RIVERBANK ACOUSTICAL LABORATORIES

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Test Report

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FOUNDED 1918 BY
WALLACE CLEMENT SABINE

SPONSOR: **ezoBord**
Mississauga, Ontario, Canada

Sound Absorption
RAL™-A22-243

CONDUCTED: 2022-05-27

ON: Macaroon Acoustic Clouds 3” (7.5 cm)

TEST METHODOLOGY

Riverbank Acoustical Laboratories™ is accredited by the U.S. Department of Commerce, National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP) as an ISO 17025:2017 Laboratory (NVLAP Lab Code: 100227-0) and for this test procedure. The test reported in this document conformed explicitly with ASTM C423-22: "Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method." The specimen mounting was performed according to ASTM E795-16: "Standard Practices for Mounting Test Specimens During Sound Absorption Tests." A description of the measurement procedure and room specifications are available upon request. The results presented in this report apply to the sample as received from the test sponsor.

INFORMATION PROVIDED BY SPONSOR

The test specimen was designated by the sponsor as Macaroon Acoustic Clouds 3” (7.5 cm). The following nominal product information was provided by the sponsor prior to testing. The accuracy of such sponsor-provided information can affect the validity of the test results.

Product Under Test

Trade Name:	Macaroon Acoustic Clouds 3” (7.5 cm)
Manufacturer:	ezoBord

SPECIMEN MEASUREMENTS & TEST CONDITIONS

Through a full external visual inspection performed on the test specimen, Riverbank personnel verified the following information:

Test Specimen

Product Type:	Baffles
Materials:	PET felt
Dimensions:	6 baffles @ 1048 mm (41.25 in.) diameter
Baffle Thickness:	74.9 mm (2.95 in.)
Felt Wall Thickness:	11.9 mm (0.4685 in.)
Overall Weight:	27.9 kg (61.5 lbs)

Physical Measurements (per object)

Dimensions:	1.05 m (41.25 in) wide by 1.05 m (41.25 in) long
Thickness:	0.07 m (2.95 in)
Weight:	4.65 kg (10.25 lbs)

Test Environment

Room Volume:	291.98 m³
Temperature:	20.8 °C ± 0.0 °C (Requirement: ≥ 10 °C and ≤ 5 °C change)
Relative Humidity:	58.7 % ± 0.0 % (Requirement: ≥ 40 % and ≤ 5 % change)
Barometric Pressure:	98.0 kPa (Requirement not defined)

Each sound absorbing object had an exposed surface area of 1.97 m^2 (21.2 ft^2). The total exposed surface area of all sound-absorbing objects was 11.8 m^2 (127 ft^2). The array of objects covered 10.8 m^2 (117 ft^2) of the horizontal test surface (total treated area).

MOUNTING METHOD

Type J Mounting: The specimen is an array of 6 spaced sound absorbing objects suspended from cables such that the closest face is located approximately 991 mm (39 in.) from the horizontal test surface. This approximates the mounting method of a typical ceiling baffle installation. The objects were distributed in two (2) rows of three (3) objects each, with rows spaced 1556 mm (61.25 in.) on center, and objects in each row spaced 1556 mm (61.25 in.) on center.

Figure 1 – Specimen mounted in test chamber

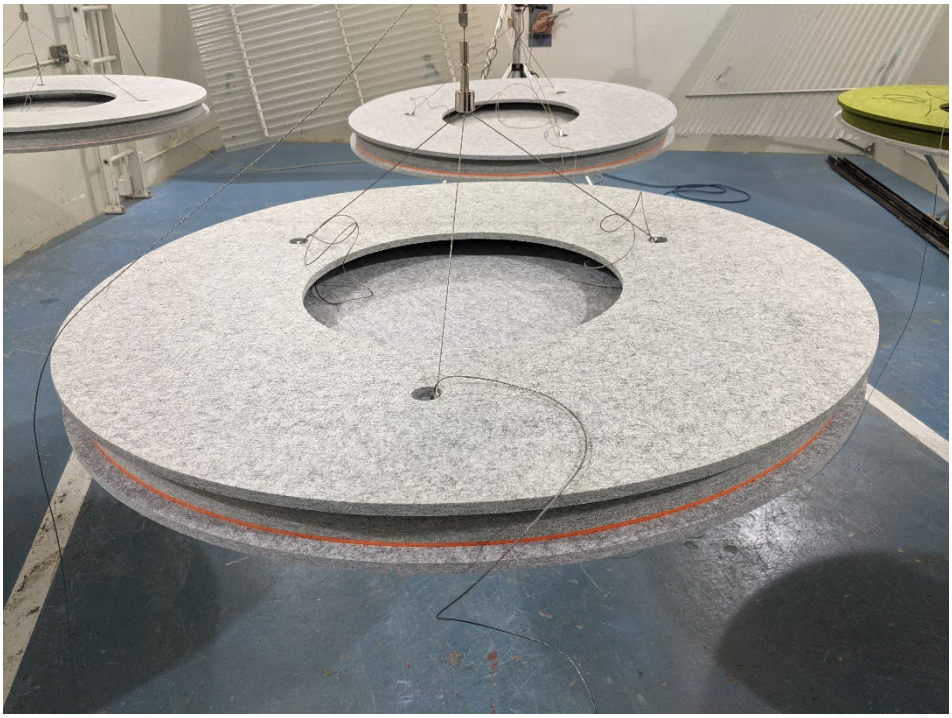

Figure 2 – Detail of specimen materials

Figure 3 – Detail of specimen materials

TEST RESULTS

Note: There is currently no standardized method for calculating Absorption Coefficients from spaced object absorbers. The sound absorption performance of spaced object absorbers should not be compared directly with specimens tested as a single rectangular area (e.g. mounting types A, E, etc.).

1/3 Octave Center Frequency	Total Absorption		Absorption per Object	
(Hz)	(m^2)	(Sabins)	(m^2 / Object)	(Sabins / Object)
100	2.98	32.10	0.50	5.35
** 125	3.61	38.86	0.60	6.48
160	2.73	29.39	0.46	4.90
200	2.87	30.95	0.48	5.16
** 250	3.93	42.32	0.66	7.05
315	5.22	56.22	0.87	9.37
400	5.66	60.93	0.94	10.15
** 500	6.77	72.87	1.13	12.15
630	7.43	79.96	1.24	13.33
800	8.49	91.44	1.42	15.24
** 1000	9.38	101.02	1.56	16.84
1250	9.92	106.81	1.65	17.80
1600	10.48	112.86	1.75	18.81
** 2000	10.68	114.96	1.78	19.16
2500	10.47	112.73	1.75	18.79
3150	10.60	114.15	1.77	19.03
** 4000	10.68	114.99	1.78	19.17
5000	10.88	117.07	1.81	19.51

Tested by Marc Sciaky
Marc Sciaky
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Report by Keith Kimberling
Keith Kimberling
Test Engineer

Approved by Eric P. Wolfram
Eric P. Wolfram
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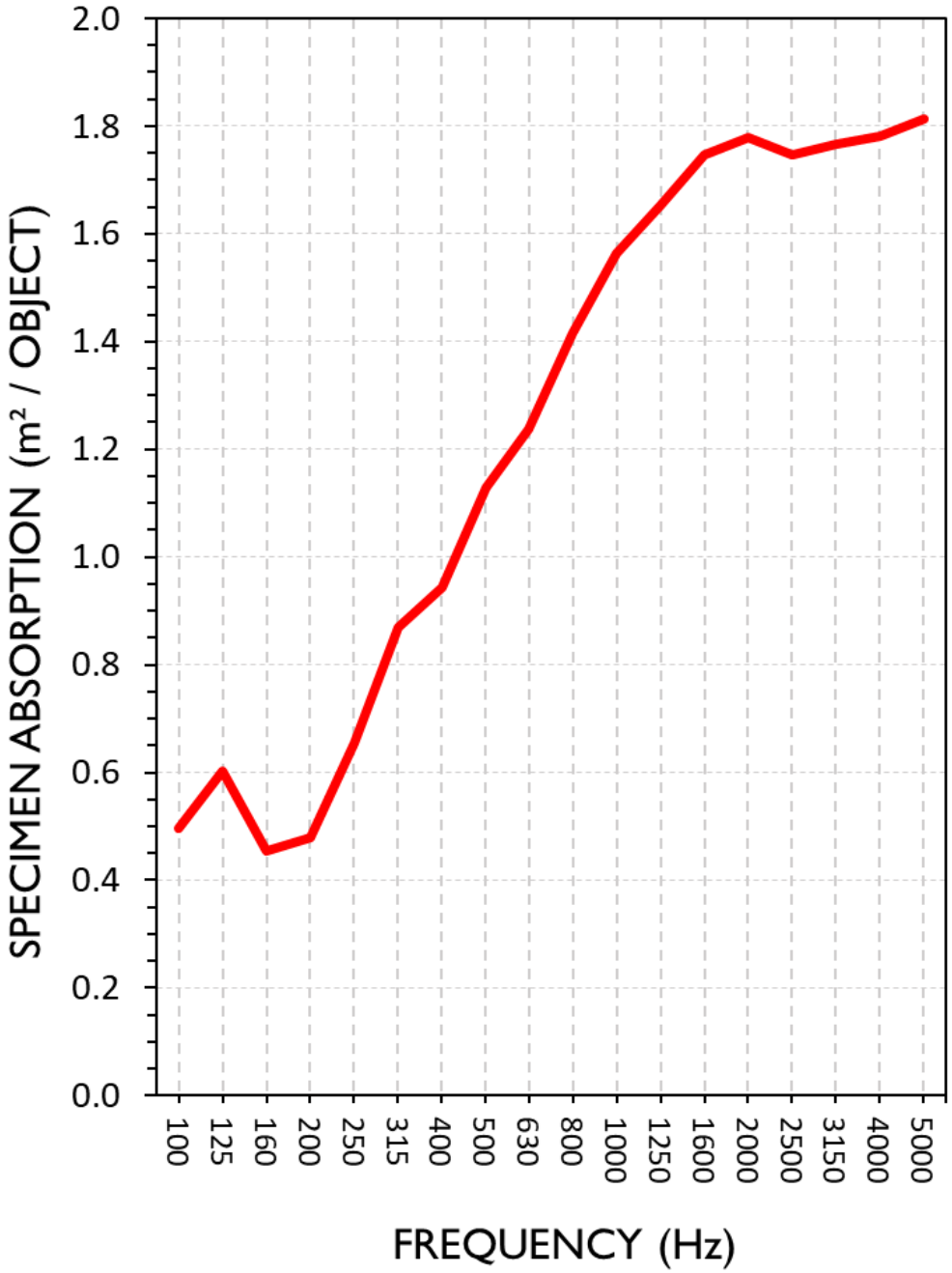
Date: 2022.06.23
10:36:04 -05'00'

SOUND ABSORPTION REPORT

Macaroon Acoustic Clouds 3" (7.5 cm)



APPENDIX A: Extended Frequency Range Data

Specimen: Macaroon Acoustic Clouds 3" (7.5 cm) (See Full Report)

The following non-accredited data were obtained in accordance with ASTM C423-22, but extend beyond the defined frequency range of 100Hz to 5,000Hz. These unofficial results are representative of the RAL test environment only and intended for research & comparison purposes.

1/3 Octave Band Center Frequency (Hz)	Total Absorption (m^2)	Total Absorption (Sabins)	Absorption per Object (m^2 / Object)	Absorption per Object (Sabins / Object)
31.5	0.01	0.08	0.00	0.01
40	1.04	11.22	0.17	1.87
50	0.89	9.56	0.15	1.59
63	0.56	6.07	0.09	1.01
80	2.63	28.35	0.44	4.73
100	2.98	32.10	0.50	5.35
125	3.61	38.86	0.60	6.48
160	2.73	29.39	0.46	4.90
200	2.87	30.95	0.48	5.16
250	3.93	42.32	0.66	7.05
315	5.22	56.22	0.87	9.37
400	5.66	60.93	0.94	10.15
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2000	10.68	114.96	1.78	19.16
2500	10.47	112.73	1.75	18.79
3150	10.60	114.15	1.77	19.03
4000	10.68	114.99	1.78	19.17
5000	10.88	117.07	1.81	19.51
6300	10.76	115.85	1.79	19.31
8000	11.27	121.32	1.88	20.22
10000	11.09	119.33	1.85	19.89
12500	11.38	122.50	1.90	20.42

APPENDIX B: Instruments of Traceability

Specimen: Macaroon Acoustic Clouds 3” (7.5 cm) (See Full Report)

Description	Model	Serial Number	Date of Certification	Calibration Due
System 1	Type 3160-A-042	3160-106968	2021-07-01	2022-07-01
Bruel & Kjaer Mic And Preamp A	Type 4943-B-001	2311428	2021-07-13	2022-07-13
Bruel & Kjaer Pistonphone	Type 4228	2781248	2021-08-13	2022-08-13
EXTECH Hygro 959	SD700	A099959	2022-03-22	2023-03-22

APPENDIX C: Revisions to Original Test Report

Specimen: Macaroon Acoustic Clouds 3” (7.5 cm) (See Full Report)

Date	Revision
2022-06-23	Original report issued

END

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Report Referenced: **RAL™-A22-243**

CONDUCTED: 2022-05-27

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Appendix D to ASTM C423 Sound Absorption Test
Non-standard calculation of equivalent NRC Rating and Absorption Coefficients from spaced absorbers

At this time, ASTM C423 does not provide a standard method for determining absorption coefficients of spaced object absorbers. Tests of a set of sound absorbing objects spaced apart from each other will yield higher absorption rates than a specimen joined together as a single patch (A-Mount or E-Mount). For this reason it is unfair to provide NRC or absorption coefficient ratings for specimens that consist of a spaced set of absorbers. Despite this, the architectural industry has expressed great demand for a simple "single number" rating for these treatments. Likewise, acoustical consultants desire equivalent absorption coefficient data for use in acoustical modeling software. The following is an attempt to appease these demands until ASTM develops a standard method for calculation. Several alternate non-standard calculation methods are provided. Riverbank Acoustical Laboratories prefers method 1. Rating titles for these methods are prepended with the word "Apparent". These rating names and their associated acronyms are provided by RAL and shall not be misconstrued as originating from any current standard.

Method 1) Apparent Sound Absorption Coefficient calculated from extended test specimen envelope
The total sound absorption yielded by the specimen is divided by the surface area of the test surface covered by the suspended objects, including intermediate spaces, with additional added area to allow theoretical extrapolation for larger arrays. The object rigging covered 10.8 m^2 (117 ft^2) of horizontal test surface area. With an extra 508 mm (20 in.) of width and 508 mm (20 in.) of length to account for the space between the tested array and what would be the next objects in a larger array, the total covered surface area comes to 14.5 m^2 (156 ft^2). Apparent sound absorption coefficients, and subsequently the Apparent Noise Reduction Coefficient (A*NRC) and Apparent Sound Absorption Average (A*SAA) ratings, are calculated using this surface area based on the methods described in ASTM C423-17. This may be the most accurate method for comparing object arrays to ceiling tile products. The apparent sound absorption coefficient data can be assigned to a single horizontal surface or plane in acoustical modeling software for approximation of object array performance. Such approximations rely on the assumptions that object spacing is similar to that of the tested array across the entire surface, that gaps are negligibly small between adjacent rows of objects if the test specimen consists of a single row, and that the installation occurs over a perfectly reflective surface material.

Method 2) Apparent Sound Absorption Coefficient calculated from total exposed surface area of specimen
The total sound absorption yielded by the specimen is divided by the total surface area of all exposed specimen faces (1.97 m^2 (21.2 ft^2) per object x 6 objects = 11.8 m^2 (127 ft^2) total surface area). Apparent sound absorption coefficients, and subsequently the Apparent Noise Reduction Coefficient (A*NRC) and Apparent Sound Absorption Average (A*SAA) ratings, are calculated using this surface area based on the methods described in ASTM C423-17. This method shows the actual absorption occurring at the exposed surfaces but does not provide a fair comparison with materials mounted as a uniform patch (in A-mount or E-mount).

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Appendix D (continued)

Method 3) Apparent Sound Absorption Coefficient calculated from one face per object

The total sound absorption yielded by the specimen is divided by the surface area of one side of one large face for each object in the specimen (0.86 m^2 (9.28 ft^2) per object x 6 objects = 5.17 m^2 (55.7 ft^2) total surface area). Apparent sound absorption coefficients, and subsequently the Apparent Noise Reduction Coefficient (A*NRC) and Apparent Sound Absorption Average (A*SAA) ratings, are calculated using this surface area based on the methods described in ASTM C423-17. This method is favored by some material manufacturers since it yields very high NRC figures, but does not provide a fair comparison with other ceiling tile or wall panel products. Riverbank Acoustical Laboratories recommends that results obtained from this method be used for research and comparison purposes only; such results should not be used for marketed claims of product performance.

Method 4) Apparent Sound Absorption Coefficient calculated from specimen envelope without extension

The total sound absorption yielded by the specimen is divided by the rectangular test surface area covered by the suspended objects, including intermediate spaces. The object rigging covered 10.8 m^2 (117 ft^2) of horizontal test surface area. Apparent sound absorption coefficients, and subsequently the Apparent Noise Reduction Coefficient (A*NRC) and Apparent Sound Absorption Average (A*SAA) ratings, are calculated using this surface area based on the methods described in ASTM C423-17. While similar in concept to Method 1, attempting to model any array larger than the tested specimen using these results would imply instances of adjacent objects with zero spacing scattered throughout the extrapolated array. Riverbank Acoustical Laboratories recommends that results obtained from this method be used for research and comparison purposes only; such results should not be used for marketed claims of product performance.

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Appendix D: Data Note: See full test report for details of mounting position, spacing, and configuration, as these parameters greatly affect sound absorption performance.

Specimen Absorption (ft^2)			Method 1	Method 2	Method 3	Method 4
Freq. (Hz)	**Sabins**	**Sabins / Object**	**Apparent** Abs. Coefficient From Total Coverage Area (156 ft^2)	**Apparent** Abs. Coefficient From Total Exposed Surface Area (127 ft^2)	**Apparent** Abs. Coefficient From One Face per Object (55.7 ft^2)	**Apparent** Abs. Coefficient From Unextended Envelope Area (117 ft^2)
31.5	0.08	0.01	0.00	0.00	0.00	0.00
40	11.22	1.87	0.07	0.09	0.20	0.10
50	9.56	1.59	0.06	0.08	0.17	0.08
63	6.07	1.01	0.04	0.05	0.11	0.05
80	28.35	4.73	0.18	0.22	0.51	0.24
100	32.10	5.35	0.21	0.25	0.58	0.28
125	38.86	6.48	0.25	0.31	0.70	0.33
160	29.39	4.90	0.19	0.23	0.53	0.25
200	30.95	5.16	0.20	0.24	0.56	0.27
250	42.32	7.05	0.27	0.33	0.76	0.36
315	56.22	9.37	0.36	0.44	1.01	0.48
400	60.93	10.15	0.39	0.48	1.09	0.52
500	72.87	12.15	0.47	0.57	1.31	0.63
630	79.96	13.33	0.51	0.63	1.44	0.69
800	91.44	15.24	0.58	0.72	1.64	0.78
1,000	101.02	16.84	0.65	0.79	1.81	0.87
1,250	106.81	17.80	0.68	0.84	1.92	0.92
1,600	112.86	18.81	0.72	0.89	2.03	0.97
2,000	114.96	19.16	0.74	0.90	2.06	0.99
2,500	112.73	18.79	0.72	0.89	2.02	0.97
3,150	114.15	19.03	0.73	0.90	2.05	0.98
4,000	114.99	19.17	0.74	0.90	2.07	0.99
5,000	117.07	19.51	0.75	0.92	2.10	1.00
6,300	115.85	19.31	0.74	0.91	2.08	0.99
8,000	121.32	20.22	0.78	0.95	2.18	1.04
10,000	119.33	19.89	0.76	0.94	2.14	1.02
12,500	122.50	20.42	0.78	0.96	2.20	1.05
		Apparent NRC:	**0.55**	**0.65**	**1.50**	**0.70**
		Apparent SAA:	**0.52**	**0.64**	**1.47**	**0.70**

Prepared by _____
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