Title: Sound Absorption Test Results

Product: Silk Metal

Application: Ceiling

Testing Standard: ASTM C522 and ASTM E1050

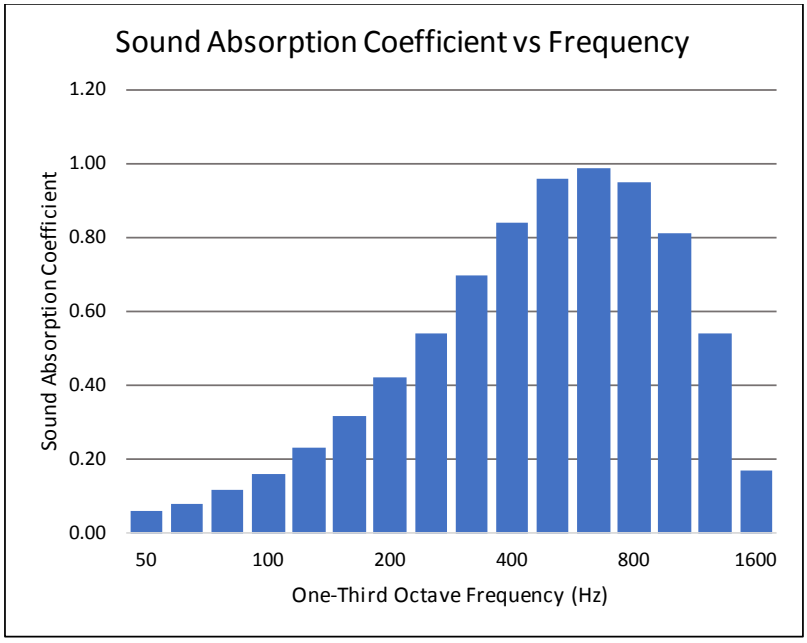
Test Date: 09/17/13

Why this test: This test evaluates a products efficiency of absorbing sound at multiple frequencies. The test simulates the product's acoustical performance with a ceiling installation.

Airflow Resistance Test Results Summary: Airflow Resistance - 52,452 Ohms; Specific Airflow - 404 MKS Rayls; Airflow Resistivity - 397,405 Rayls/m

Airflow Resistance Test Results Summary: See graph.

Frequency (Hz)	Absorption Coefficient
50	0.06
63	0.08
80	0.12
100	0.16
125	0.23
160	0.32
200	0.42
250	0.54
315	0.70
400	0.84
500	0.96
630	0.99
800	0.95
1000	0.81
1250	0.54
1600	0.17



Test ID: D1309.01-113-11-R0

123 Columbia Court North Suite 201 Chaska, MN 55318 | TOLL FREE 800.448.0121 | PHONE 952.448.5300 | FAX 952.448.2613 | WEB SITE www.acousticalsurfaces.com

Architectural Testing

D1309.01-113-11-R0
AIRFLOW RESISTANCE (ASTM C 522)
AND
IMPEDANCE TUBE (ASTM E 1050)
TEST REPORT

Rendered to:

ACOUSTICAL SURFACES, INC.

SPECIMEN TYPE: Silk Metal Ceiling Panel

Summary of Airflow Resistance Test Results			
Data File	**Airflow Resistance** (Ohms)	**Specific Airflow** Resistance (MKS Rayls)	**Airflow Resistivity** (Rayls/m)
D1309.01B	52,452	404	397,405

Summary of Impedance Tube Test Results (1/3 Octave Normal Incidence Sound Absorption Coefficients at the Octave Band Frequencies)					
Data File	**63 Hz**	**125 Hz**	**250 Hz**	**500 Hz**	**1000 Hz**
D1309.01A	0.08	0.23	0.54	0.96	0.81

The data listed above are the average results of three samples from the same material. Reference should be made to Architectural Testing, Inc. Report D1309.01-113-11-R0 for complete test specimen description.

130 Derry Court
York, PA 17406-8405
phone: 717-764-7700
fax: 717-764-4129
www.archtest.com

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Architectural Testing

Airflow Resistance and Impedance Tube Test Report

Rendered to:

ACOUSTICAL SURFACES, INC.
123 Columbia Court North
Chaska, Minnesota 55318

Report:	D1309.01-113-11-R0
Test Date:	09/17/13
Report Date:	09/30/13
Record Retention End Date:	09/30/17

Project Scope: Acoustical Surfaces, Inc. contracted Architectural Testing to conduct airflow resistance and impedance tube tests. The client provided the test specimens.

Test Methods: The airflow and impedance tube tests were conducted in accordance with the following standards. The equipment listed in the attachments meets the requirements of the following standards.

ASTM C 522-03 (Reapproved 2009), Standard Test Method for Airflow Resistance of Acoustical Materials

ASTM E 1050-12, Standard Test Method for Impedance and Absorption of Acoustical Materials Using A Tube, Two Microphones and A Digital Frequency Analysis System.

Test Procedure: All testing was conducted in the small scale test laboratory located in York, Pennsylvania. All samples were conditioned in the same environment at least 48 hours prior to testing.

Airflow Resistance Test: A rubber gasket was placed in the base. The sample holder tube was placed over the gasket and clamped into place. The test sample was placed on top of the sample holder tube. Duct seal compound was used to seal the sample to the sample holder tube.

For each sample type, three specimens were tested at four airflow set points, and the results were averaged.

Impedance Tube Test: The two-microphone impedance tube test was conducted in accordance with ASTM E 1050. Prior to testing the specimen, the impedance mismatch between the two microphones was determined. Three, 100 mm diameter samples supplied by the customer. The samples were installed flush with the open end of the sample holder. Any gaps that existed between the sample and the sample holder were sealed with petroleum jelly. The sample was tested with a 101.6 mm air space between the back of the sample and the sample holder plunger.

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Impedance Tube Test: (Continued)

Random noise was generated in the impedance tube, and 50 measurements were conducted and averaged for each sample. The results for the three samples were averaged. The impedance test was conducted at frequencies ranging from 50 to 1600 hertz. Signal processing parameters are listed in Appendix A.

The air temperature, barometric pressure, and relative humidity conditions were monitored and recorded during all measurements.

Test Equipment: A list of equipment used to conduct testing for this project is located in the attachments.

Test Results: The test results from this project are located in the attachments.

Comments: Photographs of the test specimen are included in the attachments.

Architectural Testing will service this report for the entire test record retention period. Test records, such as detailed drawings, datasheets, representative samples of test specimens, or other pertinent project documentation, will be retained by Architectural Testing for the entire test record retention period.

This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. It is the exclusive property of the client so named herein and relates only to the specimen tested. This report may not be reproduced, except in full, without the written approval of Architectural Testing.

For ARCHITECTURAL TESTING, INC:

Todd D. Kister
Digitally Signed by: Todd D. Kister

Eric J. Miller
Digitally Signed by: Eric J. Miller

Todd D. Kister
Laboratory Supervisor - Acoustical Testing

Eric J. Miller
Director - Acoustical Testing

TDK:jmcs

Attachments (6): This report is complete only when all attachments are included.

Revision Log

Rev. #	Date	Page(s)	Revision(s)
R0			Original Report Issue

0

Architectural Testing

Attachments

Instrumentation

Instrument	Manufacturer	Model	Description	ATI Number	Last Calibrated
Airflow Test Apparatus	AMTEC	C522USB	100 mm (nominal) sample size	64389	08/05/13
Weather Station	Davis Instruments	6150C	Laboratory Barometric Pressure, Temperature, and Humidity	62247	02/22/13
Analyzer	Hewlett Packard	35670A	Dynamic signal analyzer	Y002929	6/9/13
Microphone One	G.R.A.S.	Type 40AR	1/2", Pressure type, condenser microphone	Y003246	9/3/13
Microphone One Preamp	G.R.A.S.	Type 26AK	1/2" Preamplifier	Y003249	9/3/13
Microphone Two	G.R.A.S.	Type 40AR	1/2", Pressure type, condenser microphone	Y003245	9/3/13
Microphone Two Preamp	G.R.A.S.	Type 26AK	1/2" Preamplifier	Y003248	9/3/13
Microphone Calibrator	Breul & Kjaer	Type 4228	Pistonphone calibrator	Y002816	2/13/13
Driver	Morel	CAW 428	Cone Woofer	005718	N/A
Equalizer	Rane	RPE 228	Digital equalizer	005081	N/A
100 mm Impedance Tube	Architectural Testing, Inc.	N/A	100 mm Impedance tube with microphone holder, stand, and acrylic sample holder with plunger	005713	N/A

Signal Processing Parameters:

Parameter	
Frequency Resolution	1600 Lines
Frequency Span	3200 Hz.
Averaging Type	RMS
Number of Averages	50
Windowing Function	Hanning Window
Overlap	66.7%

N/A-Non Applicable

ASTM C522 Airflow Resistance Test

Architectural Testing Inc.
Acoustical Testing Laboratory
York, PA

9/17/2013 10:01

Test ID : Acoustical Surfaces, Inc., **D1309.01B-113-11**
Material Tested : Silk Metal Ceiling Panel

Test Results :

	average	
Airflow Resistance	52452	Ohms
Specific Airflow Resistance	404	Rayls
Airflow Resistivity	397405	Rayls/m
Test Linearity	0.997	R Squared

Sample #	Ohms	Rayls	Rayls/m	R Squared
1	53858	415	408058	0.999
2	53261	410	403531	0.999
3	50238	387	380627	0.993

Material & Test Description :

	Weight grams	Thickness in	Diameter mm	Density pcf	Temp C	Humid %Rh	BaroPress mm Hg
avg	15.68	0.040	99	125.163	22	42	773
# 1	15.85	0.040	99	126.520	22	42	773
# 2	15.64	0.040	99	124.844	22	42	773
# 3	15.55	0.040	99	124.126	22	42	773

Test Operation :

Sample	Step	Flow (lpm)	dP (Pa)	dP/Flow
1	1	0.97	0.92	0.95
1	2	2.00	1.81	0.90
1	3	2.99	2.57	0.86
1	4	4.00	3.52	0.88
2	1	1.00	0.92	0.92
2	2	2.02	1.81	0.89
2	3	2.98	2.57	0.86
2	4	4.00	3.52	0.88
3	1	1.03	0.92	0.89
3	2	2.03	1.62	0.80
3	3	3.00	2.57	0.86
3	4	4.00	3.20	0.80

Comments :

Report File :
C:\C522Data\D1309.01B.AF
DateTime Key :
130917100150

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TL-144

Impedance Tube Test Results

ASTM E 1050

100 mm Tube Diameter

Test Date	9/17/2013
ATI No.	D1309.01A
Client	Acoustical Surfaces, Inc.
Specimen	Silk Metal Ceiling Panel
Operator	TDK
Sample Thickness	0.10 cm
Sample Density	1.97 g/cm^3

B.P. (mb)	1029
Temp C	23
RH %	39

Freq (Hz)	Resistance Ratios r/ρc	Reactance Ratios x/ρc	Conductance Ratios gρc	Susceptance Ratio bρc	Absorption Coefficients α	Standard Deviation
50	2.28	-11.84	0.02	-0.08	0.06	0.01
63	1.70	-8.67	0.02	-0.11	0.08	0.01
80	1.44	-6.52	0.03	-0.15	0.12	0.01
100	1.21	-5.04	0.05	-0.19	0.16	0.01
125	1.10	-3.89	0.07	-0.24	0.23	0.02
160	1.03	-2.99	0.10	-0.30	0.32	0.02
200	0.99	-2.32	0.16	-0.37	0.42	0.04
250	0.92	-1.75	0.23	-0.45	0.54	0.07
315	0.91	-1.22	0.39	-0.54	0.70	0.02
400	0.91	-0.82	0.63	-0.54	0.84	0.02
500	0.91	-0.34	0.95	-0.35	0.96	0.01
630	1.03	0.06	0.97	0.04	0.99	0.00
800	1.16	0.45	0.76	0.29	0.95	0.01
1000	1.39	1.06	0.46	0.35	0.81	0.00
1250	2.31	2.54	0.21	0.23	0.54	0.02
1600	2.45	-6.25	0.05	-0.17	0.17	0.01

Notes: *The impedance tube is qualified for measurements from to 50 to 1600 hertz.*
The data listed above is the average results of three samples from the same material.

Impedance Tube Test Results

ASTM E 1050
100 mm Tube Diameter

Test Date	09/17/13
ATI No.	D1309.01A
Client	Acoustical Surfaces, Inc.
Specimen	Silk Metal Ceiling Panel
Operator	TDK
Sample Thickness	0.10 cm
Sample Density	1.97 g/cm^3

B.P. (mb)	1029
Temp C	23
RH %	39

Freq (Hz)	Sample 1 Absorption Coefficients	Sample 2 Absorption Coefficients	Sample 3 Absorption Coefficients	Average Absorption Coefficients	Standard Deviation
50	0.07	0.07	0.05	0.06	0.01
63	0.09	0.08	0.08	0.08	0.01
80	0.13	0.13	0.11	0.12	0.01
100	0.17	0.17	0.15	0.16	0.01
125	0.24	0.24	0.21	0.23	0.02
160	0.33	0.33	0.29	0.32	0.02
200	0.45	0.44	0.38	0.42	0.04
250	0.58	0.58	0.45	0.54	0.07
315	0.71	0.71	0.68	0.70	0.02
400	0.84	0.82	0.86	0.84	0.02
500	0.97	0.96	0.95	0.96	0.01
630	0.99	0.99	0.99	0.99	0.00
800	0.94	0.95	0.95	0.95	0.01
1000	0.81	0.81	0.81	0.81	0.00
1250	0.55	0.54	0.52	0.54	0.02
1600	0.17	0.18	0.16	0.17	0.01

Notes: *The impedance tube is qualified for measurements from to 50 to 1600 hertz.*
The data listed above is the average results of three samples from the same material.

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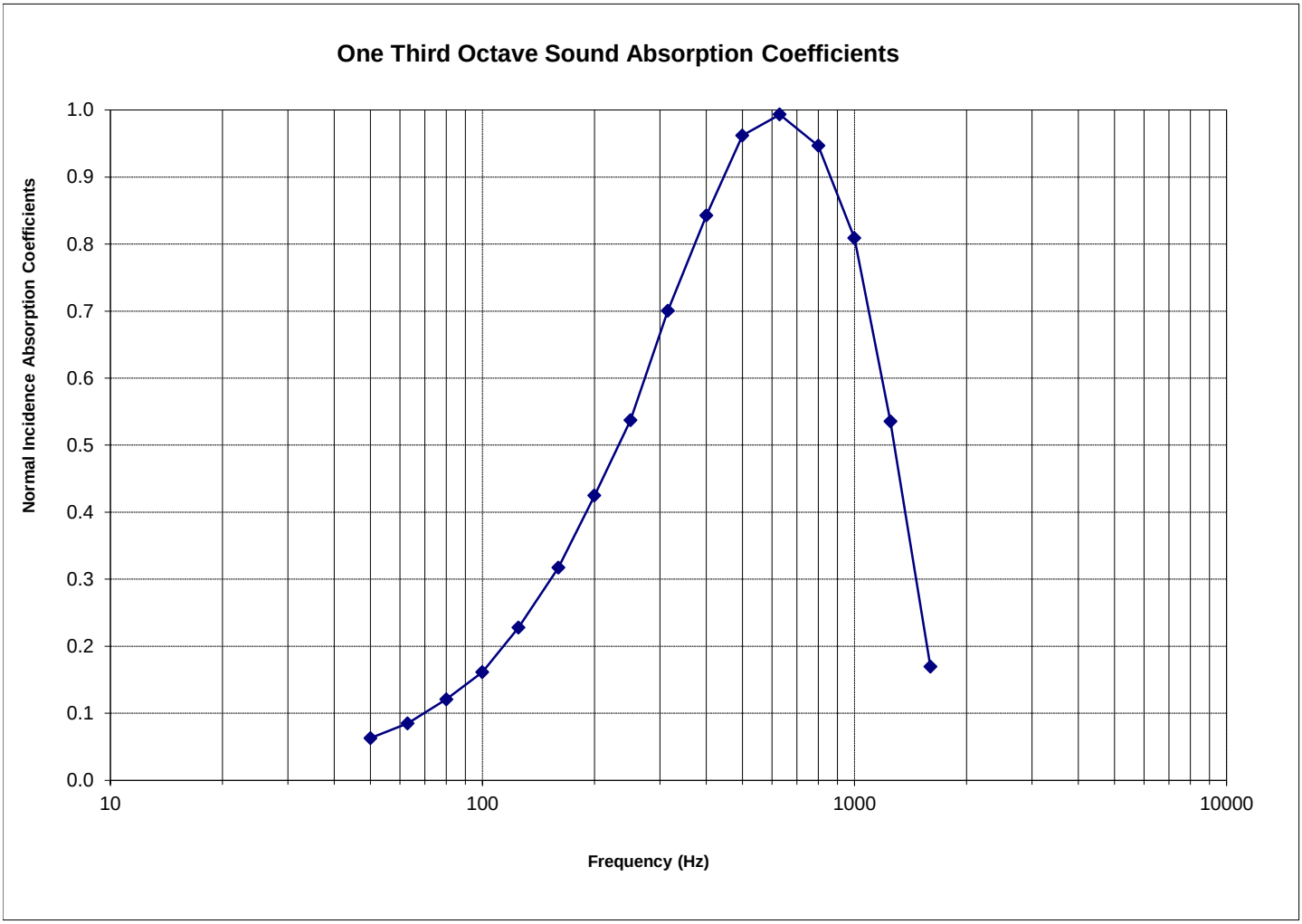
Impedance Tube Test Results

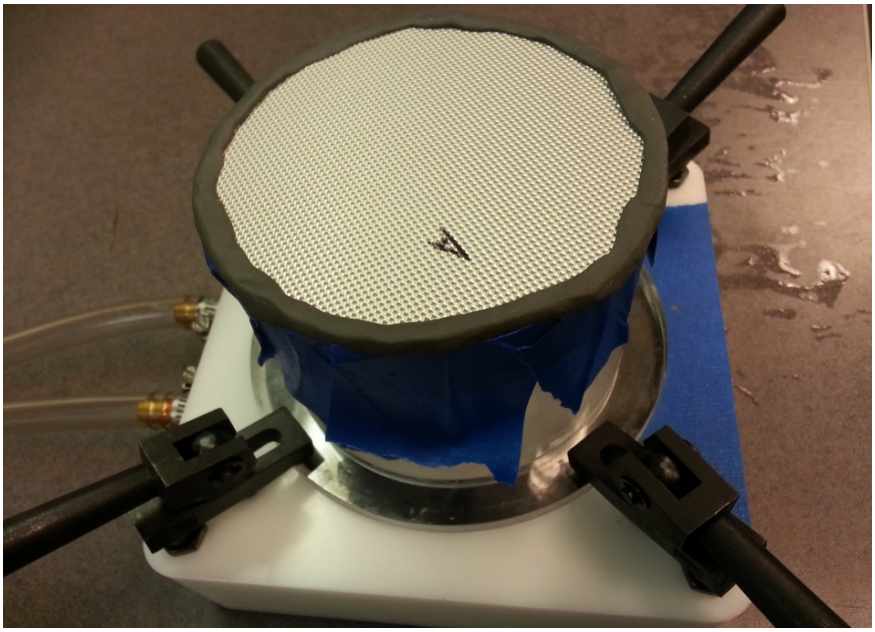
ASTM E 1050
100 mm Tube Diameter

Test Date	09/17/13
ATI No.	D1309.01A
Client	Acoustical Surfaces, Inc.
Specimen	Silk Metal Ceiling Panel
Operator	TDK
Sample Thickness	0.10 cm
Sample Density	1.97 g/cm^3

B.P. (mb)	1029
Temp C	23
RH %	39



Photographs



Sample Installed in ASTM C 522 Test Fixture

Sample Installed in ASTM E 1050 Test Fixture with 4" Air Space