

SPONSOR: **Kirei**
San Diego, CA

Sound Absorption
RAL™-A23-039

CONDUCTED: 2023-02-20

Page 1 of 8

ON: Tessellate Pendant - empty (Vertical, 25.5")

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 Tessellate Pendant - empty (Vertical, 25.5"). 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

Product Name: Tessellate Pendant
Manufacturer: Kirei

SPECIMEN MEASUREMENTS & TEST CONDITIONS

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

Test Specimen

Materials: PET felt, empty Pendant cavities
Geometry: Roughly cylindrical-shaped Pendants
Height: 22 Pendants @ 648 mm (25.5 in.)
Diameter: Approx. 184 mm (7.25 in.)
Overall Weight: 24.27 kg (53.5 lbs)

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GENEVA, IL 60134
630-232-0104

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2023-02-20

RAL™-A23-039
Page 2 of 8

Physical Measurements (per object)

Dimensions: 0.18 m (7.25 in) wide by 0.65 m (25.5 in) long

Thickness: 0.18 m (7.25 in)

Weight: 1.1 kg (2.43 lbs)

Test Environment

Room Volume: 291.98 m³

Temperature: 19.9 °C ± 0.1 °C (Requirement: ≥ 10 °C and ≤ 5 °C change)

Relative Humidity: 59.75 % ± 4.5 % (Requirement: ≥ 40 % and ≤ 5 % change)

Barometric Pressure: 97.5 kPa (Requirement not defined)

Each sound absorbing object had an exposed surface area of 0.428 m² (4.61 ft²). The total exposed surface area of all sound-absorbing objects was 9.42 m² (101 ft²). The array of objects covered 6.53 m² (70.3 ft²) of the horizontal test surface (total treated area).

MOUNTING METHOD

Type J Mounting: The specimen is an array of 22 spaced sound absorbing objects suspended from cables such that the closest face is located approximately 787 mm (31 in.) from the horizontal test surface. The objects were distributed in four rows spaced 610 mm (24 in.) on center. The rows were staggered and two of the rows had six objects each and the other two rows had five objects each. Objects in each row were spaced 610 mm (24 in.) on center.

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Page 3 of 8



Figure 1 – Specimen mounted in test chamber

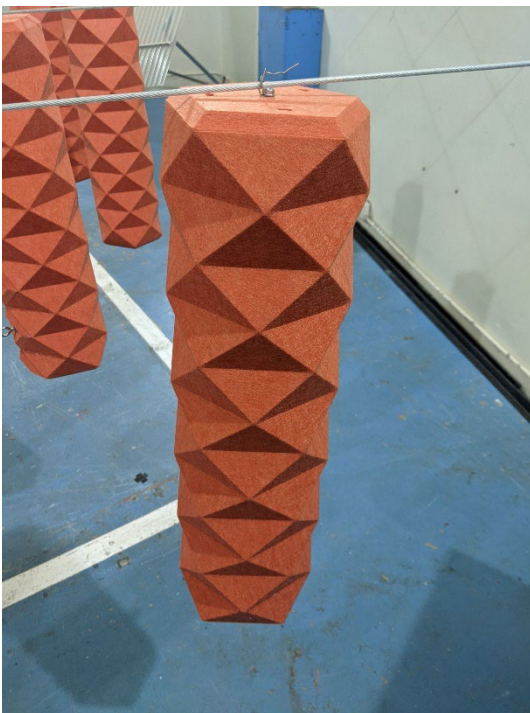


Figure 2 – Individual specimen Pendant

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RAL™-A23-039
Page 4 of 8



Figure 3 – Detail of empty specimen cavity

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Page 5 of 8

Kirei
 2023-02-20


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 (Hz)	Total Absorption		Absorption per Object	
	(m ²)	(Sabins)	(m ² / Object)	(Sabins / Object)
100	-0.32	-3.45	-0.01	-0.16
** 125	0.75	8.06	0.03	0.37
160	1.22	13.17	0.06	0.60
200	1.72	18.54	0.08	0.84
** 250	2.57	27.66	0.12	1.26
315	3.75	40.32	0.17	1.83
400	4.23	45.51	0.19	2.07
** 500	5.15	55.42	0.23	2.52
630	5.90	63.54	0.27	2.89
800	6.09	65.50	0.28	2.98
** 1000	6.28	67.57	0.29	3.07
1250	6.59	70.88	0.30	3.22
1600	7.75	83.46	0.35	3.79
** 2000	8.48	91.30	0.39	4.15
2500	9.25	99.53	0.42	4.52
3150	9.43	101.48	0.43	4.61
** 4000	9.51	102.33	0.43	4.65
5000	9.99	107.58	0.45	4.89

Tested by 
 Marc Sciaky
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Report by 
 Keith Kimberling
 Test Engineer

Approved by 
 Eric P. Wolfram
 Laboratory Manager



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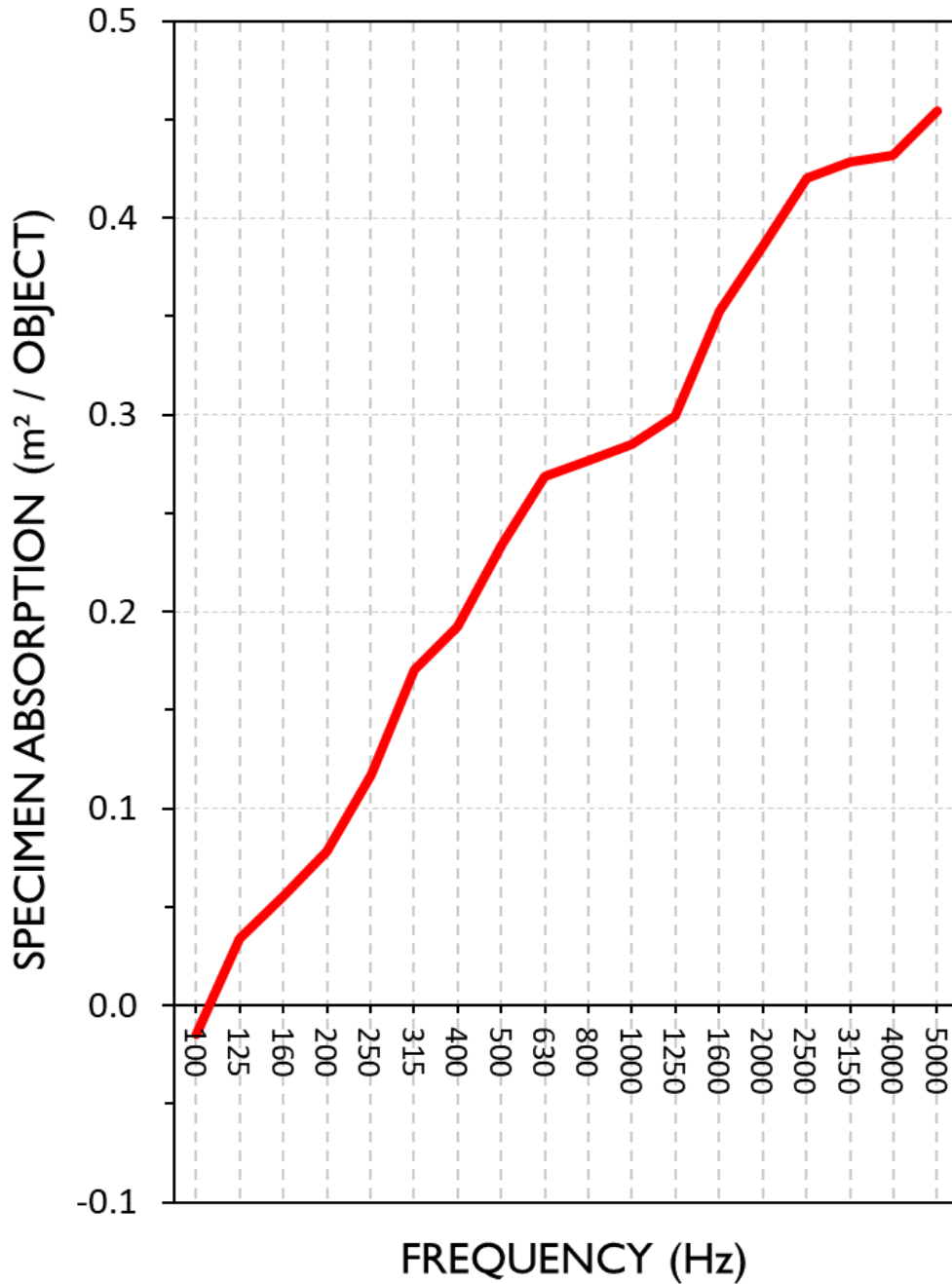
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RAL™-A23-039
Page 6 of 8

SOUND ABSORPTION REPORT
Tessellate Pendant - empty (Vertical, 25.5")



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RAL™-A23-039
 Page 7 of 8

APPENDIX A: Extended Frequency Range Data

Specimen: Tessellate Pendant - empty (Vertical, 25.5") (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		Absorption per Object	
	(m ²)	(Sabins)	(m ² / Object)	(Sabins / Object)
31.5	1.28	13.79	0.06	0.63
40	0.73	7.89	0.03	0.36
50	-0.70	-7.51	-0.03	-0.34
63	0.72	7.71	0.03	0.35
80	-0.35	-3.74	-0.02	-0.17
100	-0.32	-3.45	-0.01	-0.16
125	0.75	8.06	0.03	0.37
160	1.22	13.17	0.06	0.60
200	1.72	18.54	0.08	0.84
250	2.57	27.66	0.12	1.26
315	3.75	40.32	0.17	1.83
400	4.23	45.51	0.19	2.07
500	5.15	55.42	0.23	2.52
630	5.90	63.54	0.27	2.89
800	6.09	65.50	0.28	2.98
1000	6.28	67.57	0.29	3.07
1250	6.59	70.88	0.30	3.22
1600	7.75	83.46	0.35	3.79
2000	8.48	91.30	0.39	4.15
2500	9.25	99.53	0.42	4.52
3150	9.43	101.48	0.43	4.61
4000	9.51	102.33	0.43	4.65
5000	9.99	107.58	0.45	4.89
6300	9.80	105.51	0.45	4.80
8000	10.79	116.15	0.49	5.28
10000	11.22	120.72	0.51	5.49
12500	12.17	131.02	0.55	5.96



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RAL™-A23-039

Page 8 of 8

APPENDIX B: Instruments of Traceability

Specimen: Tessellate Pendant - empty (Vertical, 25.5") (See Full Report)

<u>Description</u>	<u>Model</u>	<u>Serial Number</u>	<u>Date of Certification</u>	<u>Calibration Due</u>
System 1	Type 3160-A-042	3160-106968	2022-07-12	2023-07-12
Bruel & Kjaer Mic and Preamp F	Type 4943-B-001	2525857	2023-01-12	2024-01-12
Bruel & Kjaer Pistonphone	Type 4228	2781248	2022-07-22	2023-07-22
EXTECH Hygro 959	SD700	A099959	2022-03-22	2023-03-22

APPENDIX C: Revisions to Original Test Report

Specimen: Tessellate Pendant - empty (Vertical, 25.5") (See Full Report)

<u>Date</u>	<u>Revision</u>
2023-03-02	Original report issued

END

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Report Referenced: **RAL™-A23-039**
Page 1 of 3

CONDUCTED: 2023-02-20

ON: Tessellate Pendant - empty (Vertical, 25.5") (See Full Test Report for Details)

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 6.53 m² (70.3 ft²) of horizontal test surface area. With an extra 108 mm (4.25 in.) of width and 425 mm (16.75 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 8.18 m² (88 ft²). 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 C423-22. 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 (0.428 m² (4.61 ft²) per object x 22 objects = 9.42 m² (101 ft²) 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 C423-22. 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).

Kirei
2023-02-20

Report Referenced: RAL™-A23-039
Page 2 of 3

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. This method is not applicable in this case 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 C423-22. 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 6.53 m² (70.3 ft²) 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 C423-22. 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.

Kirei
2023-02-20

Report Referenced: **RAL™-A23-039**

Page 3 of 3

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 (88 ft ²)	Apparent Abs. Coefficient From Total Exposed Surface Area (101 ft ²)	Apparent Abs. Coefficient From One Face per Object N/A	Apparent Abs. Coefficient From Unextended Envelope Area (70.3 ft ²)
31.5	13.79	0.63	0.16	0.14	N/A	0.20
40	7.89	0.36	0.09	0.08	N/A	0.11
50	-7.51	-0.34	-0.09	-0.07	N/A	-0.11
63	7.71	0.35	0.09	0.08	N/A	0.11
80	-3.74	-0.17	-0.04	-0.04	N/A	-0.05
100	-3.45	-0.16	-0.04	-0.03	N/A	-0.05
125	8.06	0.37	0.09	0.08	N/A	0.11
160	13.17	0.60	0.15	0.13	N/A	0.19
200	18.54	0.84	0.21	0.18	N/A	0.26
250	27.66	1.26	0.31	0.27	N/A	0.39
315	40.32	1.83	0.46	0.40	N/A	0.57
400	45.51	2.07	0.52	0.45	N/A	0.65
500	55.42	2.52	0.63	0.55	N/A	0.79
630	63.54	2.89	0.72	0.63	N/A	0.90
800	65.50	2.98	0.74	0.65	N/A	0.93
1,000	67.57	3.07	0.77	0.67	N/A	0.96
1,250	70.88	3.22	0.81	0.70	N/A	1.01
1,600	83.46	3.79	0.95	0.82	N/A	1.19
2,000	91.30	4.15	1.04	0.90	N/A	1.30
2,500	99.53	4.52	1.13	0.98	N/A	1.42
3,150	101.48	4.61	1.15	1.00	N/A	1.44
4,000	102.33	4.65	1.16	1.01	N/A	1.46
5,000	107.58	4.89	1.22	1.06	N/A	1.53
6,300	105.51	4.80	1.20	1.04	N/A	1.50
8,000	116.15	5.28	1.32	1.15	N/A	1.65
10,000	120.72	5.49	1.37	1.19	N/A	1.72
12,500	131.02	5.96	1.49	1.29	N/A	1.86
Apparent NRC:			0.70	0.60	N/A	0.85
Apparent SAA:			0.69	0.60	N/A	0.86

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