[GK2011-0374E]

TEST REPORT

ON

Laboratory measurement of sound absorption coefficients of

Polyester(T-board) 9 ㎜

OF

HUEINTEK. INC

FIRE INSURERS LABORATORIES OF KOREA

69-1 Shimsuk-Ri, Ganam-Myeon, Yeoju-Gun, Gyeonggi-Do, 469-881, Korea
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FORWARD

This report was prepared under a contract between HUEINTEK. INC and Fire Insurers Laboratories of Korea(FILK).

This test was intended to determine the sound absorption coefficients of the specimen, supplied by HUEINTEK. INC

The test result is applied only to the test specimen submitted by HUEINTEK. INC and this should not be used in a commercial advertisement, a suit and other legal requirements.

March 9, 2012

Approved by :

Seo, Jang Duck
Executive Director of FILK

※ The laboratory is accredited for the above tests by Korea Laboratory Accreditation Scheme(KOLAS), which is a signatory to the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement(MRA).

T-MAX
Hueintek, Inc. Environmentally Friendly Polyester Acoustic Insulation T-MAX
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1. SUMMARY

1.1 Name of test : Measurements of sound absorption coefficients in accordance with KS F 2805 : 2009.

1.2 Applicant : Moon Sung Sik, the president of HUEINTEK. INC
#621-18, Noha-Ri, Paltan-Myun, Hwaseong-Si, Gyunggi-Do, Korea.

1.3 Manufacturer : HUEINTEK. INC

1.4 Test specimen : Polyester(T-board) 9 ㎜

1.5 Spec. Drawing : Refer to Appendix 1.

1.6 Test Standard : KS F 2805 : 2009(Measurement of sound absorption in a reverberation room)

1.7 Test Result : The single-number rating(NRC) for the sound absorption coefficients of the specimen was shown in **Table 2.**

2. PURPOSE OF THE TEST

The purpose of the test was to determine the sound absorption coefficients and noise reduction coefficient(NRC) of the specimen through the acoustic test in condition of its type, density and thickness as described in this report.

3. OUTLINE OF THE TEST

3.1 This test method covers the measurement of sound absorption in a reverberation room by measuring decay rate. Procedures for measuring the absorption of a room, the absorption of an object and the sound absorption coefficients of a specimen.

3.2 Measurements were repeated 20 times at 5 positions of microphone in the reverberation room and with reported values,' α 'of each frequency were calculated in accordance with KS F 2805 : 2009.

3.3 A single number rating, called the noise reduction coefficient(NRC) was calculated through rounding the average of absorption coefficients for 250, 500, 1000 and 2000 Hz.

Date tested : Febraury 7, 2012 Report issued : March 9, 2010

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4. CONSTRUCTION OF THE TEST SPECIMEN

4.1 The test specimen consisted of MEGAPLAN panel (Sound absorption tile) 66 ㎜, supplied and constructed by Fursys as shown in **Table 1**.(See Appendix 1, 2.)

〈Table 1〉 Material components and arrange of the specimens

Test Specimen	Material components
Polyester (T-board) 9 ㎜	- Unit size : 1 000 ㎜ × 2 000 ㎜ × 9 ㎜ - Composed materials : Polyester(T-board) 9 ㎜

4.2 The details of the specimen was shown in appendix 1.

5. TEST PROCEDURE

5.1 INSTALLATION OF THE TEST SPECIMEN

The specimen was installed on the reverberation room floor as shown in Appendix 1, 2. The area of the specimen was 13.6 ㎡.

5.2 MEASUREMENT OF THE REVERBERATION TIME

The reverberation time of the room with and without the specimen were measured respectively, at 5 microphone points in reverberation room.

The microphone positions were located in the reverberation room with distance of not less than 2 m from sound source and 1.5 m from other measuring positions, and the distance between the specimen and wall boundary was 1 m at least.

5.3 EQUIVALENT SOUND ABSORPTION AREA OF THE EMPTY REVERBERATION ROOM

The equivalent sound absorption area of the empty reverberation room, A_1(㎡) were calculated by given equation (1) as follows

$$A_1 = \frac{55.3V}{cT_1} - 4Vm_1 \quad \text{---------- (1)}$$

where V : Volume of the empty reverberation room(㎥)

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c : Propagation speed of sound in air(c = 331+0.6 t/℃, m/s)
T_1 : Reverberation time of the empty reverberation room(sec)
m_1 : Power attenuation coefficient in the empty reverberation room(m^{-1})
(m = α/10log(e), α : sound absorption coefficient in the atmospheric pressure)

5.4 EQUIVALENT SOUND ABSORPTION AREA OF THE REVERBERATION ROOM WITH THE TEST SPECIMEN

The equivalent sound absorption area of the reverberation room with the test specimen, A_2(㎡) were calculated by given equation (2) as follows

$$A_2 = \frac{55.3V}{cT_2} - 4Vm_2 \quad \text{---------- (2)}$$

where T_2 : Reverberation time of the empty reverberation room(sec)
m_2 : Power attenuation coefficient in the reverberation room with the test specimen(m^{-1})
(m = α/10log(e), α : sound absorption coefficient in the atmospheric pressure)

5.5 EQUIVALENT SOUND ABSORPTION AREA OF THE TEST SPECIMEN

The equivalent sound absorption area of the test specimen, A_T(㎡) were calculated by given equation (3) as follows

$$A_T = A_2 - A_1 = 55.3V\left(\frac{1}{c_2T_2} - \frac{1}{c_1T_1}\right) - 4V(m_2 - m_1) \quad \text{--------- (3)}$$

where c_1 : Propagation speed of sound in air at the temperature t_1(m/s)
c_2 : Propagation speed of sound in air at the temperature t_2(m/s)

5.6 SOUND ABSORPTION COEFFICIENT

The sound absorption coefficient, α_s, of a plane absorber or a specified array of test objects were calculated by given equation (4) as follows

$$\alpha_s = \frac{A_T}{S} \quad \text{---------- (4)}$$

where A_T : Equivalent sound absorption area of the test specimen(㎡)
S : Area covered by the test specimen(㎡)

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5.7 FREQUENCY RANGE OF MEASUREMENTS

From 100 ㎐ to 5000 ㎐. (Defined as one-third octave band)

5.8 MEASURING POSITION AND REPEAT

5.8.1 Measuring position : See appendix 3.

5.8.2 Measuring position times : Total 20 times.(At 5 points in the reverberation room)

6. TEST FACILITY

6.1 TEST ROOM

The structure of the test room is made of reinforced concrete in thickness of 300 ㎜. The shape of the reverberation room is irregular polyhedrons and the volume is 200 ㎥ with seven faces.

6.2 TEST INSTRUMENT

6.2.1 SOUND SOURCE

- Broad band noise with amplifier and loudspeaker.
- Instrument model : B&K 4296 made in Denmark.

6.2.2 MICROPHONE

- Omni-directional microphone.
- Instrument model : B&K 4942, 4943 made in Denmark.

6.2.3 SOUND LEVEL ANALYSER

- Real-time frequency analyser.
- Instrument model : B&K PULSE made in Denmark.

7. TEST RESULTS

7.1 The test was carried out for the specimen in accordance with test method specified in KS F 2805 : 2009.

7.2 As the results of the tests, the sound absorption coefficients(α) and NRC of the specimen was evaluated as shown in **table 2**.

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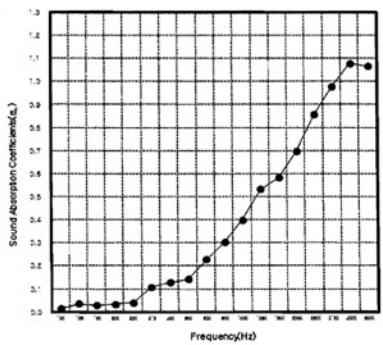
〈Table 2〉 TEST RESULTS

Test method	KS F 2805	Date tested	Febraury 7, 2012
Test specimen	Polyester(T-board) 9 ㎜	Condition	Temperature : (10 ± 1) ℃ Humidity : (50 ± 5) %RH

Frequency (Hz)	Sound absorption coefficients(α)
100	0.01
125	0.04
160	0.03
200	0.03
250	0.04
315	0.11
400	0.13
500	0.14
630	0.23
800	0.30
1 000	0.40
1 250	0.53
1 600	0.58
2 000	0.70
2 500	0.86
3 150	0.98
4 000	1.08
5 000	1.07
NRC	**0.32**

※ MEASURED GRAPH



- Unit size : 1 000 ㎜ × 2 000 ㎜ × 9 ㎜
- Composed materials : Polyester(T-board) 9 ㎜

Tested and Reported by :

Kim Jeonguk
Research Engineer
Construction materials &
Environmental Team

Reviewed by :

Jeong Jaegun
Team Leader
Construction materials &
Environmental Team

FPD03-02C(0)

210×297㎜

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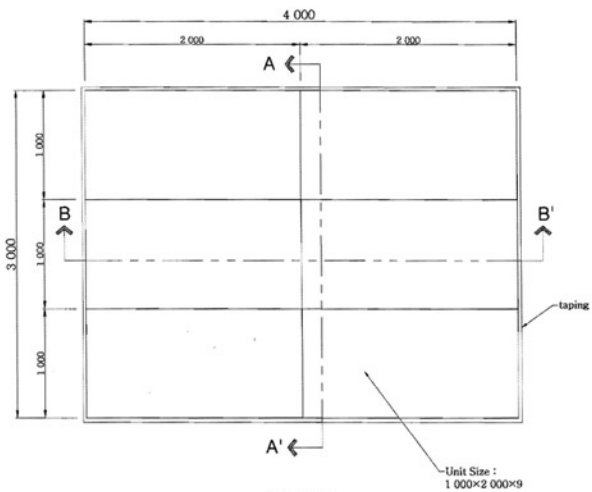
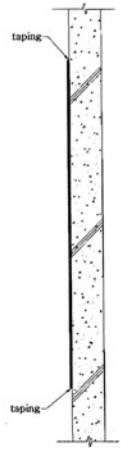
APPENDIX 1. **DRAWING OF THE TEST SPECIMEN**

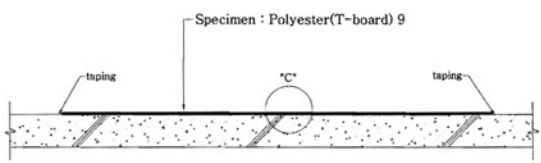
(Dimension : ㎜)



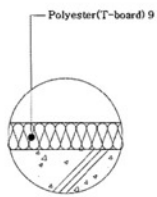
PLAN



A-A' Section



B-B' Section



"C" Detail

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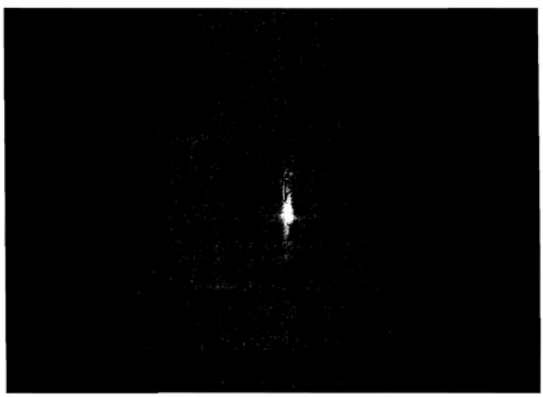
APPENDIX 2. **PHOTOGRAPHS**

[PHOTO 1] Test specimen arranged in reverberation room



[PHOTO 2] Detail of the test specimen arrangement

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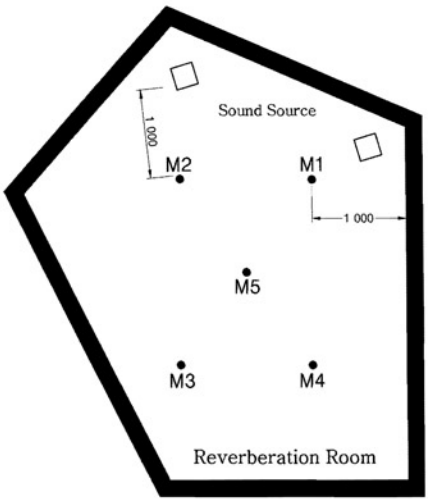
APPENDIX 3. **LAYOUT OF THE TEST FACILITY**



* M1, M2, M3, M4, M5 : Microphone position (Measuring point)

* Height of each receiving point of microphone position is 1.5 m.

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