

HEADSHIP OF TSE TEST and CALIBRATION CENTER
CONSTRUCTION MATERIALS FIRE AND ACOUSTICS LABORATORY
DIRECTORATE

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TEST REPORT

Institution of Request: KONYA CERTIFICATION OFFICE

Customer: CAG ENGINEERING ARCHITECTURE CO. FEVZI CAKMAK MH. 10615 SK.
NO:7 D:1 KARATAY/KONYA

Order Date / Number: 04 May 2018 / 213742

Description of the Sample: 405737, Loose Form Cellulose Insulation (LFCI) Material, CelluBOR,
12.00 square meter

Test Item Receive Date: 04 May 2018

Date of Test: 07 May 2018 – 17 May 2018

Applied Standard/Method: TS EN ISO 354:2007-02 , TS EN ISO 11654:2002-02

Number of Pages: 9

The Turkish Accreditation Agency (TURKAK) is signatory to the multilateral agreements of the European co-operation for the Accreditation (EA) and of the International Laboratory Accreditation (ILAC) for the Mutual recognition of test reports.

The test and/or measurement results, the uncertainties (if applicable) with confidence probability and test methods are given on the following pages which are part of this report.

<u>Seal</u>	<u>Date</u>	<u>Person in Charge for Testing</u>	<u>Reviewer</u>	<u>Approved By</u>
	17/05/2018	Berat USTA Technician	Sencer GUVEN Technical Chief	Metehan CALIS Laboratory Manager

Name and Address of the Testing Laboratory	TSE Construction Materials Fire and Acoustics Laboratory Acoustics Department
Institution of Request	Konya Certification Office
Manufacturer	Cag Engineering Architecture Co. Fevzi Cakmak Mh. 10615 Sk. No:7 D:1 Karatay/ KONYA
Type of Inspection	Follow-up audit
Sample Type	CelluBOR brand, on-site casting loose form cellulosic insulation material

1.Introduction

As a request of **TSE Konya Certification Office**, this test had been done in TSE Construction Materials Fire and Acoustics Laboratory Acoustics Department, on the date of **07.05.2018**, aiming to measure sound absorption coefficient with the standard of “**TS EN ISO 354:2007 – Measuring sound absorption coefficient in the reverberation room**” for CelluBOR branded LFCI insulation material.

2. Testing Facility

Testing facility fulfills all the requirements of TS EN ISO 354 standard. Shape-size of the reverberation room and installation method of the sample is attached to the report. (page 9)

Volume of the Reverberation Room	298,5 m ³
Surface Area of the Reverberation Room	273 m ²
Number of Diffuser	9
Surface Area of Diffuser	69,5 m ²
Microphone Located	10
Source Located	2

3. Testing Sample

Testing sample had been chosen and delivered to the Testing Facility by TSE Konya Certification Office personnel.

Production date of the sample: 2018

Laboratory arrival date of the sample: 05/2018

3.1 Identification of the Testing Sample

Definition of the sample: CelluBOR brand, on-site casting loose form cellulosic insulation material			
Unit Weight: $\approx 3,4 \text{ kg/m}^2$			
Surface Area: $\approx 12 \text{ m}^2$			
Dimensions	Width (mm)	Height (mm)	Thickness (mm)
	3000	4000	≈ 50

3.2. Installation Method of the Testing Sample

Testing sample have placed in the testing room properly according to TS EN ISO 354 standard, Attachment B, installation type A, which is;

- Sample casted on the ground of reverberation room directly inside the metal frame with the height of 50 mm, not parallel to the side walls of the room.
- Sample is casted inside the frame by hand with approximately 50 mm height.
- Because of the molecular structure of the sample, some surface unevenness observed.
- Sample size is 3000x4000 (mm) and area covered is approximately 12 meter square.

Installation and Measurement Photos



4. Testing Method

Sound absorption coefficient calculated with the formulas below by measuring the reverberation with and without the sample installed inside the reverberation room.

- A_1 – equivalent absorption area of the empty reverberation room is calculated by the formula below in unit of m^2

$$A_1 = (55,3 * V / c * T_1) - 4 * V * m_1$$

Whereas:

V: Volume of the empty reverberation room in unit of m^3

c: Speed of sound in the air in unit of meter per second

T_1 : Reverberation time of the empty reverberation room in unit of second

m_1 : power reduction coefficient calculated with formula below by ISO 9613-1 in unit of 1/m

$$m = \alpha / 10 \lg(c)$$

Whereas:

c, is between the temperatures of 15 degrees Celsius and 30 degrees Celsius

$c = 331 + 0,6 * t$ in units of m per second where t is temperature in units of degree Celsius

- A_2 – equivalent absorption area of the reverberation room with the sample is calculated with the same formula above in unit of m^2

Whereas:

V: Volume of the empty reverberation room in unit of m^3

c: Speed of sound in the air in unit of meter per second

T_2 : Reverberation time of the reverberation room with the sample in unit of second

m_2 : power reduction coefficient calculated with formula below by ISO 9613-1 in unit of 1/m

Equivalent absorption area of the sample, A_T , is calculated by formula below in unit of meter square

$$A_T = A_2 - A_1 = 55,3 * V ((1/c_2 * T_2) - (1/c_1 * T_1)) - 4 * V * (m_2 - m_1)$$

- Sound absorption coefficient of a plane absorber or test objects in an order is calculated with the formula below

$$\alpha_S = A_T / S$$

Whereas:

A_T : Equivalent absorption area of the sample

S: Surface area covered of the sample in unit of meter square

5. Environmental Conditions

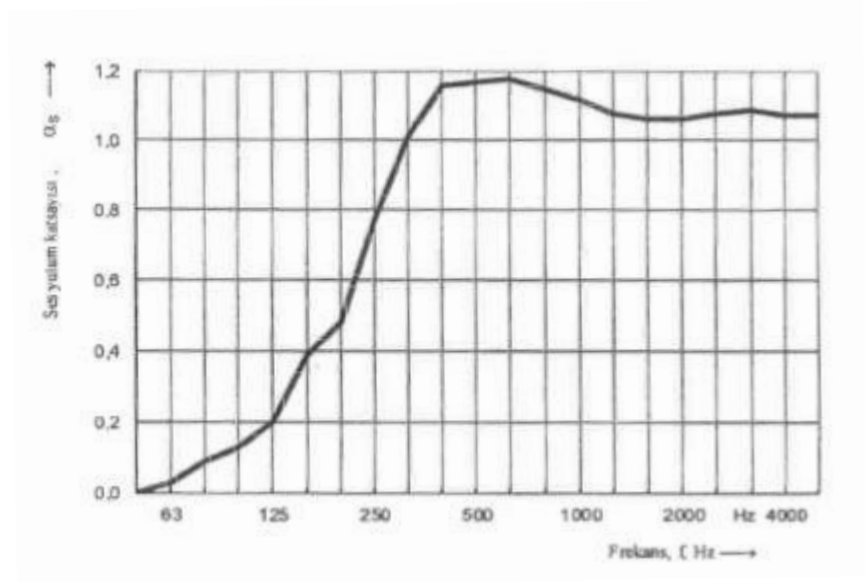
REVERBERATION ROOM	Temperature (°C)	Pressure (kPa)	Relative Humidity (%)
Empty Room	21,7	100,3	63,7
Room with the Sample	21,9	101,3	68,3

6. Results

Sound absorption coefficients are given with 1/3 octave band on the table below:

According to TS EN ISO 11654 standard, weighted sound absorption coefficient, $\alpha_w = 1,00$

Frequency f (Hz)	α_s 1/3 oktav
50	0,00
63	0,03
80	0,09
100	0,13
125	0,20
160	0,39
200	0,48
250	0,77
315	1,01
400	1,16
500	1,17
630	1,18
800	1,15
1000	1,12
1250	1,08
1600	1,06
2000	1,06
2500	1,08
3150	1,09
4000	1,07
5000	1,07



Due to ISO 11654 standard, weighted sound absorption coefficient is;

$$\alpha_w = 1,00$$

Frekans [Hz]		α_s	A [m ²]	T1 [s]	T2 [s]
50		0,00	0,0	8,94	8,90
63		0,03	0,4	11,90	10,85
80		0,09	1,1	6,14	5,37
100		0,13	1,6	7,18	5,81
125		0,20	2,4	6,02	4,65
160		0,39	4,7	6,97	4,14
200		0,48	5,8	7,12	3,84
250		0,77	9,2	5,78	2,74
315		1,01	12,2	5,91	2,37
400		1,16	13,9	6,83	2,29
500		1,17	14,1	7,32	2,33
630		1,18	14,1	7,55	2,34
800		1,15	13,8	7,39	2,36
1000		1,12	13,4	6,57	2,31
1250		1,08	12,9	5,74	2,25
1600		1,06	12,8	5,20	2,18
2000		1,06	12,8	5,11	2,17
2500		1,08	13,0	4,67	2,07
3150		1,09	13,1	4,10	1,95
4000		1,07	12,8	3,31	1,78
5000		1,07	12,9	2,82	1,63

