

**ACOUSTIC SYSTEMS
ACOUSTICAL RESEARCH FACILITY
OFFICIAL LABORATORY REPORT
AS-TL1734**

Subject: **Sound Transmission Loss Test**

Date: November 1, 2000

Contents: Transmission Loss Data, One-third Octave Brands
 Transmission Loss Data, Octave Brand
 Sound Transmission Class Rating
 Outdoor / Indoor Transmission Class Rating

on

**ArmorCore Level 4 Bullet-Resistant Fiberglass Panels (Thickness 1-3/8")
Butt Jointed with Batten Strip, Mechanically Attached**

For

Waco Composites, Inc.

**ACOUSTIC SYSTEMS ACOUSTICAL RESEARCH FACILITY is
NVLAP-Accredited for this and other test procedures.**

INTRODUCTION

The transmission Loss of a partition in a specified frequency band is defined as ten times the common logarithm of the airborne sound power incident on the partition to the sound power transmitted by the partition and radiated on the other side. The quantity so obtained is expressed in decibels.

APPLICABLE STANDARDS

ASTM E 90-97, "Standard Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions"

ASTM E 413-87, "Classification for Sound Insulation Rating"

ASTM E 1332-90, "Classification for Determination of Outdoor-Indoor Transmission Class"

SPECIMEN DESCRIPTION

The test specimen was comprised of two (2) composite panels and one (1) batten strip, all of the same composition. Each composite panel had the dimensions of 1219 mm in width by 2438 mm in height by 35 mm in thickness [*48 by 96 by 1-3/8 inches*]. They were butted together along the long dimension and secured with a 102 mm in width by 2438 mm in height by 35 mm in thickness [*4 by 96 by 1-3/8 inches*] batten strip on the Receive Room side of the specimen. The batten strip joined the two (2) composite panels together using pairs of sheet metal screws spaced nominally 305 mm [*12 inches*] on center along the long dimension of the specimen.

The test specimen was designed, manufactured, submitted for test, and designated "ArmorCore Level 4 Bullet-Resistant Fiberglass Panels (Thickness 1-3/8") Butt Jointed with Batten Strip, Mechanically Attached" by Waco Composites, Inc. of Waco, TX. Each component of specimen of the specimen was constructed with multiple plies of woven roving fiberglass impregnated with a thermoset polyester resin. The unit was then hydraulically pressed to its final thickness using 1.4×10^7 Pa [*2000 pounds per square inch*]. The test specimen was fully cured at the time of testing.

The total weight of the test specimen was measured to be 449.5 kg [*990 pounds*].

TEST SPECIMEN MOUNTING

The specimen was mounted in the 2440 mm by 2440 mm transmission loss test opening. The perimeter of the specimen was sealed to the edge of the test aperture with dense mastic putty and metal battens. The calculated transmission loss of the test assembly was adjusted to account for sound power transmitted through the facility boundaries.

DESCRIPTION OF TEST

Two (2) loudspeakers in a 200 cubic meter reverberation chamber, designated as the "Source Room", produced broadband pink noise. A 254 cubic meter reverberation chamber, designated as the "Receive Room", is coupled to the Source Room through the transmission loss opening. The steady-state space-time average sound pressure levels in the Source and Receive Room were determined using rotating microphone booms and a Norsonic NI-830 Dual Channel Real Time Analyzer. Sound absorption in the Receive Room was determined by reverberation time measurements. The precision of the resulting

calculated Sound Transmission Loss varies with frequency band and is included in the Data Table that follows. The test was performed in accordance with ASTM E90-97 except where discussed. This test took place at ACOUSTIC SYSTEMS ACOUSTICAL RESEARCH FACILITY, Austin, Texas, on October 5, 2000.

TRANSMISSION LOSS DATA

The Sound Transmission Loss of the test specimen at the preferred one-third octave band center frequencies is tabulated below and then presented graphically. Octave-band Transmission Loss values are calculated as described in Section 12.4 of ASTM E90-97.

**Waco Composites Inc. – ArmorCore Level 4 Bullet Resistant Fiberglass Panels
(Thickness 1-3/8’’)
Butt Joined with Batten Strips, Mechanically Attached**

1/3 Octave Band Center Freq.(Hz)	Transmission Loss	Uncertainty (+/- dB)	Notes	Octave Band TL (dB)	STC Deficiencies
50	26		[d][g]		
63	30		[d][g]	28	
80	29	1.7	[g]		
100	27	1.9			
125	33	2.6		29	
160	32	1.6			
200	32	0.7			
250	34	0.9		34	
315	35	0.6			
400	34	0.6			
500	33	0.5		34	2
630	34	0.4			2
800	36	0.5			1
1000	38	0.4		37	
1250	38	0.3			1
1600	35	0.2			4
2000	34	0.3		35	5
2500	37	0.3			2
3150	37	0.2			2
4000	36	0.2		37	3
5000	37	0.3			
6300	34	0.4			
8000	35	0.5		35	
10000	37	0.8			
STC	35				
OITC	34				

Note: Reverberation times are calculated based on the first 15dB of decay including an initial 5 dB drop. Acoustic Systems maintains in its files quality assurance documentation indicating the result and uncertainty are consistent with calculation method of Section 11.4.1 of ASTM E90-97. [a]: Receive room SPL corrected for background noise; [b]: Receive room SPL too close to ambient. Correction of 2 dB applied and result represents lower bound for TL in this band; [c]: Correction made for flanking transmission; [d]: Transmission Loss of specimen too close to facility limit. No facility correction applied and result represents lower bound for TL in this band; [e]: Transmission Loss of Specimen too close to filler wall. Result represents lower bound for TL in this band; [f]: Insufficient precision to meet requirements of Section A.2.2 of ASTM E90-97; [g]: An insufficient number of statistically independent samples are available in the band to determine precision.

During the test, environmental conditions in the Receive Room were 24.7C with 68.5% relative humidity. Conditions in the Source Room were 23.1C with 63.9% relative humidity. The precision values [\pm] tabulated above represent 95% probability that the true mean value lies within the stated range.

Respectfully Submitted,

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Waco Composites, Inc. ArmorCore Level 4 Bullet-Resistant Fiberglass Panels (Thickness 1-3/8") Butt Joined with Batten Strip, Mechanically Attached AS-TL 1734; STC 35 OITC 34

