EUSKO JAURLARITZA GOBIERNO VASCO

LURRALDE PLANGINTZA, ETXEBIZITZA ETA GARRAIO SAILA
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Eraikuntzaren Kalitate Kontrolerako Laborategia

DEPARTAMENTO DE PLANIFICACIÓN TERRITORIAL, VIVIENDA Y TRANSPORTES
Dirección de Vivienda, Suelo y Arquitectura
Laboratorio de Control de Calidad de la Edificación

AKUSTIKA ARLOA kudeatzailea:
ÁREA DE ACÚSTICA operated by:

Test Report No. B2020-LACUS-IN-122-3 A_En

Laboratory measurement of sound insulation

TEST SPECIMEN: NON-ACOUSTIC DIRECT WALL LINING (SENOR + CHOVA)
SE-MP/FTD-OMEGA
VISCOLAM

APPLICANT: SUSPENSIONES ELÁSTICAS DEL NORTE, S.L. (SENOR)
Polígono industrial El Garrotal, Parcela 10 - Módulos 4 y 5
14700 Palma del Río, Córdoba, España

USED STANDARDS: EN ISO 10140-1:2016 Annex G. "Acoustical linings. Improvement of airborne sound insulation".

EN ISO 10140-2:2010. "Acoustics. Laboratory measurement of sound insulation of building elements. Measurement of airborne sound insulation".

ISSUE DATE: 3rd March 2021
TRANSLATION DATE: 30th April 2021

Signature:
Technical Consultant
Susana Lopez de Aretxaga

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THIS REPORT CONTAINS:
Total number of pages: 14

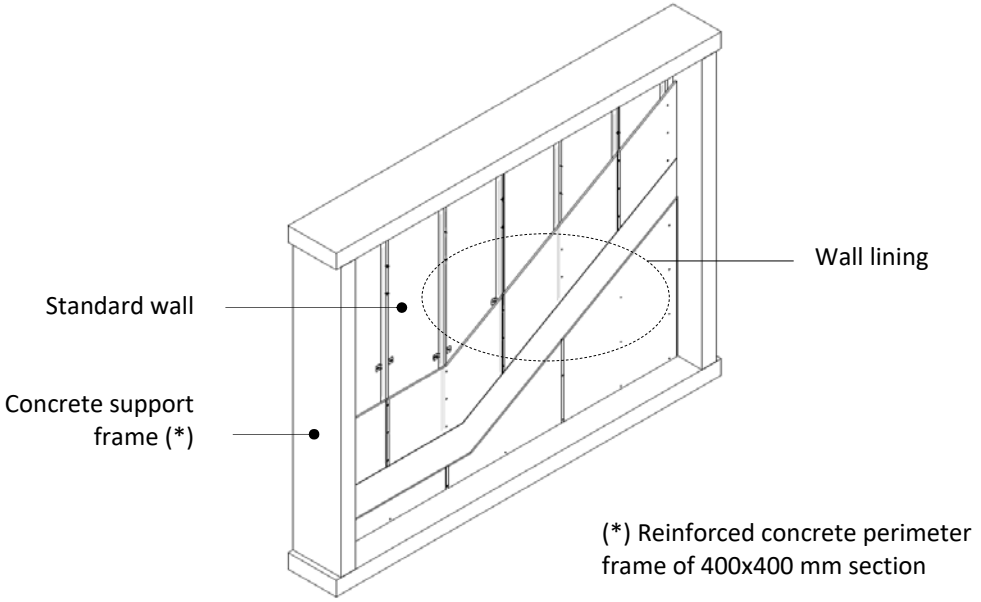
ENAC ENSAYOS Nº 4/LE456

The test specimen has been subjected to the test asked by the applicant, following the specified procedures in the used standards.

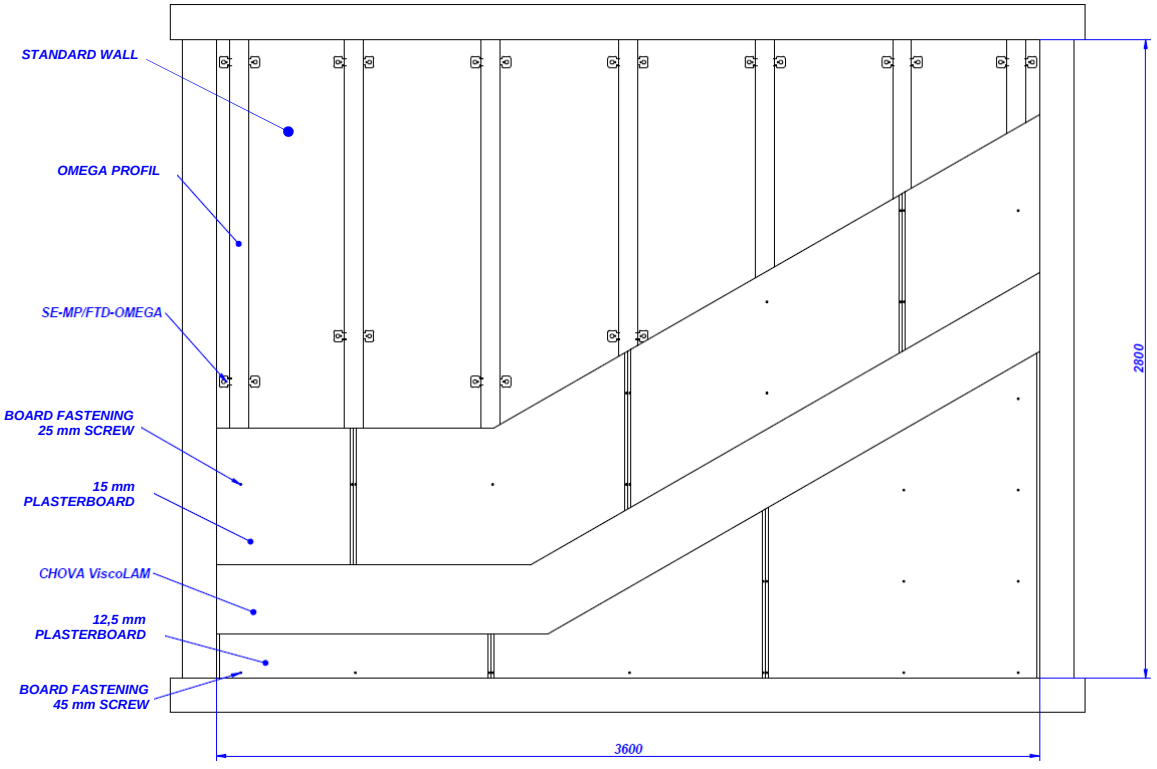
Test results are detailed in the inside pages. Uncertainty of measurement is available to the applicant.

1. TEST SPECIMEN DESCRIPTION

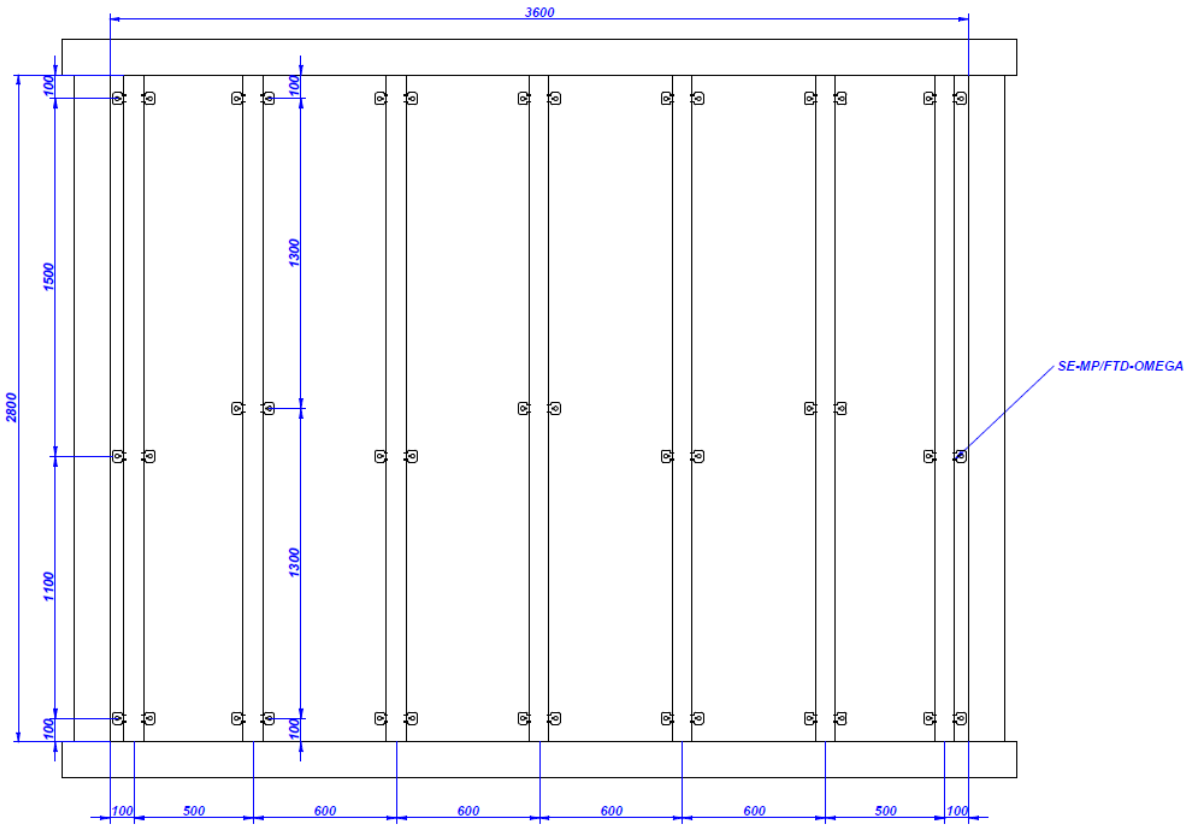
The test specimen consists of a wall lining, with the following composition according to the information provided by the applicant:



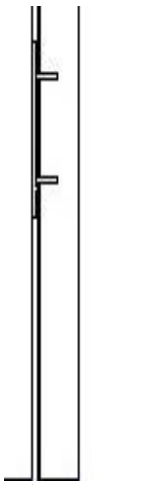
Sketch 1



Sketch 2 (cotes in mm)

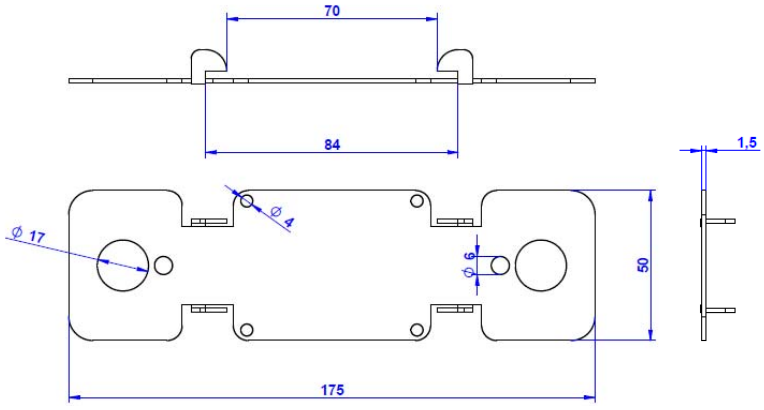


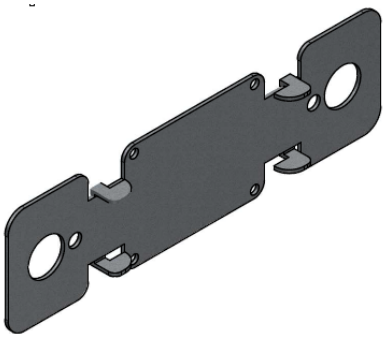
Detail of vertical section



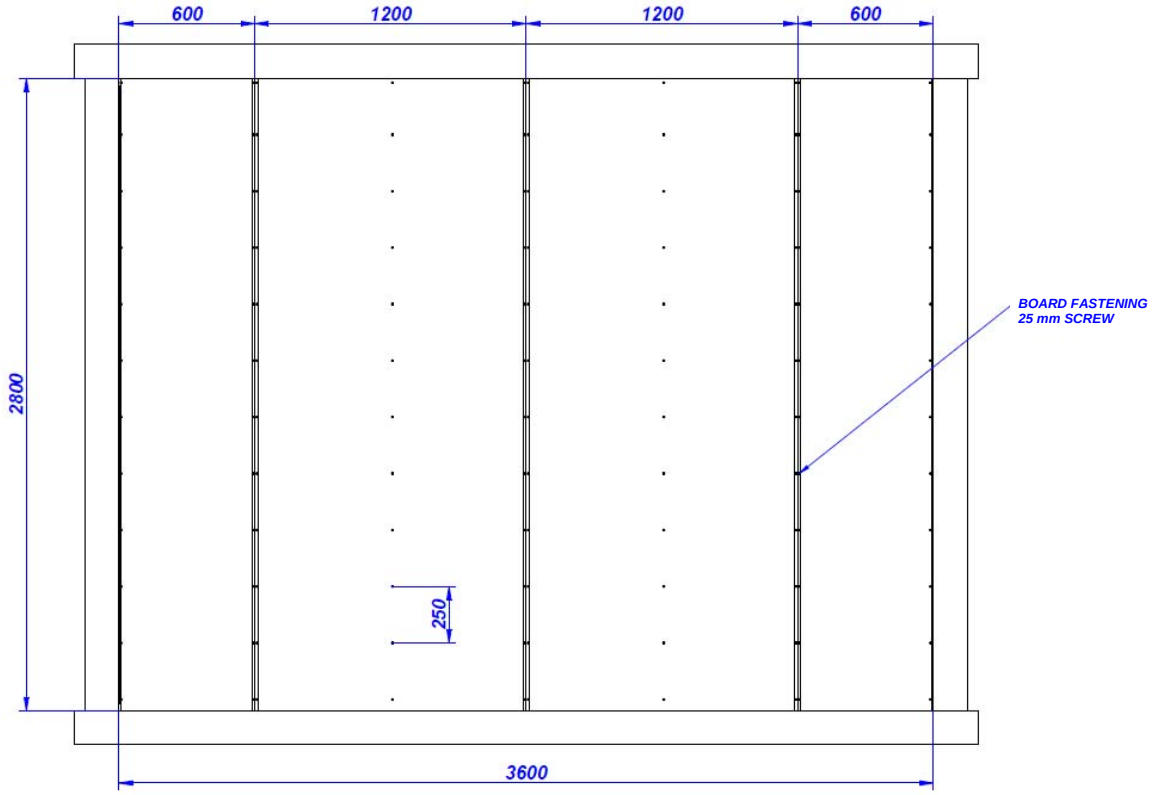
(*) Air chamber between standard wall and inner face of 15 mm plasterboard
(**) Wall lining total thickness

Detail of SE-MP/FTD OMEGA support

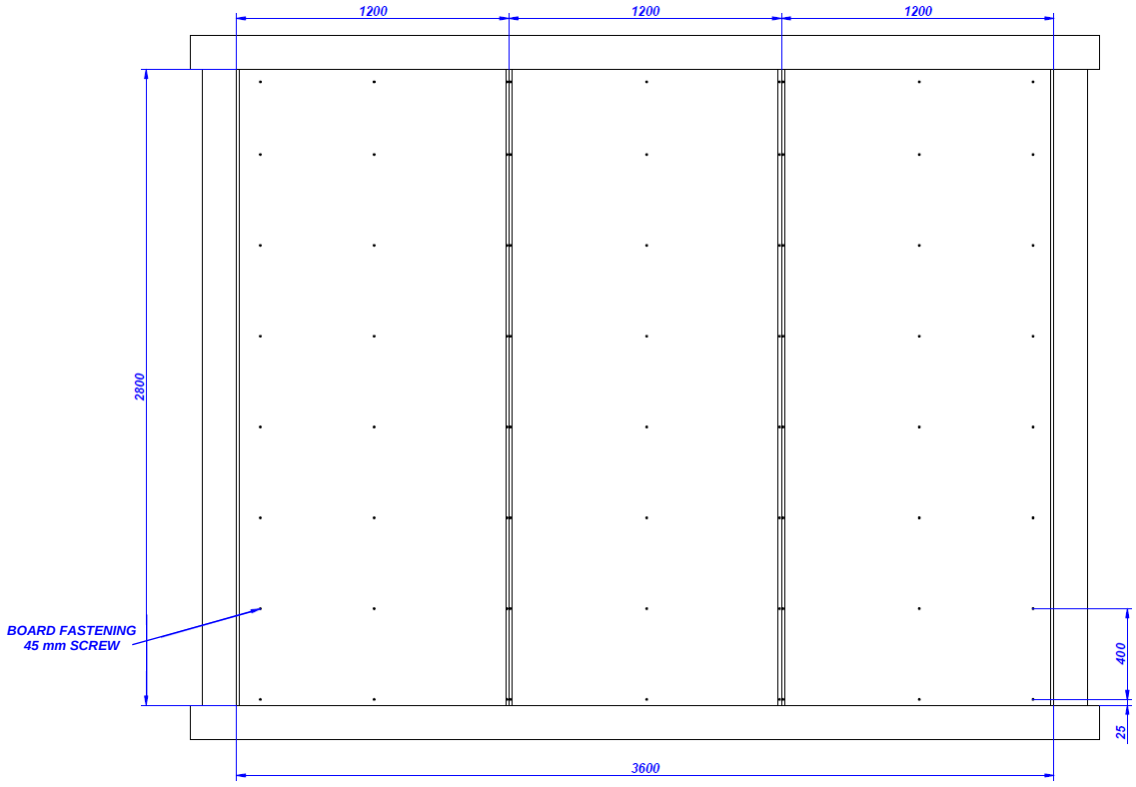




Sketch 3 (cotes in mm)



Sketch 4 (cotes in mm)



Sketch 5 (cotes in mm)

Description of materials and details of mounting:

Structure:

- OMEGA PROFILE-Knauf: 82x16 mm galvanized steel profile, fixed to support.
- SE-MP/FTD OMEGA-Senor: Galvanized steel plate 175x50 mm and 1,5 mm thick. Mechanically fixed at 2 points to wall, according to sketch 3.

15 mm plasterboard: Gypsum plasterboard Standard BA-STD 15-Knauf (15 mm & 10,5 kg/m^2).

Assembly and mechanical fixation board-profile according to sketch 4. 5 mm perimeter space between boards and frame. Sealing between boards and between boards and frame by joint tape and Knauf Unik (30') quick-drying compound.

CHOVA ViscoLAM-Chova: High density viscoelastic membrane ViscoLAM 65 (4 mm & 6,1 kg/m^2).

Mechanically fixed by lag screws for fastening until next mechanical fixation after 12,5 plasterboards installation. Butt sections, without overlap.

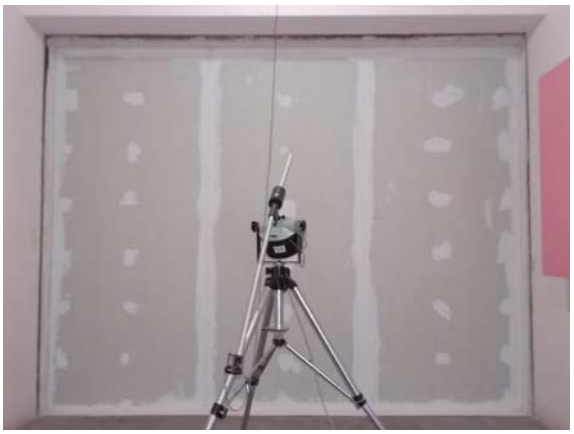
12,5 mm plasterboard: Gypsum plasterboard Standard BA-STD 12,5-Knauf (12,5 mm & 8,1 kg/m^2).

Assembly and mechanical fixation board-profile according to sketch 5. 5 mm perimeter space between boards and frame. Sealing between boards and between boards and frame by joint tape and Knauf Unik (30') quick-drying compound.


SENOR


SENOR

Photos of mounting of wall lining



Photos of wall lining on wall in the test rooms

Material selected and delivered by: SENOR, ASFALTOS CHOVA, S.A (Chova) and Knauf; each company its material as indicated in the test specimen description.

Mounting in the test opening:

Lining fixed to standard wall built in a prefabricated concrete frame, 40 cm thick and internal dimensions of 2,8 m high by 3,6 m long.

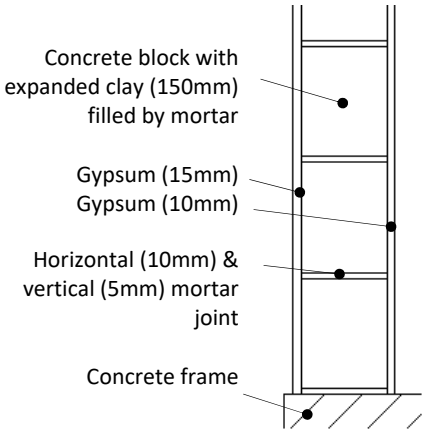
Mounting performed by: SENOR

Mounting end date: 27th October 2020

Standard wall:

Lined filled block wall, of 300 kg/m^2 estimated superficial mass (*).

(*) Filling and mortar joints included.



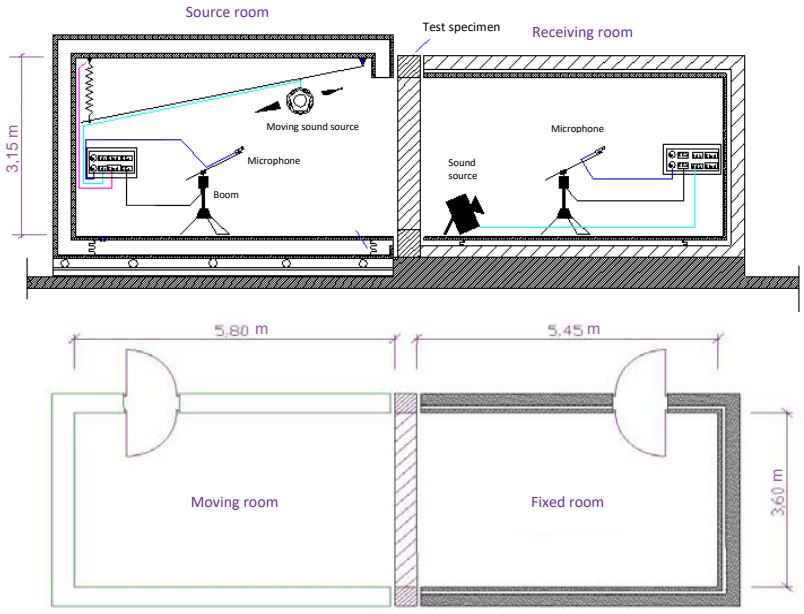
Block: 500 mm long x 190 mm high x 150 mm thick & 14,2 kg (estimated superficial mass: 149 kg/m^2).

Sketch and photos of standard wall

Standard basic element, 'Heavy wall', according to EN ISO 10140-5:2010, Annex B. Provided by the laboratory in its final condition. 10 mm gypsum side oriented to tested lining.

2. TEST FACILITIES

The test is performed in the horizontal transmission rooms, composed of a source and a receiving room. The receiving room is composed of a double concrete box of twenty and ten centimeters of thickness each one, acoustically disconnected and the source room, forty centimeters thick, is composed of a double box of metal frame and gypsum board, acoustically disconnected. The mobility of the source room allows the mounting of the test specimen into a frame outside, as well its subsequent installation between the test rooms. These rooms comply with the requirements of EN ISO 10140-5:2010.



Sketch of horizontal transmission rooms

3. EQUIPMENT AND TEST CONDITIONS

	Source Room	Receiving Room
Microphones	Brüel & Kjær 4943; Serial No. 3188436	Brüel & Kjær 4943; Serial No. 3188435
Preamplifiers	Brüel & Kjær 2669; Serial No. 1948764	Brüel & Kjær 2669; Serial No. 2025844
Sound sources	Brüel & Kjær 4296; Serial No. 2071420	CERWIN VEGA; No. 012446
Booms	Brüel & Kjær 3923; Serial No. 2036584	Brüel & Kjær 3923; Serial No. 2036591

	Control Room
Analyser	Nor850-MF1; Serial No. 8501186
Amplifier	LAB 300; Serial No. 970-967
Equalizer	Sony, SRP-E100; Serial No. 400238
Calibrator	Brüel & Kjær 4231; Serial No. 2061477
Atmospheric conditions meter	Rotronic BL-1D; Serial No. A19060062

Measurement uncertainty of atmospheric conditions:	
Air temperature	±0,5 ºC
Air humidity	±4 %
Atmospheric pressure	±2 mbar

4. TEST PROCEDURE AND EVALUATION

4.1 Determination of the sound reduction improvement index of a lining

The improvement of airborne sound insulation of a lining is characterized by the sound reduction improvement index (ΔR). For its determination, the measurement of airborne sound insulation is performed according to EN ISO 10140-2:2010, both for the basic element and basic element + lining.

The sound reduction improvement index (ΔR) of a lining placed on a basic element, for the one-third octave band from 100 Hz to 5 kHz, is obtained according to standard EN ISO 10140-1:2016 - Annex G, as the difference between the sound reduction indices of the basic element with and without the lining, as detailed in the equation:

$$\Delta R = R_{with} - R_{without}$$

R_{with}: Sound reduction index of the basic element with lining, from 100 to 5000 Hz

$R_{without}$: Sound reduction index of the basic element without lining, from 100 to 5000 Hz

4.2 Determination of the airborne sound insulation

The sound reduction index, R, for the one-third octave band from 100 Hz to 5 KHz is calculated according to EN ISO 10140-2:2010 using the following formula:

$$R=L_1-L_2+10*\text{Log } S/A$$

L_1: Average sound pressure level in the source room

L_2: Average sound pressure level in the receiving room

S: Test specimen area

A: Equivalent sound absorption area in the receiving room

The measurement of the average sound pressure levels L_1 and L_2 is performed by emitting an equalized white noise, from 100 Hz to 5 kHz, using a moving omnidirectional sound source. The sound field in the source and receiving rooms is sampled using a moving microphone with a sweep radius of 1 m and a traverse period of 16 s during 32 s of measure. Background noise in the receiving room for the one-third-octave band from 100 Hz to 5 KHz, is measured according to the same measurement process of sound field in the receiving room.

The equivalent sound absorption area, from 100 Hz to 5 kHz, is evaluated from the reverberation time measured in the receiving room, using Sabine's formula:

$$A=0,16*V/T$$

A: Equivalent sound absorption area in the receiving room

T: Reverberation time in the receiving room

V: Receiving room volume

Reverberation time in the receiving room is determined by using two positions of the sound source and three fixed microphone positions for each source position distributed at 120º in the microphone path.

Measuring chain is verified just before and after the execution of the test.

The guidelines indicated in the applicable internal procedures have been followed:

- PE.CM-AA-61-E: "Procedure for the determination of the airborne sound insulation into the horizontal and vertical transmission rooms".
- PE.MC-AA-06-M: "Procedure to manage the test specimens for acoustic tests in laboratory".

Standard EN ISO 10140-2:2010, together with the other EN ISO 10140-1:2016, EN ISO 10140-4:2010 and EN ISO 10140-5:2010, cancels and replaces EN ISO 140-3:1995. The measurement and evaluation process applied to the test specimen described in this report is according to the standard in force EN ISO 10140-2:2010, and complies with cancelled EN ISO 140-3:1995.

5. RESULTS

The following results are presented:

B2020-122-M759 MRA: Sound reduction improvement index of *Lining on the standard basic element 'heavy wall'*:

- Sound reduction improvement index, ΔR, in decibels, for the one-third-octave band from 100 Hz to 5000 Hz, in table and graph.
- Weighted sound reduction improvement index, $\Delta R_{w,heavy}$, calculated according to EN ISO 10140-1:2016, Annex G, on the standard heavy wall.

$$\Delta R_{w,heavy} = R_{w,ref,with} - R_{w,ref,without}$$

$R_{ref,with} = R_{ref,without} + \Delta R$

$R_{ref,without}$ given in EN ISO 10140-5:2010, Annex B.

- A-weighted improvement of sound reduction indices $\Delta(R_w+C)_{heavy}$ and $\Delta(R_w+C_{tr})_{heavy}$, calculated in an equivalent way.
- A-weighted improvement of sound reduction indices $\Delta(R_w+C_{100-5000})_{heavy}$ and $\Delta(R_w+C_{tr,100-5000})_{heavy}$, calculated in an equivalent way.

Additionally, are presented:

- Sound reduction index of the standard wall with lining, $R_{with,}$ for the one-third-octave band from 100 Hz to 5000 Hz.
- Sound reduction index of the standard wall without lining, $R_{without}$, for the one-third-octave band from 100 Hz to 5000 Hz.
- Global indices R_w (C; C_{tr}), R_A and $R_{A,tr}$ for the both elements mentioned above.

B2020-122-M759 RA: Airborne sound insulation of *Lining + 'heavy wall':*

- Sound reduction index, R, for the one-third octave band from 100 to 5000 Hz, in table and graph.
- Global indices R_w (C; C_{tr}), R_A and $R_{A,tr}$.

The global indices R_w (C; C_{tr}), R_A and $R_{A,tr}$ for a test specimen are calculated as follows:

- R_w: Weighted sound reduction index, calculated according to EN ISO 717-1:2013, from the sound reduction index, R.
- C y C_{tr}: Spectrum adaptation terms from 100 to 3150 Hz, calculated according to EN ISO 717-1:2013, which are the values, expressed in decibels, to be added to the global magnitude value R_w to consider the characteristics of the pink noise spectrum (C) and traffic noise spectrum (C_{tr}), respectively.
- R_A and $R_{A,tr}$: Global indices calculated according to the expression of *Documento Básico "DB-HR Protección frente al ruido" - Código Técnico de la Edificación (CTE)*, from the sound reduction index, R, obtained by laboratory measurement:
  - R_A: A-weighted sound reduction index, from 100 to 5000 Hz, expressed to one decimal place.
  - $R_{A,tr}$: A-weighted sound reduction index for exterior traffic noise, from 100 to 5000 Hz, expressed to one decimal place.

Sound reduction improvement index of a lining on standard heavy wall according to EN ISO 10140-1:2016 Annex G
Laboratory measurements according to EN ISO 10140-2:2010

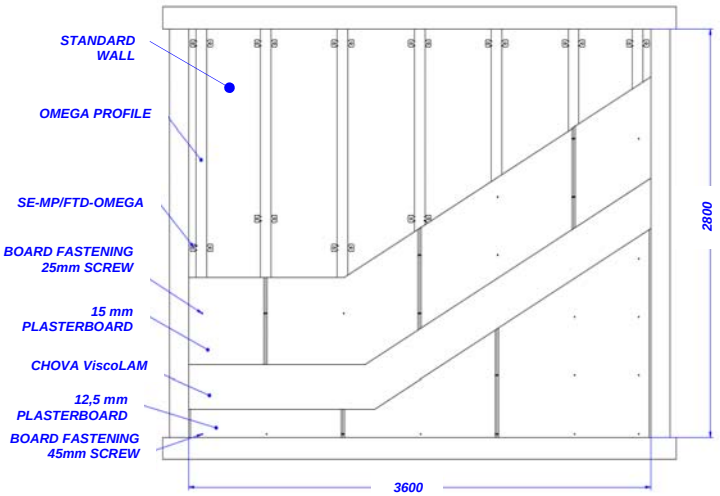
Applicant: SUSPENSIONES ELÁSTICAS DEL NORTE, S.L. (SENOR)

Result No.: B2020-122-M759 MRA

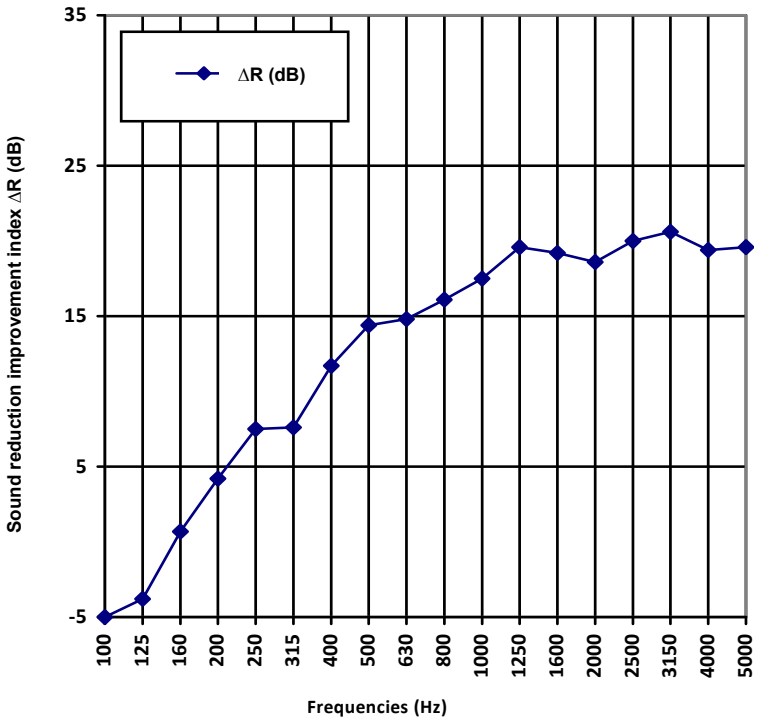
Test date: 28th October 2020

Test specimen: NON-ACOUSTIC DIRECT WALL LINING (SENOR + CHOVA): SE-MP/FTD-OMEGA; VISCOLAM.
Standard heavy wall: Lined filled concrete block wall (300 kg/m^2), tested on 19th October 2020 ($R_{without}$)

Estimated superficial mass: 25 kg/m^2
Test specimen area: 10,08 m^2 — T_{rooms}: 20,4 ºC
Source room volume: 66,6 m^3 — HR_{rooms}: 50 %
Receiving room volume: 55,2 m^3 — P_{rooms}: 961 mbar



f (Hz)	R_{with} (dB)	$R_{without}$ (dB)	ΔR (dB)
100	30,4	35,4	-5,0
125	32,2	36,0	-3,8
160	35,5	34,8	0,7
200	38,6	34,4	4,2
250	41,7	34,2	7,5
315	45,6	38,0	7,6
400	53,0	41,3	11,7
500	57,6	43,2	14,4
630	61,1	46,3	14,8
800	65,0	48,9	16,1
1000	69,5	52,0	17,5
1250	73,8	54,2	19,6
1600	75,4	56,2	19,2
2000	75,3	56,7	18,6
2500	73,9	53,9	20,0
3150	73,4	52,8	20,6
4000	73,2	53,8	19,4
5000	73,9	54,3	19,6



$R_w(C; C_{tr})_{with}$: 54(-2;-8) dB	$R_w(C; C_{tr})_{without}$: 48(-2; -5) dB
$R_{A,with}$: 52,6 dBA	$R_{A,without}$: 47,1 dBA
$R_{A,tr,with}$: 45,7 dBA	$R_{A,tr,without}$: 42,9 dBA

Weighted indices according to EN ISO 10140-1:2016 Annex G:

$\Delta R_{w,heavy}$ = 6 dB / $\Delta(R_w+C)_{heavy}$ = 5 dBA / $\Delta(R_w+C_{tr})_{heavy}$ = 3 dBA

$\Delta(R_w+C_{100-5000})_{heavy}$ = 5 dBA / $\Delta(R_w+C_{tr,100-5000})_{heavy}$ = 3 dBA

Evaluation based on laboratory measurement results obtained by an engineering method

ilac-MRA ENAC ENSAYOS Nº 4 / LE 456

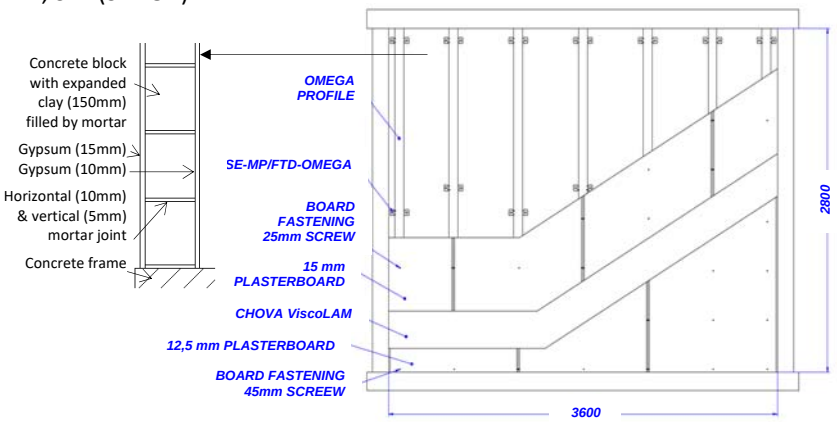
Airborne Sound Insulation according to EN ISO 10140-2:2010
Laboratory Measurements

Applicant: SUSPENSIONES ELÁSTICAS DEL NORTE, S.L. (SENOR)

Result No.: B2020-122-M759 RA

Test date: 28th October 2020

Test specimen: NON-ACOUSTIC DIRECT WALL LINING (SENOR + CHOVA): SE-MP/FTD-OMEGA; VISCOLAM, ON LINED BLOCK WALL.

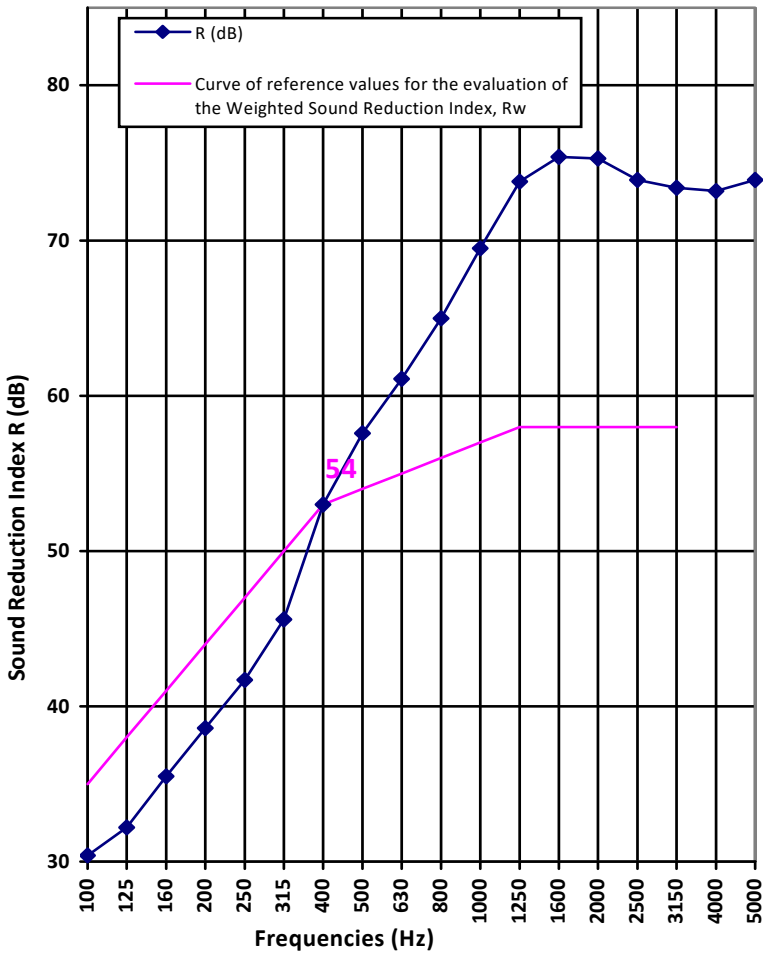


Estimated superficial mass: 325 kg/m^2
Test specimen area: 10,08 m^2

Source room volume: 66,6 m^3
Receiving room volume: 55,2 m^3

T_{rooms}: 20,4 ºC
HR_{rooms}: 50 %
P_{rooms}: 961 mbar

f (Hz)	R (dB)
100	30,4
125	32,2
160	35,5
200	38,6
250	41,7
315	45,6
400	53,0
500	57,6
630	61,1
800	65,0
1000	69,5
1250	73,8
1600	75,4
2000	75,3
2500	73,9
3150	73,4
4000	73,2
5000	73,9



Rating according to EN ISO 717-1:2013:	R_w ($C;C_{tr}$):	54 (-2; -8)	dB
Rating according to CTE DB-HR:	R_A:	52,6	dBA
	$R_{A,tr}$:	45,7	dBA

Evaluation based on laboratory measurement results obtained by an engineering method

ilac-MRA ENAC ENSAYOS Nº 4/LE456