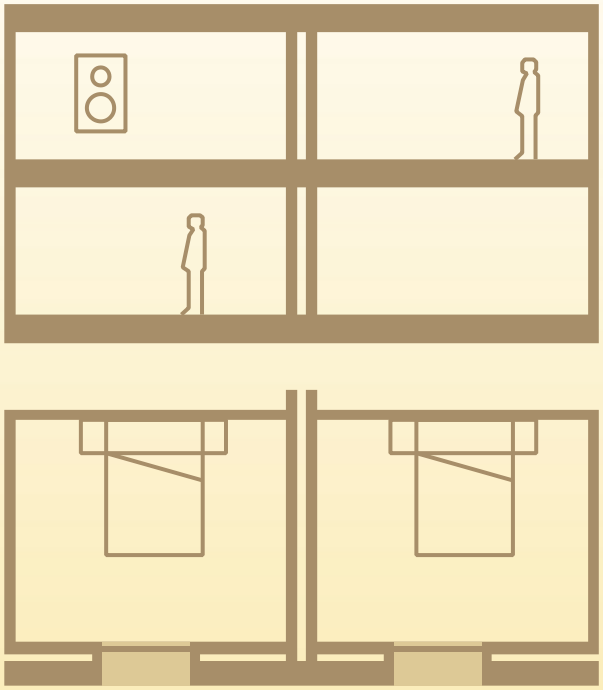
Floor structure
-One-way floor with concrete prefabricated beams and lightweight concrete (30+5cm)
-Anti-impact material : 2cm de EEPS

Party wall between dwellings
- 1/2 foot LP
- Mineral wool insulation 4cm
- Simple hollow brick 5 cm with perimeter elastic bands EEPS 1,5 cm

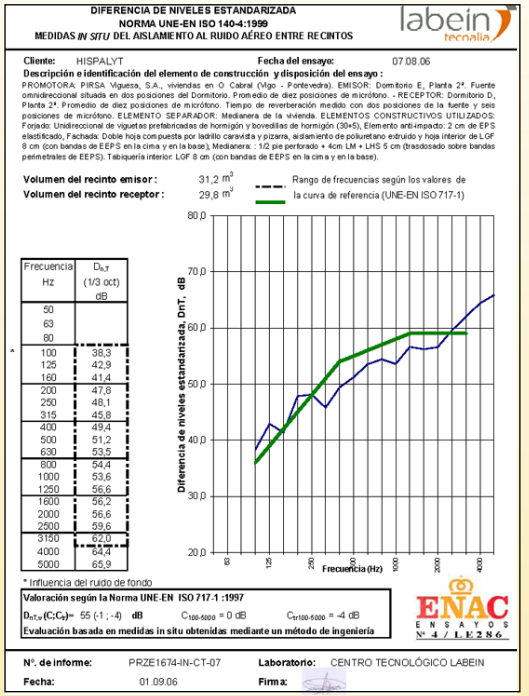
Interior wall
- Hollow brick large format 8 cm elastic bands EEPS 1,5 cm

Facade
- Face brick + slate
- Extruded polyurethane insulation
- Hollow brick large format 8 cm with perimeter elastic bands EEPS 1,5 cm

Validation of the Silensis System on site. Measurement of sound insulation on site



Construction in Vigo



DIFERENCIA DE NIVELES ESTANDARIZADA
NORMA UNE-EN ISO 140-4:1999
MEDIDAS *IN SITU* DEL AISLAMIENTO AL RUIDO AÉREO ENTRE RECINTOS

labein tecnalia

Cliente: HISPALYT **Fecha del ensayo:** 07.08.06

Descripción e identificación del elemento de construcción y disposición del ensayo :
PROMOTORA PIRSA Viguesa, S.A., viviendas en O Cabral (Vigo - Pontevedra). EMISOR: Dormitorio E, Planta 2ª. Fuente omnidireccional situada en dos posiciones del Dormitorio. Promedio de diez posiciones de micrófono. - RECEPTOR: Dormitorio D, Planta 2ª. Promedio de diez posiciones de micrófono. Tiempo de reverberación medido con dos posiciones de la fuente y seis posiciones de micrófono. ELEMENTO SEPARADOR: Medianera de la vivienda. ELEMENTOS CONSTRUCTIVOS UTILIZADOS: Forjado: Unidireccional de viguetas prefabricadas de hormigón y bovedillas de hormigón (30+5), Elemento anti-impacto: 2 cm de EPS elastificado, Fachada: Doble hoja compuesta por ladrillo caravista y pizarra, aislamiento de poliuretano extruido y hoja interior de LGF 8 cm (con bandas de EEPS en la cima y en la base), Medianera: : 1/2 pie perforado + 4cm LM + LHS 5 cm (trasdosado sobre bandas perimetrales de EEPS). Tabiquería interior: LGF 8 cm (con bandas de EEPS en la cima y en la base).

Volumen del recinto emisor : 31,2 m³
Volumen del recinto receptor : 29,8 m³

Rango de frecuencias según los valores de la curva de referencia (UNE-EN ISO 717-1)

Frecuencia Hz	D_{nT} (1/3 oct) dB
50	
63	
80	
100	38,3
125	42,9
160	41,4
200	47,8
250	48,1
315	45,8
400	49,4
500	51,2
630	53,5
800	54,4
1000	53,6
1250	56,6
1600	56,2
2000	56,6
2500	59,6
3150	62,0
4000	64,4
5000	65,9

* Influencia del ruido de fondo

Valoración según la Norma UNE-EN ISO 717-1 :1997
$D_{nT,w}(C;C_{tr})$= 55 (-1 ; -4) dB $C_{100-5000}$ = 0 dB $C_{tr100-5000}$ = -4 dB
Evaluación basada en medidas in situ obtenidas mediante un método de ingeniería

ENAC ENSAYOS Nº 4 / LE286

Nº. de informe: PRZE1674-IN-CT-07 **Laboratorio:** CENTRO TECNOLÓGICO LABEIN
Fecha: 01.09.06 **Firma:**

Horizontal airbone insulation	$D_{nT,w}$ (C100-5k)= 55 dBA
Vertical airbone insulation	$D_{nT,w}$ (C100-5k)= 52 dBA
Vertical impact	$L'_{nT,w}$= 61 dBA

It complies the CTE DB HR

Compliance with all the requirements of the CTE DB HR (airborne noise and impact)
Measured in unfavorable building enclosures

Stability of the Silensis solutions: measures of safety in use

We have made tests according to the criteria of the ETA 003 guide (EOTA) / December 1998 Edition elements used as non-structural interior partition walls to:

Category of loads "a"
(Moderate category of loads: Laundry and small shelves)

Category of use "III"
(Enclosures with the possibility of accumulation of people, with moveable furniture, commercial premises)

In these tests the wall is subject to functional testing and structural damage:

- Hard - body impacts

- Soft - body impacts

- Vertical eccentric load

Checking if the results comply the requirements of maximum instantaneous and residual deformation, of the traces left by the impacts, with no penetration and no collapse of the wall that are established in the guide DITE

Stability of the Silensis solutions: measures of safety in use

Impact with a 50 kg bag releasing an energy of up to 300 Nm

Stability of the Silensis solutions: measures of safety in use

Application of a load of 1.000N located 30cm from the wall
on a shelf, applied continuously for 24h

Stability of the Silensis solutions: measures of safety in use

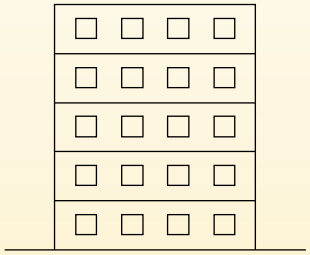
Type of test of the DITE 003 (EOTA)		Description of the test
Functional damage	Hard body impact	Impact with a steel sphere of 500 g. with an energy 6 Nm in 20 different positions at heights from 1,3 m and 1,7 m from the base.
	Vertical weight eccentric	Application of a load located 30 cm from the wall on a shelf positioned a 1,7 m from the base. The applied load is 500 N with a rate of 200 N / min for 7,5 min 30 cycles
	Soft body impact	Three impacts at the same point with a sack of 50 Kg releasing an energy of 120 Nm at 50 cm from the free end of the wall at a height of 1,5 m from the base.
Structural damage	Vertical eccentric load	Application of a load at 30 cm from the wall on a shelf positioned 1,7 m from the base. The applied load is 1000 N continuously for 24 h.
	Hard body impact	Impact with a steel sphere of 1 kg with an energy of 10 Nm in 20 different positions at heights from 1,3 and 1,7 m of the base
	Soft body impact	Impact with a sack of 50 Kg, a 50 cm from the end free wall, releasing an energy of 300 Nm.

Stability of the Silensis solutions: measures of safety in use

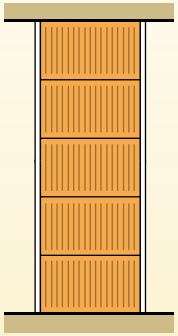
Test of safety in use		
Test sample	**Category**	**Result of the test**
Partition LHGF 7 cm. 4,20 m of length and 3,15 m of height. With a edge free end and the of rest edges with bands of EEPS. The partition has the face tested plastered.	Category loads "a" and use "III"	**It complies with the criteria established**

Structural stability ensured even in the worst case scenario

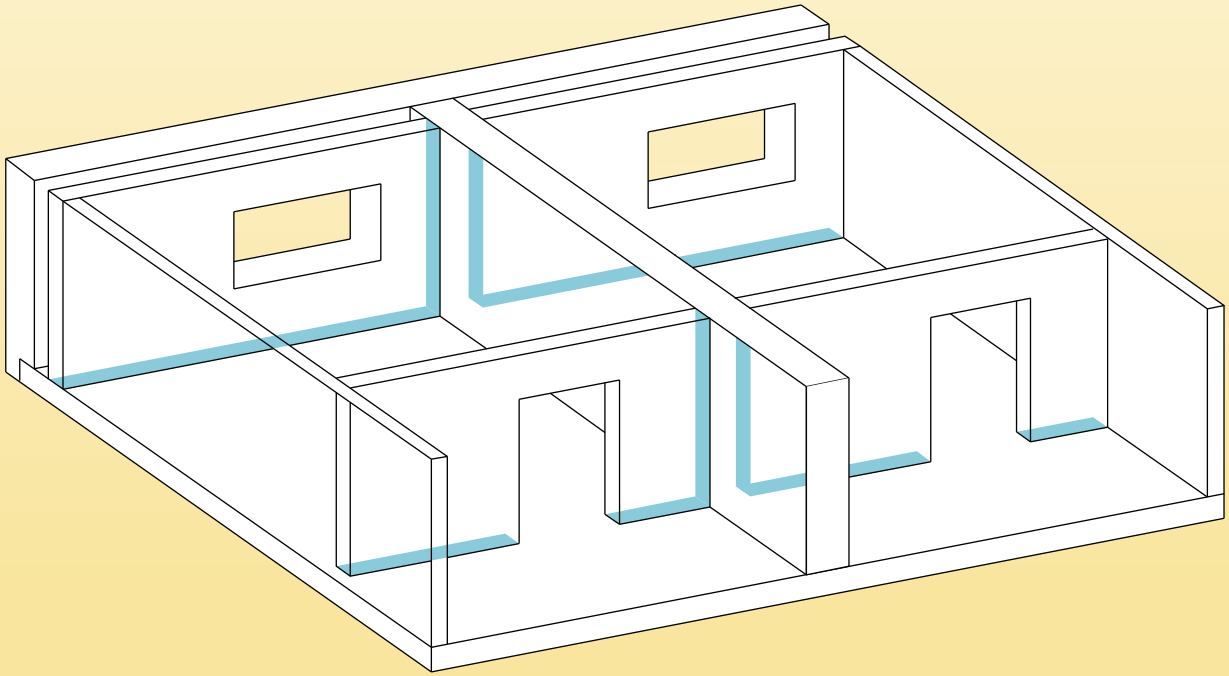
Stability of the Silensis solutions: worst case scenarios



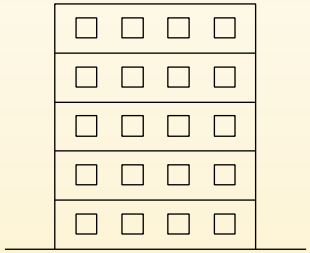
Buildings with acoustic insulation requirements in vertical



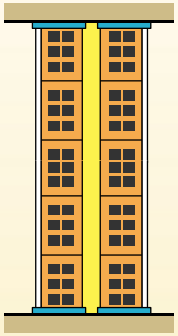
Silensis type 1A (Type 1 DB HR)



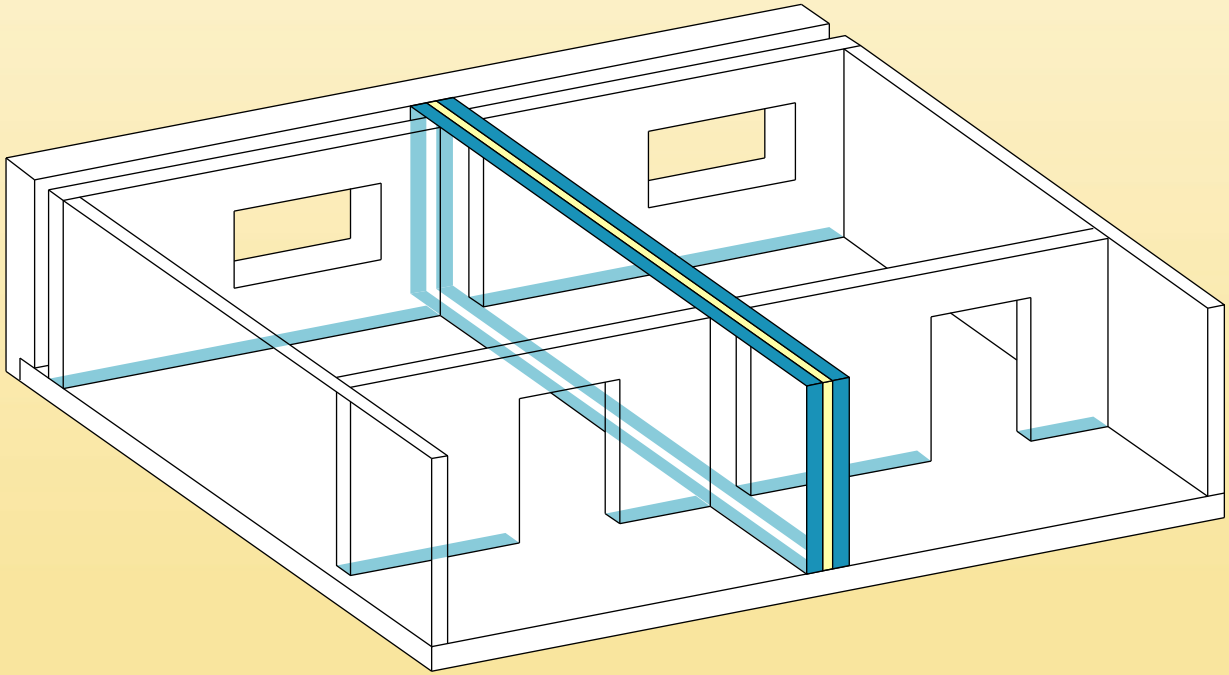
Stability of the Silensis solutions: worst case scenarios



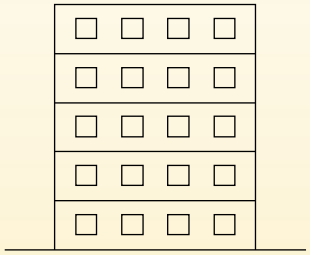
Buildings with acoustic insulation requirements in vertical



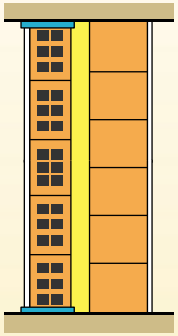
Silensis type 2A (Type 2 DB HR)



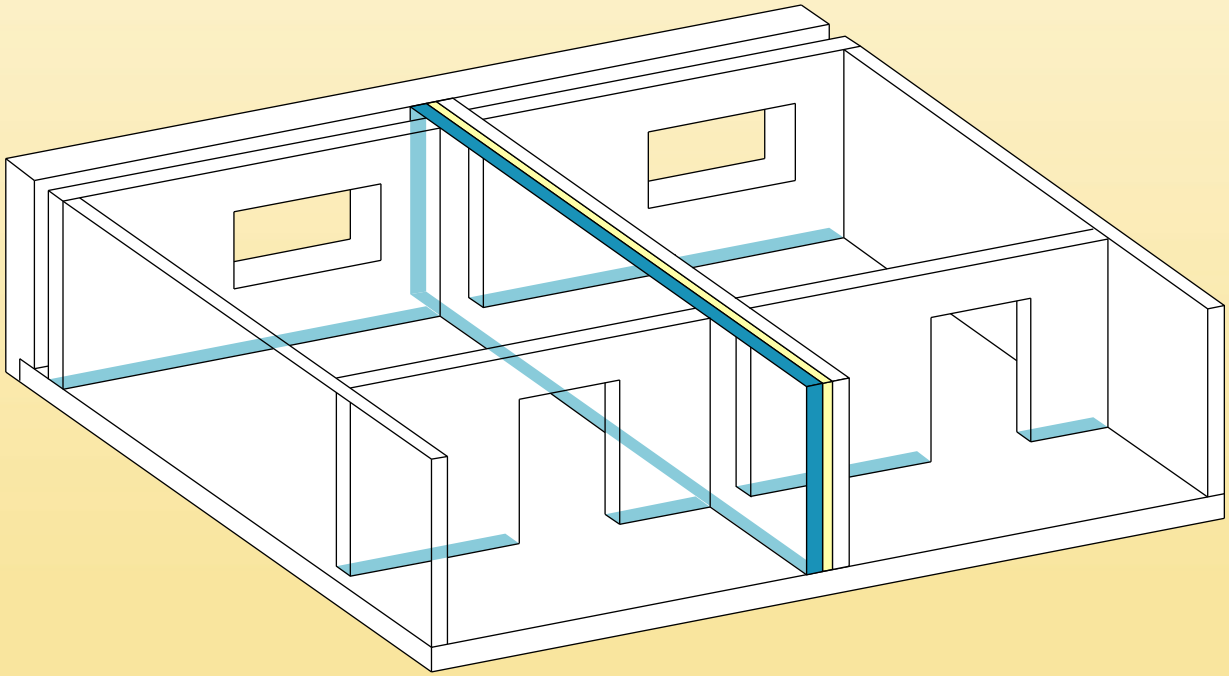
Stability of the Silensis solutions: worst case scenarios



Buildings with acoustic insulation requirements in vertical



Silensis type 2B (Type 2 DB HR)



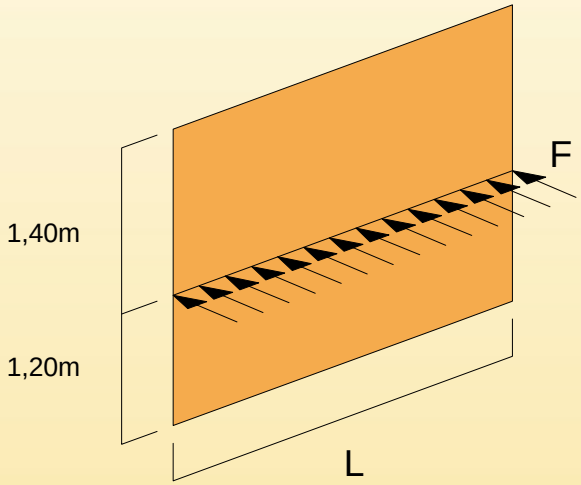
02 Silensis: high performance acoustic insulating ceramic brick walls system.
02.3 Stability (DB SE-F). Calculations

STUDY OF THE MECHANICAL BEHAVIOUR OF SILENSIS WALLS

- Compliance of the three fundamental aspects of the requirements demanded for any structural element: STABILITY, RESISTANCE, and CRACKING.

- Resistance value of horizontal action set for the partitions in the DB SE-AE (Article 3.2, paragraph 3):

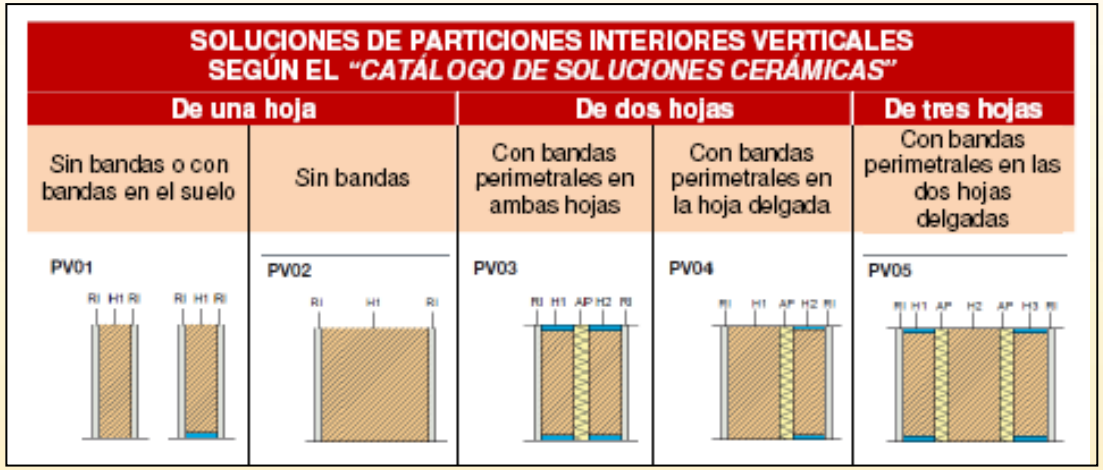
- Application of a linear load F (kN/m) at a height of 1,2 m



Actions applied on the walls	
Category of use (*)	**Horizontal force F (kN/m) (*)**
C5	**1,5**
C3, C4, E, F	**0,8**
Other cases	**0,4**

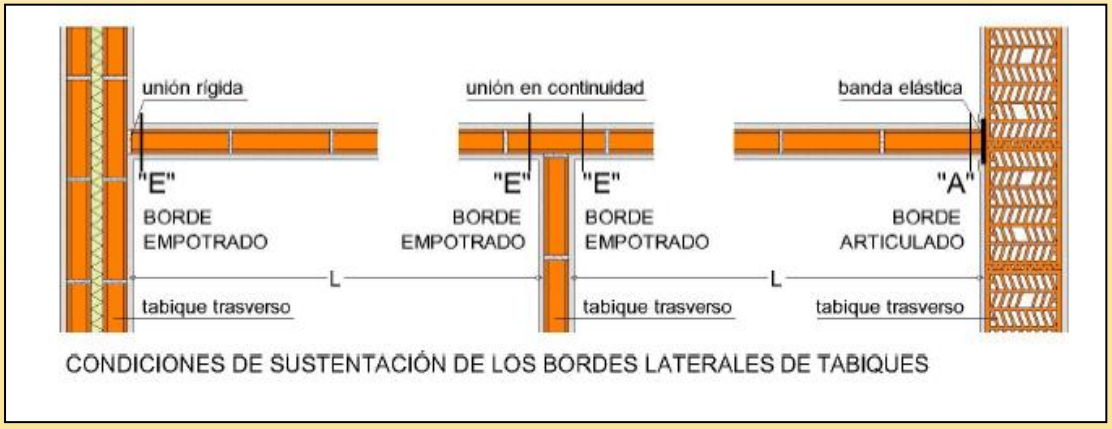
C5: Areas with people agglomerations(concert halls, stadiums, etc.).
C3: Areas without obstacles to the free movement of persons such as lobbies of public buildings, administrative museum showrooms, etc.
C4: Areas intended for fitness or physical activities
E: Areas of traffic and parking for light vehicles (total weight <30 kN).
F: Weight-bearing roofs with private access.

STUDY OF THE MECHANICAL BEHAVIOUR OF SILENSIS WALLS



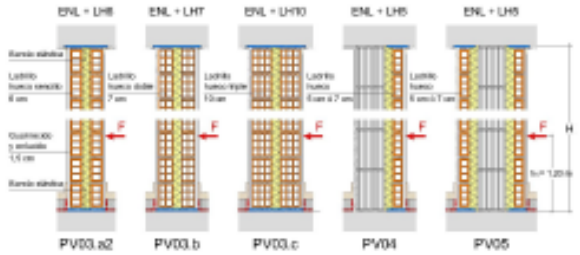
Determination of the MAXIMUM LENGTH (distance between braced vertical edges) depending on the FACTORS:

- VERTICAL TYPE INTERIOR PARTITION
- CONDITIONS OF SUPPORTING EDGES
- CLEARANCE HEIGHT
- SIDE ACTION



CONDICIONES DE SUSTENTACIÓN DE LOS BORDES LATERALES DE TABIQUES

SERIE 3. *"PARTICIONES VERTICALES INTERIORES PV03-04-05"*. TABLA 6



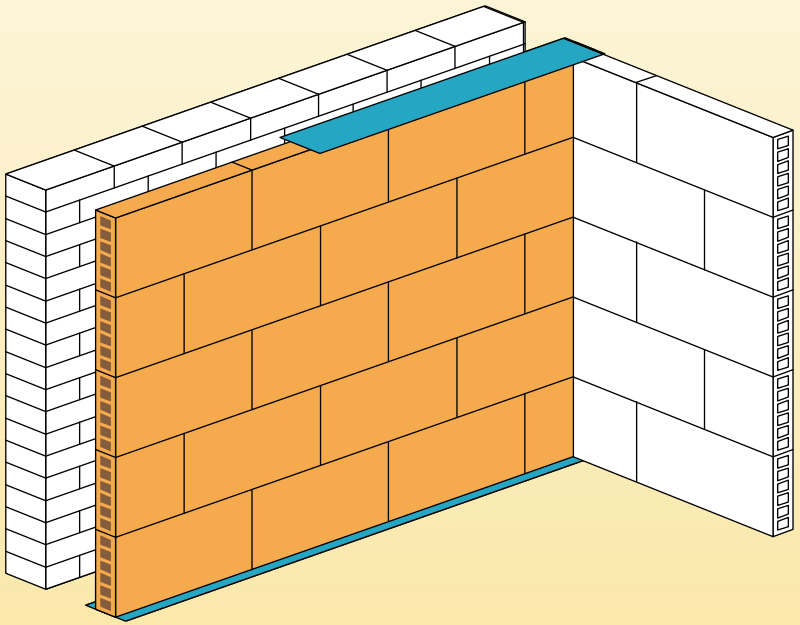
LH + ENL 1,5 cm

CON BANDAS EN EL TECHO

H (m)	Longitud máxima del tabique entre bordes verticales arriostrados (m) F = 0,4 kN/m											
	LH 5 cm			LH 6 cm			LH 7 cm			LH 10 cm		
	E-E	E-A	A-A	E-E	E-A	A-A	E-E	E-A	A-A	E-E	E-A	A-A
2,50	4,80	4,20	3,40	6,90	5,90	4,80	10,20	9,20	7,50	13,80	13,80	13,80
2,75	4,80	4,20	3,40	6,80	5,90	4,80	9,50	8,60	7,00	13,80	13,80	13,80
3,00	4,10	4,10	3,40	6,35	5,90	4,80	8,60	8,40	6,90	13,80	13,80	13,80
3,50	3,10	3,10	3,10	4,60	4,60	4,60	6,85	6,85	6,85	13,60	13,60	13,60
4,00	2,85	2,85	2,85	3,60	3,60	3,60	5,10	5,10	5,10	11,85	11,85	11,85
4,50	2,60	2,60	2,60	3,35	3,35	3,35	4,10	4,10	4,10	10,10	10,10	10,10
5,00	2,60	2,60	2,60	3,10	3,10	3,10	3,85	3,85	3,85	8,35	8,35	8,35
5,50	H máxima = 5,20			3,00	3,00	3,00	3,60	3,60	3,60	6,60	6,60	6,60
6,00				3,00	3,00	3,00	3,40	3,40	3,40	5,60	5,60	5,60
6,50				H máxima = 6,00			3,40	3,40	3,40	5,35	5,35	5,35
7,00							H máxima = 6,80			5,10	5,10	5,10
8,00										4,60	4,60	4,60
9,00										4,60	4,60	4,60
										H máxima = 9,20		

Stability of the Silensis solutions: maximum length of partitions

Partition of LHGF, 7 cm and 5 cm of thickness, and 2,75 m of height
Disconnected in three edges
Rigidly attached to another transverse partition
(Most unfavorable from the point of view of stability)



Assuming a linear load F = 0,4 KN / m applied to a height of 1,20 m

The maximum allowable length of wall bracing would be:

8,30 m for partitions LHGF 7 cm with plaster 1,5 cm

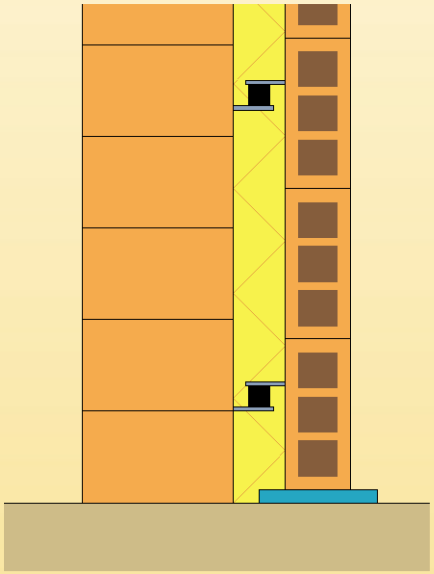
4,10 m for partitions LHGF 5 cm with plaster 1,5 cm

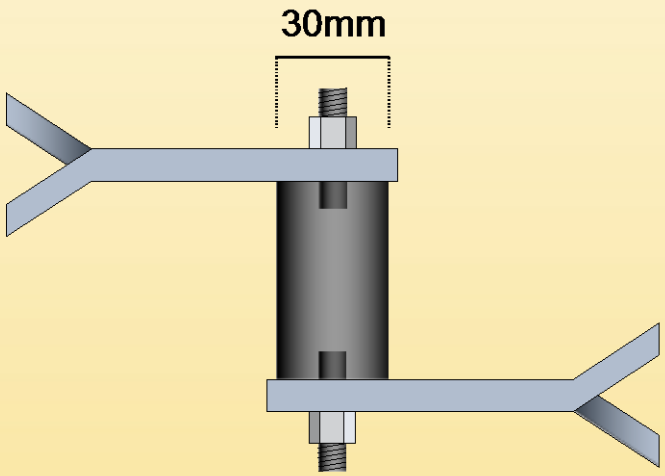
Stability of the Silensis solutions: maximum length of partitions

Acoustic connectors improve the stability of the partition to horizontal actions and does not affect the acoustic performance of the building solutions.

The use of these connectors is recommended in the walls of LHS 5 cm.

These connectors have been validated on site by acoustic insulation measures





Fire reaction of the Silensis solutions

The NBE CPI-96 classified ceramic materials (such as mortars, plasters and gypsum-based pastes) **like M0 materials.**

(MO: non-combustible, no fire reaction, without liberation of heat energy, without liberation of combustion fumes)

From now according to the Decision 96/603/CE of the Commission, of the 4 october of 1996, modificated by the Decision 2000/605/CE of the Commission, of the 26 september of 2000, and by the Decision 2003/424/CE of the Commission, of the 6 of june of 2003;

"...those materials can be considered class A1 of fire reaction without being tested..."

Which represents maximum security for the user.

Fire resistance of the Silensis solutions

The DB SI1 (Interior propagation) in table 1.1 (Conditions of compartmentalisation of fire sectors for use in dwelling) includes the requirement that the constructive **elements which separate dwellings from each other or dwellings from common areas of the building, must be at least EI 60** (RF60).

In addition, in table 1.2 **(Fire resistance of walls and ceilings that are delimiting fire sectors)** to the walls that separate the sector considered of others, being its use dwelling, residential public, educational or administrative, some requirements of minimum fire resistance are established :

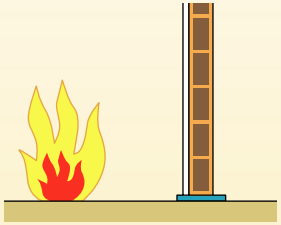
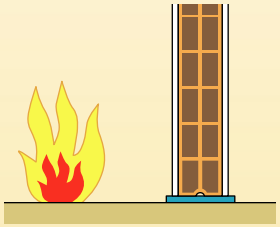
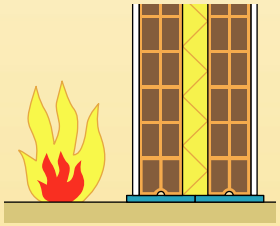
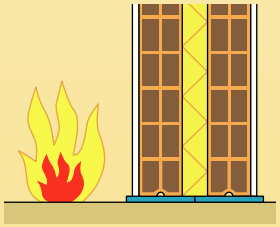
Sector above ground:
EI 60 (RF60) (if evacuation height is less than 15 m.)
EI 90 (RF90) (if evacuation height is between 15 and 28 m.)
EI 120 (RF120) (if evacuation height exceeds 28 m.)

Sector below ground:
EI 120 (RF120)

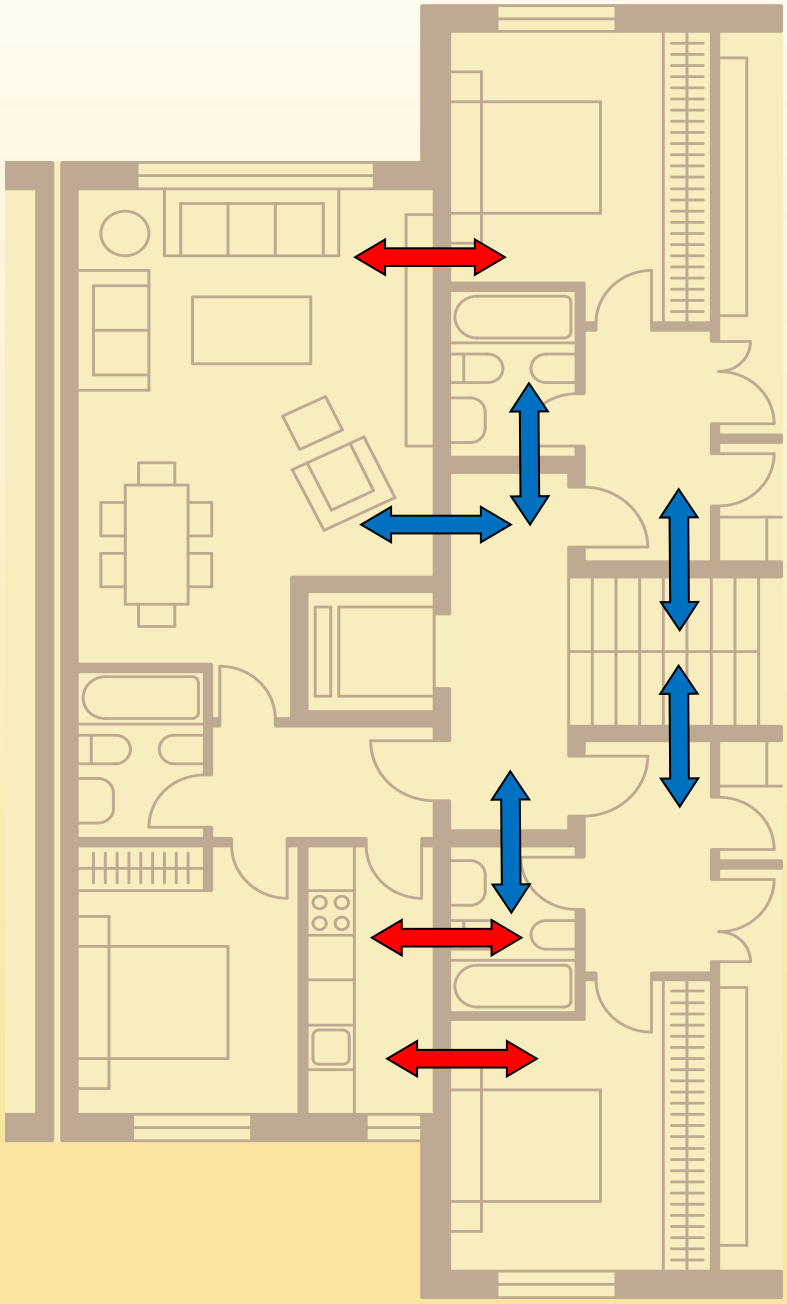
Fire resistance of the Silensis solutions

To determine the value of fire resistance of the Silensis solutions, different thicknesses of the double walls with perimeter elastic bands and with plaster have been tested according to the UNE EN 1364-1: 2000 [9]
(Fire resistance tests for non-loadbearing elements Part 1: Walls)

Fire resistance of the Silensis solutions

Test sample		Classification according with section 7.5 of EN 13501-2: 2002
	3x3 m wall of LHGF 5 cm with one free end and perimeter EEPS bands in the others edges. The wall is plastered only in the face exposed to fire.	**EI 30**
	3x3 m wall of LHGF 7 cm with one free end and perimeter EEPS bands in the others edges. The wall is plastered in both faces.	**EI 60**
	3x3 m wall of LHGF 7 cm with one free end and perimeter EEPS bands in the others edges + 4 cm Mineral wool insulation (70 Kg/m3) + LHGF 7 cm with one free end and perimeter EEPS bands in the others edges .The wall is plastered in both faces	**EI 240**
	3x3 m wall of LHGF 6 cm with one free end and perimeter EEPS bands in the others edges + 4 cm Mineral wool insulation (70 Kg/m3) + LHGF 6 cm with one free end and perimeter EEPS bands in the others edges .The wall is plastered in both faces	**EI 240**

Compliance with the thermal requirements of DB HE1



Separating walls between dwellings:

Required values established in Table 2.5 to avoid thermal decompensations:

Tabla 2.5 Transmitancia térmica límite de particiones interiores, cuando delimiten unidades del mismo uso, U en W/m²·K

Tipo de elemento	Zona climática de invierno					
	α	A	B	C	D	E
Particiones horizontales	1,90	1,80	1,55	1,35	1,20	1,00
Particiones verticales	1,40	1,40	1,20	1,20	1,20	1,00

Separating walls between dwellings and common areas and separating walls between dwellings and other uses:

Required values established in Table 2.4 to avoid thermal decompensations:

Tabla 2.4 Transmitancia térmica límite de particiones interiores, cuando delimiten unidades de distinto uso, zonas comunes, y medianerías, U en W/m²·K

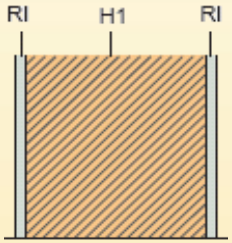
Tipo de elemento	Zona climática de invierno					
	α	A	B	C	D	E
Particiones horizontales y verticales	1,35	1,25	1,10	0,95	0,85	0,70

Interior walls, partitions that separate enclosures of the same unit of use:

There is not any thermal requirement for the interior walls.

Compliance with the thermal requirements of DB HE1

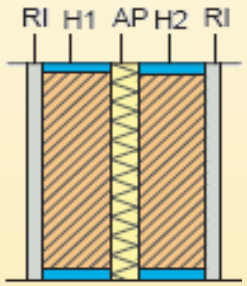
Silensis solutions Type 1 (single walls) will have to guarantee a minimum thermal resistance in compliance with the thermal requirement of the DB HE 1.



Código	H1 Hoja 1	SI	HE													
			$U_{lim,mod}$													
			0,50	0,70	0,90	1,10	1,30	1,50	1,70	1,90	2,10	2,30	2,50	2,70	2,90	3,10	3,30
		R	Resistencia térmica mínima de la hoja H1 (m^2K/W)														
PV02.P.P	LP11,5*+LP11,5*	R 180	1,69	1,12	0,80	0,60	0,46	0,36	0,28	0,22	0,17	0,13	0,09	0,06	0,04	0,01	-
PV02.P	LP24*	R 240															
PV02.B2	BC 19	R 180															
PV02.B3	BC 24	R 240															
PV02.B4	BC 29	R 240															
PV02.B3+	BC 24	R 240															
PV02.B4+	BC 29	R 240															

Compliance with the thermal requirements of DB HE1

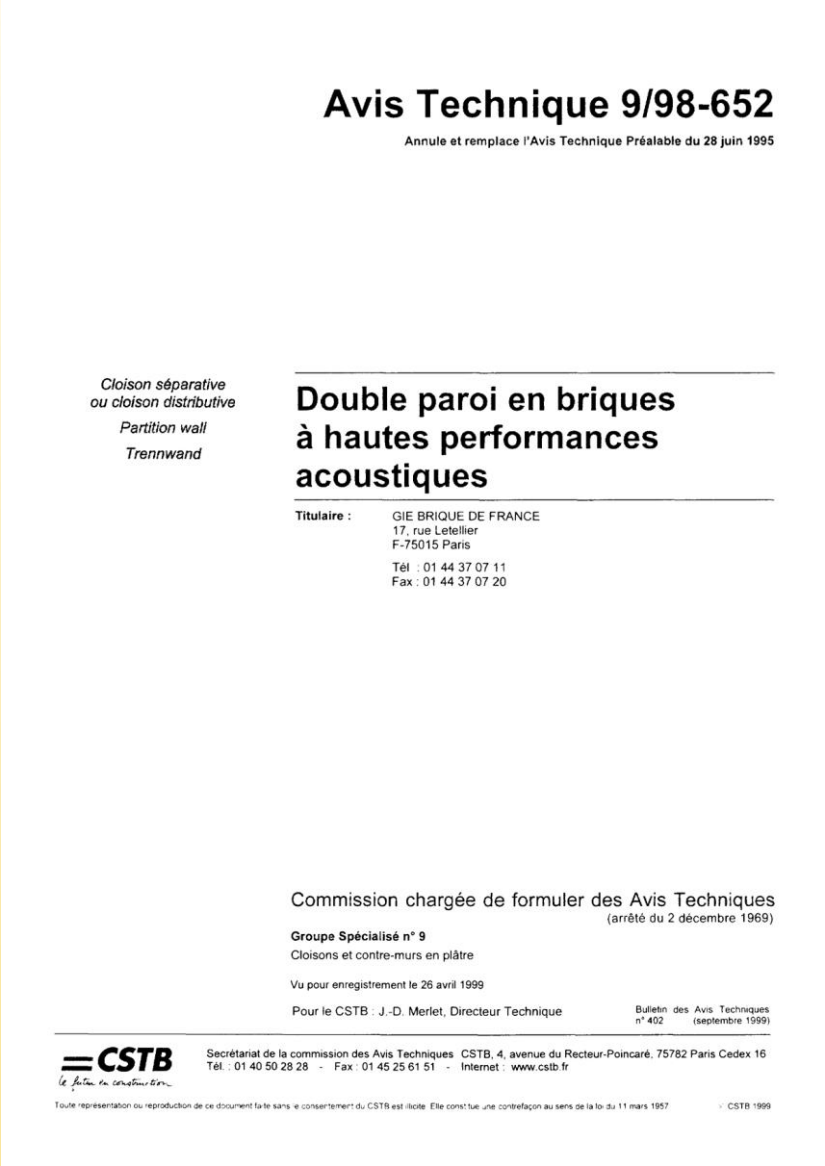
Silensis solutions Type 2A and 2B (double walls) guarantee compliance with the thermal requirement of the DB HE 1 considering the 4 cm of mineral wool insulation necessary for good acoustic performance.



Código	H1 y H2 Hojas 1 y 2	SI	HE								
			$U_{lim,mod}$								
			0,50	0,70	0,90	1,10	1,30	1,50	1,70	1,90	≥ 2,10
		R	Resistencia térmica mínima del aislante R_{AT} (m^2K/W)								
PV03.a3	LH6		1,51	0,94	0,62	0,42	0,28	0,18	0,10	0,04	-
PV03.a3'	LHGF6		1,33	0,76	0,44	0,24	0,10	-	-	-	-
PV03.b	LH7		1,37	0,80	0,48	0,28	0,14	0,04	-	-	-
PV03.b'	LHGF7		1,03	0,46	0,14	-	-	-	-	-	-
PV03.c	LH10		1,23	0,66	0,34	0,14	-	-	-	-	-
PV03.c'	LHGF10		0,73	0,16	-	-	-	-	-	-	-

02 Silensis: high performance acoustic insulating ceramic brick walls system.
02.6 Similar experience in other countries.

Implemented for years in other European countries and included in their regulations



Avis Technique 9/98-652

Annule et remplace l'Avis Technique Préalable du 28 juin 1995

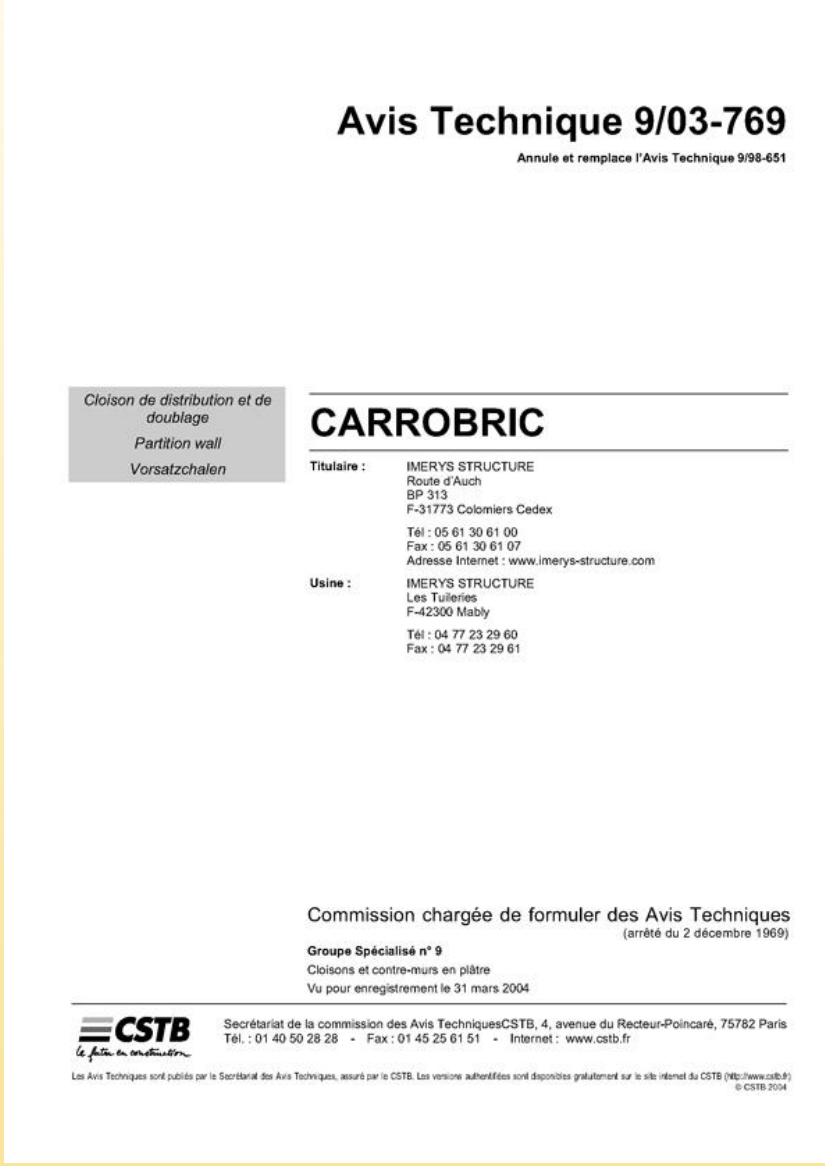
Cloison séparative ou cloison distributive
Partition wall
Trennwand

Double paroi en briques à hautes performances acoustiques

Titulaire : GIE BRIQUE DE FRANCE
17, rue Letellier
F-75015 Paris
Tél : 01 44 37 07 11
Fax : 01 44 37 07 20

Commission chargée de formuler des Avis Techniques
(arrêté du 2 décembre 1969)
Groupe Spécialisé n° 9
Cloisons et contre-murs en plâtre
Vu pour enregistrement le 26 avril 1999
Pour le CSTB : J.-D. Merlet, Directeur Technique
Bulletin des Avis Techniques n° 402 (septembre 1999)

CSTB le futur en construction
Secrétariat de la commission des Avis Techniques CSTB, 4, avenue du Recteur-Poincaré, 75782 Paris Cedex 16
Tél. : 01 40 50 28 28 - Fax : 01 45 25 61 51 - Internet : www.cstb.fr



Avis Technique 9/03-769

Annule et remplace l'Avis Technique 9/98-651

Cloison de distribution et de doublage
Partition wall
Vorsatzchalen

CARROBRIC

Titulaire : IMERYS STRUCTURE
Route d'Auch
BP 313
F-31773 Colomiers Cedex
Tél : 05 61 30 61 00
Fax : 05 61 30 61 07
Adresse Internet : www.imerys-structure.com

Usine : IMERYS STRUCTURE
Les Tuileries
F-42300 Mably
Tél : 04 77 23 29 60
Fax : 04 77 23 29 61

Commission chargée de formuler des Avis Techniques
(arrêté du 2 décembre 1969)
Groupe Spécialisé n° 9
Cloisons et contre-murs en plâtre
Vu pour enregistrement le 31 mars 2004

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Secrétariat de la commission des Avis TechniquesCSTB, 4, avenue du Recteur-Poincaré, 75782 Paris
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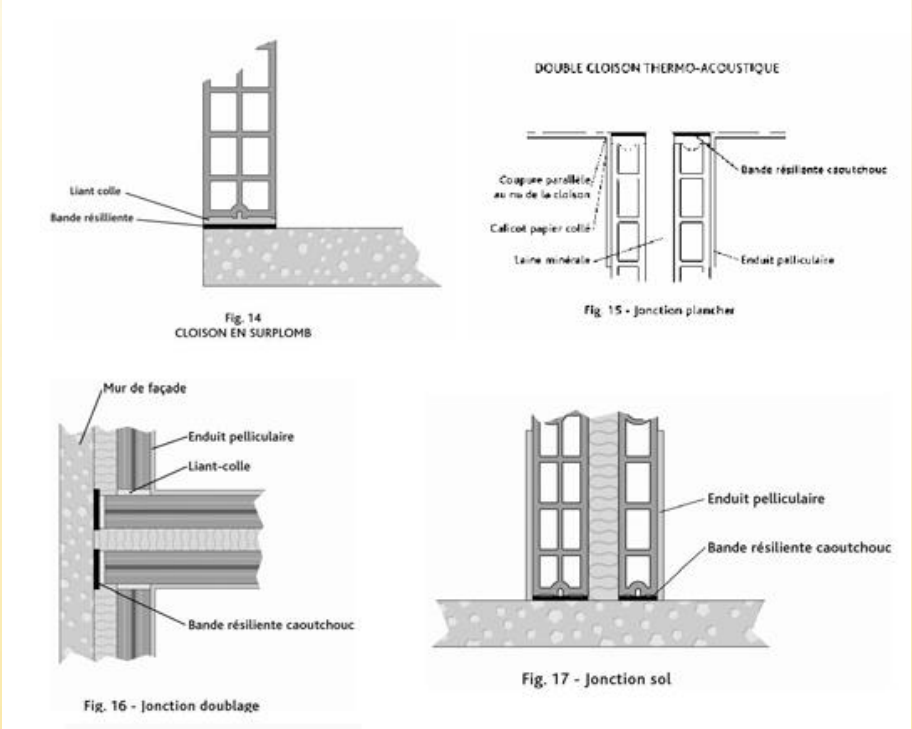
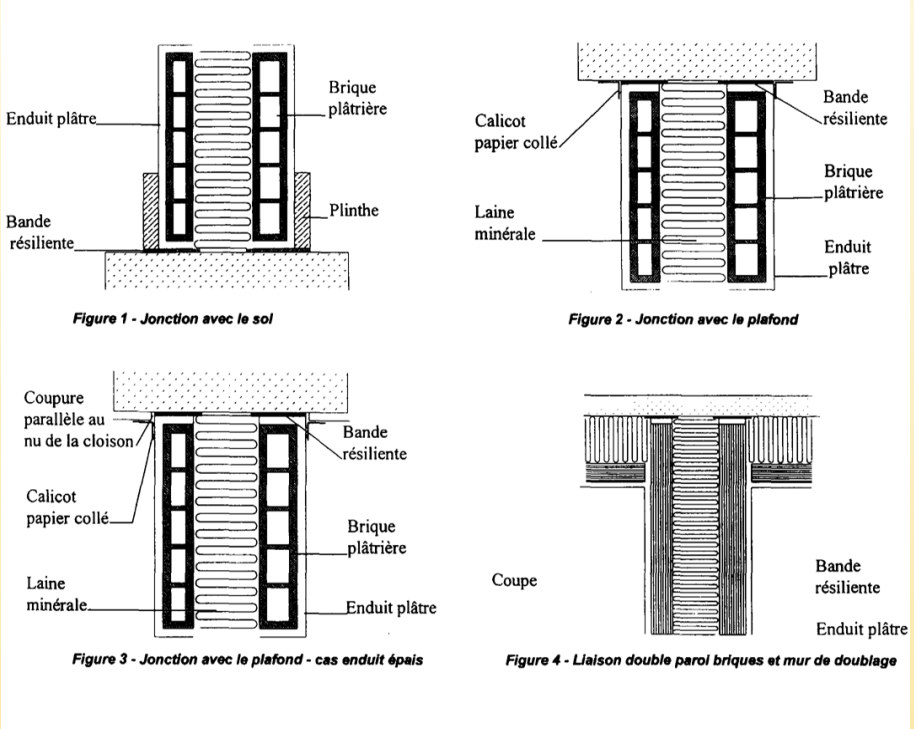
02 Silensis: high performance acoustic insulating ceramic brick walls system.
02.6 Similar experience in other countries.

Implemented for years in other European countries and included in their regulations





Advantages of the Silensis System

- **Improves airborne sound insulation horizontally and vertically**
- **The Silensis system has the reliability of the traditional masonry system based on mass and the optimization of the performance of other lightweight and dry systems.**
- **The system maintains the inherent characteristics of ceramic regarding fire resistance and security against intrusiveness**