



Report No. L/3504/A

for  
Buzzispace  
Groeningenlei 141  
2550 Kontich  
BELGIUM

Dated: 27 August 2020

**LABORATORY MEASUREMENTS  
OF THE  
SPEECH LEVEL REDUCTION  
OF  
BUZZINEST POD**

Report Author: M Sawyer MIOA

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**LABORATORY MEASUREMENTS  
OF THE  
SPEECH LEVEL REDUCTION  
OF  
BUZZINEST POD**

**1. INTRODUCTION**

This report presents the results of measurements made in the AIRO Acoustics Laboratory of the Speech Level Reduction of BuzziNest Pod.

The measurements were made on 29 July 2020 for Buzzispace.

Measurements to determine the Level Reduction ( $D$ ) of a booth were conducted in accordance with International Standard ISO 23351-1:2020 (ref 1). Single figure ratings of sound insulation performance, known as the Speech Level Reduction ( $D_{S,A}$ ) and Class, are derived from these measurements in accordance with Reference 1.

**2. SUMMARY OF RESULTS**

The results of the measurements presented in this report are summarised in the following table:

AIRO Test No.	Test Specimen	$D_{S,A}$ (dB)	Class
L/3504/A/1	BuzziNest Pod – left seat	27.8	B
L/3504/A/2	BuzziNest Pod – right seat	28.4	B

Approved by:

Report Author:

*D L Watts*

*M Sawyer*

Eur Ing D L Watts BEng CEng FIOA  
Principal Consultant

M Sawyer MIOA  
Laboratory Manager

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### 3. TEST SPECIMEN DETAILS AND CONDITIONS

It shall be noted that the results in this report relate only to the specimen as received for test.

The specimen was delivered and installed for test by Screen Solutions Ltd on 29 July 2020 with the selection of the components for test made by Screen Solutions Ltd.

Screen Solutions Ltd has supplied drawings of the test specimen which AIRO considers to be accurate. The following description has been produced by AIRO from its observations.

#### 3.1 BuzziNest Pod

AIRO Test No. L/3504/A/1 and 2

The test specimen comprised a BuzziNest Pod 2-person privacy pod. The fabric covered BuzziNest Pod, with external dimensions of 2405 mm wide x 1222 mm deep x 2191 mm high, and a footprint of 2210 mm wide x 1222 mm deep, comprised a timber famed construction with internal and external sound absorbent panels. The front wall comprised 8.8 mm acoustic laminate glass panels each side of an 8.8 mm acoustic laminate glass door with a magnetic latch which closed onto a soft seal. The rear wall of the Pod also comprised 8.8 mm acoustic laminate glass. The Pod included 2 bench seats, a central table and a carpet. The Pod also included a ceiling mounted lighting and ventilation unit with the fan not powered during the measurements. The Pod was installed for test at two locations within the reverberation chamber over fifteen 500 x 500 mm carpet tiles arranged in a 3 x 5 array. The two locations were at least 1.7 m apart as required by ISO 23351-1.

Measurements of the Pod were made for both the left and right seats, when viewed from the front, as required by ISO 23351-1.

Drawing No. 016 HAW 600 issue 02 (2 pages) on the following pages shows further details, with the following photograph showing BuzziNest Pod installed for test.



**Speech Level Reduction according to ISO 23351-1:2020**

Test No. L/3504/A/1

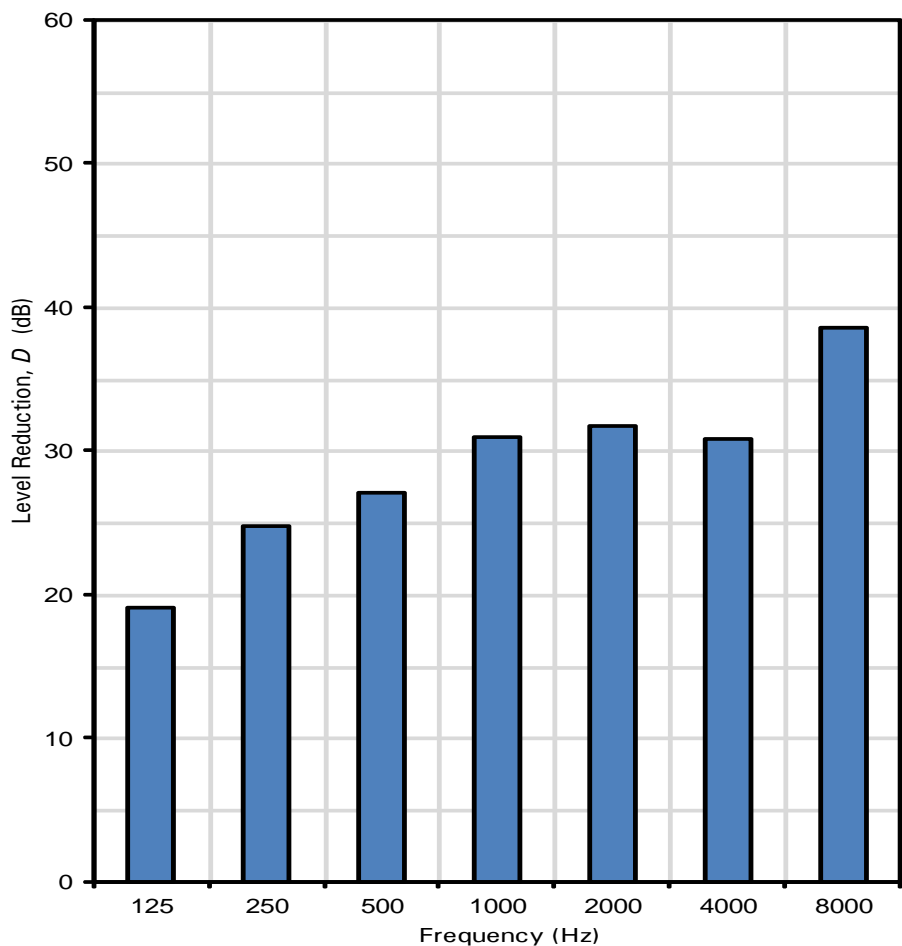
Date of Test: 29 August 2020

Client: Buzzispace

Specimen: BuzziNest Pod – left seat

Chamber Conditions	Volume	Air Temperature	Relative Humidity	Air Pressure
Reverberant Chamber	212 m <sup>3</sup>	19°C	65%	1005 hPa

Frequency (Hz)	<i>D</i> (dB)
125	19.1
250	24.8
500	27.1
1000	31.0
2000	31.7
4000	30.8
8000	38.5



Rating according to ISO 23351-1:2020

**Speech Level Reduction,  $D_{S,A}$  = 27.8 dB**

**Class : B**

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Laboratory Manager

**Speech Level Reduction according to ISO 23351-1:2020**

Test No. L/3504/A/2

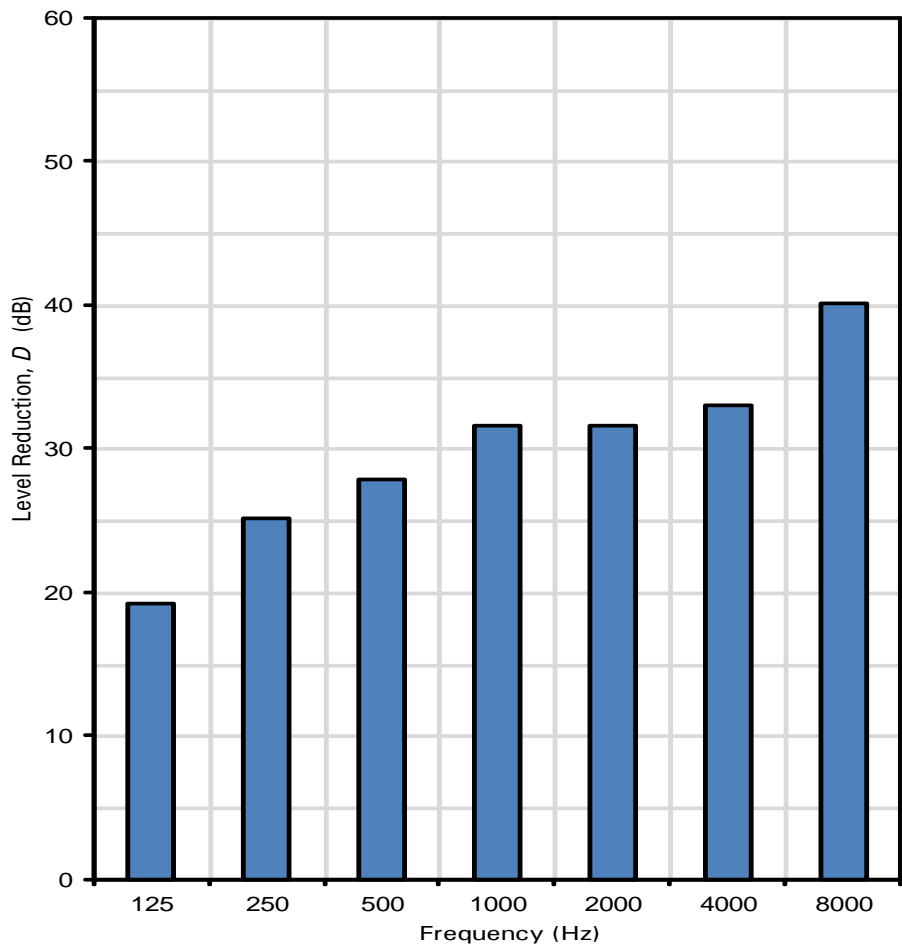
Date of Test: 29 August 2020

Client: Buzzispace

Specimen: BuzziNest Pod – right seat

Chamber Conditions	Volume	Air Temperature	Relative Humidity	Air Pressure
Reverberant Chamber	212 m <sup>3</sup>	19°C	65%	1005 hPa

Frequency (Hz)	<i>D</i> (dB)
125	19.2
250	25.1
500	27.8
1000	31.6
2000	31.6
4000	33.0
8000	40.1



Rating according to ISO 23351-1:2020

**Speech Level Reduction,  $D_{S,A}$  = 28.4 dB**                      **Class : B**

Approved by:

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Principal Consultant

Report Author:

*M Sawyer*  
 M Sawyer MIOA  
Laboratory Manager

**APPENDIX A1 - METHOD OF MEASUREMENT OF SPEECH LEVEL REDUCTION**

A steady sound source with a continuous spectrum in the frequency bands of interest is used to drive an omnidirectional loudspeaker at a height of 1.2 metres inside the booth, which is equivalent to the head height of a seated person.

The Sound Power Levels emitted from the booth are determined according to the method described in Appendix A2.

The measurement process is then repeated with the booth removed but all other conditions equivalent.

The insulation of the booth against airborne sound (Level Reduction) in each octave band is calculated from the following equation:

$$D = L_{W,P,1} - L_{W,P,2} \quad \text{dB}$$

- where  $D$  is the Level Reduction
- $L_{W,P,1}$  is the Sound Power Level radiated from the sound source in the absence of the booth (dB re 1pW)
- $L_{W,P,2}$  is the Sound Power Level radiated from the sound source when located inside the booth (dB re 1pW)

The measurements are made for each of 2 booth positions at least 1.7 m apart, with the arithmetic average of the 2 sets of data determined.

The sound power level radiated from the booth in each octave band assuming a standardized sound power level of genderless speech ( $L_{W,S,2}$ ) is determined from:

$$L_{W,S,2} = L_{W,S,1} - D \quad \text{dB re 1pW}$$

- where  $L_{W,S,2}$  is the sound power level of speech radiated from the booth (dB re 1pW)
- $L_{W,S,1}$  is the known standardized sound power level of genderless speech (dB re 1pW)
- $D$  is the measured Level Reduction

The single figure Speech Level Reduction ( $D_{S,A}$ ) is determined from :

$$D_{S,A} = L_{W,S,A,1} - L_{W,S,A,2} \quad \text{dB}$$

where	$D_{S,A}$	is the Speech Level Reduction (dB)
	$L_{W,S,A,1}$	is the A-weighted sound power level of standardized genderless speech (68.4 dB re 1pW)
	$L_{W,S,A,2}$	is the A-weighted sound power level of standardized genderless speech radiated from the booth (dB re 1pW)

The Class rating is determined by comparison of the  $D_{S,A}$  with the look-up table in Annex D of ISO 23351-1.

**APPENDIX A2 – METHOD OF MEASUREMENT OF SOUND POWER LEVEL**

The Sound Power Levels emitted by a specimen are measured under reverberant sound conditions by the direct method and in accordance with the requirements of BS EN ISO 3741:2010 (ref 2).

The specimen is installed for test over the floor of a purpose built reverberation chamber. The chamber is constructed of 215 mm brick with a 250 mm thick reinforced concrete floor and ceiling, and has a volume of 212 cubic metres and surface area of 228 square metres. The chamber rests on resilient mountings to give it good acoustical isolation from the building exterior. In order to give a good diffusion of the sound field within the chamber, the walls are non-parallel and eight randomly suspended diffuser panels are included with a surface area of 14.1 square metres.

Whilst the test specimen is operating sound pressure level measurements are made within the chamber in the octave bands with centre frequencies from 125 Hz to 8000 Hz. The measurements are made using a microphone connected to a rotating boom located in two positions within the chamber for each booth/sound source location in order to obtain a good average of the sound pressure level in the chamber may be obtained. Measurements are also made when the sound source is not operating in order to determine the noise floor of the test chamber and measuring system in order that corrections may be made for their influence if applicable.

The Sound Power Level ( $L_W$ ) of the noise source under test in each octave band is calculated from the following:

$$L_W = L_{p(ST)} + \left\{ 10 \lg \frac{A}{A_0} + 4.34 \frac{A}{S} + 10 \lg \left[ 1 + \frac{S_c}{8Vf} \right] + C_1 + C_2 - 6 \right\} \quad \text{dB re 1pW}$$

where	$L_{p(ST)}$	is the mean octave band time-averaged sound pressure level in the reverberation chamber of the specimen under test, corrected for the influence of background noise if appropriate (dB re 20 $\mu$ Pa)
	A	is the equivalent absorption area ( $m^2$ ) of the reverberation chamber
	$A_0$	is the reference absorption area = 1 $m^2$
	S	is the surface area ( $m^2$ ) of the reverberation chamber

- c is the speed of sound (m/s)
- V is the volume (m<sup>3</sup>) of the reverberation chamber
- f is the mid-band frequency (Hz) in the appropriate frequency band
- C<sub>1</sub> is the reference quantity correction (dB)
- C<sub>2</sub> is the radiation impedance correction (dB)

The value of 'A' is determined from:

$$A = \frac{55.26}{c} \left( \frac{V}{T_{60}} \right) \quad \text{m}^2$$

where T<sub>60</sub> is the reverberation time (seconds) of the reverberation chamber which is determined from the arithmetic average of twelve measurements.

**A3 - REFERENCES**

1. International Standard ISO 23351  
Acoustics – Measurement of speech level reduction of furniture ensembles and enclosures  
  
ISO 23351:1-2020  
Laboratory method
  
2. International Standard ISO 3741  
Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Precision methods for reverberation test rooms



**APPENDIX A4 - SCHEDULE OF EQUIPMENT**

Use	Type	Serial No.
Measuring System	Nor850 Multi Channel Analyser	8501193
	B&K 4165 Condenser Microphone	1042002
	B&K 2669 Microphone Pre-Amplifier	2221217
	NEAS 265 Rotating Microphone Boom	29465
Calibration	B&K 4228 Pistonphone	1756569
Noise Source	NEAS 223 Dodecahedron Loudspeaker	16251
	HH V-150L Power Amplifier	40545
	MXR 172 Graphic Equaliser	n/a

End of AIRO Report No. L/3504/A dated 27 August 2020

# AIRO

Report No. L/3513

for  
Buzzispace  
Groeningenlei 141  
2550 Kontich  
BELGIUM



0483

Dated: 21 December 2020

**LABORATORY MEASUREMENTS  
OF THE  
EQUIVALENT SOUND ABSORPTION AREA  
AND  
OBJECT SOUND ABSORPTION COEFFICIENT  
OF  
BUZZINEST POD**

Report Author: M Sawyer MIOA

Page 1 of 9

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**LABORATORY MEASUREMENTS  
OF THE  
EQUIVALENT SOUND ABSORPTION AREA  
AND  
OBJECT SOUND ABSORPTION COEFFICIENT  
OF  
BUZZINEST POD**

**1. INTRODUCTION**

This report presents the results of measurements made in the AIRO Acoustics Laboratory of the sound absorption of the external surfaces of BuzziNest Pod.

The measurements were made on 10 December 2020 for Buzzispace.

Measurements of sound absorption, Equivalent Sound Absorption Area ( $A_{obj}$ ), were conducted in accordance with International Standard ISO 354 (ref 1). Octave band values of Object Sound Absorption Coefficient ( $\alpha_{obj}$ ) are derived from these measurements in accordance with International Standard ISO 20189 (ref 2).

AIRO is a UKAS accredited testing laboratory No. 0483 with measurements to International Standard ISO 354 included on our schedule of accreditation. International Standard ISO 20189 is not however included on our UKAS schedule of accreditation. UKAS is the United Kingdom Accreditation Service.

**2. SUMMARY OF RESULTS**

The following table presents a summary of the measurements included in this report.

AIRO Test No.	Test Specimen
L/3513	BuzziNest Pod

Approved by:

Report Author:

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Principal Consultant

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Laboratory Manager

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### 3. TEST SPECIMEN DETAILS AND CONDITIONS

It shall be noted that the results in this report relate only to the specimen as received for test.

The specimen was delivered and installed for test by Screen Solutions Ltd on 10 December 2020. AIRO has had no involvement in the selection of the specimen or the components which make-up the specimen.

Screen Solutions Ltd has supplied drawings of the test specimen which AIRO considers to be accurate. The following description has been produced by AIRO from its observations.

#### 3.1 BuzziNest Pod

AIRO Test No. L/3513

The test specimen comprised a BuzziNest Pod 2-person privacy pod. The fabric covered BuzziNest Pod, with external dimensions of 2405 mm wide x 1222 mm deep x 2191 mm high, and a footprint of 2210 mm wide x 1222 mm deep, comprised a timber famed construction with internal and external sound absorbent panels. The front wall comprised 8.8 mm acoustic laminate glass panels each side of an 8.8 mm acoustic laminate glass door with a magnetic latch which closed onto a soft seal. The rear wall of the Pod also comprised 8.8 mm acoustic laminate glass. The Pod was fully fitted-out except for the central table and internal door frame trims. The Pod also included a ceiling mounted lighting and ventilation unit with fan which was not powered during the measurements. As required by ISO 20189 the Pod was tested at three locations within the reverberation chamber which were at least 2 m apart.

The calculated surface area of the smallest cuboid (excluding the base) of the specimen is 18.83 m<sup>2</sup>.

Drawing No. 016 HAW 600 issue 02 (2 pages) on the following pages shows further details of the test specimen, with the following photograph showing BuzziNest Pod installed for test.



**Equivalent Sound Absorption Area according to ISO 354:2003**

Test No. L/3513

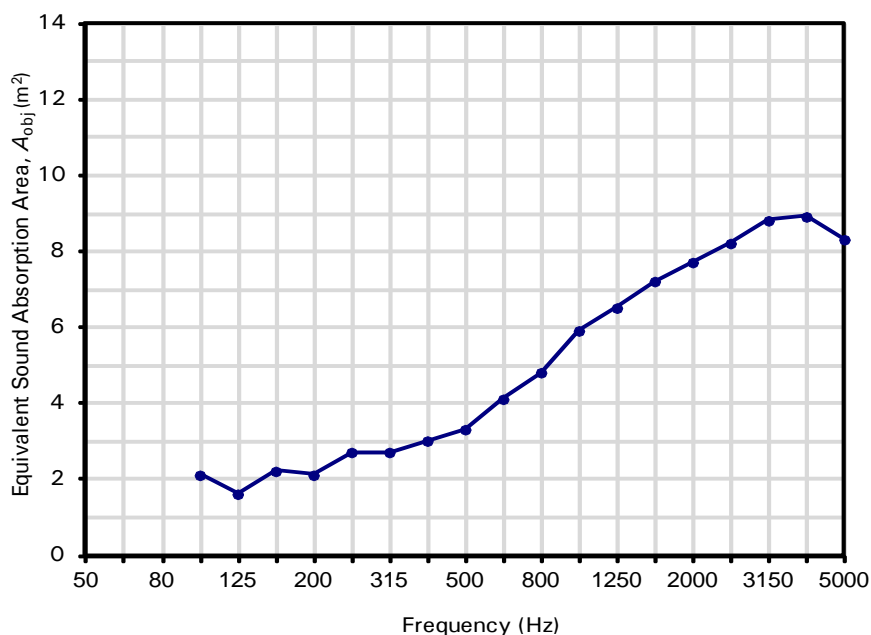
Date of Test: 10 December 2020

Client: Buzzispace

Specimen: BuzziNest Pod

Chamber Conditions	Volume	Air Temperature	Relative Humidity	Air Pressure
Empty Chamber	221 m <sup>3</sup>	8 °C	75%	985 hPa
Chamber with Specimen	221 m <sup>3</sup>	8 °C	75%	985 hPa

Frequency (Hz)	$A_{obj}$ One-third Octave (m <sup>2</sup> )	$\alpha_{obj}$ Octave *
50		
<b>63</b>		
80		
100	2.1	
<b>125</b>	1.6	0.10
160	2.2	
200	2.1	
<b>250</b>	2.7	0.15
315	2.7	
400	3.0	
<b>500</b>	3.3	0.20
630	4.1	
800	4.8	
<b>1000</b>	5.9	0.30
1250	6.5	
1600	7.2	
<b>2000</b>	7.7	0.40
2500	8.2	
3150	8.8	
<b>4000</b>	8.9	0.45
5000	8.3	
6300		
<b>8000</b>		
10000		



See Appendix A5 for Reverberation Times of Empty Chamber and Chamber with Specimen

\* ISO 20189:2018 and  $\alpha_{obj}$  are not included on our UKAS schedule of accreditation.

Approved by:

Report Author:

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Laboratory Manager

**APPENDIX A1 - METHOD OF MEASUREMENT TO ISO 354:2003**

The sound absorption of a specimen is measured under diffuse field conditions where sound is incident upon the specimen from all directions.

The specimen is installed directly over the floor of a purpose built reverberation chamber. The chamber is constructed of 215 mm brick with a 250 mm thick reinforced concrete floor and ceiling and has a volume of 221 cubic metres and surface area of 225 square metres. The chamber rests on resilient mountings to give it good acoustical isolation from the building exterior. In order to give a good diffusion of the sound field, the walls are non-parallel, the ceiling pitched and twenty randomly suspended diffuser panels are included with a surface area of 37.2 square metres.

A steady sound source with a continuous spectrum in the frequency bands of interest is used to drive an omnidirectional loudspeaker which is located in the chamber. The reverberation times of the chamber are determined using the interrupted noise method with three decay measurements made at each of four microphone positions for each of three loudspeaker positions to obtain a good average at each of the one-third octave intervals from 100 Hz to 5000 Hz as prescribed in the Standard (ref 1). The test is conducted with the specimen installed within the chamber, and also in the absence of the specimen and any associated framework. Where only one example of the specimen is available then the measurements are made with the specimen in three locations.

The Equivalent Sound Absorption Area ( $A_{obj}$ ) of the specimen is calculated using the following formula:

$$A_{obj} = 55.3 \frac{V}{n} \left( \frac{1}{c_2 T_2} - \frac{1}{c_1 T_1} \right) - 4V(m_2 - m_1) \quad \text{Equation (i)}$$

where:  $V$  is the volume of the empty reverberation chamber ( $m^3$ )

$n$  is the number of discrete objects

$T_1$  is the mean reverberation time of the empty reverberation chamber (seconds)

$T_2$  is the mean reverberation time of the reverberation chamber with the test specimen installed (seconds)

$m_1$  and  $m_2$  are the power attenuation coefficient at  $T_1$  and  $T_2$  calculated according to ISO 9613:1993 (ref 3)

$c_1$  and  $c_2$  are the velocity of sound calculated from the following formula:

$$c = 331 + 0.6t \quad \text{m/s} \quad \text{Equation (ii)}$$

where:  $t$  is the air temperature of the reverberation chamber (Celsius)

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Octave band values of Equivalent Sound Absorption Area ( $A_{obj}$ ) are calculated from the one-third octave results in accordance with International Standard ISO 20189 (ref 2) and hence octave band values of Object Sound Absorption Coefficient ( $\alpha_{obj}$ ) are determined from the following formula:

$$\alpha_{obj} = A_{obj}/S$$

where:  $A_{obj}$  is the octave band Equivalent Sound Absorption Area ( $m^2$ )

$S$  is the total exposed surface area of the smallest cuboid of the object in the laboratory measurement for the actual mounting condition ( $m^2$ )

The calibration of all equipment is traceable via an unbroken chain to National Standards.

### **APPENDIX A2 - PRACTICAL APPLICATION OF TEST RESULTS**

The Equivalent Sound Absorption Area and Object Sound Absorption Coefficient are absolute physical constants of a material, however their effect upon the acoustic environment will be influenced by the method of mounting and the distribution of the material or system within a space.

### **APPENDIX A3 - REFERENCES**

1. International Standard ISO 354:2003  
Acoustics - Measurement of sound absorption in a reverberation room
2. International Standard ISO 20189:2018  
Acoustics – Screens, furniture and single objects intended for interior use – Rating of sound absorption and sound reduction of elements based on laboratory measurements
3. International Standard ISO 9613  
Acoustics - Attenuation of sound during propagation outdoors  
  
ISO 9613-1:1993  
Calculation of the absorption of sound by the atmosphere

**APPENDIX A4 - SCHEDULE OF EQUIPMENT**

Use	Type	Serial No.
Measuring System	Nor850 Multi Channel Analyser	8501193
	B&K 4165 ½" Condenser Microphone	1042002
	B&K 4165 ½" Condenser Microphone	1471398
	B&K 2669 Microphone Pre-Amplifier	1856926
	B&K 2669 Microphone Pre-Amplifier	2221217
Calibration	B&K 4228 Pistonphone	1704324

**APPENDIX A5 - MEAN REVERBERATION TIMES**

Frequency Hz	Mean Reverberation Times, secs	
	Empty Chamber	Chamber with Test Specimen
100	8.42	5.67
125	6.89	5.29
160	5.71	4.25
200	5.81	4.37
250	6.21	4.25
315	6.86	4.53
400	7.01	4.47
500	7.08	4.30
630	7.13	3.94
800	7.00	3.65
1000	6.82	3.25
1250	6.26	2.95
1600	5.65	2.67
2000	5.00	2.43
2500	4.08	2.12
3150	3.26	1.82
4000	2.73	1.64
5000	1.93	1.34

End of AIRO Report No. L/3513 dated 21 December 2020