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An ALION Technical Center

Test Report

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FOR: **Turf Design**
Elgin, IL

Sound Absorption
RAL-A17-259

CONDUCTED: 2017-08-29

ON: 6" Straight Baffle with 6" O.C. spacing

TEST METHOD

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 17025:2005 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 measuring procedure and room qualifications is available upon request.

DESCRIPTION OF THE SPECIMEN

The test specimen was designated by the manufacturer as 6" Straight Baffle with 6" O.C. spacing. An external visual inspection performed on the test specimen by Riverbank personnel verified the manufacturer's description.

Specimen

Material:	99% PET Felt
Dimensions:	13 @ 152.4 mm (6 in.) x 2413 mm (95 in.)
Thickness:	9.73 mm (0.383 in.)
Average Unit Weight:	1.04 kg (2.3 lbs)
Overall Weight:	13.61 kg (30 lbs)

Physical Measures (per unit)

Dimensions:	2.41 m (95.00 in.) wide by 152.40 mm (6.00 in.) long
Thickness:	9.73 mm (0.38 in.)
Weight:	1.04 kg (2.30 lbs.)
Area:	1.21 m^2 (13.00 ft^2)
Mass per Unit Area:	2.83 kg/m^2 (0.58 lbs/ft^2)

Test Environment

Volume:	292.0 m^3 (10,311.0 ft^3)
Temperature:	21.7±0.0ºC (71.1±0.0ºF) (Requirement: ≥10° C and ≤ 5° C change)
Humidity:	62.6±0.5% (Requirement: ≥40% RH and ≤ 5% change)
Barometric Pressure:	99.0 kPa. (Requirement not defined)

DESCRIPTION OF THE SPECIMEN (CONTINUED)

Each sound absorbing unit had an absorptive area (all exposed surfaces) of 0.79 m^2 (8.45 ft^2). The total absorptive area (all exposed surfaces) of all sound-absorbing units was 10.21 m^2 (109.90 ft^2). The array of units covered 4.54 m^2 (48.82 ft^2) of chamber floor surface (total treated area).

MOUNTING METHOD

Type J Mounting: The specimen is an array of spaced sound absorbing baffles suspended from cables approximately 1.52 m (60.0 in.) above the horizontal test surface. This approximates the mounting method of a typical ceiling baffle installation. Baffles were spaced 152.4 mm (6 in.) apart on center.

Figure 1 - Specimen mounted in the test chamber.

Figure 2 - Detail of the test specimen.

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.).

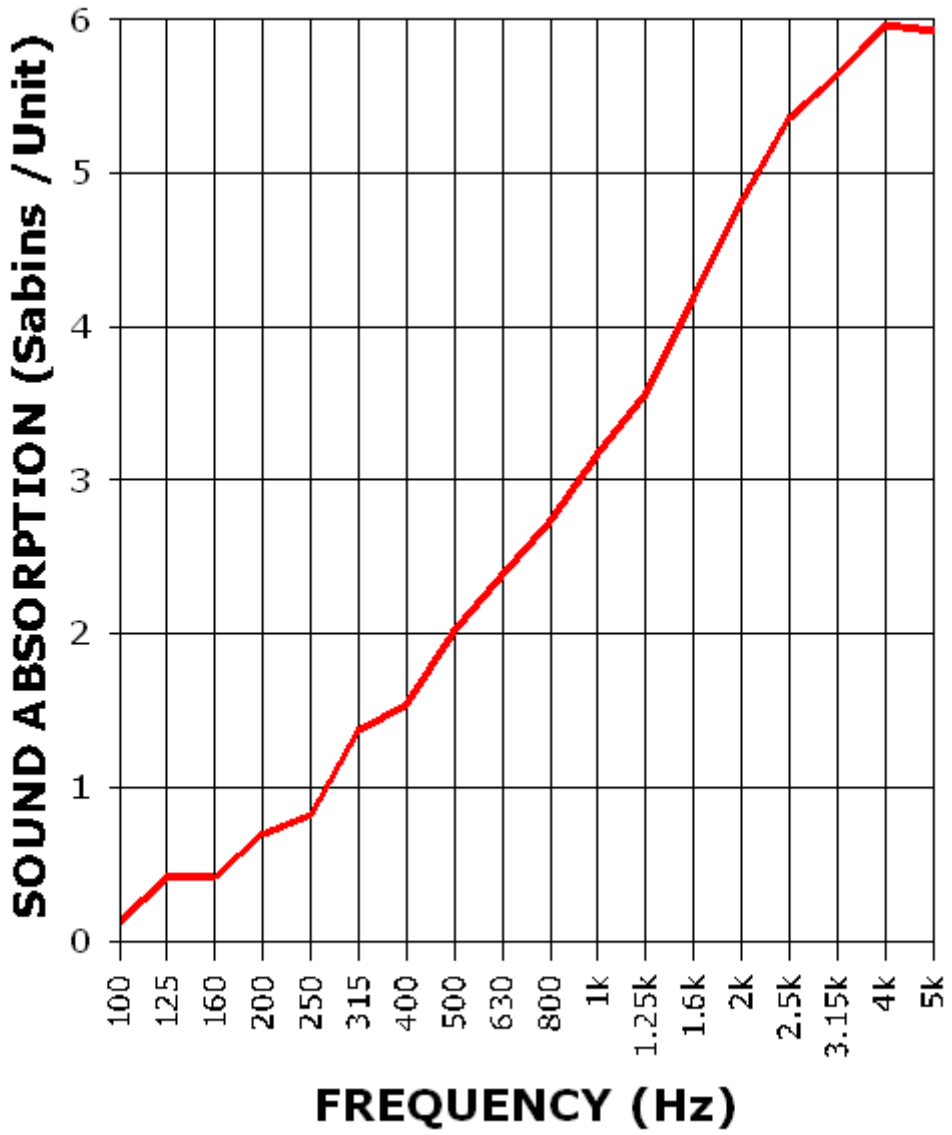
1/3 Octave Center Frequency (Hz)	Total Absorption (SI) (m^2)	Total Absorption (IP) (Sabins)	Absorption (Sabins/Unit)
100	0.15	1.58	0.12
** 125	0.49	5.32	0.41
160	0.50	5.38	0.41
200	0.84	9.08	0.70
** 250	0.98	10.60	0.82
315	1.66	17.85	1.37
400	1.86	19.97	1.54
** 500	2.43	26.17	2.01
630	2.87	30.88	2.38
800	3.30	35.55	2.73
** 1000	3.83	41.20	3.17
1250	4.31	46.40	3.57
1600	5.07	54.56	4.20
** 2000	5.82	62.70	4.82
2500	6.47	69.69	5.36
3150	6.81	73.27	5.64
** 4000	7.20	77.56	5.97
5000	7.16	77.06	5.93

Tested by Marc Sciaky, *Experimentalist*
Report by Malcolm Kelly, *Acoustical Test Engineer*
Approved by Eric P. Wolfram, *Laboratory Manager*

Digitally signed by Eric Wolfram
DN: cn=Eric Wolfram, o=Alion Science and Technology, ou=Riverbank Acoustical Laboratories, email=ewolfram@alionscience.com, c=US
Date: 2017.09.07 13:42:03 -05'00'

SOUND ABSORPTION REPORT

6" Straight Baffle with 6" O.C. spacing



APPENDIX A: Extended Frequency Range Data

Specimen: 6" Straight Baffle with 6" O.C. spacing (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** (Sabins)	**Sabins per Unit**
31.5	3.22	0.25
40	-13.24	-1.02
50	-0.68	-0.05
63	0.10	0.01
80	2.70	0.21
100	1.58	0.12
125	5.32	0.41
160	5.38	0.41
200	9.08	0.70
250	10.60	0.82
315	17.85	1.37
400	19.97	1.54
500	26.17	2.01
630	30.88	2.38
800	35.55	2.73
1000	41.20	3.17
1250	46.40	3.57
1600	54.56	4.20
2000	62.70	4.82
2500	69.69	5.36
3150	73.27	5.64
4000	77.56	5.97
5000	77.06	5.93
6300	77.06	5.93
8000	75.36	5.80
10000	73.16	5.63
12500	72.11	5.55

APPENDIX B: Instruments of Traceability

Specimen: 6" Straight Baffle with 6" O.C. spacing (See Full Report)

Description	Model	Serial Number	Date of Certification	Calibration Due
Bruel & Kjaer Pulse Analyzer - System3	Type 3560-C	2647140	2017-04-21	2018-04-21
Bruel & Kjaer Mic And Preamp D	Type 4943-B-001	2311440	2016-09-19	2017-09-19
Bruel & Kjaer Pistonphone	Type 4228	2781248	2017-08-02	2018-08-02
Omega Digital Temp., Humid. And Pressure Recorder	OM-CP-PRHTemp2000	P97844	2017-01-16	2018-01-16

END

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Appendix C 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 programs. 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 4.54 m^2 (48.82 ft^2) of horizontal test 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 may be the most accurate method for comparing baffle arrays to ceiling tile products. In acoustical modeling applications, 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 (assuming baffle spacing is similar to that tested).

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 (0.79 m^2 (8.45 ft^2) per baffle x 13 baffles = 10.21 m^2 (109.90 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 (0.37 m^2 (3.96 ft^2) per baffle x 13 baffles = 4.78 m^2 (51.46 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.

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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 (US)			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	3.22	0.25	0.07	0.03	0.06
40	-13.24	-1.02	-0.27	-0.12	-0.26
50	-0.68	-0.05	-0.01	-0.01	-0.01
63	0.10	0.01	0.00	0.00	0.00
80	2.70	0.21	0.06	0.02	0.05
100	1.58	0.12	0.03	0.01	0.03
125	5.32	0.41	0.11	0.05	0.10
160	5.38	0.41	0.11	0.05	0.10
200	9.08	0.70	0.19	0.08	0.18
250	10.60	0.82	0.22	0.10	0.21
315	17.85	1.37	0.37	0.16	0.35
400	19.97	1.54	0.41	0.18	0.39
500	26.17	2.01	0.54	0.24	0.51
630	30.88	2.38	0.63	0.28	0.60
800	35.55	2.73	0.73	0.32	0.69
1,000	41.20	3.17	0.84	0.37	0.80
1,250	46.40	3.57	0.95	0.42	0.90
1,600	54.56	4.20	1.12	0.50	1.06
2,000	62.70	4.82	1.28	0.57	1.22
2,500	69.69	5.36	1.43	0.63	1.35
3,150	73.27	5.64	1.50	0.67	1.42
4,000	77.56	5.97	1.59	0.71	1.51
5,000	77.06	5.93	1.58	0.70	1.50
6,300	77.06	5.93	1.58	0.70	1.50
8,000	75.36	5.80	1.54	0.69	1.46
10,000	73.16	5.63	1.50	0.67	1.42
12,500	72.11	5.55	1.48	0.66	1.40
	Apparent NRC:		0.70	0.30	0.70
	Apparent SAA:		0.72	0.32	0.69

Prepared by _____
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Acoustical Test Engineer