



Report No. L/3562/A

**for
The Collective Agency London Limited
The Glassworks
Mill Bay
Folkestone
Kent
CT20 1JG**



0483

Dated: 17 November 2022

**LABORATORY MEASUREMENTS
OF THE
SOUND ABSORPTION COEFFICIENTS
OF
REWRAP**

Report Author: M Sawyer MIOA

Page 1 of 8

This report shall only be reproduced in full except by prior written approval from AIRO

ACOUSTICAL INVESTIGATION & RESEARCH ORGANISATION LTD

**Duxons Turn
Maylands Avenue
Hemel Hempstead
Hertfordshire
HP2 4SB**

**Telephone: +44(0)1442 247146
E-mail: airo@airo.co.uk
Web: <https://www.airo.co.uk/>**

**LABORATORY MEASUREMENTS
OF THE
SOUND ABSORPTION COEFFICIENTS
OF
REWRAP**

1. INTRODUCTION

This report presents the results of measurements made in the AIRO Acoustics Laboratory of the sound absorption of ReWrap.

The measurements were made on 11 August 2022 for The Collective Agency London Limited.

Measurements of sound absorption, Sound Absorption Coefficient (α_s), were conducted in accordance with British Standard BS EN ISO 354 (ref 1). Single figure ratings of sound absorption performance, known as the Weighted Sound Absorption Coefficient (α_w) and Sound Absorption Class, are derived from these measurements in accordance with British Standard BS EN ISO 11654 (ref 2).

AIRO is a UKAS accredited testing laboratory No. 0483 and measurements to the above British Standards are included on our schedule of accreditation. UKAS is the United Kingdom Accreditation Service.

2. SUMMARY OF RESULTS

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

AIRO Test No.	Test Specimen	α_w	Class
L/3562/A	ReWrap with 2 layers of PET	0.90	A

Approved by:

Report Author:

D L Watts

M Sawyer

Eur Ing D L Watts BEng CEng FIOA
Technical Director

M Sawyer MIOA
Laboratory Manager

3. TEST SPECIMEN DETAILS AND CONDITIONS

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

The specimen for test was received at AIRO from the client on 10 August 2022, and installed for test by AIRO on 11 August 2022. AIRO has had no involvement in the selection of the test specimen or the components which make up the specimen and/or its components, with the results in this report applying only to the specimen as received and tested.

3.1 ReWrap with 2 layers of PET

AIRO Test No. L/3562/A

The client has supplied the following specimen description:

It's a rectangular or square panel made of recycled PET acoustic panel with sides which are folded and wrapped with fabric on the facia and sides and with additional PET panels within its core.

The standard dimensions of the product are: 1000 mm wide x 2200 mm high. However, as part of a range of standard sizes the panels come in a range of other dimensions as below:

- *Widths: 300 mm, 600 mm, 900 mm*
- *Heights: 600 mm, 900 mm, 1200 mm, 1500 mm, 2400 mm, 2600 mm*

In addition to the client's description AIRO has produced the following description:

The specimen comprised 5 no. ReWrap wall panels each nominally 1000 mm wide x 2200 mm high which were laid directly over the floor of the test chamber in a 5 x 1 array to cover a rectangular area of 5025 mm x 2200 mm, thereby satisfying the area requirement of the measurement standard. Due to the panel dimensions, it was not possible to also meet the aspect ratio requirements of the measurement standard. The measured panel thickness was approximately 38 mm, with steel hanging hook bars protruding from the rear face by approximately a further 8 mm. For testing purposes the perimeter of the specimen was shielded by 45 mm deep timber battens.

Two panels were selected at random with each weighing 16.7 kg which equates to a superficial mass of 7.6 kg/m².

See the following images for further details.

ReWrap installed for test



ReWrap with 2 layers of PET

End of specimen descriptions

Sound Absorption Coefficient according to BS EN ISO 354:2003

Test No. L/3562/A

Date of Test: 11 August 2022

Client: The Collective Agency London Limited

Specimen: ReWrap with 2 layers of PET

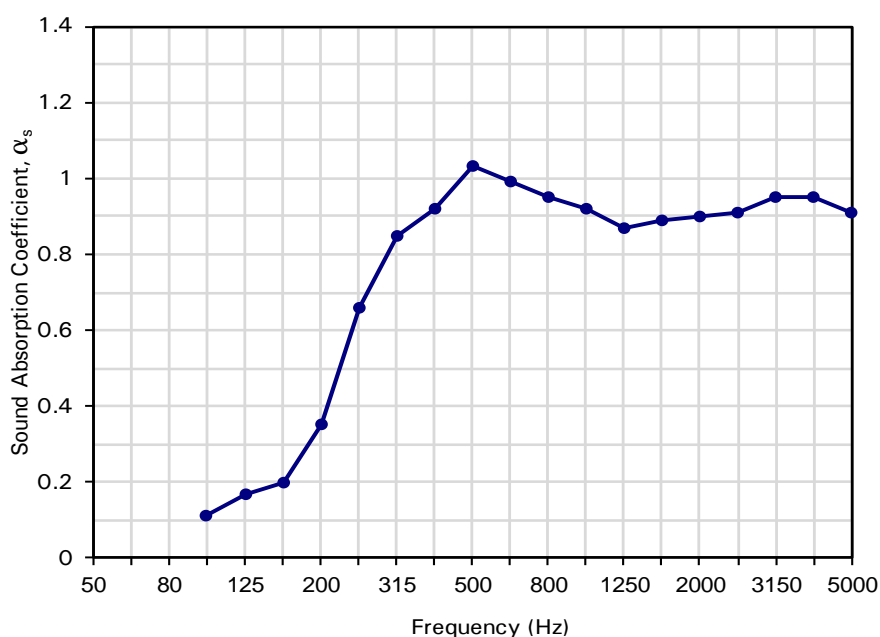
Installed by: AIRO

 Specimen area: 11.06 m²

 Mass per unit area: 7.6 kg/m²

Chamber Conditions	Volume	Air Temperature	Relative Humidity	Air Pressure
Empty Chamber	221 m ³	24°C	67%	1013 hPa
Chamber with Specimen	221 m ³	24°C	67%	1013 hPa

Frequency (Hz)	α_s	α_p
50		
63		
80		
100	0.11	
125	0.17	0.15
160	0.20	
200	0.35	
250	0.66	0.60
315	0.85	
400	0.92	
500	1.03	1.00
630	0.99	
800	0.95	
1000	0.92	0.90
1250	0.87	
1600	0.89	
2000	0.90	0.90
2500	0.91	
3150	0.95	
4000	0.95	0.95
5000	0.91	
6300		
8000		
10000		



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

Rating according to BS EN ISO 11654:1997

 $\alpha_w = 0.90$
Sound Absorption Class: A

Approved by:

Report Author:

D L Watts

Eur Ing D L Watts BEng CEng FIOA
Technical Director

M Sawyer

M Sawyer MIOA
Laboratory Manager

APPENDIX A1 - METHOD OF MEASUREMENT TO BS EN 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.

The Sound Absorption Coefficient (α_s) of the specimen is calculated using the following formula:

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

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

S is the area of the test specimen (m^2)

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)

The Standard requires that the specimen and chamber should be environmentally stable before testing can commence. It is possible for coefficients greater than unity to be measured due to the diffraction effects at the boundaries of finite specimens. Where this occurs the Standard requires that no 'correction' term be applied.

Octave band values of Practical Sound Absorption Coefficient (α_p) are calculated from the one-third octave results. The Weighted Sound Absorption Coefficient (α_w) is calculated by comparing the five values of α_p from 250 Hz to 4000 Hz with a defined reference curve which is moved towards the measured values until the requirements of BS EN ISO 11654:1997 are met.

In addition, shape indicators of L, M and H are given in parenthesis to represent the low, middle and high frequency bands whenever the α_p exceeds the shifted reference curve by 0.25 or more.

From the α_w the Sound Absorption Class is also determined.

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

APPENDIX A2 - PRACTICAL APPLICATION OF TEST RESULTS

The Sound Absorption Coefficient is an absolute physical constant of a material, however its 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. British Standard BS EN ISO 354:2003
Acoustics - Measurement of sound absorption in a reverberation room
2. British Standard BS EN ISO 11654:1997
Acoustics - Sound absorbers for use in buildings - Rating of sound absorption
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

APPENDIX A5 - MEAN REVERBERATION TIMES

Frequency Hz	Mean Reverberation Times, secs	
	Empty Chamber	Chamber with Test Specimen
100	8.61	6.60
125	7.51	5.41
160	5.52	4.11
200	6.00	3.61
250	6.31	2.75
315	6.74	2.42
400	6.73	2.30
500	6.53	2.10
630	6.37	2.14
800	6.22	2.18
1000	6.04	2.21
1250	5.60	2.22
1600	5.22	2.13
2000	4.71	2.03
2500	4.15	1.90
3150	3.54	1.73
4000	2.97	1.58
5000	2.30	1.39

End of AIRO Report No. L/3562/A dated 17 November 2022