NOISE ABSORPTION

Ambient noise has a real effect on health and wellness.

Loud sound levels can:

- raise heart rates
- quicken breathing
- increase stress hormone levels
- interrupt concentration
- decrease motivation
- block creativity
- decrease productivity

Materials that absorb sound in a space are one method to reduce the overall sound in a space.

Attached documents showing noise absorption testing

- for hardback carpet (NRC 0.15), and
- Milliken's cushion carpet (NRC 0.25)

As seen in the documents **Milliken's cushion carpets typically absorb at least 60% more noise** than a standard hardback carpet tile since 0.25 NRC is 60% larger than 0.15 NRC.

The question here is: **How well does a particular material absorb sound?** When you walk into a space and it sounds "echoey," the reason has to do with reverberation times. The longer the reverberation time, the more echo you'll hear — and the louder a space tends to sound. Good sound absorption materials broadly applied over large surface areas tends to yield the best ambient noise level results.

The noise absorption capability of a material is determined by measuring the change in reverberation when placed into an acoustic room, measured using the noise reducation coefficient (or NRC). **A NRC value of 0 represents a non-absorptive material whereas a NRC value of 1 implies that the material absorbs all the sound that impinges on it.**

Carpets typically absorb more noise than a hard flooring and Milliken's open cell cushion absorbs more than a hardback carpet.

REPORT

3933 US ROUTE 11, CORTLAND, NEW YORK, 13045

FOR THE SCOPE OF
ACCREDITATION UNDER NVLAP LAB
CODE 100402-0.

Order No. 101821304 Date: October 19, 2018

REPORT NO. 101821304CRT-001aa

**SOUND ABSORPTION TEST
ON MILLIKEN UNDERSCORE
CARPET TILES**

RENDERED TO

**INDEPENDENT TEXTILE TESTING
PO BOX 1948
1503 MURRAY AVENUE
DALTON, GA 30722**

INTRODUCTION

This report gives the results of a Sound Absorption test and the determination of the Noise Reduction Coefficient on Milliken Underscore carpet tiles. The test specimen was selected and supplied by the client and received at the laboratories on September 17, 2014. The sample appeared to be in a new, unused condition.

AUTHORIZATION

Signed Intertek Quotation No. 500552156.

TEST METHOD

The specimen was tested in accordance with the American Society for Testing and Materials designation ASTM C423-09a, "Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method".

GENERAL

This test method describes the measurement of sound absorption by analyzing the decay rate of sound in a reverberation room. The difference of the decay with and without the specimen in the room is utilized to determine the sound absorption of the specimen under test. Intertek Testing Services Acoustical Facilities utilizes a 16,640 cu. ft. (470 cubic meter) reverberation room.

GENERAL - Cont'd

The sound absorption coefficient is ideally defined as the fraction of the randomly incident sound power absorbed by the material. The greater the coefficient, the greater the sound absorption.

The Noise Reduction Coefficient (NRC) is a single number rating obtained by taking the arithmetic average of the absorption coefficients at 250, 500, 1000, and 2000 Hz rounded to the nearest multiple of 0.05.

The Sound Absorption Average (SAA) is a single number rating obtained by taking the arithmetic average of the one-third octave bands from 200 through 2500 Hz rounded to the nearest 0.01.

DESCRIPTION OF TEST SPECIMEN

The test specimen consisted of Milliken Underscore carpet tiles. The overall 19 5/8 inch by 19 5/8 inch tiles weighed 0.66 lbs./sq. ft. The sample was laid on the floor of our 16,400 cubic foot reverberation chamber. The sample was identified with Design Name: Backbeat – Modular and Colour Name: BKB135 – 109 – Etched with T. The sample has ID number S-14520.

FOR THE SCOPE OF
ACCREDITATION UNDER NVLAP
LAB CODE 100402-0.

RESULTS OF TEST

MILLIKEN UNDERSCORE
CARPET TILES

One Third Octave Band Center Frequency, Hz	Absorption Coefficients Sabins/ft^2	Repeatability, R	Reproducibility, r
80	0.00	0.14	0.14
100	0.02	0.15	0.27
125	**0.08**	0.11	0.22
160	0.12	0.11	0.23
200	0.19	0.09	0.17
250	**0.17**	0.07	0.15
315	0.24	0.09	0.22
400	0.17	0.14	0.16
500	**0.17**	0.09	0.14
630	0.30	0.06	0.14
800	0.43	0.07	0.14
1000	**0.35**	0.06	0.12
1250	0.27	0.05	0.13
1600	0.28	0.05	0.14
2000	**0.31**	0.05	0.13
2500	0.35	0.06	0.14
3150	0.38	0.08	0.15
4000	**0.39**	0.11	0.16
5000	0.43	0.15	0.21
Sound Absorption Average (SAA)	**0.27**	0.08	0.03

Absorption Coefficients – Sabins/ft.^{2}
One-Third Octave Band Center Frequency, Hz

IDENTIFICATION	125	250	500	1000	2000	4000	NRC
Carpet Tiles	0.08	0.17	0.17	0.35	0.31	0.39	0.25

MOUNTING: Type “A” per ASTM Designation E795-05 (Reapproved 2012), “Standard Practices for Mounting Test Specimens During Sound Absorption Tests”.

FOR THE SCOPE OF
ACCREDITATION UNDER NVLAP
LAB CODE 100402-0.

REMARKS

1. Aging Period: None
2. Ambient Temperature: 70°F
3. Relative Humidity: 57%

CONCLUSION

The test method employed for this test has no pass-fail criteria, therefore, the evaluation of the test results is left to the discretion of the client.

This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

Date of Test: September 24, 2014

Report Approved by:

Brian Cyr
Engineer
Acoustical Testing

Report Reviewed By:

James R. Kline
Engineer/Quality Supervisor
Acoustical Testing

Attachments: None

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MILLIKEN & COMPANY ACOUSTICAL PERFORMANCE TEST REPORT

SCOPE OF WORK
ASTM C423 SOUND ABSORPTION TESTING ON A PVC HARDBACK, CARPET TILE

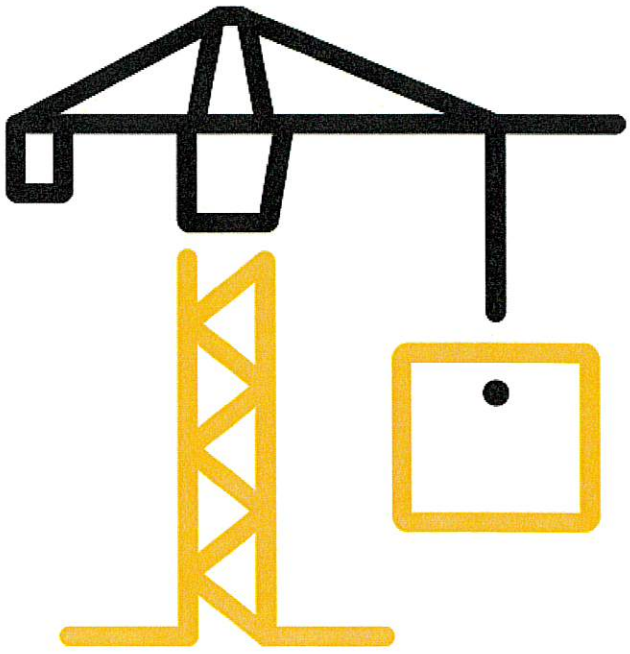
REPORT NUMBER
J0180.05-303-11-R0

TEST DATE
11/13/18

ISSUE DATE
12/06/18

PAGES
10

DOCUMENT CONTROL NUMBER
RT-R-AMER-Test-2755 (10/17/18)



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TEST REPORT FOR MILLIKEN & COMPANY
Report No.: J0180.05-303-11-R0
Date: 12/06/18

REPORT ISSUED TO
MILLIKEN & COMPANY
P.O. Box 1926
Spartanburg, South Carolina 29304

SECTION 1
SCOPE

Intertek Building & Construction (B&C) was contracted by Milliken & Company to perform a sound absorption test. Results obtained are tested values and were secured by using the designated test method(s). The complete test data is included herein. The client provided the test specimen. All measurements were conducted in the HT test chambers at Intertek B&C located in Lake Forest, California.

This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. Intertek B&C will service this report for the entire test record retention period. The test record retention period ends four years after the test date. Test records, such as detailed drawings, datasheets, representative samples of test specimens, or other pertinent project documentation, will be retained for the entire test record retention period.

For INTERTEK B&C:

COMPLETED BY:	David A. Pendleton	**REVIEWED BY:**	Leeland S. Hoover
TITLE:	Technician II Acoustical Testing	**TITLE:**	Laboratory Manager Acoustical Testing
SIGNATURE:	Digitally Signed by: David Pendleton	**SIGNATURE:**	Digitally Signed by: Leeland Hoover
DATE:	12/06/18	**DATE:**	12/06/18

DAP:LSH:ab

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TEST REPORT FOR MILLIKEN & COMPANY
Report No.: J0180.05-303-11-R0
Date: 12/06/18

SECTION 2
SUMMARY OF TEST RESULTS

SERIES/MODEL	PVC Hardback							
SAMPLE TYPE	Carpet Tile							
MOUNTING TYPE	A							
DATA FILE NO.	1/3 OCTAVE SOUND ABSORPTION COEFFICIENTS AT THE OCTAVE BAND FREQUENCIES						NRC	SAA
	125	250	500	1000	2000	4000		
J0180.01E	0.01	0.02	0.08	0.17	0.33	0.48	0.15	0.16

SECTION 3
TEST METHODS

The specimens were evaluated in accordance with the following with the exceptions stated in the Test Procedure section of this report:

ASTM C423-17, *Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method*

ASTM E795-16, *Standard Practices for Mounting Test Specimens During Sound Absorption Tests*

SECTION 4
SPECIMEN MOUNTING

For the Type A mounting, the test specimen was placed directly against the floor of the reverberation room with the absorptive side facing the sound field. The perimeter of the specimen was sealed to the floor with duct tape.

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SECTION 5
EQUIPMENT

The equipment listed below meets the requirements of the test methods stated in Section 3 of this report.

INSTRUMENT	MANUFACTURER	MODEL	DESCRIPTION	ASSET #	CAL DATE
Data Acquisition Card	National Instruments	PXIe-4464	Data Acquisition Card	INT00627	10/17
Data Acquisition Card	National Instruments	PXIe-4464	Data Acquisition Card	INT00395	10/17
Data Acquisition Card	National Instruments	PXIe-4464	Data Acquisition Card	INT00396	10/17
Source Room Microphone	PCB Piezotronics	378C20	Microphone and Preamplifier	64902	04/18
Source Room Microphone	PCB Piezotronics	378C20	Microphone and Preamplifier	INT00240	04/18
Source Room Microphone	PCB Piezotronics	378C20	Microphone and Preamplifier	INT00241	04/18
Source Room Microphone	PCB Piezotronics	378C20	Microphone and Preamplifier	INT00242	04/18
Source Room Microphone	PCB piezotronics	378C20	Microphone and Preamplifier	INT00243	04/18
Receive Room Microphone	PBC Piezotronics	378C20	Microphone and Preamplifier	INT00244	04/18
Receive Room Microphone	PCB Piezotronics	378C20	Microphone and Preamplifier	INT00245	04/18
Receive Room Microphone	PCB Piezotronics	378C20	Microphone and Preamplifier	INT00246	04/18
Receive Room Microphone	PCB Piezotronics	378C20	Microphone and Preamplifier	INT00247	04/18
Receive Room Microphone	PCB Piezotronics	378C20	Microphone and Preamplifier	INT00228	04/18
Receive Room Environmental Indicator	Comet	T7510	Receive Room	INT00299	04/18
Source Room Environmental Indicator	Comet	T7510	Source Room	INT00300	04/18
Microphone Calibrator	Norsonic	1251	Acoustical Calibrator	INT00288	07/18

TEST CHAMBER

	VOLUME	DESCRIPTION
RECEIVE ROOM	231 m³	Rotating vane and stationary diffusers Temperature and humidity controlled Isolation pads under the floor
SOURCE ROOM	196 m³	Stationary diffusers only Temperature and humidity controlled

	MAXIMUM SIZE	DESCRIPTION
TL TEST OPENING	4.27 m wide by 3.05 m high	Vibration break between source and receive rooms

N/A-Not Applicable

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TEST REPORT FOR MILLIKEN & COMPANY
Report No.: J0180.05-303-11-R0
Date: 12/06/18

SECTION 6
LIST OF OFFICIAL OBSERVERS

NAME	COMPANY
Padmakumar Puthillath	Milliken & Company
Leeland S. Hoover	Intertek B&C
David A. Pendleton	Intertek B&C

SECTION 7
TEST PROCEDURE

The sensitivity of the microphones was checked before measurements were conducted. Empty room sound absorption measurements were conducted before the specimen was installed. Full room sound absorption measurements were conducted after the specimen was installed.

For the empty and full room measurements, ten decay measurements were conducted at each of the five microphone positions. Data was obtained at 1/3 octave band frequencies ranging from 80 to 5000 hertz. The air temperature and relative humidity conditions were monitored and recorded during the measurements.

Intertek B&C will store samples of test specimens for four years.

SECTION 8
TEST CALCULATIONS

The Sound Absorption Coefficient is the full room absorption minus the empty room absorption divided by the area of the sample in m^2. The Sound Absorption Coefficient is dimensionless.

The Noise Reduction Coefficient (NRC) rating is the arithmetic average of the sound absorption coefficients at 250, 500, 1000 and 2000 hertz. The average is rounded to the nearest multiple of 0.05.

The Sound Absorption Average (SAA) rating is the arithmetic average of the sound absorption coefficients at the frequencies ranging from 200 to 2500 hertz. The average is rounded to the nearest multiple of 0.01.

The Sound Absorption Coefficient is the full room absorption minus the empty room absorption divided by the number of units being tested. The Sound Absorption Coefficient is dimensionless.

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SECTION 9
TEST SPECIMEN DESCRIPTION

SERIES/MODEL	PVC Hardback
SAMPLE TYPE	Carpet Tile
MOUNTING TYPE	A

27, 250.825 mm by 1000.125mm (9.875 in by 39.375 in) panels, were arranged to produce the 2.44 m by 2.74 m (96 in by 108 in) test specimen. The total weight of the specimen was 19.5951744 kg (43.2 lbs).The client did not supply a report drawing of the test specimen.

DESCRIPTION	THICKNESS
PVC Hardback Carpet Tile	5.1 mm 0 20"

** - Stated per Client/Manufacturer*

Photographs are included in Section 11.

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TEST REPORT FOR MILLIKEN & COMPANY

Report No.: J0180.05-303-11-R0
Date: 12/06/18

SECTION 10
TEST RESULTS

ASTM C423
SOUND ABSORPTION TEST

ACCREDITED
Testing Laboratory

TEST DATE	11/13/18
DATA FILE NO.	J0180.01D
CLIENT	Milliken & Company
DESCRIPTION	Carpet panels
TECHNICIAN	David A. Pendleton
SPECIMEN AREA	6.69 m²
MOUNTING TYPE	A

	EMPTY	FULL
TEMP °C	18.9	18.4
RH %	50	50
B.P. (mb)	1027	1027

FREQ (Hz)	EMPTY ROOM ABSORPTION (m^2)	UNCERTAINTY	FULL ROOM ABSORPTION (m^2)	UNCERTAINTY	ABSORPTION COEFFICIENT	RELATIVE UNCERTAINTY
50	4.74	1.827	4.64	2.038	0.00	0.409
63	5.90	0.278	5.98	0.335	0.01	0.065
80	4.48	0.377	4.48	0.307	0.00	0.073
100	4.62	0.751	4.73	0.698	0.02	0.153
125	5.29	0.230	5.39	0.140	0.01	0.040
160	4.90	0.514	5.12	0.523	0.03	0.110
200	5.70	0.161	5.96	0.217	0.04	0.040
250	6.34	0.086	6.50	0.105	0.02	0.020
315	6.08	0.229	6.41	0.209	0.05	0.046
400	5.20	0.157	5.62	0.168	0.06	0.034
500	4.52	0.133	5.06	0.285	0.08	0.047
630	4.74	0.132	5.40	0.070	0.10	0.022
800	4.72	0.109	5.61	0.042	0.13	0.017
1000	4.63	0.134	5.79	0.070	0.17	0.023
1250	4.58	0.084	6.04	0.060	0.22	0.015
1600	4.84	0.098	6.81	0.077	0.29	0.019
2000	5.39	0.081	7.62	0.332	0.33	0.051
2500	5.50	0.061	8.68	0.158	0.47	0.025
3150	5.49	0.037	8.56	0.024	0.46	0.007
4000	5.62	0.033	8.81	0.037	0.48	0.007
5000	5.83	0.041	9.38	0.012	0.53	0.006
6300	5.80	0.011	9.66	0.025	0.58	0.004
8000	5.60	0.015	9.46	0.008	0.58	0.003
10000	5.31	0.010	9.45	0.012	0.62	0.002

NRC RATING	0.15	*(Noise Reduction Coefficient)*
SAA RATING	0.16	*(Sound Absorption Average)*

Notes:

1) The NRC rating is the arithmetic average of the sound absorption coefficients at 250, 500, 1000, and 2000 hertz. The average is rounded to the nearest multiple of 0.05.

2) The SAA rating is the arithmetic average of the sound absorption coefficients at the frequencies ranging from 200 to 2500 hertz. The average is rounded to the nearest multiple of 0.01.

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Report No.: J0180.05-303-11-R0
Date: 12/06/18

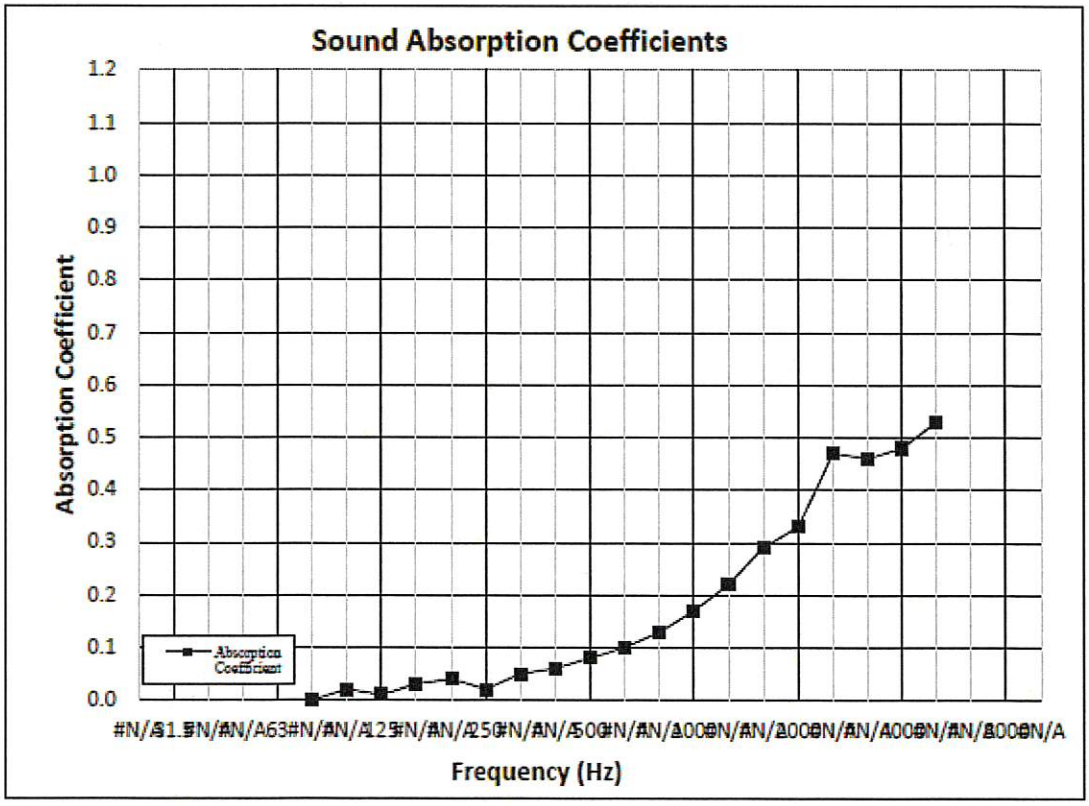
RESULTS GRAPH

ASTM C423
SOUND ABSORPTION TEST

ACCREDITED
Testing Laboratory

TEST DATE	11/13/18
DATA FILE NO.	J0180.01D
CLIENT	Milliken & Company
DESCRIPTION	Carpet panels
TECHNICIAN	David A. Pendleton
SPECIMEN AREA	6.69 m²
MOUNTING TYPE	A

	EMPTY	FULL
TEMP °C	18.9	18.4
RH %	50	50
B.P. (mb)	1027	1027



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SECTION 11
PHOTOGRAPHS

Photo No. 1

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SECTION 12
REVISION LOG

REVISION #	DATE	PAGES	REVISION
0	12/06/18	N/A	Original Report Issue