Mountain Technical Center

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Acoustical Testing of Merrick Panel Sound Absorber

for

Merrick and Company
2450 South Peoria St.
Aurora, CO 80014

ref. Merrick P.O. 36222

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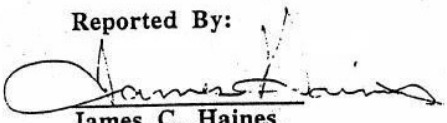

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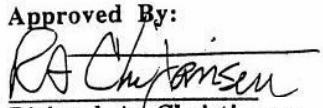

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INTRODUCTION

Measurements were made to determine the ASTM C423, random incidence sound absorption properties of a 48 square foot specimen of a sound absorbing panel system submitted by Merrick and Company of Aurora, Colorado. Supplementary measurements were made to determine if the absorbing panels evidenced audible resonances or "buzzing" when acoustically excited with high intensity, low frequency noise.

The sound absorption of the test panel was found to be exceptionally high with a Noise Reduction Coefficient or "NRC" of 1.10. The panel system was found not to evidence any audible resonances or "buzzing" when excited with sine wave signals of from 20 Hz. to 250 Hz. at a sound pressure level of approximately 120 dB.

TEST SPECIMEN

The test specimen consisted of four replicate panels measuring 41-1/2 inches by 41-1/2 inches with a thickness of 6-1/2 inches. The panels had a rectangular, 7 x 7 array of circular shaped, 2-3/8 inch diameter "ports" installed on one side. The ports were formed with a proprietary geometry "nozzle" shape thus providing access to the interior of the panel. The opposite side of the panels were formed of solid, sheet metal. The panel sides and the panel front surfaces not covered with ports were faced with a gray colored, woven fabric. Each panel weighed 98 pounds.

SOUND ABSORPTION TEST METHOD

Testing was conducted in accordance with the procedure described in ASTM C423-90a. Measurements were made at the 1/3 octave bands with center frequencies of from 100 to 5000 Hz.

The panels were tested in a 2 x 2 array and were placed directly on the laboratory floor as shown in Photograph "A" attached to this report. This mounting corresponds to the type "A" mounting as described in ASTM E795-93. No effort was made to cover the exposed vertical edges of the specimens as these surfaces were judged to be of very low sound absorption.

It should be pointed out that the ASTM C423 method specifies that the "..customary and strongly recommended..." sample area be 72 square feet and that "an area less than 48 square feet shall not be used" Thus, the sample tested under this program represents the lower limit of acceptable test specimen area under the current C423 method. It can be expected that the effects of sound diffraction on the measured sound absorption coefficients will be greater for this 48 square foot specimen than would be expected for a 72 square foot specimen. Unfortunately, the effects of diffraction are not completely understood to the degree that adjustments for sample area can be made with confidence. Accordingly, no such adjustments have been made to the results reported herein. This should be kept in mind when comparing the results measured for this test specimen with results measured for materials tested using a larger specimen area.

The Mountain Technical Center is currently accredited to perform the ASTM C423 test under the National Institute for Standards and Technology, National Voluntary Laboratory Accreditation Program (NVLAP.)

SOUND ABSORPTION TEST RESULTS

The detailed test results including the measured sound absorption coefficients as well as the 95 percent confidence limits on the measured coefficients are included in the attached copy of MTC sound absorption test F296E93 dated 11/4/94. These results are also shown graphically in the attached Graph 1.

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RESONANCE TEST METHOD

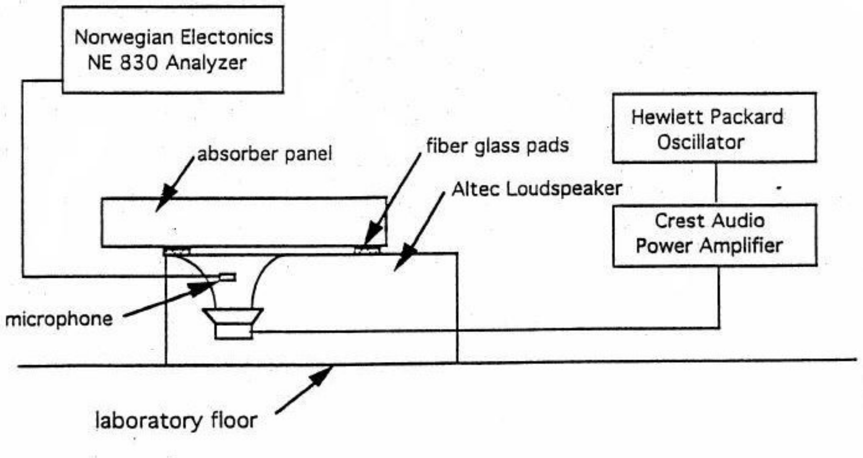
To the best of our knowledge, a standardized test method for the determination of audible panel resonance's with acoustic excitation does not exist at this time. The following method was devised to provide an initial indication of such resonances.

An Altec Model N501-8A, "Voice-of-the Theater" loudspeaker was used as the source of acoustic excitation for this study. The loudspeaker was placed on the floor of the MTC Acoustical laboratory control room and was connected to a sine wave source and amplifier as shown in Figure 1 below. A Bruel and Kjaer 1 inch condenser microphone was placed within the cone loudspeaker outlet as shown in Figure 1. The microphone was connected to a Norwegian Electronics type NE830, one-third octave band analyzer.

A single, 41-1/2 inch by 41-1/2 inch absorber panel was placed over the loudspeaker with the absorber "ports" facing downward towards the loudspeaker cone as shown in Figure 1. Four, one inch thick, 2 pcf fiber glass discs measuring 4 inches in diameter were placed between the loudspeaker and the absorber panel to vibration isolate the absorber panel from the source.

A sine wave test signal from a Hewlett Packard type 3325A digital function generator was applied to the loudspeaker voice coil through a Crest Audio type LA601 power amplifier. The frequency of the oscillator was slowly swept over the range of 20 Hz. to 250 Hz. while the sound pressure level within the speaker compartment was maintained at 120 ± 1 dB. Two technicians were stationed at the absorber panel to detect any audible buzzing or resonances which might occur as the test signal was slowly changed in frequency.

Figure 1
Resonance Test Set Up



RESONANCE TEST RESULTS

No audible resonances or "buzzing" could be detected during the process of repeatedly sweeping the test signal over the frequency range of 20 to 250 Hz. at a sound pressure level of 120 ± 1 dB.

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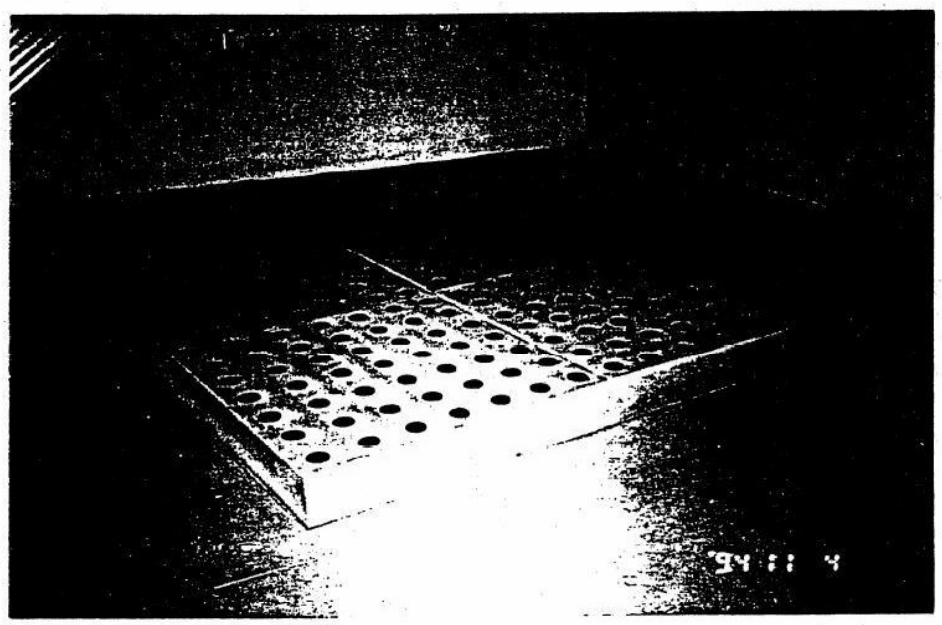
Figure 1
Merrick sound absorber panels installed for
ASTM C423 sound absorption test



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MOUNTAIN TECHNICAL CENTER
ACOUSTICAL LABORATORIES
ASTM C-423 SOUND ABSORPTION TEST

TEST NO.: F296E93

FULL ROOM TEST NO.: 296 TEMP 70 HUMIDITY 65
FULL ROOM TEST DATE: 11/4/94
EMPTY ROOM TEST NO.: 93 TEMP 70 HUMIDITY 65
EMPTY ROOM TEST DATE: 11/4/94
SAMPLE I.D.: 110494_2

DESCRIPTION: MERRICK PANELS TYPE A MOUNT

SAMPLE AREA : 47.84 sq ft

CH. NO.	FREQ. Hz.	FULL ABS. SABINS	95% UNCT'Y SABINS	EMPTY ABS. SABINS	95% UNCT'Y SABINS	ABS. COEF (SABINS/SQ. FT)	95% UNCT'Y
20	100	129.7	3.5	77.7	2.4	1.09	.09
21	125	138.8	6.9	79.8	2.1	1.25	.15
22	160	147.2	3.7	85.5	1.7	1.29	.09
23	200	143.0	2.7	79.0	1.4	1.34	.06
24	250	139.8	2.5	82.6	1.1	1.20	.06
25	315	129.4	1.7	72.3	.7	1.19	.04
26	400	126.3	.9	73.6	.8	1.10	.03
27	500	126.0	1.0	72.7	.5	1.11	.02
28	630	126.7	.6	74.6	.5	1.09	.02
29	800	129.9	1.0	78.9	.4	1.07	.02
30	1000	133.3	.8	82.1	.5	1.07	.02
31	1250	135.5	1.1	86.0	.4	1.03	.02
32	1600	145.3	.7	95.1	.5	1.05	.02
33	2000	157.5	.9	108.6	.4	1.02	.02
34	2500	167.1	.7	119.2	.5	1.00	.02
35	3150	180.9	1.3	132.2	.6	1.02	.03
36	4000	209.3	1.2	159.0	.4	1.05	.03
37	5000	241.0	2.3	192.5	1.3	1.01	.06

NOTE: UNDERLINED VALUES ARE FOR NRC DETERMINING FREQUENCIES

NRC=1.10

EXACT NRC= 1.100

95% UNCERTAINTY IN NRC= .070

Graph 1
ASTM C423 random incidence sound absorption for 48 square foot specimen of Merrick sound absorbing panel