

MEASUREMENTS OF SOUND ABSORPTION COEFFICIENT AND TRANSFER LOSSES IN IMPEDANCE TUBE

STANDARD: LVS EN ISO 10534-2:2002 Acoustics. Determination of sound absorption coefficient and impedance in impedance tubes. Part 2: Transfer-function method.

METHODS: Brüel & Kjær. Impedance/Transmission Loss Measurement Tubes. Type 4206. The Four-microphone Method with PULSE Acoustic Material Testing software - Type 7758.

Measured parameters:

- r – sound refraction coefficient of normal angle of incidence in linear frequency scale
- α – sound absorption coefficient of normal angle of incidence in linear frequency scale
- TL – coefficient of sound transfer losses in linear frequency scale

Calculable parameters:

- $Z/\rho c_0$ – relative acoustic impedance of material in linear frequency scale
- α_N – sound absorption coefficient of normal angle of impedance in 1/3 octave bands
- TL – coefficient of sound transfer losses in 1/3 octave bands.

Measurements of these parameters for surface finishing, volume absorbent, sound scattering or insulation construction materials are crucial for development or manufacturing control. These parameters give the possibility to prognosticate achieving the goal. If information base has been accrued for measurements of different material constructions or rooms with their surfaces treated with materials, then their correlations with simpler measurements in impedance tube are used, because this method requires small samples ($\varnothing 99,5$ un 29mm). Final criteria for suitability of materials is prognosticated or tested conformity with borderline values of sound insulation or room acoustics limitations in Construction standard LBN 016-11 "Building acoustics".

Measurement situation examples



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Measurement result example with "PULSE Acoustic Material Testing software-Type 7758"

The screenshot displays the software interface for measuring acoustic transmission loss. It includes a diagram of the impedance tube setup with two dummy microphones (DP 0821) and a sample. The software shows a list of measurement steps, a measurement organizer tree, and a graph of Total Loss (dB) versus frequency (Hz). The graph shows a peak at 316.0 Hz with a value of 72.3 dB/1.00.

Acoustic Transmission Loss for Large Tube - TL - Total Loss

Note for Transmission Loss

- 2/ Activate Generator
- 4/ Activate Autorange
- 5/ Wait for Autorange finished
- 6/ Start Measurement
- 7/ Save Measurement in Measurement Organizer
- 8/ Mark Measurement as "TLO" (meaning Total Loss Open)
- 9/ Close the tube with the anechoic termination:

Measurement Organiser

- Working
 - Frontend
 - Signals
 - Groups
 - Setup
 - FFT Analyzer
 - Input (Input)
 - BCC (BCC) (BCC)
 - BCO (BCO) (BCO)
 - 2_1_TLC
 - 2_1_TLO(TLO)
 - K1_TLO (TLO) (TLO)
 - K1_TLC (TLC) (TLC)

Level Meter

dB/Max

Signal 1: -83.5

Signal 2: -82.8

Signal 3: -30.4

Signal 4: -25.8

PLF - Total Loss

PLF - Total Loss (Magnitude)

Total Loss (#11)

Cursor Values

Y = 72.3 dB/1.00

X = 316.0 Hz

Status

2010.10.19. 12:32:17.918

Averages: 1000

Overload: 0.00 %

PIELIKUMS 1

Materiālu skaņas pārnēsības zudumu - TL testēšana
(Firmas "Brüel & Kjær" stāvlīniju iekārtas Type 4206T četru mikrofonu testēšanas metode)

Klients: Mērījumu datums: 2009.g. 15-18

Mērāmo paraugu identifikācija un apraksts:

- 1) Paraugs Nr 1 (≠ 25mm - Ø99.5mm)
- 2) Paraugs Nr 2 (≠ 30mm - Ø99.5mm)
- 3) Paraugs Nr 3 (≠ 25mm - Ø29mm)
- 4) Paraugs Nr 4 (≠ 30mm - Ø29mm)

Paraugu 1,3 laukuma masa 12 kg/m²

Paraugu 2,4 laukuma masa 16 kg/m²

Paraugu Ø (fīdž 630Hz) 99.5 mm

Paraugu Ø (virs 630Hz) 29.0 mm

Gaisa temperatūra 16.0 °C

Gaisa relatīvais mitrums 76.0 %

Mērīto paraugu parametru vidējās vērtības

| Frekvence f [Hz] | TL 25mm 1/2 okt [dB] | TL 30mm 1/2 okt [dB] | ΔTL 30mm - 25mm [dB] |
|------------------|----------------------|----------------------|----------------------|
| 50 | 72.5 | 71.0 | -1.5 |
| 63 | 70.9 | 72.8 | 1.8 |
| 80 | 72.8 | 74.6 | 1.9 |
| 100 | 76.4 | 74.9 | -1.5 |
| 125 | 68.0 | 68.3 | 0.3 |
| 160 | 73.1 | 70.5 | -2.6 |
| 200 | 73.5 | 70.2 | -3.3 |
| 250 | 74.0 | 69.7 | -4.4 |
| 315 | 73.7 | 69.2 | -4.5 |
| 400 | 71.7 | 66.9 | -4.8 |
| 500 | 66.7 | 63.1 | -3.6 |
| 630 | 63.4 | 59.9 | -3.4 |
| 800 | 67.2 | 68.0 | 0.9 |
| 1000 | 77.7 | 81.2 | 3.5 |
| 1250 | 70.4 | 65.2 | -5.2 |
| 1600 | 74.9 | 79.0 | 4.1 |
| 2000 | 67.3 | 70.5 | 3.2 |
| 2500 | 70.9 | 74.7 | 3.7 |
| 3150 | 71.7 | 75.9 | 4.2 |
| 4000 | 66.4 | 70.3 | 3.9 |
| 5000 | 64.5 | 67.9 | 3.5 |

Aprēķināts pamatojoties uz inženiermetodes mērījumu rezultātiem 1/2 oktavu joslās laboratorijas apstākļos. Mērījumi tika veikti lineārā frekvencu skalā pēc tam aprēķinot vidējās vērtības 1/2 oktavu joslās katram paraugam. Līdz 630Hz tika izmantoti 99.6mm paraugu mērījumi, bet virs 630Hz 29mm paraugu mērījumi. Testēti trīs paraugi katrā diapazonā, katram tipam. Vidējām rezultātiem izmanto divu vistuvāko paraugu vērtības.

Testēšanas pārskats: Nr. 00X/2009 AL8.4 SIA "R&D Akustika" Akustikas laboratorija T-282

Datums: 21.12.2009. Operātora paraksts:

PIELIKUMS 2

Skaņas absorbcijas koeficienta noteikšana saskaņā ar LVS EN ISO 10534-2
Mērījumi pilnās pretestības caurulēs. Pārejas funkcijas metode.

Klients: SIA Mērījumu datums: 2010.g. 21-23. Septembris

Mērāmo paraugu identifikācija un apraksts:

- 1) Koka paneli apvīti ar auduma ≠ 15mm - Ø99.5 ; 29mm (Nr.1)
- 2) Perforēta KŠP ≠ 19mm - Ø 99.5 ; 29mm (Paraugs Nr.2)
- 3) KŠP ar spraugām un akmens vati ≠ 19mm - Ø99.5 ; 29mm (Nr.3)

Paraugu Nr.1 laukuma masa 12.7 kg/m²

Paraugu Nr.2 laukuma masa 15.2 kg/m²

Paraugu Nr.3 laukuma masa 14.6 kg/m²

Paraugu Ø (fīdž 630Hz) 99.5 mm

Paraugu Ø (virs 630Hz) 29.0 mm

Gaisa temperatūra 16.0 °C

Gaisa relatīvais mitrums 76.0 %

Mērīto paraugu parametru vidējās vērtības

| Frekvence f [Hz] | α _{Nr.1} 1/2 okt [dB] | α _{Nr.2} 1/2 okt [dB] | α _{Nr.3} 1/2 okt [dB] |
|------------------|--------------------------------|--------------------------------|--------------------------------|
| 50 | 0.02 | 0.02 | 0.17 |
| 63 | 0.03 | 0.03 | 0.18 |
| 80 | 0.03 | 0.04 | 0.22 |
| 100 | 0.03 | 0.02 | 0.26 |
| 125 | 0.02 | 0.03 | 0.30 |
| 160 | 0.02 | 0.02 | 0.34 |
| 200 | 0.02 | 0.03 | 0.38 |
| 250 | 0.02 | 0.04 | 0.42 |
| 315 | 0.03 | 0.05 | 0.47 |
| 400 | 0.03 | 0.07 | 0.51 |
| 500 | 0.03 | 0.11 | 0.55 |
| 630 | 0.04 | 0.18 | 0.55 |
| 800 | 0.04 | 0.35 | 0.52 |
| 1000 | 0.06 | 0.61 | 0.50 |
| 1250 | 0.08 | 0.71 | 0.51 |
| 1600 | 0.12 | 0.67 | 0.53 |
| 2000 | 0.18 | 0.53 | 0.57 |
| 2500 | 0.31 | 0.41 | 0.59 |
| 3150 | 0.51 | 0.35 | 0.62 |
| 4000 | 0.67 | 0.32 | 0.65 |
| 5000 | 0.76 | 0.35 | 0.68 |
| 6300 | 0.84 | 0.37 | 0.71 |
| 8000 | 0.90 | 0.37 | 0.74 |
| 10000 | 0.94 | 0.38 | 0.76 |

Aprēķināts pamatojoties uz inženiermetodes mērījumu rezultātiem 1/2 oktavu joslās laboratorijas apstākļos. Mērījumi tika veikti lineārā frekvencu skalā pēc tam aprēķinot vidējās vērtības 1/2 oktavu joslās katram paraugam. Līdz 630Hz tika izmantoti 99.6mm paraugu mērījumi, bet virs 630Hz 29mm paraugu mērījumi. Testēti trīs paraugi katrā diapazonā, katram tipam. Vidējām rezultātiem izmanto divu vistuvāko paraugu vērtības.

Testēšanas pārskats: Nr. 0XX/2010 AL8.4 SIA "R&D Akustika" Akustikas laboratorija T-282

Datums: 28.09.2010. Operātora paraksts: