soundlab®

LABORATORIO DE MEDICIONES ACÚSTICAS

REPORT ON THE ON-SITE ACOUSTIC MEASUREMENTS CARRIED OUT TO CALCULATE THE ACOUSTIC INSULATION OF ONE CABIN MODEL FOR THE SIBELMED BRAND

Testing laboratory

SOUNDLAB

Calle Loreto 17, Bajos, Local G

08029 – Barcelona

Tel: +34 93 322 28 63

Fax: +34 93 439 72 02

E-mail: info@soundlab.es

Webpage: www.soundlab.es

Client ref. number.: 2182-17-L

SIBEL S.A.U.

c/ Rosselló, 500, bajos

08026 – Barcelona

Contact person: Jordi Rigau

Tel.: 93 433 54 49

E-mail: jrigau@sibelgroup.com

APLING, SLU - Comm. Reg. of Barcelona: Tome 32162. Sheet 0188. General Sect. Entry. 1ª Page 209026 – C.I.F. B-60413499

INDEX

Barcelona, November 6 2017

SUBJECT: Report on on-site acoustic measurements for the calculation of the acoustic insulation of one cabin model of the Sibelmed brand.

Ref. N..: 2182-17-L

1.- PURPOSE

The purpose of this document is to show our client the results obtained in the acoustic measurements carried out on November 3 2017 by technicians Ivan Martínez and Jordi Vida.

2.- TEST EQUIPMENT USED

In order to carry out the acoustic measurements, we used the following test equipment:

- 01dB SOLO Integrating Sound Level Meter (s/n 11273) with a spectrum analysis and reverb time analysis module, a MCE-212 microphone (s/n 75503) and a PRE21-S pre-amplifier.
- CESVA SC310 Integrating Sound Level Meter (s/n T221736) with a spectrum analysis and reverb time analysis module, a C-130 (s/n 8268) microphone and a PA-13 pre-amplifier.
- A CESVA CB-5 sound calibrator (s/n T025183).
- A RION NC-74 sound calibrator (s/n 34762370).
- A CESVA AP602 pink noise generator with equalizer (s/n T242201) and a CESVA BP012 dodecahedron loudspeaker (s/n T244701).

- A GEOS nº 11 SKYWATCH weather station.

All test equipment used in measurements (sound level meters) are type 1 according to IEC 651 or IEC 804.

3.- TEST PIECES

Specifically, the tests are carried out on one Sibelmed-brand cabin used for audiometries, which is made up of self-supporting, detachable blocks. These blocks are made up of an average-density wooden board, a layer of sound absorbing material, and pressed polyurethane elastic and another wooden board. They are linked together by wooden pegs with EPDM bands that allow the blocks to be assembled without using screws. It has an aluminium-framed door with a glass panel and a door window. Beneath the door window there is an entrance for cables and a wooden shelf. The inside of the cabin is treated with sound-absorbing materials to control reverberation inside. The cabin stand upon self-levelling legs. The features of the cabin is as follows:

Model S-40 B:

Outside measurements 111 x 111 x 215 cm; Inside measurements 94 x 94 x 178 cm; One door window; One door; No furnishings.

4.- METHODOLOGY OF ACOUSTIC MEASUREMENTS

The measurements have been carried out following the methodology outlined in regulation UNE-EN ISO 11957 – On the determination of acoustic insulation performance of cabins. *In situ* measurement method (ISO 11957:1996).

The *in situ* measurements were carried out using loudspeakers.

The loudspeakers were placed in three, uniformly spread positions around the cabin at a distance of at least 3 metres from each other. The distance between the

cabin and the loudspeaker must be no less than 2 metres. The pink noise signal was especially sampled with 6 microphone positions per loudspeaker position, for 10 seconds, at less than three metres from the loudspeaker.

Sampling within the cabin was carried out with 3 microphone positions per loudspeaker position for 10 seconds, arrayed in a sphere with a 0,3 metre radius whose centre is the theoretical head of the cabin operator in a sitting position if he were inside the cabin.

Background noise measurements were carried out within the cabin. The desired goal is for background noise to be 6 dB below, preferably 12 dB, the noise received with the loudspeaker on in each of the third-octave bands.

In order to obtain a homogenous emission spectrum, as established in the regulation, it is necessary to check that there were no differences greater than 6 dB between the 125 Hz third-octave bands, 5 dB in the 250 Hz band and 4 dB in bands with a higher frequency. Should the differences be greater than the above, the issued signal will be equalized, outlining the equalisation carried out in section 5 of this report.

The results obtained were then used to calculate the apparent pressure acoustic insulation (D'_p).

The results of the measurements are presented in the format specified in regulation UNE-EN ISO 717-1:2013.

The measurement parameters used to determine insulation were:

- Apparent acoustic insulation, D'_p

$$D'_p = (L_p)_{room} - (L_p)_{cabin}$$

In which:

- $(L_p)_{room}$ is the average level of acoustic pressure, in dB, in octave third bands in the room;
- $(L_p)_{cabin}$ is the average level of acoustic pressure, in dB, in octave third bands in the cabin;

Based on the frequency insulation curve, we have calculated the acoustic reduction index, pondering $D'_{p,w}$ and the terms of adaptation to pink noise and traffic (C and C_{tr}), based on regulation UNE-EN ISO 717-1:2013.

5.- RESULTS OBTAINED

Below is a table with the atmospheric conditions at the time of the measurements:

Measurement period	Temperature	Relative humidity
11h - 11h30	20,9 ºC	50,1 % rH

Table 1.- Weather conditions

The measurements were carried out within a room with a surface of 5,4 x 6,2 metres and 2,9 metres tall. The windows and doors were closed at all times. The industrial unit had an average reverberation time of 0,8 seconds.

Concerning the equalisation of the issued signal, it wasn't necessary to equalize it, as we observed no significant differences between adjacent bands.

Below are the averaged acoustic insulation values:

Model	$D'_{p,w}$ (C ; C_{tr})
S-40 B	36 (-2 ; -7) dB

Table 2.- Obtained acoustic insulation values

In Appendix I, you will find detailed calculations of the apparent acoustic insulation (D'_p) of the cabins based on frequency.

Appendix II contains a copy of the verification certificates for the testing equipment used to carry out the measurements. All of the testing equipment used for measurements was verified and calibrated by a certified ENAC laboratory.

The results obtained in the measurements are representative of the weather conditions in which they were sampled, of the time of the day on the abovementioned date.

SOUNDLAB,

REPORT N.: 2182-17-L

Report drafted by:

Ivan Martinez

Firmado digitalmente por Ivan Martinez
Nombre de reconocimiento (DN): cn=Ivan Martinez, o=Apling, Acustica e Insonorizacion, ou, email=ivan.martinez@apling.es, c=<n
Fecha: 2017.11.06 12:09:11 +01'00'

Ivan Martínez

Laboratory Manager

Telecommunications Tech. Engineer

Supervised by:

MIGUEL ANTONIO VIDA PRIETO / num:7446

Firmado digitalmente por MIGUEL ANTONIO VIDA PRIETO / num:7446
Fecha: 2017.11.06 12:29:23 +01'00'

Miguel Vida Prieto

Technical Director

Industrial engineer

n. 7446

Appendix I

Calculation of acoustic insulation

TEST REPORT

DETERMINATION OF ACOUSTIC INSULATION PERFORMANCE OF CABINS

IN SITU MEASUREMENT METHOD (ISO 11957:1996)

CLIENT: Sibel, S.A.U. **DATE OF ESSAY: 11/03/17**

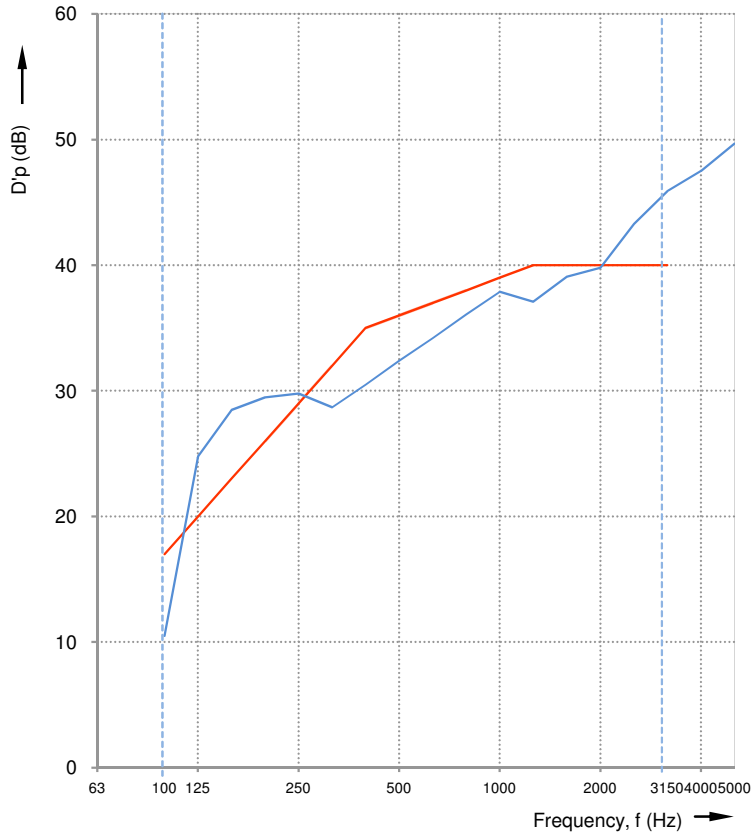
IDENTIFICATION ELEMENT: Sibelmed brand cabin model S-40 B
Outside measurements 111x111x215 cm
Inside measurements 94x94x178 cm
1 window
1 door

Cabin volume =	1,6 m³
Source room volume =	95,8 m³

Frequency *f* Hz	*D'p (octave third)* dB
100	10,5
125	24,8
160	28,5
200	29,5
250	29,8
315	28,7
400	30,5
500	32,4
630	34,2
800	36,1
1000	37,9
1250	37,1
1600	39,1
2000	39,8
2500	43,3
3150	45,9
4000	47,5
5000	49,7
6300	44,1
8000	45,0
10000	45,6

Frequency range according to reference curve (ISO 717-1)

D'p (dB) **REFERENCE CURVE ISO 717-1**



Value according to the standard ISO 717-1:

Insulation index according UNE EN ISO 717-1 $D'p_{,w}$ (C,Ctr) = 36 (-2 ; -7) dB

No corrections were made for background noise

Report nº 2182-17-L soundlab LABORATORIO DE MEDICIONES ACÚSTICAS Essay executed by: Ivan Martínez

Appendix II

Testing equipment calibration certificates

ENAC
INSPECCIÓN
Nº OC-I/162

CERTIFICADO DE VERIFICACIÓN

Número 17/34524510-V

Applus laboratories

LGAI Technological Center, S.A.
Ronda de la Font del Carme, s/n
08193 Bellaterra
T +34 93 567 20 50
F +34 93 567 20 01
metrologia@applus.com
www.applus.com

Nº OAVM: 02-OV-0005

INSTRUMENTO	SONÓMETRO INTEGRADOR-PROMEDIADOR
SOLICITANTE	APLING ACÚSTICA - INSONORIZACIÓN, S.L.U.
DIRECCIÓN	c/ Loreto, 17, bajos, local G 08029 BARCELONA (Barcelona)
TIPO DE ACTUACIÓN	Ensayos de verificación después de reparación conforme a la Orden ITC/2845/2007, disposición transitoria primera.

IDENTIFICACIÓN

	Sonómetro	Micrófono
Marca	01dB	01dB
Modelo	SOLO	MCE212
Número de serie	11273	175244

CARACTERÍSTICAS METROLÓGICAS

Tipo/Clase	1
Nivel de referencia	94,0 dB
Rango de medida	20,0 - 137,0 dB
Resolución	0,1 dB

FECHAS

Verificación	Válido hasta	
2017-05-12	2018-05-12	*(si antes no hay una operación de reparación que obligue a superar una verificación después de reparación o modificación)*

RESULTADO VERIFICACIÓN: FAVORABLE

PRECINTADO: 2, adhesivos autodestructibles, colocados lateralmente entre carcasa anterior y posterior

SIGNATARIO/S AUTORIZADO/S:

Responsable Técnico

JORDI GIL DEL RIO 15/05/2017 09:57:51
Código Seguro de Verificación (CSV): 105307294FCKU

Inspector

Jordi Messeguer Morales
12/05/2017 17:05:18

Este documento ha sido firmado electrónicamente según la Ley 59/2003 e identificado mediante un Código Seguro de Verificación (CSV). Consulte la validez del documento en el servicio Web de verificación http://metrosign.appluscorp.com

ENAC
INSPECCIÓN
Nº OC-I-162

CERTIFICADO DE VERIFICACIÓN

Número 17/34524512-V

Applus laboratories

LGAI Technological Center, S.A.
Ronda de la Font del Carme, s/n
08193 Bellaterra
T +34 93 567 20 50
F +34 93 567 20 01
metrologia@applus.com
www.applus.com

Nº OAVM: 02-OV-0005

INSTRUMENTO	CALIBRADOR ACÚSTICO	
SOLICITANTE	APLING ACÚSTICA - INSONORIZACIÓN, S.L.U.	
DIRECCIÓN	c/ Loreto, 17, bajos, local G 08029 BARCELONA (Barcelona)	
TIPO DE ACTUACIÓN	Ensayos de verificación periódica conforme a la Orden ITC/2845/2007, disposición transitoria primera.	
IDENTIFICACIÓN	Marca	RION
	Modelo	NC-74
	Núm. de serie	34362132
CARACTERÍSTICAS METROLÓGICAS	Tipo / clase	1
	Nivel/es nominal/es	94,0 dB
	Frecuencia nominal	1000 Hz
FECHAS	Verificación: 2017-05-12	Válido hasta: 2018-05-12 *(si antes no hay una operación de reparación que obligue a superar una verificación después de reparación o modificación)*
RESULTADO VERIFICACIÓN	FAVORABLE	
PRECINTADO	1, adhesivo autodestructible, situado en tornillo interno de ensamblaje	

SIGNATARIO/S AUTORIZADO/S:

Responsable Técnico

JORDI GIL DEL RIO 15/05/2017 09:57:55
Código Seguro de Verificación (CSV): 468975830NK4W

Inspector

Jordi Messeguer Morales
12/05/2017 17:05:08

Este documento ha sido firmado electrónicamente según la Ley 59/2003 e identificado mediante un Código Seguro de Verificación (CSV).
Consulte la validez del documento en el servicio Web de verificación http://metrosign.appluscorp.com

ENAC
INSPECCIÓN
Nº OC-I/162

CERTIFICADO DE VERIFICACIÓN

Número 17/34543266-V

Applus laboratories

LGAI Technological Center, S.A.
OAVM nº 02-OV-0005

Ronda de la Font del Carme, s/n
08193 Bellaterra
T +34 93 567 20 50
F +34 93 567 20 01
metrologia@applus.com
www.applus.com

INSTRUMENTO	SONÓMETRO
SOLICITANTE	APLING ACUSTICA INSONORIZACION, S.L.
DIRECCIÓN	c/ Loreto 17 baixos Local G 08029 BARCELONA (BARCELONA)
TIPO DE ACTUACIÓN	Ensayos de verificación periódica conforme a la Orden ITC/2845/2007, disposición transitoria primera.

IDENTIFICACIÓN

	Sonómetro	Micrófono	Preamplificador
Marca	CESVA	CESVA	CESVA
Modelo	SC-310	C-130	PA13
Número de serie	T221736	8268	1181

CARACTERÍSTICAS METROLÓGICAS

Tipo/Clase	1
Nivel de referencia	94,0 dB
Rango de medida	24,0 - 137,0 dB
Resolución	0,1 dB

FECHAS

Verificación	Válido hasta	
2017-09-08	2018-09-08	*(si antes no hay una operación de reparación que obligue a superar una verificación después de reparación o modificación)*

RESULTADO VERIFICACIÓN: FAVORABLE

PRECINTADO: 2, laterales entre carcasas

Números de precinto: 02-OV-0005386

SIGNATARIO/S AUTORIZADO/S:

Responsable Técnico

JORDI GIL DEL RIO 08/09/2017 13:54:09
Código Seguro de Verificación (CSV): 537577916SWMK

Inspector

Jordi Messeguer Morales
08/09/2017 12:09:13

Este documento ha sido firmado electrónicamente según la Ley 59/2003 e identificado mediante un Código Seguro de Verificación (CSV). Consulte la validez del documento en el servicio Web de verificación http://metrosign.appluscorp.com

ENAC
INSPECCIÓN
Nº OC-I/162

CERTIFICADO DE VERIFICACIÓN

Número 17/34543267-V

Applus laboratories

LGAI Technological Center, S.A.
OAVM: 02-OV-0005
Ronda de la Font del Carme, s/n
08193 Bellaterra
T +34 93 567 20 50
F +34 93 567 20 01
metrologia@applus.com
www.applus.com

INSTRUMENTO	CALIBRADOR ACÚSTICO	
SOLICITANTE	APLING ACUSTICA INSONORIZACION, S.L.	
DIRECCIÓN	c/ Loreto 17 baixos Local G 08029 BARCELONA (BARCELONA)	
TIPO DE ACTUACIÓN	Ensayos de verificación periódica conforme a la Orden ITC/2845/2007, disposición transitoria primera.	
IDENTIFICACIÓN	Marca	CESVA
	Modelo	CB-5
	Núm. de serie	25183
CARACTERÍSTICAS METROLÓGICAS	Tipo / clase	1
	Nivel/es nominal/es	94,0 / 104,0 dB
	Frecuencia nominal	1000 Hz
FECHAS	Verificación: 2017-09-08	Válido hasta: 2018-09-08 *(si antes no hay una operación de reparación que obligue a superar una verificación después de reparación o modificación)*
RESULTADO VERIFICACIÓN	FAVORABLE	
PRECINTADO	1, adhesivo autodestructible, situado en el potenciómetro interno de ajuste	Números de precinto: --

SIGNATARIO/S AUTORIZADO/S:

Responsable Técnico

JORDI GIL DEL RIO 08/09/2017 13:54:16
Código Seguro de Verificación (CSV): 566120024YGVD

Inspector

Jordi Messeguer Morales
08/09/2017 12:09:01

Este documento ha sido firmado electrónicamente según la Ley 59/2003 e identificado mediante un Código Seguro de Verificación (CSV).
Consulte la validez del documento en el servicio Web de verificación http://metrosign.appluscorp.com