

Acoustic test report no 20003

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|------------------------------|---|--|----------------|------------------------|-----|------|-----|------|-----|------|-----|------|-----|------|-----|------|-----|------|-----|------|-----|------|-----|------|-----|------|--------|------|-------|------|-----|------|-------|------|--------|------|-----|------|-----|------|
| Date of test | 30.11.2020 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Customer | Plaat Detail OÜ, represented by Karmo Lomp (karmo@plaatdetail.ee) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Task | Determination of sound absorption coefficient | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Test object | Material sample provided by Plaat Detail OÜ (see also Appendix A1): rib-panels backed with porous acoustic layer, placed at the distance of 48 mm from the solid surface. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Method | Reverberation room method according to EN ISO 354:2003, see Appendix A3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Equipment | <ul style="list-style-type: none"> • noise level meter Brüel & Kjær 2270 • measurement microphone Brüel & Kjær 4189 • omnidirectional loudspeaker Brüel & Kjær 4292-L • sound amplifier Brüel & Kjær 2734 • acoustic calibrator Brüel & Kjær 4231. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Results | <p>Sound absorption coefficient of the test sample, see also Appendix A2:</p> <table border="1"> <caption>Sound Absorption Coefficient vs Frequency</caption> <thead> <tr> <th>Frequency (Hz)</th> <th>Absorption Coefficient</th> </tr> </thead> <tbody> <tr><td>100</td><td>0,00</td></tr> <tr><td>125</td><td>0,10</td></tr> <tr><td>160</td><td>0,10</td></tr> <tr><td>200</td><td>0,12</td></tr> <tr><td>250</td><td>0,25</td></tr> <tr><td>315</td><td>0,35</td></tr> <tr><td>400</td><td>0,40</td></tr> <tr><td>500</td><td>0,52</td></tr> <tr><td>630</td><td>0,75</td></tr> <tr><td>800</td><td>1,00</td></tr> <tr><td>1 k</td><td>1,05</td></tr> <tr><td>1.25 k</td><td>1,05</td></tr> <tr><td>1.6 k</td><td>1,02</td></tr> <tr><td>2 k</td><td>1,00</td></tr> <tr><td>2.5 k</td><td>0,88</td></tr> <tr><td>3.15 k</td><td>0,82</td></tr> <tr><td>4 k</td><td>0,80</td></tr> <tr><td>5 k</td><td>0,80</td></tr> </tbody> </table> | | Frequency (Hz) | Absorption Coefficient | 100 | 0,00 | 125 | 0,10 | 160 | 0,10 | 200 | 0,12 | 250 | 0,25 | 315 | 0,35 | 400 | 0,40 | 500 | 0,52 | 630 | 0,75 | 800 | 1,00 | 1 k | 1,05 | 1.25 k | 1,05 | 1.6 k | 1,02 | 2 k | 1,00 | 2.5 k | 0,88 | 3.15 k | 0,82 | 4 k | 0,80 | 5 k | 0,80 |
| Frequency (Hz) | Absorption Coefficient | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 100 | 0,00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 125 | 0,10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 160 | 0,10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 200 | 0,12 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 250 | 0,25 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 315 | 0,35 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 400 | 0,40 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 500 | 0,52 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 630 | 0,75 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 800 | 1,00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 k | 1,05 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.25 k | 1,05 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.6 k | 1,02 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 k | 1,00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.5 k | 0,88 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.15 k | 0,82 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 k | 0,80 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 k | 0,80 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Test conditions | Temperature: 22.4°C. rel humidity: 64%. barometric pressure: 99.8kPa | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Responsible for tests | Prof. Jüri Lavrentjev (juri.lavrentjev@ttu.ee) Govt Certified Expert in Tech. Acoustics, PhD in Tech. Acoustics | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Appendices:

A1: OBJECTS TESTED

Rib-panels backed with porous material layer made from pressed felt. The thickness of the felt was 10 mm, the ribs, made from MDF had thickness of 13 mm and width 26 mm. The space between the ribs was 14 mm. The total area of panels used in tests was 2.9 m², see Photo A1-1. For the measurements, the panels were placed at the distance from the concrete surface of the reverberation room by using wooden frame. The upper surface of the test object was 48 mm and the lower surface 23 mm from the solid surface. The edges of the wooden frame were taped.

The test method is described in Appendix A3.



Photo A1-1. The test object in the measurement room.

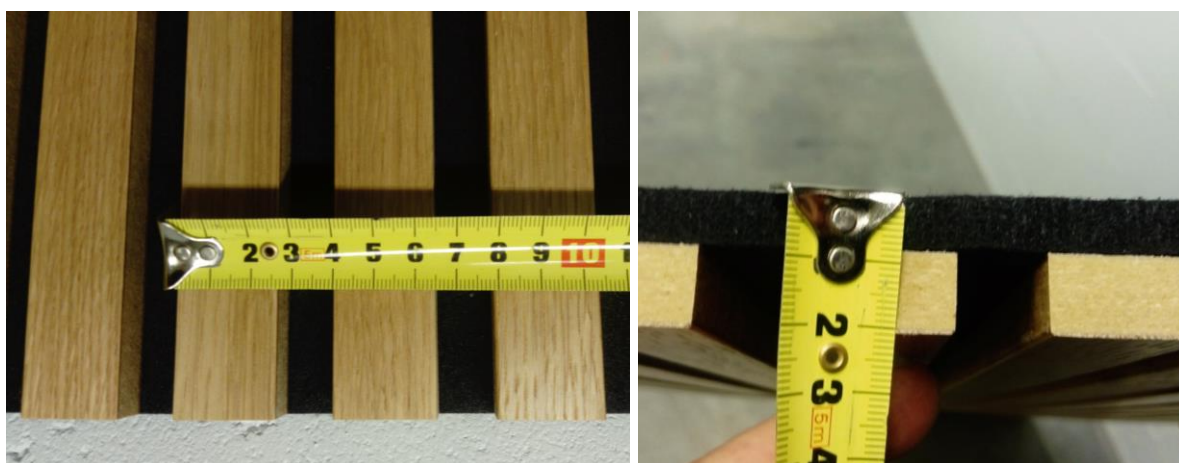


Photo A1-2. Top view of the panel.

A2. RESULTS:

The calculated absorption coefficients in the third-octave bands in the frequency range 100-5000 Hz are presented in Figure A2-1.

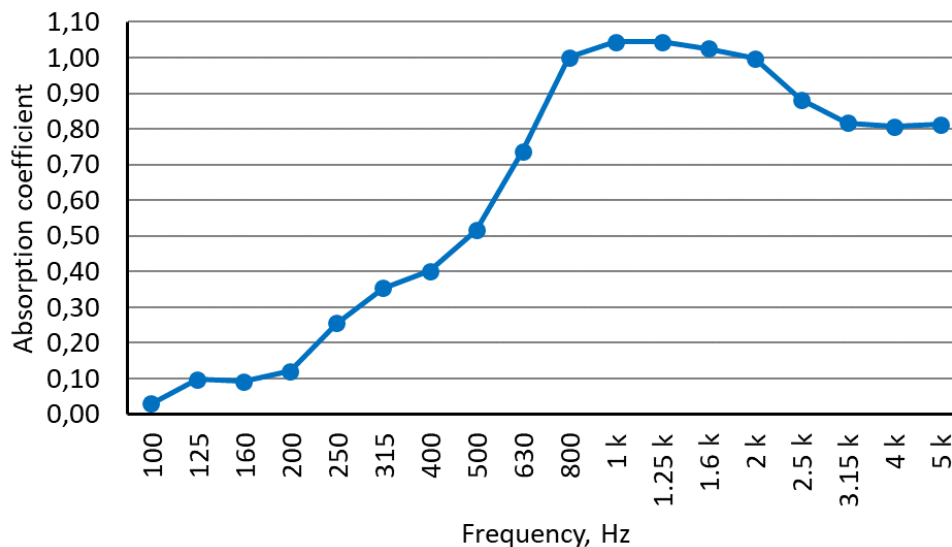


Figure A2-1. Measured and calculated absorption coefficient.

According to EN ISO 354:2003, the measured reverberation times are presented in Table A2-1.

Table A2-1. Measured reverberation times

| Third-octave band central frequency, Hz | 100 | 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1 k | 1.25 k | 1.6 k | 2 k | 2.5 k | 3.15 k | 4 k | 5 k |
|---|------|------|------|------|------|------|------|------|------|------|------|--------|-------|------|-------|--------|------|------|
| Reverb. time with object (T2), s | 3,17 | 3,44 | 3,07 | 3,03 | 2,72 | 2,47 | 2,49 | 2,30 | 1,86 | 1,63 | 1,54 | 1,50 | 1,49 | 1,47 | 1,49 | 1,46 | 1,35 | 1,23 |
| Reverb. time empty room (T1), s | 3,25 | 3,79 | 3,33 | 3,36 | 3,35 | 3,24 | 3,42 | 3,41 | 2,99 | 2,94 | 2,75 | 2,63 | 2,54 | 2,45 | 2,32 | 2,16 | 1,93 | 1,69 |

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A3. TEST METHOD

Laboratory room:

Rectangular reverberation room with masonry concrete block walls (see Photo A3-1), with the wall mass greater than 400 kg/m^2 (class: heavy). Dimensions of the room: $2.8 \times 4.0 \times 5.9 \text{ m}$. Total area of the walls: 55.4 m^2 , of the floor: 23.6 m^2 and of the ceiling: 23.6 m^2 . An appropriate system of sound diffusers has been installed according to EN ISO 354:2003.

Equipment:

- noise level meter Brüel & Kjær 2270
- measurement microphone Brüel & Kjær 4189
- omnidirectional loudspeaker Brüel & Kjær 4292-L
- sound amplifier Brüel & Kjær 2734
- acoustic calibrator Brüel & Kjær 4231.

All equipment follows class 1 rating and is calibrated.

Method:

The measurements were carried out according to standard EN ISO 354:2003. The reverberation time was measured with and then without the tested object. The interrupted noise method with white noise was applied. The frequency range was set to $100 - 5000 \text{ Hz}$. For both measurement cases 2 different loudspeaker positions and 6 microphone positions were used. For each measurement case the average value of 3 reverberation times was calculated.



Photo A3-1. The installation of test objects (acoustic material sample) in AcouTechLab reverberation room. Omnidirectional acoustic source (loudspeaker) and tripod mounted measurement microphone are exhibited in the background.

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