



MATERIAL LOGIQ

Title: Sound Absorption Test Results

Product: Baffle - 2"T x 11"H x 12" o.c. spacing

Material: Silk Metal

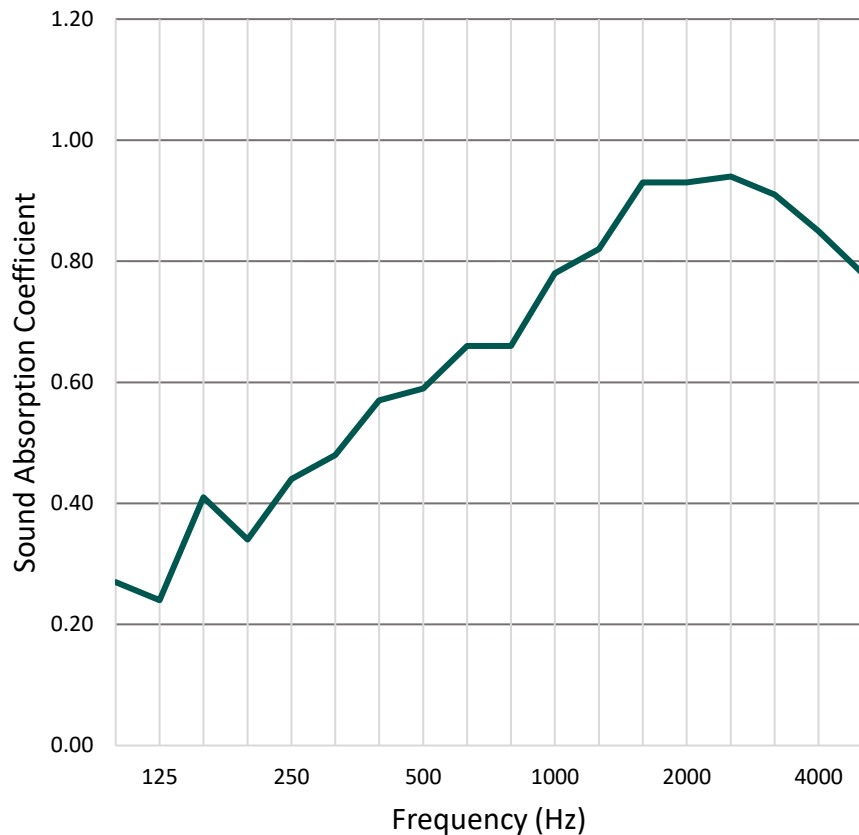
Testing Standard: ASTM C423 (J Mount)

About This Test: This test evaluates the effectiveness of a product to absorb sounds at multiple frequencies when suspended in a hanging baffle or cloud configuration.

Test Result Summary: NRC - 0.70; SAA - 0.68

NRC	SAA
0.70	0.68

Frequency (Hz)	Absorption Coefficient
100	0.27
125	0.24
160	0.41
200	0.34
250	0.44
315	0.48
400	0.57
500	0.59
630	0.66
800	0.66
1000	0.78
1250	0.82
1600	0.93
2000	0.93
2500	0.94
3150	0.91
4000	0.85
5000	0.78



Test Date: 12/15/2009

Test ID: 719166181-MEC10-01B-EMK

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SUBJECT:

Laboratory measurement of sound absorption of aluminum absorption baffles

TESTED FOR:

Rendered by Manufacturer and Released to:
ASI
123 Columbia Court N.
Chaska, MN 55318

DATE OF TEST:

15 Dec 2009

DESCRIPTION OF SAMPLE:

22 pieces of aluminium absorption panels of the following description were received for testing.

Description	:	Silk Metal Baffle System
Panel Material	:	1.0mm thick aluminium
Nominal size of each panel	:	1770mm (length) x 280mm (height) x 50mm (thickness)

The aluminium absorption panels were mounted onto a 400mm height wooden frame in the reverberation room as shown in figure 2 for sound absorption test using Type E400 mounting configuration setup.

The edges of the wooden frame were sealed with reflective aluminium tapes.

The technical drawing of the acoustics panel layout for sound absorption test and typical details of the acoustics panel were shown in the Appendix.

A handwritten signature in black ink, consisting of stylized letters.

METHOD OF TEST:

The test was conducted in accordance with ASTM C423-02a "Standard test method for sound absorption and sound absorption coefficients by the reverberation room method"

Test specimen exposed area of the 22 pieces panel (system) = 24.16m^2

Equivalent area of the test specimen = 10.8m^2

Test specimen exposed area per panel = 1.0982m^2

Temperature in reverberation room: 25°C

Relative humidity in reverberation room: 56%

Reverberation room volume: 206m^3

Location of the test: Acoustics Lab of TÜV SÜD PSB Pte Ltd

Figure 2 shows the test set-up in the reverberation room.

TEST EQUIPMENT:

The following instruments were used for the test.

- 1) Multi-channel Data Acquisition Unit (B & K Type 2816) with Pulse System
- 2) 1 unit of loudspeaker (JBL MPro MP415)
- 3) 1 set of $\frac{1}{2}$ " diffuse-field microphone (B & K Type 4943) and pre-amplifier (B & K Type 2669)
- 4) A power amplifier for speaker (Crown Model CE 1000)
- 5) A Sound Pressure Level Calibrator (Norsonic Type 1251)



TEST PROCEDURES:

- 1) Instrumentation was set up according to ASTM C423.
- 2) Measurement system was calibrated using a sound level calibrator.
- 3) Loudspeaker and microphone were placed in 2 different speaker positions with a total of 16 microphone positions.
- 4) Microphone was placed at 1m away from the test specimen, testing room and diffusers and 2m away from loudspeaker.
- 5) Measurement was conducted in 16 decays for each centre frequency of 1/3 octave band from 100Hz to 5000Hz.
- 6) Mean reverberation time was calculated based on 16 measured reverberation time for each individual frequency of 1/3 octave band from 100Hz to 5000Hz.
- 7) Step 3 to 6 were repeated after the test sample was installed in the testing room to obtain mean reverberation time for each frequency band.
- 8) Sound absorption area of the test specimen was calculated using formula

$$A = (55.3V/c) \times (1/T_2 - 1/T_1)$$

where V is the volume of the empty reverberation room, (m³)

c is the velocity of sound in air,

T₁ is the mean reverberation time of empty reverberation room, (s)

T₂ is the mean reverberation time of reverberation room with test specimen installed, (s)

- 9) Sound absorption coefficient α_s was calculated using formula, $\alpha_s = A/S$ where S is the exposed surface area of the test specimen, (m²).
- 10) Noise reduction coefficient (NRC) was the average of the sound absorption coefficient in 250Hz, 500Hz, 1000Hz, 2000Hz frequency bands.
- 11) Sound absorption average, SAA was the average of the sound absorption coefficients for the 12 1/3-octave bands from 200Hz to 2500Hz.



RESULTS:

The results of the sound absorption coefficient of the tested sample for each individual 1/3 octave band centre frequency were tabulated in Table 1.

Table 1: Sound absorption coefficients of Silk Metal Baffles System

1/3 Octave Frequency (Hz)	Test Results				
	Silk Metal Baffles System (Type E400 mounting)				
	Sound Absorption Coefficient, α_s			Uncertainty	
100	0.27	0.31	±	0.05	
125	0.24		±	0.03	
160	0.41		±	0.05	
200	0.34	0.42	±	0.03	
250	0.44		±	0.06	
315	0.48		±	0.04	
400	0.57	0.61	±	0.04	
500	0.59		±	0.04	
630	0.66		±	0.04	
800	0.66	0.75	±	0.02	
1000	0.78		±	0.04	
1250	0.82		±	0.03	
1600	0.93	0.93	±	0.03	
2000	0.93		±	0.03	
2500	0.94		±	0.03	
3150	0.91	0.85	±	0.02	
4000	0.85		±	0.02	
5000	0.78		±	0.02	
Noise Reduction Coefficient, NRC	0.70				
Sound Absorption Average, SAA (200Hz - 2500Hz)	0.68				

Remark : The values of sound absorption coefficient for 1/3 octave frequency bands were plotted in as shown in Figure 1.



RESULTS:

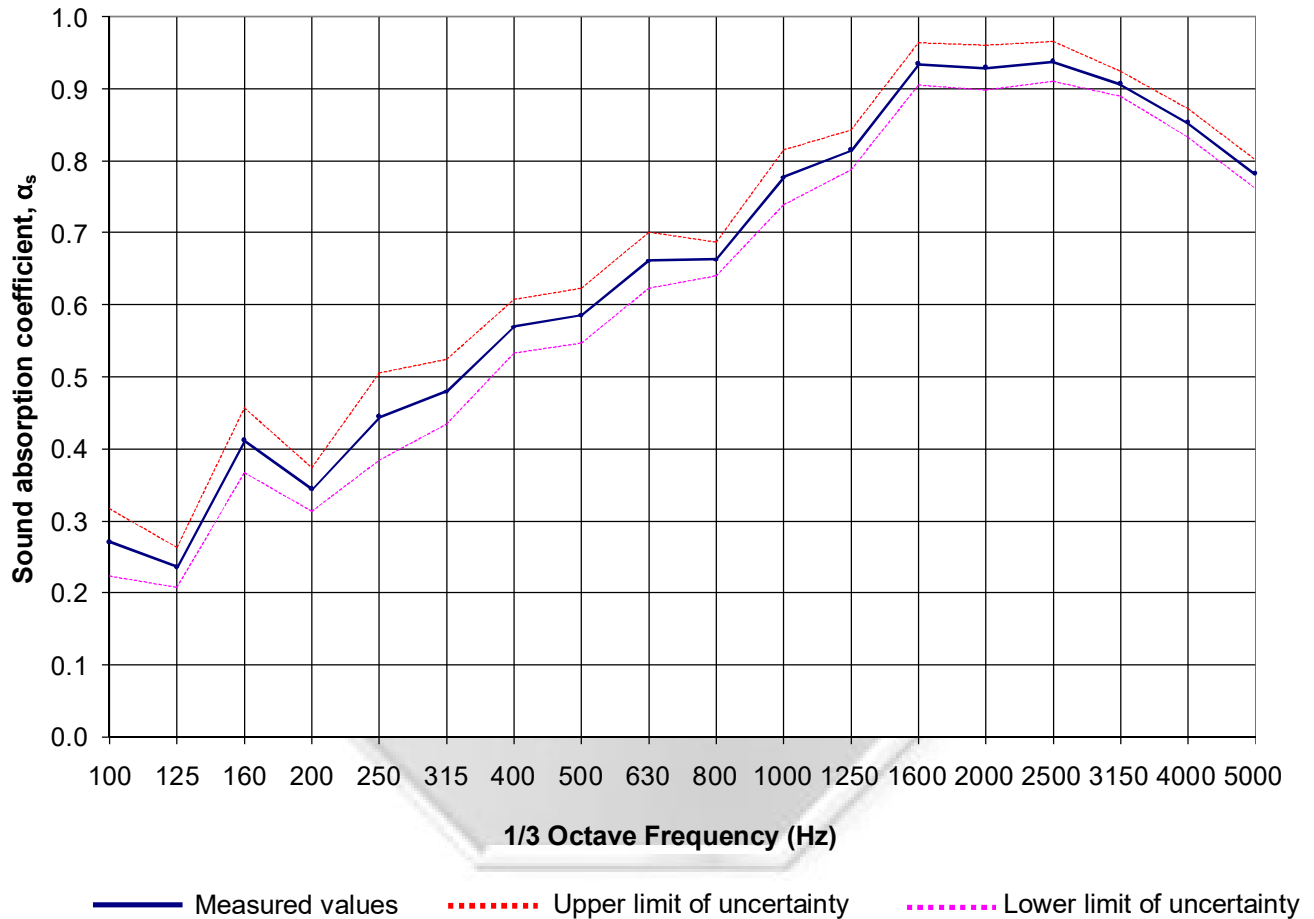
Table 2 (cont'd): Sound absorption parameters of Silk Metal Baffles System

1/3 Octave Frequency (Hz)	Sound Absorption Area of 22 pieces panel system (m ²)	Sound Absorption Area per panel (m ²)	Sound Absorption per panel unit length (m) (Length = 1.77m)
100	2.92	0.13	0.07
125	2.54	0.12	0.07
160	4.45	0.20	0.11
200	3.71	0.17	0.10
250	4.80	0.22	0.12
315	5.18	0.24	0.13
400	6.16	0.28	0.16
500	6.32	0.29	0.16
630	7.15	0.32	0.18
800	7.17	0.33	0.18
1000	8.40	0.38	0.22
1250	8.81	0.40	0.23
1600	10.09	0.46	0.26
2000	10.04	0.46	0.26
2500	10.14	0.46	0.26
3150	9.80	0.45	0.25
4000	9.21	0.42	0.24
5000	8.45	0.38	0.22

Remarks: These values depend on the test configuration,(see Fig 2).

RESULTS:

**Figure 1 : Sound absorption performance of Silk Metal Baffles System NRC 0.7
(Type E400 mounting)**




Ee Min Kuen
Testing Officer

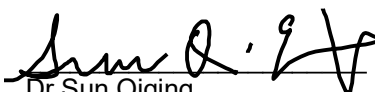

Dr Sun Qiqing
Assistant Vice President
Building and Acoustics
Mechanical Centre



Figure 2 : Aluminum absorption panel setup in reverberation room



Figure 3 : Silk Metal 1.0mm Aluminum Absorption Baffle Panel



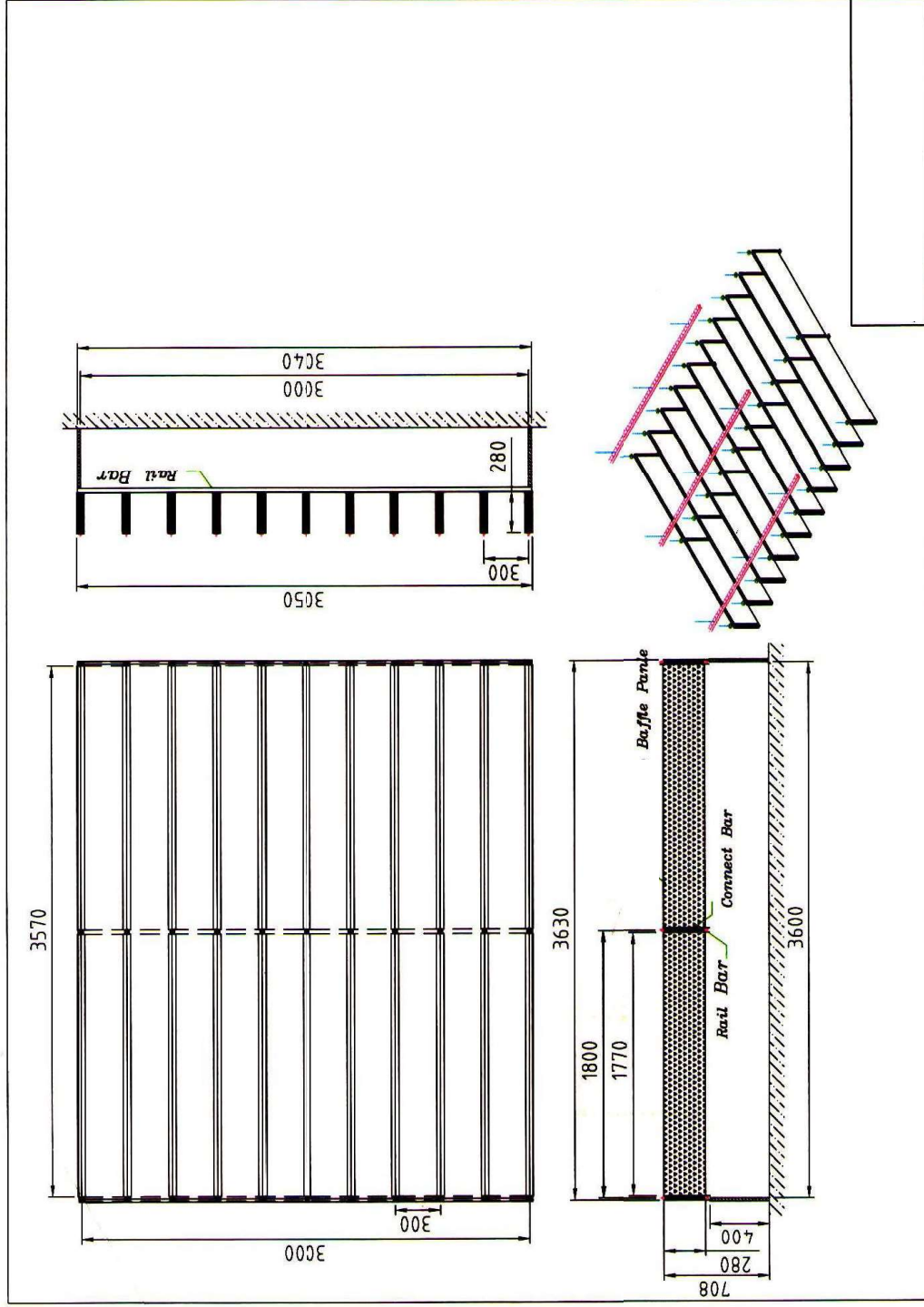


Figure 4 : Technical Drawing

Handwritten signature



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March 2009