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Test Report

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SPONSOR: **Pinnacle Architectural Lighting**
Denver, CO

Sound Absorption
RAL™-A20-018

CONDUCTED: 2020-01-08

ON: EX1 Acoustic 4 baffles (5 units spaced 26 in. apart)

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 C423-17: "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 EX1 Acoustic 4 baffles (5 units spaced 26 in. apart). 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:	EX1 Acoustic 4
Manufacturer:	Pinnacle Architectural Lighting

SPECIMEN MEASUREMENTS & TEST CONDITIONS

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

Test Specimen

Construction:	Extruded aluminum channel Semirigid felt paneling adhered around perimeter, open bottom
Dimensions:	5 @ 406.4 mm (16 in.) x 2463.8 mm (97 in.)
Thickness:	Felt panels @ 9 mm (0.354 in.) each Assembled fixture, overall @ 64 mm (2.52 in.)
Overall Weight:	41.39 kg (91.25 lbs)

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Physical Measurements (per unit)

Dimensions:	0.41 m (16.0 in) wide by 2.46 m (97.0 in) long
Thickness:	0.06 m (2.52 in)
Weight:	8.28 kg (18.25 lbs)

Test Environment

Room Volume:	291.98 m^3
Temperature:	21.3 °C ± 0.1 °C (Requirement: ≥ 10 °C and ≤ 5 °C change)
Relative Humidity:	65.65 % ± 0.1 % (Requirement: ≥ 40 % and ≤ 5 % change)
Barometric Pressure:	100.1 kPa (Requirement not defined)

Each sound absorbing unit had an absorptive area (all exposed surfaces) of 2.37 m^2 (25.51 ft^2). The total absorptive area (all exposed surfaces) of all sound-absorbing units was 11.85 m^2 (127.55 ft^2). The array of units covered 7.26 m^2 (78.14 ft^2) of the horizontal test surface (total treated area).

MOUNTING METHOD

Type J Mounting: The specimen is an array of 5 spaced sound absorbing baffles suspended from cables such that the closest face of the baffles is located approximately 1041.4 mm (41 in.) from the horizontal test surface. This approximates the mounting method of a typical ceiling baffle installation. The baffles were evenly distributed in a single row, spaced 660.4 mm (26 in.) apart.

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Figure 1 – Specimen mounted in test chamber

Figure 2 – Individual baffle, aluminum channel and felt paneling

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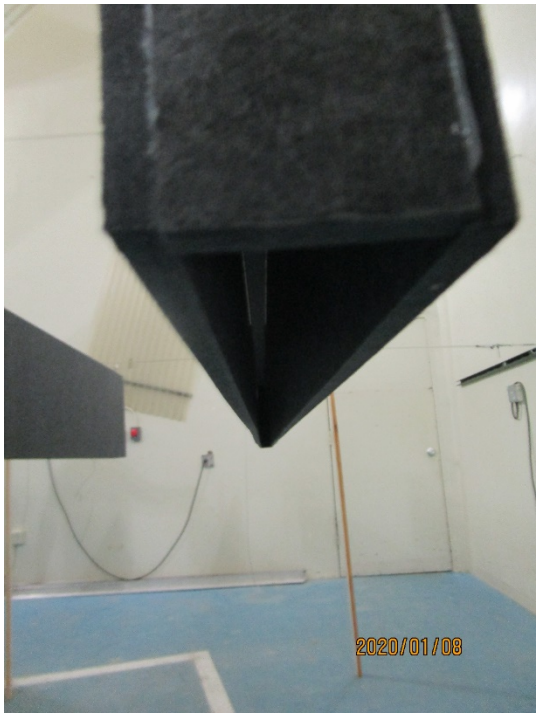

Figure 3 – Underside of individual baffle, open air cavity at bottom

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Pinnacle Architectural Lighting
2020-01-08

RAL™-A20-018

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 Unit	
(Hz)	(m^2)	(Sabins)	(m^2 / Unit)	(Sabins / Unit)
100	0.11	1.19	0.02	0.24
** 125	1.26	13.55	0.25	2.71
160	1.54	16.54	0.31	3.31
200	2.14	23.03	0.43	4.61
** 250	2.67	28.71	0.53	5.74
315	3.55	38.16	0.71	7.63
400	4.04	43.47	0.81	8.69
** 500	5.05	54.35	1.01	10.87
630	5.92	63.74	1.18	12.75
800	6.74	72.55	1.35	14.51
** 1000	7.34	78.97	1.47	15.79
1250	7.89	84.90	1.58	16.98
1600	8.69	93.51	1.74	18.70
** 2000	9.20	98.99	1.84	19.80
2500	9.51	102.41	1.90	20.48
3150	9.44	101.60	1.89	20.32
** 4000	9.85	106.03	1.97	21.21
5000	10.38	111.74	2.08	22.35

Tested by: Marc Sciaky
Senior Experimentalist

Report by: Malcolm Kelly
Test Engineer, Acoustician

Approved by: Eric P. Wolfram
Laboratory Manager

Digitally signed by Eric P Wolfram
Location: Geneva, IL
Date: 2020.01.21 13:43:02 -06'00'

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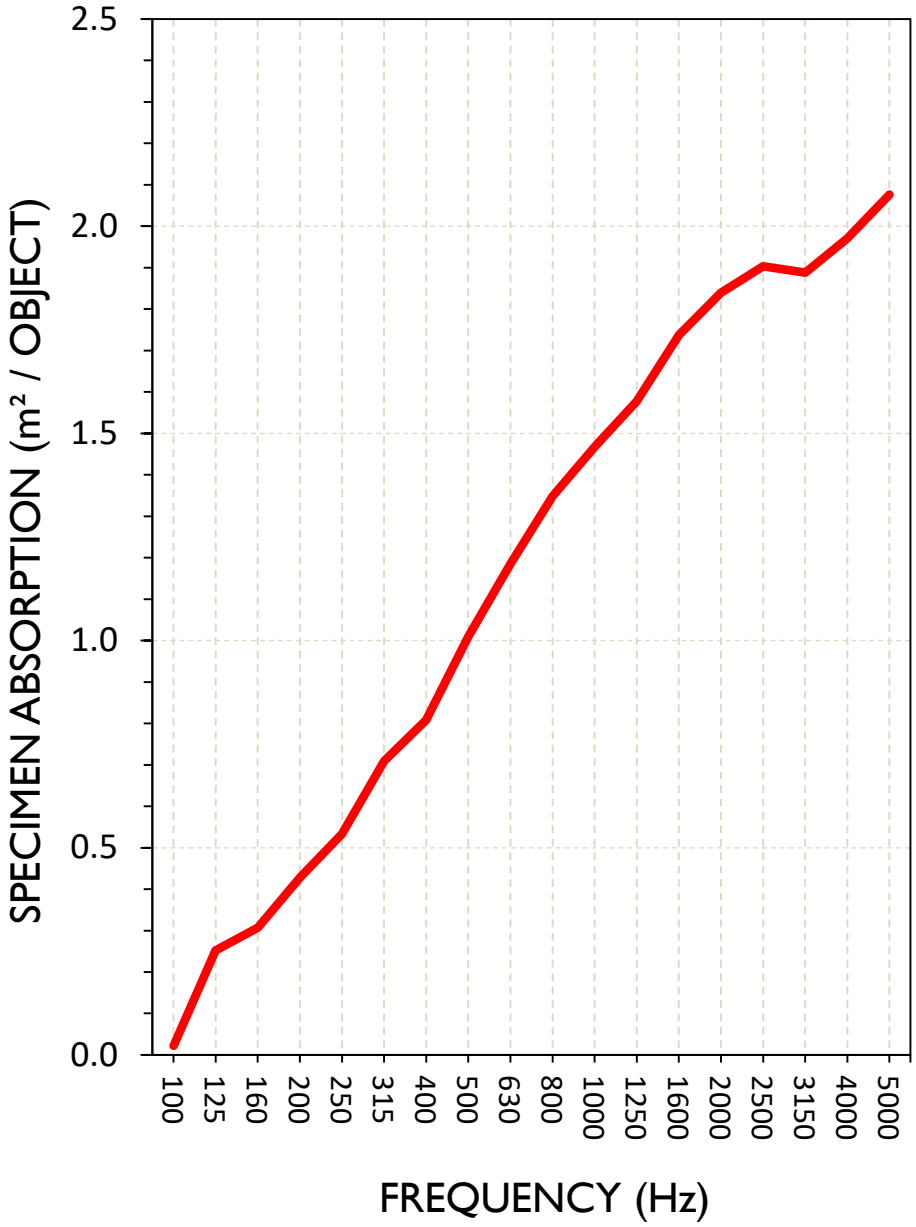
SOUND ABSORPTION REPORT

EX1 Acoustic 4 baffles (5 units spaced 26 in. apart)



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APPENDIX A: Extended Frequency Range Data

Specimen: EX1 Acoustic 4 baffles (5 units spaced 26 in. apart) (See Full Report)

The following non-accredited data were obtained in accordance with ASTM C423-17, 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 Unit (m^2 / Unit)	Absorption per Unit (Sabins / Unit)
31.5	0.88	9.53	0.18	1.91
40	-0.10	-1.10	-0.02	-0.22
50	-0.89	-9.62	-0.18	-1.92
63	-0.44	-4.70	-0.09	-0.94
80	0.55	5.97	0.11	1.19
100	0.11	1.19	0.02	0.24
125	1.26	13.55	0.25	2.71
160	1.54	16.54	0.31	3.31
200	2.14	23.03	0.43	4.61
250	2.67	28.71	0.53	5.74
315	3.55	38.16	0.71	7.63
400	4.04	43.47	0.81	8.69
500	5.05	54.35	1.01	10.87
630	5.92	63.74	1.18	12.75
800	6.74	72.55	1.35	14.51
1000	7.34	78.97	1.47	15.79
1250	7.89	84.90	1.58	16.98
1600	8.69	93.51	1.74	18.70
2000	9.20	98.99	1.84	19.80
2500	9.51	102.41	1.90	20.48
3150	9.44	101.60	1.89	20.32
4000	9.85	106.03	1.97	21.21
5000	10.38	111.74	2.08	22.35
6300	10.76	115.80	2.15	23.16
8000	11.21	120.64	2.24	24.13
10000	12.25	131.81	2.45	26.36
12500	13.15	141.55	2.63	28.31

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APPENDIX B: Instruments of Traceability

Specimen: EX1 Acoustic 4 baffles (5 units spaced 26 in. apart) (See Full Report)

Description	Model	Serial Number	Date of Certification	Calibration Due
System 1	Type 3160-A-042	3160-106968	2019-06-25	2020-06-25
Bruel & Kjaer Mic And Preamp A	Type 4943-B-001	2311428	2019-09-27	2020-09-27
Bruel & Kjaer Pistonphone	Type 4228	2781248	2019-08-09	2020-08-09
EXTECH Hygro 662	SD700	A083662	2019-12-04	2020-12-04

APPENDIX C: Revisions to Original Test Report

Specimen: EX1 Acoustic 4 baffles (5 units spaced 26 in. apart) (See Full Report)

Date	Revision
2020-01-13	Original report issued

END

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SPONSOR: **Pinnacle Architectural Lighting**
Chicago, IL

Report Referenced: **RAL™-A20-018**

CONDUCTED: 2020-01-08

ON: EX1 Acoustic 4 baffles (5 units spaced 26 in. apart) (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.

Method 1) Apparent Sound Absorption Coefficient calculated from total test surface area covered
The total sound absorption yielded by the specimen is divided by the total surface area of the test surface covered by the suspended baffles, including intermediate spaces. The baffle rigging covered 7.26 m^2 (78.14 ft^2) of horizontal test surface area. With an extra 660.4 mm (26 in.) of width to account for the space between the tested array and what would be the next baffle in a larger array, the surface area comes to 8.89 m^2 (95.65 ft^2). Apparent Noise Reduction Coefficient (NRC) rating and Sound Absorption Average (SAA) figures are calculated from this data based on the methods described in ASTM C423-17. This may be the most accurate method for comparing baffle 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 baffle array performance. Such approximations rely on the assumptions that baffle spacing is similar to that of the tested array across the entire surface, that the spacing between adjacent rows of baffles is negligibly small, and that the installation occurs over a perfectly reflective ceiling surface.

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 (2.37 m^2 (25.51 ft^2) per baffle x 5 baffles = 11.85 m^2 (127.55 ft^2) total surface area). Apparent Noise Reduction Coefficient (NRC) rating and Sound Absorption Average (SAA) figures are calculated from this data 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).

Method 3) Apparent Sound Absorption Coefficient calculated from one face per baffle
The total sound absorption yielded by the specimen is divided by the surface area of one side of one large face for each baffle in the specimen (1.00 m^2 (10.78 ft^2) per baffle x 5 baffles = 5.01 m^2 (53.89 ft^2) total surface area). Apparent Noise Reduction Coefficient (NRC) rating and Sound Absorption Average (SAA) figures are calculated from this data 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.

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CONDUCTED: 2020-01-08

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			Method 1	Method 2	Method 3
Freq. (Hz)	Sabins	Sabins / Unit	Apparent Abs. Coefficient From Total Coverage Area	Apparent Abs. Coefficient From Total Exposed Surface Area	Apparent Abs. Coefficient From One Face/Baffle
31.5	9.53	1.91	0.10	0.07	0.18
40	-1.10	-0.22	-0.01	-0.01	-0.02
50	-9.62	-1.92	-0.10	-0.08	-0.18
63	-4.70	-0.94	-0.05	-0.04	-0.09
80	5.97	1.19	0.06	0.05	0.11
100	1.19	0.24	0.01	0.01	0.02
125	13.55	2.71	0.14	0.11	0.25
160	16.54	3.31	0.17	0.13	0.31
200	23.03	4.61	0.24	0.18	0.43
250	28.71	5.74	0.30	0.23	0.53
315	38.16	7.63	0.40	0.30	0.71
400	43.47	8.69	0.45	0.34	0.81
500	54.35	10.87	0.57	0.43	1.01
630	63.74	12.75	0.67	0.50	1.18
800	72.55	14.51	0.76	0.57	1.35
1,000	78.97	15.79	0.83	0.62	1.47
1,250	84.90	16.98	0.89	0.67	1.58
1,600	93.51	18.70	0.98	0.73	1.74
2,000	98.99	19.80	1.03	0.78	1.84
2,500	102.41	20.48	1.07	0.80	1.90
3,150	101.60	20.32	1.06	0.80	1.89
4,000	106.03	21.21	1.11	0.83	1.97
5,000	111.74	22.35	1.17	0.88	2.07
6,300	115.80	23.16	1.21	0.91	2.15
8,000	120.64	24.13	1.26	0.95	2.24
10,000	131.81	26.36	1.38	1.03	2.45
12,500	141.55	28.31	1.48	1.11	2.63
		Apparent NRC:	**0.70**	**0.50**	**1.20**
		Apparent SAA:	**0.68**	**0.51**	**1.21**

Prepared by
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