



ARISTOTLE UNIVERSITY OF THESSALONIKI

## TEST REPORT

Measurement of Sound Absorption Coefficient measured according  
with EN ISO 354:1993 in a Reverberation room.

TEST REPORT NUMBER

**ABS.02.2024**

DATE

**05.04.2024**

LABORATORY OF ARCHITECTURAL TECHNOLOGY

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DEPARTMENT OF ARCHITECTURAL DESIGN & ARCHITECTURAL TECHNOLOGY / SCHOOL OF ARCHITECTURE / FACULTY OF TECHNOLOGY

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## 1. GENERAL CONDITIONS

The test result reflects exclusively on the properties of the specific test specimen which was provided by the Client to the Laboratory facility on his own responsibility. The tests have taken place under laboratory conditions,

The Laboratory maintains the right to use the test results in scientific publications, scientific papers, research reports, and any other kind of studies of purely research or scientific nature, without revealing the name of the Client or the type of the product.

The Laboratory does not have Accreditation for the Measurement of the Sound Absorption Coefficient.

## 2. PROCEDURES

### 2.1 Applied Standards

EN ISO 354 1993, Acoustics – Measurement of sound absorption in a reverberation room

EN ISO 11654:1997, Acoustics — Sound absorbers for use in buildings — Rating of sound absorption

### 2.2 Test Procedure

The test environment consists of a parallelepiped shaped reverberation room with a rectangular base and the following size specifications.

- Plan dimensions 7,76 x 6,91 m
- Height 4,01 m
- Volume 215 m3

The test involves measuring reverberation times of the empty room T<sub>1</sub> and reverberation room containing the test specimen T<sub>2</sub> in order to determine said specimen's sound absorption coefficient  $\alpha_s$ . The reverberation time T corresponds to the time taken in seconds for the sound pressure level to decay 60dB after the noise source has stopped.

Throughout the test, the specimen was laid on the floor of the reverberation room. It was also ensured that the sides of the specimen were not parallel to the walls of the reverberation room and were situated at a distance of not less than 1m from said walls and every microphone position.

Measurements were taken in 1/3 octave bands within the range 100Hz to 5000Hz, as requested by the EN ISO 354 : 1993 standard.

The sound absorption coefficient  $\alpha_s$  was calculated using the following formulas

$$\alpha_s = \frac{A}{S}$$

$$A = A_2 - A_1 = 55,3 \cdot \frac{V}{c} \cdot \left( \frac{1}{T_2} - \frac{1}{T_1} \right)$$

$$c = 331 + 0,6 \cdot t$$

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| Fq (Hz) | T1    | T2    | Room<br>V in m <sup>3</sup> | test<br>specimen<br>S in m <sup>2</sup> | Room<br>Temperature<br>in °C | Speed<br>of<br>Sound<br>in m/sec | A1    | A2    | A     | as 1/3 Octave | a% 1/3 Octave |
|---------|-------|-------|-----------------------------|-----------------------------------------|------------------------------|----------------------------------|-------|-------|-------|---------------|---------------|
| 100     | 1,59  | 1,19  | 215                         | 12                                      | 22                           | 344,2                            | 21,72 | 29,03 | 7,30  | 0,61          | 60,85         |
| 125     | 1,445 | 1,235 | 215                         | 12                                      | 22                           | 344,2                            | 23,90 | 27,97 | 4,06  | 0,34          | 33,87         |
| 160     | 1,41  | 1,12  | 215                         | 12                                      | 22                           | 344,2                            | 24,50 | 30,84 | 6,34  | 0,53          | 52,86         |
| 200     | 1,375 | 1,03  | 215                         | 12                                      | 22                           | 344,2                            | 25,12 | 33,54 | 8,41  | 0,70          | 70,12         |
| 250     | 1,225 | 0,89  | 215                         | 12                                      | 22                           | 344,2                            | 28,20 | 38,81 | 10,61 | 0,88          | 88,45         |
| 315     | 1,19  | 0,83  | 215                         | 12                                      | 22                           | 344,2                            | 29,03 | 41,62 | 12,59 | 1,05          | 104,92        |
| 400     | 1,16  | 0,82  | 215                         | 12                                      | 22                           | 344,2                            | 29,78 | 42,12 | 12,35 | 1,03          | 102,89        |
| 500     | 1,1   | 0,755 | 215                         | 12                                      | 22                           | 344,2                            | 31,40 | 45,75 | 14,35 | 1,20          | 119,58        |
| 630     | 1,115 | 0,785 | 215                         | 12                                      | 22                           | 344,2                            | 30,98 | 44,00 | 13,02 | 1,09          | 108,53        |
| 800     | 1,26  | 0,855 | 215                         | 12                                      | 22                           | 344,2                            | 27,41 | 40,40 | 12,99 | 1,08          | 108,22        |
| 1000    | 1,385 | 0,93  | 215                         | 12                                      | 22                           | 344,2                            | 24,94 | 37,14 | 12,20 | 1,02          | 101,68        |
| 1250    | 1,57  | 1,01  | 215                         | 12                                      | 22                           | 344,2                            | 22,00 | 34,20 | 12,20 | 1,02          | 101,66        |
| 1600    | 1,71  | 1,085 | 215                         | 12                                      | 22                           | 344,2                            | 20,20 | 31,84 | 11,64 | 0,97          | 96,97         |
| 2000    | 1,655 | 1,055 | 215                         | 12                                      | 22                           | 344,2                            | 20,87 | 32,74 | 11,87 | 0,99          | 98,92         |
| 2500    | 1,62  | 1,055 | 215                         | 12                                      | 22                           | 344,2                            | 21,32 | 32,74 | 11,42 | 0,95          | 95,16         |
| 3150    | 1,53  | 1,04  | 215                         | 12                                      | 22                           | 344,2                            | 22,58 | 33,21 | 10,64 | 0,89          | 88,64         |
| 4000    | 1,4   | 0,98  | 215                         | 12                                      | 22                           | 344,2                            | 24,67 | 35,25 | 10,57 | 0,88          | 88,12         |
| 5000    | 1,255 | 0,92  | 215                         | 12                                      | 22                           | 344,2                            | 27,52 | 37,55 | 10,02 | 0,84          | 83,52         |

where as = sound absorption coefficient

A = equivalent acoustic absorption area of test specimen

S = surface area of test specimen

A2 = equivalent sound absorption area of reverberation room containing test specimen

A1 = equivalent sound absorption area of empty reverberation room

V = effective volume of empty reverberation room

c = propagation speed of airborne sound

T2 = reverberation time of reverberation room containing test specimen

T1 = reverberation time of empty reverberation room

t = temperature of air in reverberation room

The equivalent absorptive surface of the empty space is larger than the one specified in the relevant ISO standards. However, this does not have a significant, measurable effect in the final results

## 2.3 Equipment used

| Apparatus                         | Type                                                                           | Manufacturer       | Serial Number |
|-----------------------------------|--------------------------------------------------------------------------------|--------------------|---------------|
| Handheld Real time sound analyzer | XL2 Type Approval Class1 (with room acoustics and sound insulation extensions) | NTI Acoustics      | A2A-11069-E0  |
| Microphone Pre-Amp                | MA 220                                                                         | NTI Acoustics      | 005933        |
| Microphone                        | MC230a                                                                         | NTI Acoustics      | A18779        |
| Sound Calibrator                  | Type 105                                                                       | Pulsar Instruments | 98287         |
| Sound Calibrator pinstipphone     | Type 4220                                                                      | Bruel & Kjaer      | 894012        |
| Sound Source                      | Type 4224                                                                      | Bruel & Kjaer      | 1126056       |

All the Equipment used, during measurements, have, valid certifications



### 3. TEST SPECIMEN

#### 3.1 Description

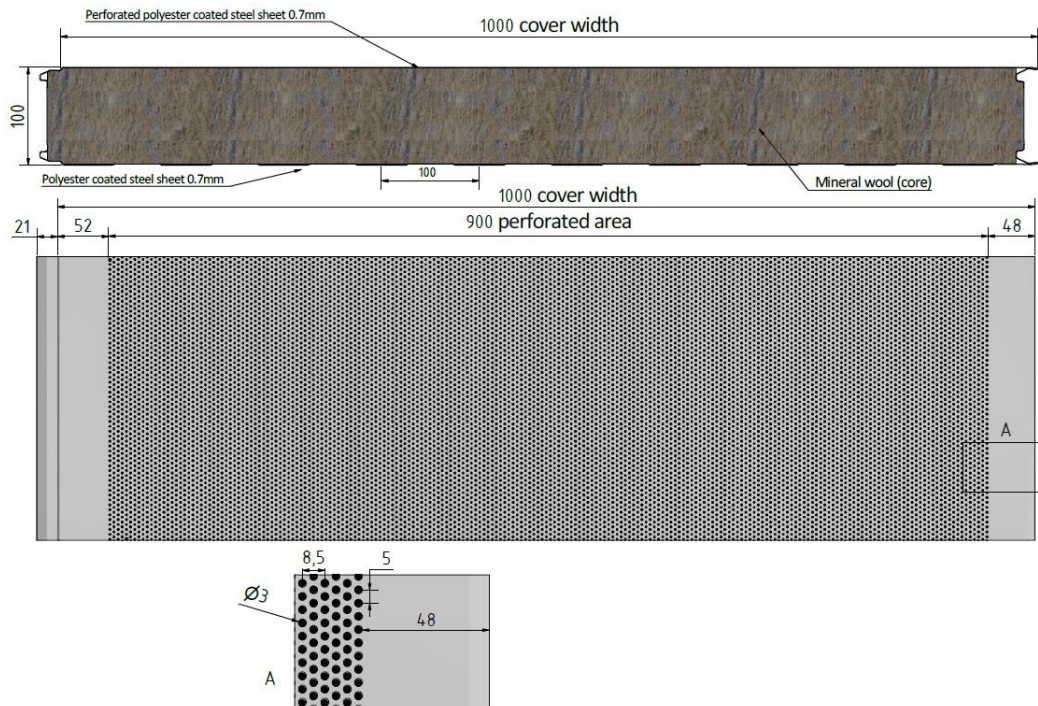
|                    |                                                                                           |
|--------------------|-------------------------------------------------------------------------------------------|
| Product:           | Mineral wool wall covering panel                                                          |
| Manufacturer:      | Metallemporiki Th. Makris S.A.                                                            |
| Client:            | Metallemporiki Th. Makris S.A.                                                            |
| Address:           | 6th km Larissa-Sikurio, 41500, Larissa, tel 2410 575207, e-mail: makris@metallemporiki.gr |
| Installation:      | Metallemporiki Th. Makris S.A.                                                            |
| Product name:      | Mineral wool wall covering panel 100mm                                                    |
| Production date:   | 05/01/2024                                                                                |
| Sample dimensions: | 6 panels of 1000x2000 mm                                                                  |

#### 3.2 Construction

The test specimen comprises an assembly of 6 Mineral wool wall covering panels fitted to the floor of the reverberation room. The size specifications of the specimen are as follows.

- Length of modular panel = 2000mm
- Width of modular panel = 1000mm
- Thickness of modular panel = 100mm
- Overall length of specimen = 4000mm
- Overall width of specimen = 3000mm
- Thickness of specimen = 100mm

#### 3.3 Drawing



\* The drawings have been prepared by the Client.

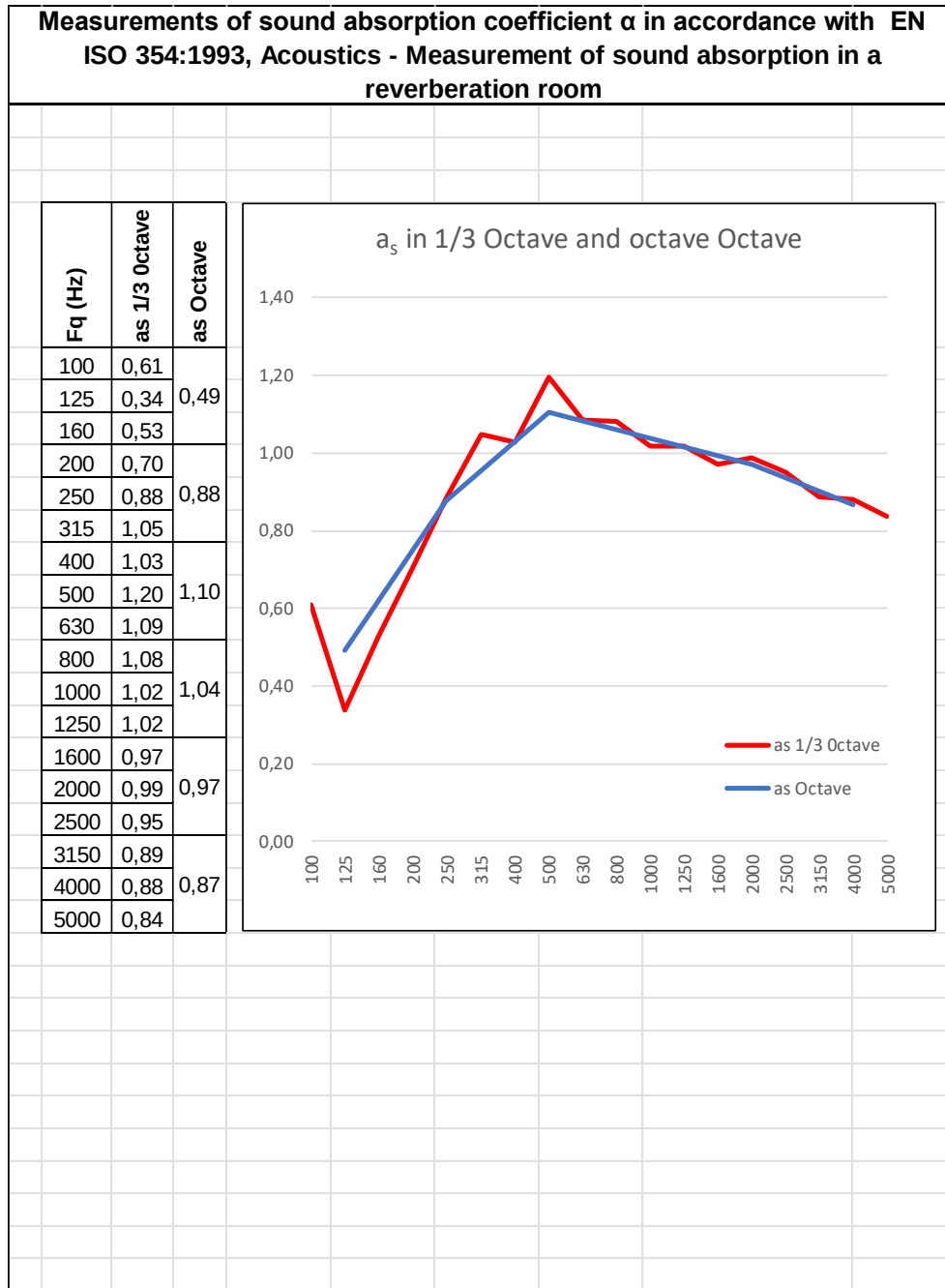
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## 4. TEST RESULTS



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| $a_s$ Octave | $a_p$ per Octave<br>(Rounded (EN<br>ISO 11654:97,<br>par: 4.1 | Final mean<br>value |
|--------------|---------------------------------------------------------------|---------------------|
|              |                                                               |                     |
| 0,49         | 0,50                                                          | 0,50                |
| 0,88         | 0,90                                                          | 0,90                |
| 1,10         | 1,10                                                          | 1,00                |
| 1,04         | 1,05                                                          | 1,00                |
| 0,97         | 1,00                                                          | 1,00                |
| 0,87         | 0,90                                                          | 0,90                |

|                                             |      |
|---------------------------------------------|------|
| Weighted sound absorption coefficient $a_w$ | 1,00 |
| Sound absorption class                      | A    |

Θεσσαλονίκη/Thessaloniki, 05.04.2024

Vasileios Vasileiadis

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05.04.2024 09:54

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PANAGIOTIS KARAMPATZAKIS  
Father's name: ΣΤΑΥΡΟΣ / STAVROS  
TIN: 073567906  
Date of signature: 06/04/2024 13:35:00