

1 April 2011

**Committee E33 on Building and Environmental Acoustics
Subcommittee E33.03 on Sound Transmission**

Research Report E33-1013

**Interlaboratory Study to Establish Precision Statements for ASTM
E1414-11, Airborne Sound Attenuation between Rooms Sharing a
Common Ceiling Plenum**

Technical contact:

Robert Hallman,
Armstrong World Industries
2500 Columbia Avenue
PO Box 3001
Lancaster, PA 17604
US
robert_a_hallman@armstrong.com

ASTM International
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959

1. Introduction:

Interlaboratory Study 176 was conducted to establish a precision statement for E1414, Airborne Sound Attenuation between Rooms Sharing a Common Ceiling Plenum.

2. Test Method:

The Test Method used for this ILS is E1414-06. To obtain a copy of E1414, go to ASTM's website, www.astm.org, or contact ASTM Customer Service by phone at **610-832-9585** (8:30 a.m. - 4:30 p.m. Eastern U.S. Standard Time, Monday through Friday) or by email at service@astm.org.

3. Participating Laboratories:

The following laboratories participated in this interlaboratory study

1. Armstrong Acoustics Laboratory
PO Box 3001
2500 Columbia Avenue
Lancaster, PA
17552
US
Mr. Robert Hallman
(717) 396-6225
rahallman@armstrong.com

2. Johns Manville Technical Center
10100 W Ute Ave
LITTLETON, CO
80127
US
Mr. Jamie Kemp
303-978-3024
babineau@jm.com

3. NGC Testing Services
1650 Military Road
BUFFALO, NY
14217
US
Mr. Robert Menchetti
716-873-9750
rjmenchetti@ngctestingservices.com

4. USG Corporate Innovation Center
700 N Highway 45
LIBERTYVILLE, IL
60048
US
Ms. Erin Dugan
847-970-5222
spayne@usg.com

4. Description of Samples:

There were 2 samples of varying targeted results used for this study. Each sample was prepared and distributed by Robert Hallman of Armstrong World Industries. Below is a list of the samples with the corresponding supplier:

1. Glass Fiber Specimen
Provided by Armstrong World Industries
2. Mineral Fiber Specimen
Provided by the USG Corporate Innovation Center

The suspension system was provided by Chicago Metallic.

5. Interlaboratory Study Instructions

Laboratory participants were emailed the test program instructions. For a copy of the instructions, please see Annex A.

6. Description of Equipment/Apparatus¹:

For information on the equipment/apparatus used by each laboratory, please see Annex B.

7. Data Report Forms:

Each laboratory was provided with a data report form for the collection of data. A copy of the data is provided in Annex C.

Please note: The laboratories have been randomly coded and cannot be identified herein.

8. Statistical Data Summary:

A summary of the statistics calculated from the data returned by the participating laboratories is provided in Annex D.

9. Precision and Bias Statement:

9.1 The precision of this test method is based on an interlaboratory study of ASTM E1414 - 06 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum, conducted in 2009. Each of four laboratories tested two different ceiling materials (mineral fiber and glass fiber). Every “test result” represents an individual determination, and all participants reported triplicate test results. Except for the limited number of laboratories participating, and materials tested, Practice E 691 was followed for the design and analysis of the data; the details are given in ASTM Research Report No. E33-1013.¹

9.1.1 *Repeatability limit (r)* - Two test results obtained within one laboratory shall be judged not equivalent if they differ by more than the “*r*” value for that material; “*r*” is the interval representing the critical difference between two test results for the same material, obtained by the same operator using the same equipment on the same day in the same laboratory.

9.1.1.1 Repeatability limits are listed in Tables 1 -2 below.

9.1.2 *Reproducibility limit (R)* - Two test results shall be judged not equivalent if they differ by more than the “*R*” value for that material; “*R*”

¹ The equipment listed was used to develop a precision statement for E1414-11. This listing is not an endorsement or certification by ASTM International.

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is the interval representing the critical difference between two test results for the same material, obtained by different operators using different equipment in different laboratories.

9.1.2.1 Reproducibility limits are listed in Tables 1 - 2 below.

9.1.3 The above terms (repeatability limit and reproducibility limit) are used as specified in Practice E 177.

9.1.4 Any judgment in accordance with statements 9.1.1 and 9.1.2 would normally have an approximate 95% probability of being correct, however the precision statistics obtained in this ILS must not be treated as exact mathematical quantities which are applicable to all circumstances and uses. The limited number of materials tested and laboratories reporting results guarantees that there will be times when differences greater than predicted by the ILS results will arise, sometimes with considerably greater or smaller frequency than the 95% probability limit would imply. Consider the repeatability limit and the reproducibility limit as general guides, and the associated probability of 95% as only a rough indicator of what can be expected.

Table 1. Mineral Fiber Results

Frequency	Average ⁱⁱ D_{nc}	Repeatability Standard Deviation	Reproducibility Standard Deviation	Repeatability Limit	Reproducibility Limit
Hz	\bar{x}	s_r	s_R	r	R
125	21.74	1.92	4.35	5.39	12.17
400	25.19	0.98	3.45	2.73	9.67
200	26.68	0.43	4.31	1.23	12.08
200	27.02	0.48	2.23	1.31	6.26
315	26.5	0.46	3.41	1.23	9.56
400	29.87	0.5	1.78	1.01	4.99
800	31.55	0.7	2.13	1.95	5.96
630	33.25	0.42	2.96	1.18	8.3
800	36.62	0.43	2.53	1.01	7.09
1600	40.42	0.61	1.73	1.7	4.97
1250	44.31	0.56	1.24	1.58	3.48
1600	47.26	0.43	0.55	1.2	1.53
2000	48.81	0.74	2.57	2.08	7.09
2500	51.11	0.36	2.36	1.01	6.6
3150	52.76	0.47	1.69	1.31	4.75
4000	53.73	0.77	2.06	2.15	5.77
CAC	36.8	0.4	2.7	1.1	7.4