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## REPORT N.128-2022-IAP Eng

### UNI EN ISO 10140-2:2021 LABORATORY MEASUREMENT OF SOUND INSULATION OF BUILDING ELEMENTS MEASUREMENT OF AIRBORNE SOUND INSULATION

**Issue place and date:** Cerea (VR), 18 November 2022

**Customer:** AD Solutions s.r.l.

**Customer address:** Via Leonardo da Vinci, 4, 30020, Torre di Mosto (VE) - Italy

**Sample delivery date:** 17 October 2022

**Sample provenance:** AD Solutions s.r.l.

**Sample installation date:** 19 October 2022

**Sample installed in laboratory by:** Customer (sampling made by the committee)

**Test date:** 19 October 2022

**Test location:** Z Lab S.r.l. – Via Pisa, 7 – 37053 Cerea (VR) – Italy

**Sample denomination:** SLIM Wall – Single Glass



LAB N° 1416 L

| PREPARED         | VERIFIED        | APPROVED        |
|------------------|-----------------|-----------------|
| Annunziata Bruno | Antonio Scofano | Antonio Scofano |

## Sample description

The test sample is made of a wall having the following characteristics:

|   |       |
|---|-------|
| Width <sup>(2)</sup> [mm]                       | 3590  |
| Height <sup>(2)</sup> [mm]                      | 2970  |
| Frame Nominal <sup>(1)</sup> thickness [mm]     | 40    |
| Sample surface <sup>(2)</sup> [m <sup>2</sup> ] | 10.73 |

The sample consists of (1):

Glass wall, named "SLIM Wall" having dimensions 3510 x 2970 mm, thickness 40 mm, consisting of the following materials:

- N°3 glass sheets having dimensions 1181 x 2937 mm, with Glass "55.2 Acoustic - PVB 0.76", density 26 kg/m<sup>2</sup>, 0.76 mm.

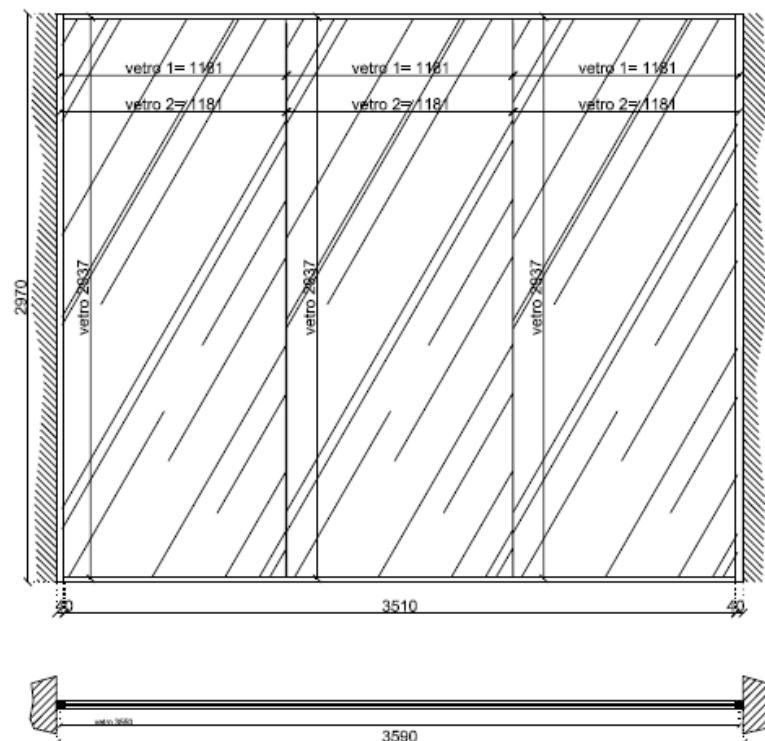
Internal metal structure consisting of:

- Horizontal metal rails made of U-shaped extruded aluminum profiles with dimensions 40 x 54 mm / 40 x 25 mm.

- (1) nominal data provided by the client  
(2) data measured by test element sampling  
(3) nominal data provided by the manufacturer

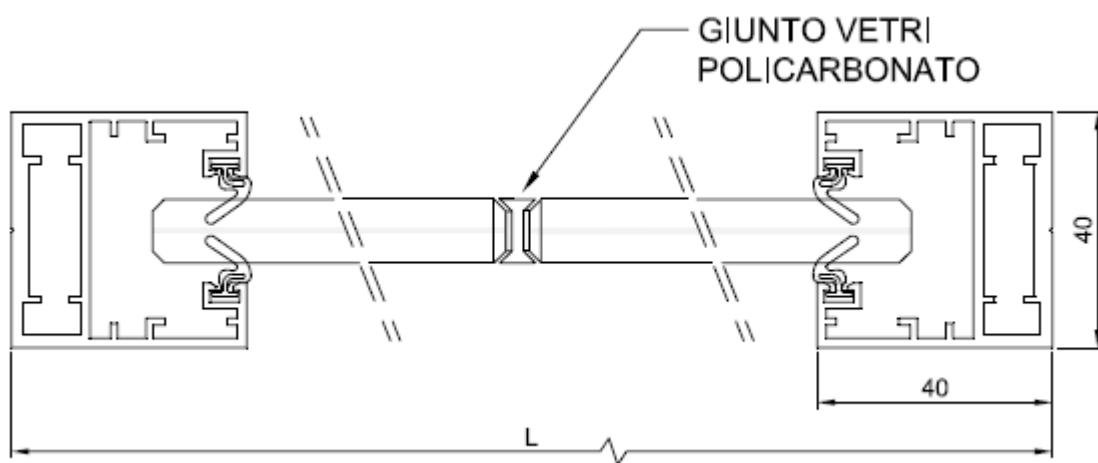
The technical drawing of the sample is shown below<sup>(1)</sup>:

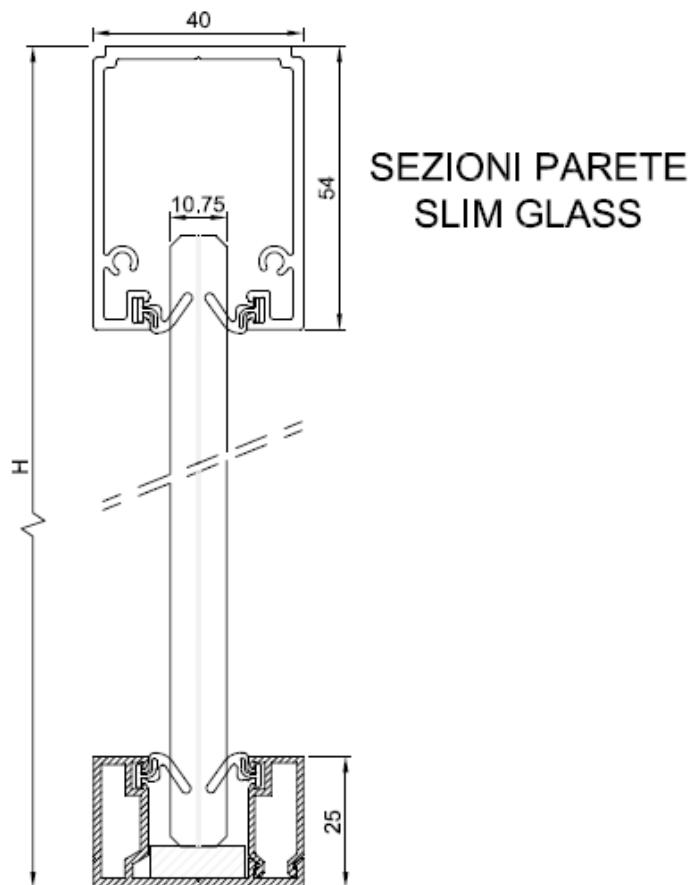
#### Front View



**DENOMINAZIONE PARETE: SLIM  
VETRO SINGOLO 5+5+0.76**

#### Horizontal Section



**Vertical sections**

## Test sample illustrations



Figure 1 - View side Source room

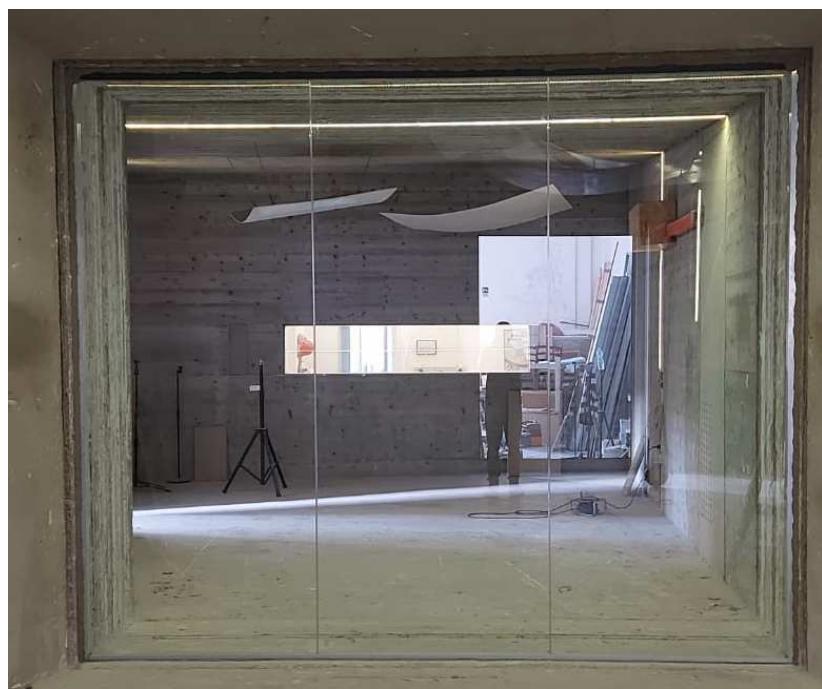


Figure 2 - View side Receiving room

The specimen is mounted inside the test opening according to the indications provided by the UNI EN ISO 10140-1 standard.

The test has been made as soon as the sample installation was completed.

## Standards references

|                         |  |
|-------------------------|--|
| UNI EN ISO 10140-1:2021 | <i>Acoustics - Laboratory measurement of sound insulation of building elements Application rules for specific products</i>                             |
| UNI EN ISO 10140-2:2021 | <i>Acoustics - Laboratory measurement of sound insulation of building elements - Part 2: Measurement of airborne sound insulation.</i>                 |
| UNI EN ISO 10140-4:2021 | <i>Acoustics - Laboratory measurement of sound insulation of building elements Measurement procedures and requirements</i>                             |
| UNI EN ISO 10140-5:2021 | <i>Acoustics - Laboratory measurement of sound insulation of building elements Measurement - Part 5 Requirements for test facilities and equipment</i> |
| UNI EN ISO 717-1:2021   | <i>Acoustics – Acoustic insulation verification in buildings and in building elements Part 1: Airborne sound insulation.</i>                           |

## Test environment description

The test environment structure is made of reinforced concrete, wholly insulated from the laboratory through anti-vibration supports. In particular, this environment consists of a source room and a receiving room, both characterized by an irregularly-shaped volume, free of any parallel partition. The rooms are separated by a 100 cm thick test frame.

The dimensional data and Environmental data during the testare:

|                                  | Source room          | Receiving room       |
|----------------------------------|----------------------|----------------------|
| Average dimensions (L x W x H)   | 700 X 500 X 330 cm   | 770 X 560 X 370 cm   |
| Volume                           | 125.7 m <sup>3</sup> | 162.4 m <sup>3</sup> |
| Average temperature              | 22.0 ± 0.2 °C        | 22.0 ± 0.2 °C        |
| Average relative humidity        | 60.5 ± 0.9 %         | 61.4 ± 0.9 %         |
| Atmospheric pressure             | 102.1 kPa ± 1kPa     |                      |
| Separation Surface               |                      | 10.73 m <sup>2</sup> |
| Area S. of the free test opening |                      | 10.73 m <sup>2</sup> |

## Test equipment and instruments

| Instrument                       | Model                          | Serial number              |
|----------------------------------|--------------------------------|----------------------------|
| Sound Level Meter                | BRUEL & KJAER 2250             | 3011945                    |
| Microphone                       | GRAS 146AE                     | 357199                     |
| Calibrator                       | Brue&Kjaer 4231                | 2583667                    |
| Omnidirectional source           | LOOK LINE S 103                | AM14117                    |
| Temperature and humidity sensor  | DeltaOHM HD35AP.E + HD35ED1NTV | 17008603+16037651+16037652 |
| Tape                             | Stanley 33 - 442               | 13/946                     |
| Microclimate with pressure gauge | DeltaOHM HD35EDL14bNTV.E       | 20014238                   |

## Measurement method

The airborne sound insulation test between two rooms is based on the difference between the average sound pressure level in the source room ( $L_1$ ) and the one detected in the receiving room ( $L_2$ ). The acoustic source (which produces pink noise) has been operated within the source room in 3 different positions.

The microphone is located in 5 different positions, both in the source room and in the receiving room. A measurement for each source-microphone combination has been performed, for a total of 15 measurements in the source room and 15 in the receiving room. The integration time, for each measure, has been at least 15 s.

Having detected the average level of sound pressure in the receiving environment, the source is switched off, in order to allow the background noise level measurement,  $L_b$ . The spectrum corrections,  $L_2$ , which need to be calculated for each spectrum frequency component, are equal to:

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

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

The reverberation time calculation, T allows to determinate the sound reduction index, R.

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

where:

S: is the free test area opening in which the test element is installed, expressed in m<sup>2</sup>;

A: equivalent sound absorption area in the receiving room, calculated by the Sabine equation:

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

where V is the volume of the receiving environment, in m<sup>3</sup>.

The experimental curve has been evaluated and compared with the reference one, which is provided within the standard UNI EN ISO 717-1. Then, the curves comparison method is applied, up to the point where the sum of the unfavorable differences between relative curves values is on the reference curve less than or equal to 32 dB. The value corresponding to the 500 Hz frequency has subsequently been evaluated: this value is the index of evaluation of the sound reduction index  $R_w$ .

The spectrum adaptation terms are also calculated. The resulting spectrum adaptation term is an integer by definition and shall be identified in accordance with the spectrum used, as follows: C when calculated with A-weighted pink noise and Ctr when calculated with A-weighted urban traffic noise.

These values, "C" and "Ctr" are to be added to the  $R_w$  index.

## Measured values

| f [Hz]    | L <sub>1</sub> [dB] | L <sub>2</sub> [dB]  | L <sub>b</sub> [dB] | T [s]              | R [dB]                |
|-----------|---------------------|----------------------|---------------------|--------------------|-----------------------|
| Frequency | Source room level   | Receiving room level | Background noise    | Reverberation time | Sound reduction index |
| 50        | 73,2                | 54,4                 | 30,4                | 6,07               | 22,8                  |
| 63        | 84,3                | 74,8                 | 27,9                | 5,55               | 13,1                  |
| 80        | 82,8                | 63,6                 | 16,8                | 2,73               | 19,7                  |
| 100       | 85,3                | 61,3                 | 13,6                | 3,02               | 25,0                  |
| 125       | 89,1                | 67,1                 | 13,1                | 2,91               | 22,8                  |
| 160       | 90,7                | 65,2                 | 13,3                | 2,86               | 26,3                  |
| 200       | 90,2                | 63,1                 | 10,8                | 2,75               | 27,6                  |
| 250       | 91,2                | 62,5                 | 9,3                 | 2,74               | 29,2                  |
| 315       | 91,8                | 61,6                 | 9,6                 | 2,61               | 30,5                  |
| 400       | 92,8                | 61,0                 | 12,1                | 2,39               | 31,8                  |
| 500       | 93,0                | 60,4                 | 15,2                | 2,55               | 32,8                  |
| 630       | 93,2                | 58,2                 | 15,9                | 2,45               | 35,0                  |
| 800       | 92,9                | 56,8                 | 12,5                | 2,60               | 36,4                  |
| 1000      | 91,9                | 54,9                 | 9,2                 | 2,36               | 36,8                  |
| 1250      | 91,6                | 53,5                 | 7,1                 | 2,28               | 37,9                  |
| 1600      | 91,4                | 52,7                 | 6,3                 | 2,32               | 38,5                  |
| 2000      | 92,6                | 55,2                 | 6,1                 | 2,09               | 36,8                  |
| 2500      | 93,5                | 55,3                 | 5,8                 | 1,96               | 37,3                  |
| 3150      | 90,8                | 47,9                 | 6,5                 | 1,79               | 41,5                  |
| 4000      | 91,7                | 44,0                 | 7,5                 | 1,60               | 45,9                  |
| 5000      | 89,8                | 38,5                 | 8,5                 | 1,46               | 49,1                  |

*Sound reduction index. R. according to UNI EN ISO 10140-2*

Sample description:

SLIM Wall – Single Glass

Area S. of the test opening:

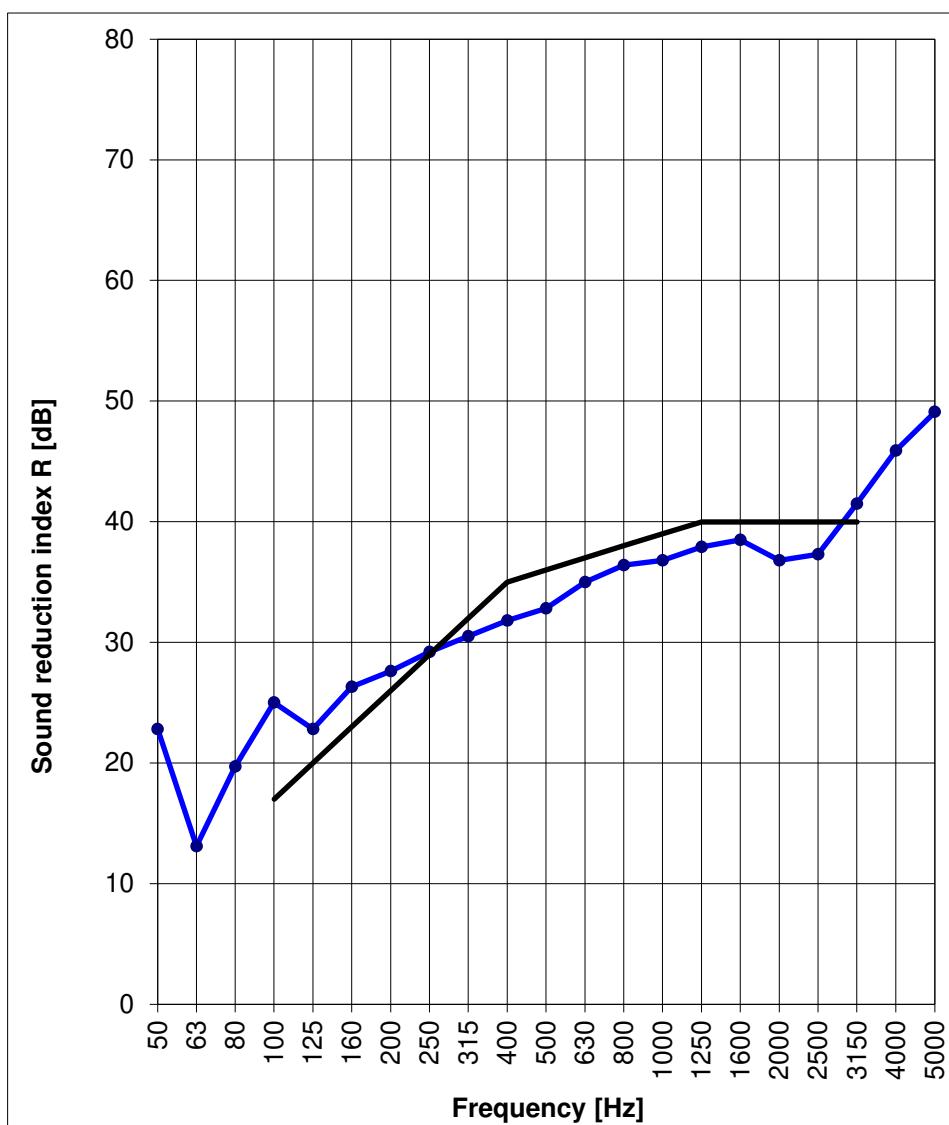
10.73 m<sup>2</sup>

Rooms volume:

Emitting 125.7 m<sup>3</sup>

Receiving 162.4 m<sup>3</sup>

| f    | R    |
|------|------|
| [Hz] | [dB] |
| 50   | 22,8 |
| 63   | 13,1 |
| 80   | 19,7 |
| 100  | 25,0 |
| 125  | 22,8 |
| 160  | 26,3 |
| 200  | 27,6 |
| 250  | 29,2 |
| 315  | 30,5 |
| 400  | 31,8 |
| 500  | 32,8 |
| 630  | 35,0 |
| 800  | 36,4 |
| 1000 | 36,8 |
| 1250 | 37,9 |
| 1600 | 38,5 |
| 2000 | 36,8 |
| 2500 | 37,3 |
| 3150 | 41,5 |
| 4000 | 45,9 |
| 5000 | 49,1 |



Evaluation of conformity according to UNI EN ISO 717-1

Rw (C;Ctr) = 36 ( 0 ; -3) dB      C<sub>50-3150</sub> = -1 dB;      C<sub>50-5000</sub> = 0 dB;      C<sub>100-5000</sub> = 0 dB

Evaluation based on laboratory measurement results by means of a technical method.

C<sub>tr.50-3150</sub> = -5 dB;      C<sub>tr.50-5000</sub> = -5 dB;      C<sub>tr.100-5000</sub> = -3 dB

Evaluation of sound reduction index. elaborated by steps of 0.1 dB: 36,8 dB

Laboratory Manager Ing. Antonio Scofano

END OF TEST REPORT