



# MFPA Leipzig GmbH

Testing, Inspection and Certification Authority for  
Construction Products and Construction Types

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Recognized Testing Laboratory by the VMPA  
Acoustic Testing VMPA-SPG-129-97-SN

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## Test Report No. PB 4.2/17-378-1

- English version -

11 April 2018

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**Subject matter:** Test of sound absorption coefficients in reverberation room according to DIN EN ISO 354 and rating of sound absorption according to DIN EN ISO 11654 of a fill of cellulose with 5 cm thickness, product name Insulation Cellulose Wadding, with bulk density of 40 kg/m<sup>3</sup>

**Client:** POWER CELL – ISOLATION  
Cellulose Wadding  
3 Rue 8603 Z.I Chargaia 1  
Tunis – Usine: Lot: 12 / Z.I Utique

**Date of order:** 27 November 2017

**Date of test:** 29 March 2018

**Responsible for preparation:** Dipl.-Ing. M. Busch  
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This document consists of 6 sheets and 3 annexes.

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Testing laboratory accredited by DAKKS GmbH according to DIN EN ISO/IEC 17025. The certificate can be seen on [www.mfpa-leipzig.de](http://www.mfpa-leipzig.de)

Notified testing laboratories, inspection bodies and certification bodies recognized according to the Construction Products Regulation (NB 800) and the State Building Code (SAC 02).

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## 1 Task specification

The sound absorption coefficients  $\alpha_s$  of a fill of cellulose with 5 cm thickness, product name Insulation Cellulose Wadding, with bulk density of 40 kg/m<sup>3</sup>, shall be measured in order of

POWER CELL – ISOLATION  
Cellulose Wadding  
3 Rue 8603 Z.I Charguia 1  
Tunis – Usine: Lot: 12 / Z.I Utique

in reverberation room according to DIN EN ISO 354. On this basis, acoustic absorption coefficients  $\alpha_p$  and  $\alpha_w$  shall be determined by rating of sound absorption according to DIN EN ISO 11654.

## 2 Test object, test arrangement

Following product of a fill of cellulose was delivered by client and the test arrangement with this product was installed in reverberation room of MFPA Leipzig:

- Insulation Cellulose Wadding

The test arrangement is shown in annex 3.

Date of test is revealed on the cover sheet of this report.

### Test arrangement:

5 cm fill of cellulose, product name Insulation Cellulose Wadding, installed with bulk density of 40 kg/m<sup>3</sup>

(disposed on the floor of reverberation room)

A planed plank consisting of wood material with a thickness of 20 mm and with a height up to the top of test object was installed to cover the peripheral edge around of test arrangement. The joints between planks and reverberation room floor and between planks and test object were sealed with sealing adhesive tape.

The test arrangement corresponds to the type A according to DIN EN ISO 354, annex B.2.

### Dimensions and weight per unit area of test objekt:

The weight per unit area was determined by testing institute to 2,0 kg/m<sup>2</sup>. This value corresponds to a bulk density of 40 kg/m<sup>3</sup>.

Size of test object: 3,76 m (length) x 3,19 m (wide) = 12,0 m<sup>2</sup>

### 3 Test method

Measurement of the sound absorption coefficient  $\alpha_s$  was carried out in accordance with

- DIN EN ISO 354, Acoustics - Measurement of sound absorption in a reverberation room, edition December 2003.

Rating of sound absorption by determining of the acoustic absorption coefficients  $\alpha_p$  and  $\alpha_w$  was carried out in accordance with

- DIN EN ISO 11654, Acoustics – Sound absorbers for use in buildings – Rating of sound absorption, edition April 1997.

Sound absorption coefficient was determined out of the reverberation times before and after insertion of test object into reverberation room. A broad band noise was used as test signal. In all frequency bands, the measurements were carried out 3 times at every combination of the 8 different microphone positions and 3 different loudspeaker positions. A total of 72 decay curves were analysed.

The reverberation room has a volume of 223 m<sup>3</sup> and a surface area of 222 m<sup>2</sup>. The oblique angled reverberation room has the following average dimensions: length 6.94 m, width 6.26 m and height 5.14 m. To increase diffusivity, curved pieces of plywood were suspended in the reverberation room as diffusers at irregular distances.

The climatic conditions during the measurements are also shown in annexes 1 and 2.

## 4 Measuring instruments

The following measuring instruments were used.

**Table 1:** Used measuring instruments

| measuring instrument                   | typ      | serial number  | manufacturer      |
|--|----------|--|-------------------|
| analyser Harmonie Octav                | 974008.7 | # 5501   | Sinus Messtechnik |
| output amplifier                       | Nor 280  | 2804085  | Norsonic          |
| loudspeaker combination (Dodecahedron) | Nor 276  | 2765709  | Norsonic          |
| Microphone                             | M370     | 0300, 0309, 0317,<br>0333, 0361, 0363,<br>0365, 0367, 0369 | Microtech Gefell  |

used analysing software: Samurai 2.0 (in combination with Notebook)

Testing laboratory has been registered as test board in the “List of test, monitoring and certification boards in accordance with the regional building regulations” of *Deutsches Institut für Bautechnik DIBt* under number “SAC 02”.

MFPA Leipzig is a testing laboratory accredited by DAkkS GmbH according to DIN EN ISO/IEC 17025.

## 5 Measuring results

The reverberation time with and without test specimen is as stated below.

**Table 2:** reverberation time

| Frequenz<br>f [Hz] | reverberation time with test<br>object<br>T [s] | reverberation time without<br>test object<br>T [s] |
|--------------------|---|--|
| 100                | 9,91  | 13,90  |
| 125                | 10,30   | 14,56  |
| 160                | 7,64  | 12,41  |
| 200                | 5,87  | 10,74  |
| 250                | 4,86  | 10,06  |
| 315                | 3,77  | 9,13   |
| 400                | 3,25  | 8,94   |
| 500                | 2,91  | 8,61   |
| 630                | 2,61  | 8,10   |
| 800                | 2,44  | 7,32   |
| 1000               | 2,30  | 6,48   |
| 1250               | 2,14  | 5,58   |
| 1600               | 1,99  | 4,73   |
| 2000               | 1,87  | 4,14   |
| 2500               | 1,68  | 3,31   |
| 3150               | 1,54  | 2,73   |
| 4000               | 1,42  | 2,28   |
| 5000               | 1,37  | 2,08   |

Determined sound absorption coefficients  $\alpha_s$  in 1/3 octave bands are displayed graphically vs. frequency in annex 1. Determined acoustic absorption coefficients  $\alpha_p$  and  $\alpha_w$  by rating of sound absorption according to DIN EN ISO 11654 are displayed in annex 2.

The weighted acoustic absorption coefficient  $\alpha_w$  with form factor according to DIN EN ISO 11654 was determined to

$$\alpha_w = 0,65 \text{ (H)} \quad (\text{s. annex 2}).$$

It is recommended to use this single number value in conjunction with the complete curve of sound absorption coefficient.

The results of the tests exclusively relate to the items tested. This document does not replace a certificate of conformity or suitability according to national and European building codes.

Leipzig, 11 April 2018

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## Sound absorption coefficient according to ISO 354:2003

Measurement of sound absorption in a reverberation room

Client: POWER CELL – ISOLATION, 3 Rue 8603 Z.I Charguia 1, Tunis – Usine: Lot: 12 / Z.I Utique Date of test: 29 March 2018

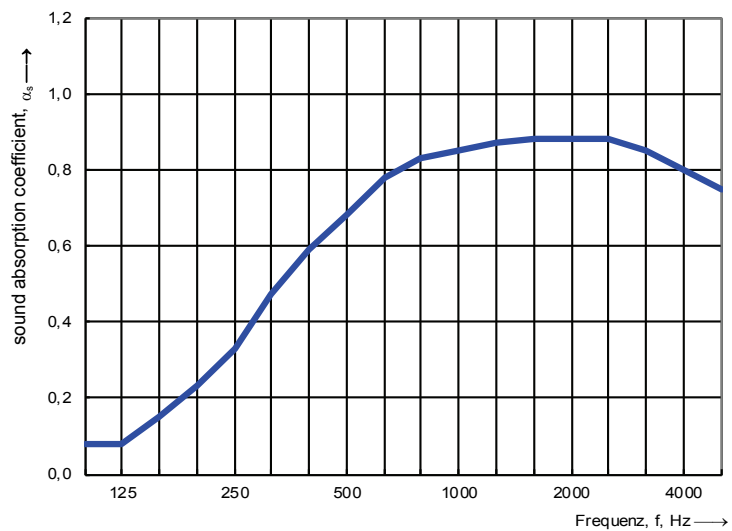
Product: Sound absorbing fill of cellulose with 5 cm thickness, product name Insulation Cellulose Wadding, with bulk density of 40 kg/m<sup>3</sup>

Test arrangement:

5 cm fill of cellulose, product name Insulation Cellulose Wadding, with bulk density of 40 kg/m<sup>3</sup>  
(disposed on the floor of reverberation room)

|                           |                     |                           |                      |        |                                      |                      |        |
|---------------------------|---------------------|---------------------------|----------------------|--------|--------------------------------------|----------------------|--------|
| Surface area:             | 12.0 m <sup>2</sup> | Empty reverberation room: | Relative humidity:   | 60 %   | Reverberation room with test object: | Relative humidity:   | 60 %   |
| Reverberation room volume | 223 m <sup>3</sup>  |                           | Temperature:         | 16 °C  |                                      | Temperature:         | 16 °C  |
|                           |                     |                           | Barometric pressure: | 99 kPa |                                      | Barometric pressure: | 99 kPa |

| frequency<br>f<br>[Hz] | $\alpha_s$ |
|------------------------|------------|
| 100                    | 0,08       |
| 125                    | 0,08       |
| 160                    | 0,15       |
| 200                    | 0,23       |
| 250                    | 0,33       |
| 315                    | 0,47       |
| 400                    | 0,59       |
| 500                    | 0,68       |
| 630                    | 0,78       |
| 800                    | 0,83       |
| 1000                   | 0,85       |
| 1250                   | 0,87       |
| 1600                   | 0,88       |
| 2000                   | 0,88       |
| 2500                   | 0,88       |
| 3150                   | 0,85       |
| 4000                   | 0,80       |
| 5000                   | 0,75       |



## Sound absorption coefficient according to ISO 11654

Measurement of sound absorption in a reverberation room

Client: POWER CELL – ISOLATION, 3 Rue 8603 Z.I Charguia 1, Tunis – Usine: Lot: 12 / Z.I Utique Date of test: 29 March 2018

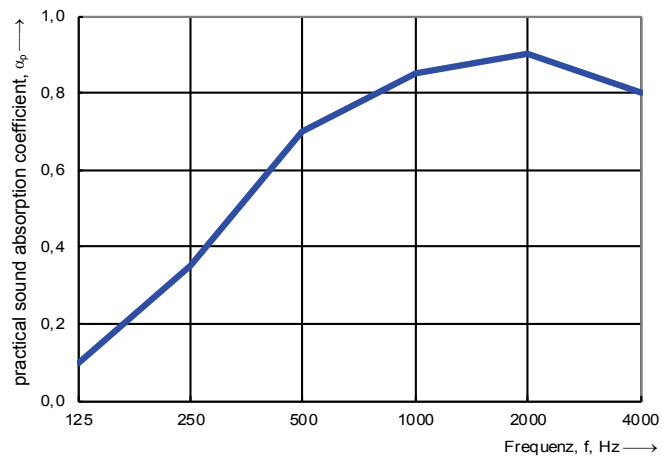
Product: Sound absorbing fill of cellulose with 5 cm thickness, product name Insulation Cellulose Wadding, with bulk density of 40 kg/m<sup>3</sup>

Test arrangement:

5 cm fill of cellulose, product name Insulation Cellulose Wadding, with bulk density of 40 kg/m<sup>3</sup>  
(disposed on the floor of reverberation room)

|                           |                     |                           |        |                                      |        |
|---------------------------|---------------------|---------------------------|--------|--------------------------------------|--------|
|                           |                     | Empty reverberation room: |        | Reverberation room with test object: |        |
| Surface area:             | 12.0 m <sup>2</sup> | Relative humidity:        | 60 %   | Relative humidity:                   | 60 %   |
| Reverberation room volume | 223 m <sup>3</sup>  | Temperature:              | 16 °C  | Temperature:                         | 16 °C  |
|                           |                     | Barometric pressure:      | 99 kPa | Barometric pressure:                 | 99 kPa |

| frequency<br>f<br>[Hz] | $\alpha_p$ |
|------------------------|------------|
| 125                    | 0,10       |
| 250                    | 0,35       |
| 500                    | 0,70       |
| 1000                   | 0,85       |
| 2000                   | 0,90       |
| 4000                   | 0,80       |



Weighted sound absorption coefficient according to ISO 11654

$$\alpha_w = 0,65 \text{ (H)}$$



**Picture A.3.1:** test arrangement in reverberation room