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TEST REPORT NO. 079-2017-IAP

UNI EN ISO 10140-2:2010

MEASUREMENT IN LABORATORY OF THE ACOUSTIC INSULATION OF BUILDINGS AND BUILDING ELEMENTS

MEASUREMENT IN LABORATORY OF ACOUSTIC INSULATION IN AIR

Place and date of issue: Cerea (VERONA), 30/03/2017

Client: ENTREMATIC ITALY SPA

Client's address: LARGO U. BOCCIONI 1, 21040 ORIGGIO (VARESE)

Sample supply date: 22/03/2017

Origin of the sample: ENTREMATIC ITALY SPA

Sample installation date: 22/03/2017

Sample installed in laboratory by: Z Lab S.r.l. (sampling carried out by the client)

Test performance date: 22/03/2017

Place of the test: Z Lab S.r.l. Via Pisa, 5/7 – 37053 Cerea (VERONA) – Italy

Name of the sample: Aluminium Frame with panelled wing in AISI 304 Stainless Steel Sheet, with screening in Lead sheet thickness 3 mm

LAB N° 1416

PREPARED	VERIFIED	APPROVED
Antonio Scofano	Antonio Scofano	Antonio Scofano

Description of the sample

The sample tested consists of a door with the following characteristics:

Width detected** [mm]	1568
Height detected** [mm]	2234
Nominal thickness** [mm]	60
Useful area** [m^2]	3.5

The sample is described by the following elements (*):

- Wing for sliding door consisting of rounded extruded aluminium profile frame and flush panel.
- 60 mm thick wing with non-toxic silicone perimeter seals.
- The outer slot-in profile is fully aligned and sealed with non-toxic silicone.
- The internal panel consists of two sandwiched AISI 304 Stainless Steel laminate plates, in Scotch Brite finishing and an internal structure consisting of a class EA self-extinguishing high-density extruded polyester sheet between two 4 mm-thick class 1 fireproof MDF sheets.
- Insertion of 3 mm lead sheets for screening against X-rays applied both on the inside of the panel and on all the perimeter profiles of wings and fixed frame.
- The fixed frame of the sliding door is made on three sides of the passageway with rounded extruded aluminium profiles.

(*) nominal data provided by the manufacturer
(**) data measured by sampling on the test element

Diagrams and images of the sample

Figure 1: Emitting room side

Figure 2: Receiving room side

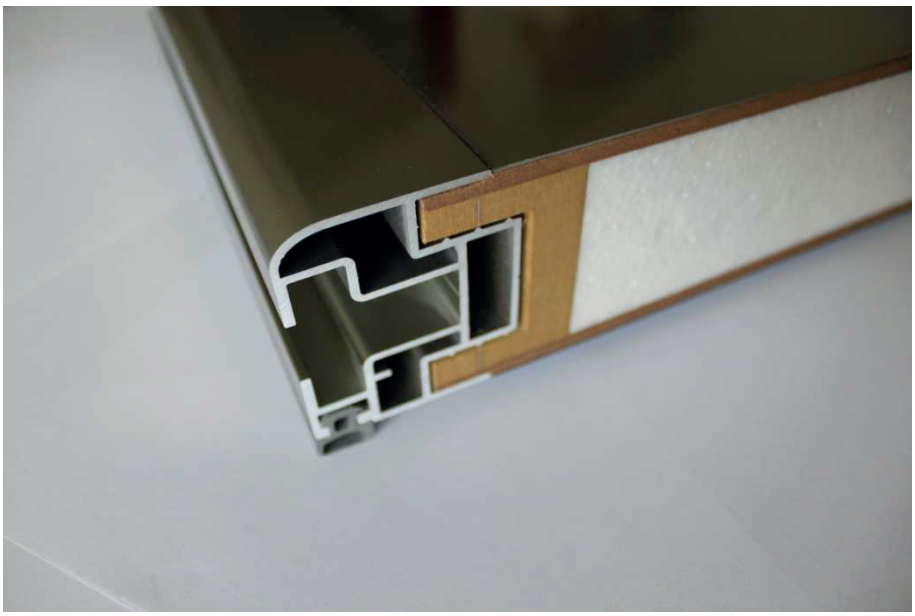


Figure 3: Detail of wing

The test was carried out as soon as the sample was ready.

Legislative references

UNI EN ISO 10140-2:2010	*Acoustic – Measurement in laboratory of the acoustic insulation of buildings and building elements Part 2: Measurement of acoustic insulation in air*
UNI EN ISO 717-1:2013	*Acoustic – Measurement of the acoustic insulation of buildings and building elements Part 1: Acoustic insulation in air.*

Description of the test rooms

The test structure is made of reinforced concrete, completely insulated from the laboratory floor by means of anti-vibration supports. It is made up of an emitting room and a receiving room, both of irregular shape and without parallel partitions. They are separated by a test frame with a thickness of 100 cm. The dimensional specifications are:

Emitting room dimensions (average L x W x H)	700 X 500 X 330 cm
Receiving room dimensions (average L x W x H)	770 X 560 X 370 cm

Test equipment

Instrument	Make and Model	Serial no.
Phonometer	LARSON DAVIS L&D 2900B	1080
Microphone	G.R.A.S. 40AQ	204027
Pre-amplifier	LARSON DAVIS L&D PRM900C	1267
Calibrator	LARSON DAVIS L&D CAL200	3852
Omnidirectional source	LOOKLINE D303	SM900126
Thermo-hygrometer	DELTA OHM HD2301.0	09020599
Combined temperature and humidity gauge	DELTA OHM HP472AC R	09028736
Flexometer	STANLEY POWERLOCK 33-442	13/946
Micro-climate with pressure meter	DELTA OHM HD 32.1	MSP430F4618

Physical conditions at the moment of the test

	Emitting room	Receiving room
Volume	117.4 m^3	164.2 m^3
Average temperature	18 ± 1.0 °C	17 ± 1.0 °C
Average relative humidity	62 ± 2.0 %	66 ± 2.0 %
Atmospheric pressure	102.4 kPa ± 1 hPa	
Separation area	10.73 m^2	

Detection method

The testing of the acoustic insulation in air between rooms is based on the principle of the difference between the average level of sound pressure in the emitting room (L_1) and that detected in the receiving room (L_2). The acoustic source (which produces pink noise) is turned on in the emitting room in 3 different positions; the microphone is positioned in 5 different points of the emitting and receiving room. A measurement is taken for each source-microphone combination, for a total therefore of 15 measurements in the emitting room and 15 in the receiving room. The integration time is, for each measurement, at least 15 s.

When the detection of the average level of sound pressure in the receiving room has been completed, the source is deactivated, in order to enable the measurement of the level of background noise L_b. The corrections to be made to the spectrum L_2, to be calculated for every single frequency making up the spectrum, are:

$$L_2 = L_2 - 1.3 \text{ [dB] if } L_2 - L_b \leq 6\text{dB}$$

$$L_2 = 10 \cdot \log(10^{(L_2/10)} - 10^{(L_b/10)}) \text{ [dB] if } 6 < L_2 - L_b < 10\text{dB}$$

The calculation of reverberation time T is aimed at determining the sound insulation power R or the normalised acoustic insulation of small elements $D_{n,e}$, parameters that result from applying the following formulae:

$$R = L_1 - L_2 + 10 \cdot \log(S/A) \text{ [dB]}$$

$$\mathrm{D}_{n,e} = L_1 - L_2 + 10 \cdot \log(A_0/A) \text{ [dB]}$$

where:
S: area of free test opening in which the test element is installed, expressed in m^2;
A_0: equivalent area of acoustic absorption of reference, of 10 m^2;
A: equivalent area of acoustic absorption in the receiving room calculated in the following way using Sabine's expression:

$$\mathrm{A} = 0.16 \cdot (V/T) \text{ [m}^2\text{]}$$

where V is the volume of the receiving room in m^3.
On the basis of the single values calculated for each frequency from 100 Hz to 3150 Hz of the spectrum in bands of 1/3 of an octave, the experimental curve is reconstructed. This is to be compared with that of reference which is contained in the UNI EN ISO 717-1 standard.
The method of bringing the reference curve closer to the measured one is then applied, up to the point in which the sum of the unfavourable gaps on the reference curve is less than or equal to 32 dB; the value corresponding to the frequency of 500 Hz is then determined. This value is the measurement index of the apparent sound insulation power R_w (or index of normalised acoustic insulation of small elements $D_{n,e,w}$).

Values measured

f [Hz]	L_1 [dB]	L_2 [dB]	L_b [dB]	T [s]	R [dB]
Frequency	*Level in emitting environment*	*Level in receiving environment*	*Level of background noise*	*Reverberation time*	*Sound insulation power*
50	85.7	50.1	29.5	3.77	33.8
63	90.0	60.9	27.8	3.57	27.1
80	87.1	56.6	20.6	3.18	27.2
100	92.9	54.5	17.3	3.41	35.6
125	94.6	56.8	14.3	2.74	33.4
160	94.4	58.7	13.2	2.54	30.9
200	94.6	54.4	10.4	2.31	35.1
250	95.6	56.3	9.2	2.05	33.7
315	95.5	52.3	8.4	1.97	37.4
400	95.7	52.3	9.6	2.08	37.8
500	96.3	56.3	6.6	2.07	34.4
630	97.1	59.7	7.3	2.05	31.8
800	97.9	60.8	4.2	2.19	31.8
1000	96.0	64.0	3.0	2.04	26.4
1250	97.1	60.5	3.2	2.07	31.0
1600	98.2	56.7	3.3	2.16	36.1
2000	99.5	56.2	3.6	2.19	37.9
2500	98.8	56.5	3.7	2.06	36.7
3150	98.1	55.4	4.2	1.80	36.4
4000	101.0	56.2	4.7	1.63	38.1
5000	94.3	47.6	5.3	1.49	39.6

(**) Correction applied for background noise according to UNI EN ISO 10140-4:2010, §4.3.

(***) The uncertainty is calculated with coverage factor k corresponding to the confidence level of 95%. k=2.78.

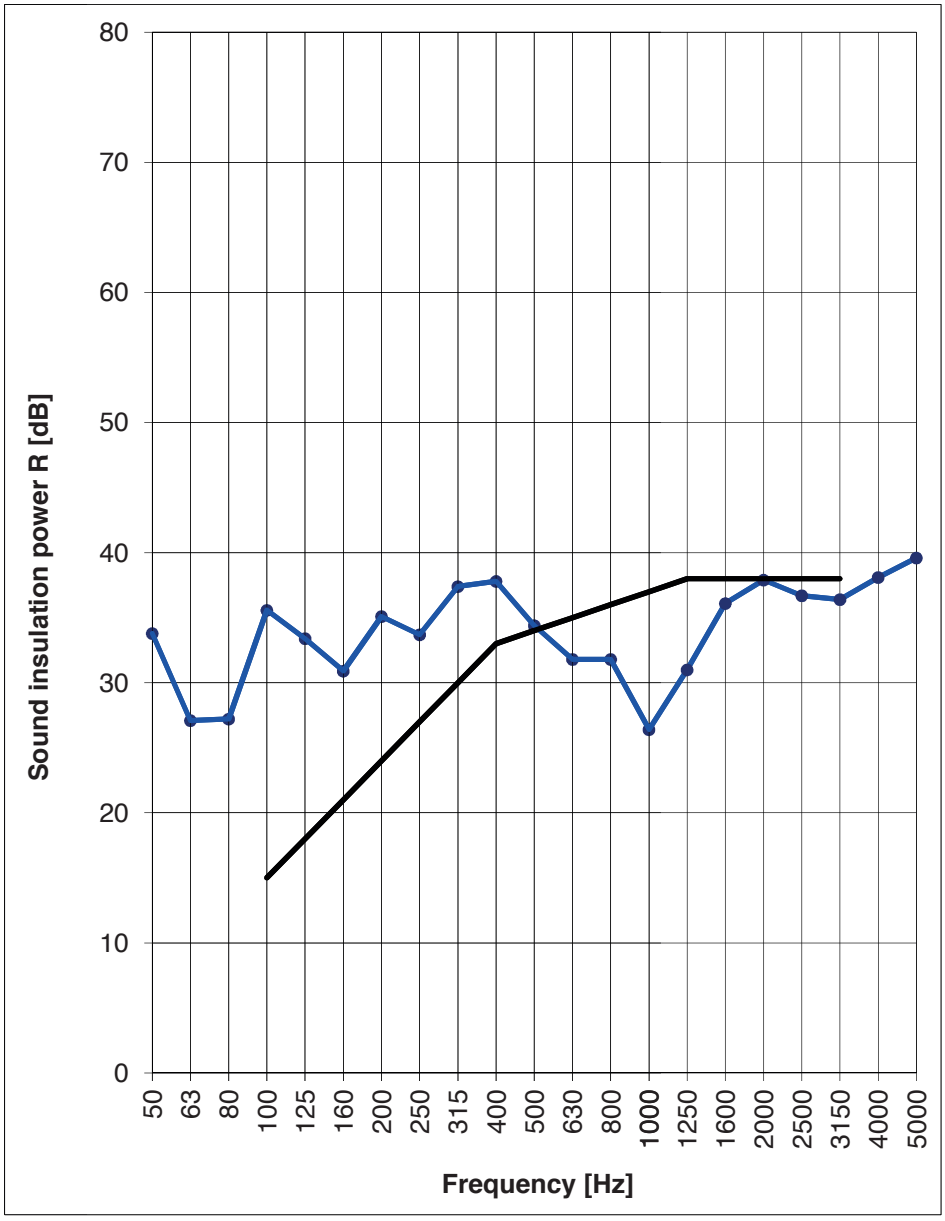
Sound insulation power, R, according to ISO 10140-2

Description of the test element: Aluminium Frame with panelled wing in AISI 304 Stainless Steel Sheet, with screening in Lead sheet thickness 3 mm

Area of the test element: 3.5 m^2

Volume of the spaces: Emitter 117.4 m^3 Receiver 164.2 m^3

f	R
[Hz]	[dB]
50	33.8
63	27.1
80	27.2
100	35.6
125	33.4
160	30.9
200	35.1
250	33.7
315	37.4
400	37.8
500	34.4
630	31.8
800	31.8
1000	26.4
1250	31.0
1600	36.1
2000	37.9
2500	36.7
3150	36.4
4000	38.1
5000	39.6



Measurement in conformity with ISO 717-1

R_w (C;C_{tr}) = 34 (-2 ; -3) dB $C_{50\text{-}3150}$ = -2 dB; $C_{50\text{-}5000}$ = -1 dB; $C_{100\text{-}5000}$ = -1 dB

Assessment based on results of measurements in the laboratory obtained using a technical method.

$C_{tr,50\text{-}3150}$ = -3 dB; $C_{tr,50\text{-}5000}$ = -3 dB; $C_{tr,100\text{-}5000}$ = -3 dB

Laboratory Manager Mr Antonio Scofano