# TFI Report 481331-01

## Sound Absorption
## Impact Sound Insulation

**Customer**

Voxflor
Room 2606 & 27/F
F, Central Park Building No.868 Changshou Road
200060 Shanghai

**Product**

textile floor covering

Nylon carpet tile with cushion back

This report includes 2 pages and 2 annex(es)

**Responsible at TFI**

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**Aachen, 13.08.2018**

Dr. Alexander Siebel
- Head of the testing laboratory -

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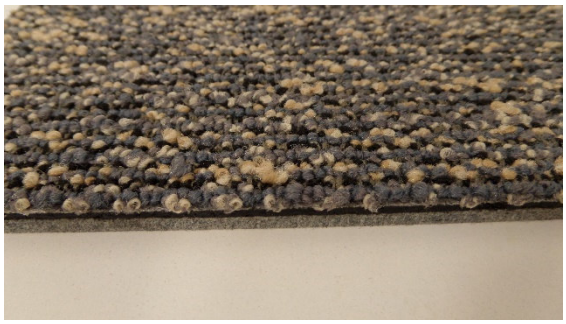
TFI Aachen GmbH Germany

## 1 Transaction

| | |
|---|---|
| Test order | sound absorption according to EN ISO 354<br>impact sound insulation according to EN ISO 10140 |
| Order date | 12 July 2018 |
| Your reference | Darcy Xu |
| Product designation | Nylon carpet tile with cushion back |
| TFI sample number | 18-07-0168 |

## 2 Product Specification

| | |
|---|---|
| Type of manufacture | tufted |
| Type of surface | loop pile |
| Backing | textile fleece backing |
| Pattern | tonal effect without pattern |
| Colour | blue, grey, beige, black |
| View |  |
| Thickness [mm] | 10±0.5* |
| Area density [g/m²] | 4800±200* |
| Type of delivery | tiles |
| | *customer information |

## 3 Results

| | |
|---|---|
| Sound absorption | $\alpha_W$ = 0,25 |
| Impact sound insulation | $\Delta L_w$ = 26 dB |

## 4 Annexes

| | |
|---|---|
| Sound absorption | SA 481331-01[a] |
| Sound absorption | TS 481331-01[a] |

The annexes marked [a] are based on tests accredited in accordance with EN ISO/IEC 17025.





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# **Annex SA** - Sound Absorption Coefficient

## 1 Transaction

| | |
|---|---|
| Product designation | Nylon carpet tile with cushion back |
| TFI sample number | 18-07-0168 |
| Testing period | 07 August 2018 |

## 2 Test Method / Requirements

| | |
|---|---|
| EN ISO 354:2003 | Measurement of sound absorption in a reverberation room |
| EN ISO 11654:1997 | Sound absorbers for use in buildings – Rating of sound absorption |
| Deviation from the standard | None |

## 3 Remarks

None

## 4 Measuring Operation

| | |
|---|---|
| Test noise: | broadband pink noise |
| Receive filter: | third octave band filter |
| Measurement: | 2 loudspeaker positions |
| | 6 microphone positions |

## 5 Laboratories

| | |
|---|---|
| Test rooms: | laboratory of the TFI Aachen GmbH, Hauptstr. 133, 52477 Alsdorf, Germany |
| Test method: | reverberation room method |
| Volume: | 211 m³ |
| Total surface: | 213 m² |
| Floor plan: | trapezoidal |
| Reflectors: | 6 aluminium plates 1.0 m x 2.0 m |
| | 7 plywood boards 1.5 m x 1.3 m |
| | 1 aluminium plate 1.8 m x 0.9 m |

## 6 Measuring Devices





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| | |
|---|---|
| Real time analyser: | Norsonic Nor140, SN: 1406926 |
| Microphone: | Norsonic Type 1209/21134 |
| Loudspeaker: | 2 dodecahedrons |

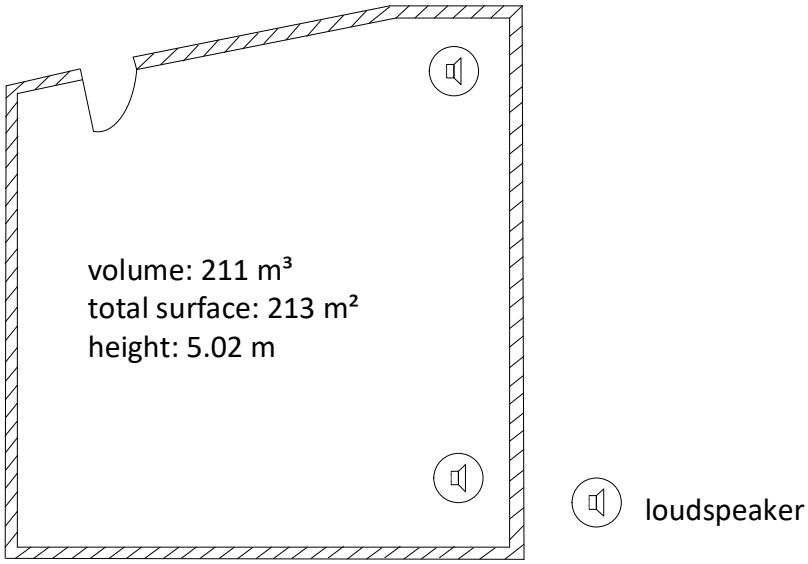
## 7 Evaluation

The decay curves are determined using the interrupted noise method. Several decay curves measured at one microphone and/or loudspeaker position are averaged in order to reach a sufficient reproducibility. The reverberation time of the room is expressed by the arithmetic mean derived from the total number of all reverberation time measurements in each frequency band.

The equivalent sound absorption area of the test specimen $A_T$ is calculated as the difference between the equivalent sound absorption area of the reverberation room with test specimen $A_2$ and the equivalent sound absorption area of the empty reverberation room $A_1$ without test specimen.

The equivalent sound absorption coefficient $\alpha_s$ describes the ratio of the equivalent sound absorption area $A_T$ of a test specimen divided by the area of the test specimen.

The evaluated sound absorption coefficient $\alpha_w$ is a single-number frequency-independent value which equals the value of the reference curve at 500 Hz after shifting it.




*Drawing reverberation room*





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# Sound absorption according ISO 11654

SA 481331-01

Measurement of sound absorption coefficient in a reverberation room

Annex SA – Sound absorption



TFI sample no.: 18-07-0168 Testing period: 07.08.2018

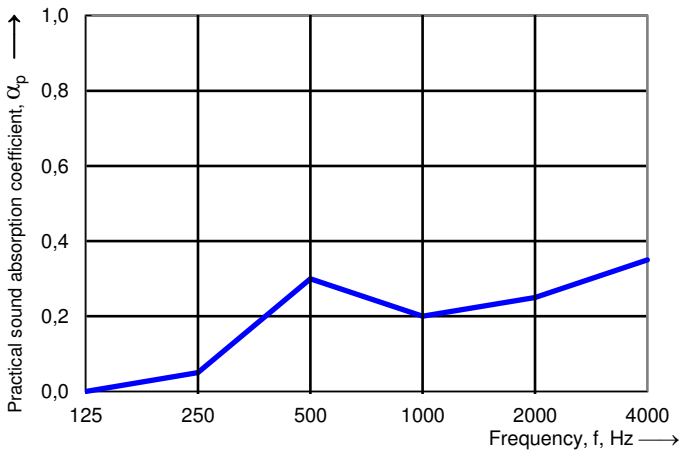
Construction: (from top to bottom) -

Product name: Nylon carpet tile with cushion back

| Reverberation room / without | | | Reverberation room / with sample | |
|---|---|---|---|---|
| Relative humidity: | 61,3 | % | Relative humidity: | 61,3 % |
| Temperature: | 24,3 | °C | Temperature: | 24,3 °C |
| Barometric pressure: | 99,4 | kPa | Barometric pressure: | 99,4 kPa |

| | | |
|---|---|---|
| Surface area: | 12,00 | m² |
| Room volume: | 211,0 | m³ |
| Total room area St: | 213 | m² |

| Frequency f [Hz] | $\alpha_p$ Oktave |
|---|---|
| 100<br>125<br>160 | 0,00 |
| 200<br>250<br>315 | 0,05 |
| 400<br>500<br>630 | 0,30 |
| 800<br>1000<br>1250 | 0,20 |
| 1600<br>2000<br>2500 | 0,25 |
| 3150<br>4000<br>5000 | 0,35 |




Weighted sound absorption coefficient according to ISO 11654

$\alpha_w$ = 0,25

# Sound absorption according ISO 354

SA 481331-01

Measurement of sound absorption coefficient in a reverberation room



Weighted s -

$\alpha_w$ = 0,25

Surface area: 12,00 m²
Room volume: 211,0 m³
Total room area St: 213,0 m²

| Frequency [Hz] | $\alpha_p$ | $\alpha_s$ | A [m²] | T1 [s] | T2 [s] |
|---|---|---|---|---|---|
| 50 | | -0,01 | -0,1 | 7,68 | 7,92 |
| 63 | 0,00 | -0,01 | -0,1 | 8,07 | 8,21 |
| 80 | | 0,02 | 0,3 | 8,82 | 8,25 |
| 100 | | 0,00 | -0,1 | 11,08 | 11,29 |
| 125 | 0,00 | -0,01 | -0,2 | 6,84 | 7,08 |
| 160 | | -0,02 | -0,2 | 6,43 | 6,66 |
| 200 | | 0,02 | 0,3 | 7,05 | 6,67 |
| 250 | 0,05 | 0,06 | 0,7 | 6,58 | 5,78 |
| 315 | | 0,10 | 1,2 | 5,79 | 4,81 |
| 400 | | 0,30 | 3,6 | 5,89 | 3,61 |
| 500 | 0,30 | 0,41 | 4,9 | 5,93 | 3,20 |
| 630 | | 0,25 | 3,0 | 5,86 | 3,85 |
| 800 | | 0,19 | 2,3 | 5,39 | 3,96 |
| 1000 | 0,20 | 0,19 | 2,3 | 5,37 | 3,95 |
| 1250 | | 0,21 | 2,5 | 5,37 | 3,85 |
| 1600 | | 0,22 | 2,7 | 5,10 | 3,63 |
| 2000 | 0,25 | 0,25 | 3,0 | 4,85 | 3,38 |
| 2500 | | 0,30 | 3,6 | 4,30 | 2,95 |
| 3150 | | 0,32 | 3,8 | 3,68 | 2,60 |
| 4000 | 0,35 | 0,35 | 4,2 | 3,04 | 2,21 |
| 5000 | | 0,43 | 5,1 | 2,42 | 1,77 |

Reverberation room / without sample:
Relative humidity: 61,3 %
Temperature: 24,3 °C
Barometric pressure: 99,4 kPa

Reverberation room / with sample:
Relative humidity: 61,3 %
Temperature: 24,3 °C
Barometric pressure: 99,4 kPa

# **Annex TS** - Impact Sound Insulation

## 1 Transaction

| | |
|---|---|
| Product designation | Nylon carpet tile with cushion back |
| TFI sample number | 18-07-0168 |
| Testing period | 08 August 2018 |

## 2 Test Method / Requirements

| | |
|---|---|
| EN ISO 10140-1:2014 | Acoustics - Laboratory measurement of sound insulation of building elements - Part 1: Application rules for certain products |
| EN ISO 10140-2:2010 | Acoustics - Laboratory measurement of sound insulation of building elements - Part 2: Measurement of airborne sound insulation |
| EN ISO 10140-3:2015 | Acoustics - Laboratory measurement of sound insulation of building elements - Part 3: Measurement of impact sound reduction |
| EN ISO 10140-4:2010 | Acoustics - Laboratory measurement of sound insulation of building elements - Part 4: Measurement procedures and requirements |
| EN ISO 10140-5:2014 | Acoustics - Laboratory measurement of sound insulation of building elements - Part 5: Requirements for test facilities and equipment |
| EN ISO 717-1:2013 | Acoustics - Rating of sound insulation in buildings and of building elements - Part 1: Airborne sound insulation |
| EN ISO 717-2:2013 | Acoustics - Rating of sound insulation in buildings and of building elements - Part 2: Impact sound reduction |
| EN ISO 12999-1: 2014 | Acoustics - Determination and application of measurement uncertainties in building acoustics - Part 1: Sound insulation |

## 3 Remarks

None

## 4 Measuring Operation

| | |
|---|---|
| Measurement of the impact sound pressure level: | Using 4 fixed microphone positions, with 1 tapping machine position for each microphone position<br>(The single results of the one-third-octave-bands were averaged on an energy basis) |
| Test surface: | ~1,5m² |
| Category: | I |
| Connection with the floor: | loose laid |





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| | |
|---|---|
| Damage to the sample: | None |
| Corrections: | - background noise correction<br>- airborne sound correction |

## 5 Laboratories

| | |
|---|---|
| Test rooms: | Laboratories of the TFI Aachen GmbH, Hauptstrasse133, 52477 Alsdorf, Germany |
| Sending room (1.04): | V = 52.1 m³ (with diffusers) |
| Receiving room (0.01): | 4.05 m x 3.95 m x 3.33 m + 2.00 m x 0.98 m x 0.18 m; V = 53.6 m³ (cuboid room, with diffusers) |
| Reference floor: | 4.27 m x 4.46 m; S = 19.04 m²<br>14 cm concrete slab floor with an area-related mass of<br>m‘ ~ 322 kg/m² |
| Flanking walls: | Lime sand brick walls with light wall facings (facing shell d= 12cm)<br>with an average area-related mass of m‘ ~ 330 kg/m² |

## 6 Measuring Devices

| | |
|---|---|
| Real time analyser: | Norsonic Nor140, SN: 1406927<br>Norsonic Nor140, SN: 1406926 |
| Microphone: | Norsonic Type 1209/21135<br>Norsonic Type 1209/21134 |
| Tapping machine: | NORSONIC, Type 211, SN: 502<br>(standard tapping machine with 3 feet and 5 hammers according to ISO 10140) |

## 7 Evaluation

The impact sound pressure level generated by the standard tapping machine is measured in the receiving room under a bare heavy floor with and without a floor covering. The impact sound reduction is determined on the basis of the measured values as follows:

$\Delta L = L_{n,0} - L_n$ (dB)

$L_{n,0}$ Impact sound pressure level without a floor covering (dB)

$L_n$ Impact sound pressure level with a floor covering (dB)

For the evaluation of the weighted reduction in impact sound pressure level ΔLw, the relevant reference curve is shifted in increments of 1 dB towards the measured curve until the sum of unfavourable deviations is as large as possible, but not more than 32 dB.





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The linear impact sound level $\Delta L_{lin}$ is determined according to the following equation:

$$\Delta L_{in} = L_{n,r,0,w} + C_{l,r,0} - (L_{n,r,w} + C_{l,r}) = \Delta L_w + C_{l,\Delta}$$

| | |
|---|---|
| $L_{n,r,w}$ | is the calculated weighted normalized impact sound pressure level of the reference floor with the floor covering under test |
| $L_{n,r,0,w}$ | 78 dB, calculated from $L_{n,r,0}$ according to Section 4.3.1 of DIN EN ISO 717-2: 2013 |
| $C_{l,r}$ | Spectrum adaptation term for the reference floor with the floor covering to be tested |
| $C_{l,r,0}$ | -11 dB, spectrum adaptation term for the reference floor with $L_{n,r,0}$ determined according to Annex A, Section A.2.1 of DIN EN ISO 717-2:2013 |

## 8 Note

The results are based on measurements performed under laboratory conditions with artificial excitation (standard procedure). The test results are applicable in due consideration of the national provisions and the local circumstances and/or constructions.





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# Impact sound insulation according ISO 10140-1

TS 481331-01

Laboratory measurements of the reduction of transmitted impact noise by floor coverings on a heavyweight reference floor

Annex TS – Impact sound insulation

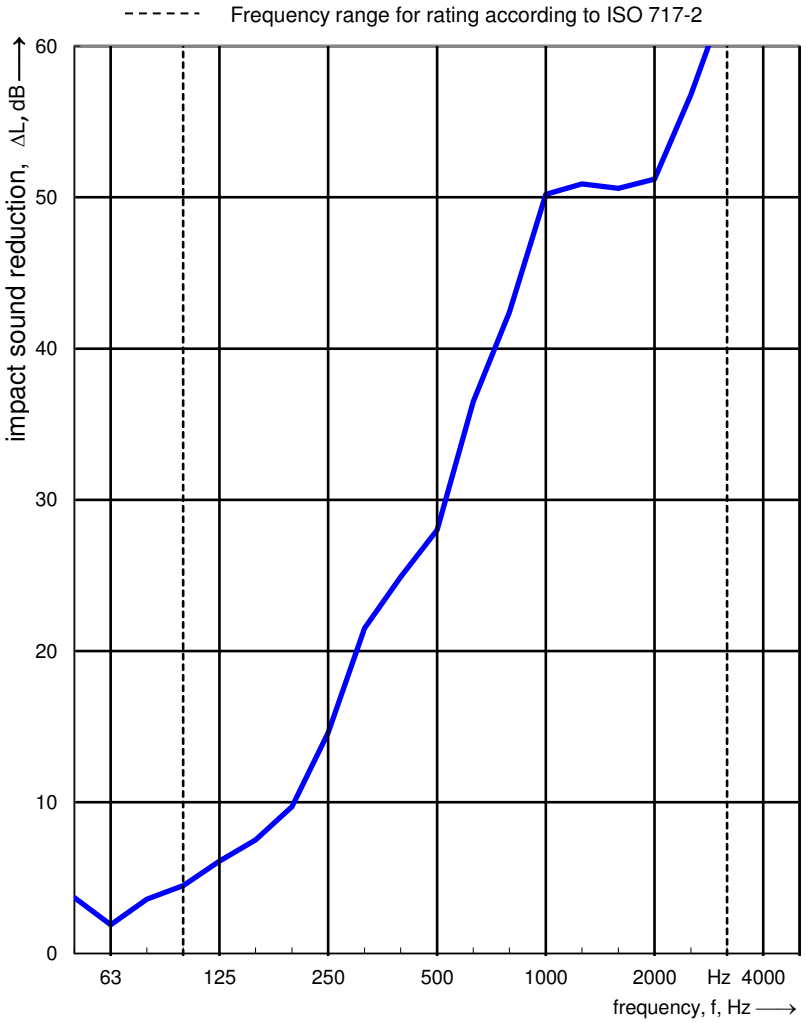


| | | | |
|---|---|---|---|
| TFI sample number: | 18-07-0168 | Prüfdatum: | 08.08.2018 |
| Product name: | Nylon carpet tile with cushion back | | |
| Installed by: | TFI Aachen GmbH | | |
| Construction: (from top to bottom) | - | | |

| Receiving room: | | Source room: | |
|---|---|---|---|
| Volume: | 53,6 m³ | Volume: | 52,1 m³ |
| Air temperature: | 22,5 °C | Air temperature: | 24,5 °C |
| Relative air humidity: | 72,7 % | Relative air humidity: | 63,8 % |
| Static pressure: | 99,3 kPa | Type of reference floor: | Heavyweight |

| Frequency f [Hz] | $L_{n,0}$ 1/3 oct. [dB] | $\Delta L$ 1/3 oct. [dB] |
|---|---|---|
| 50 | 60,3 | 3,7 |
| 63 | 63,4 | 1,9 |
| 80 | 61,5 | 3,6 |
| 100 | 58,4 | 4,5 |
| 125 | 64,0 | 6,1 |
| 160 | 60,3 | 7,5 |
| 200 | 64,1 | 9,7 |
| 250 | 67,9 | 14,6 |
| 315 | 64,8 | 21,5 |
| 400 | 64,5 | 24,9 |
| 500 | 65,9 | 28,0 |
| 630 | 64,9 | 36,5 |
| 800 | 65,5 | 42,4 |
| 1000 | 67,2 | 50,2 |
| 1250 | 67,8 | 50,9 |
| 1600 | 68,2 | 50,6 |
| 2000 | 68,2 | 51,2 |
| 2500 | 67,8 | 56,8 |
| 3150 | 67,7 | 63,4 [1] |
| 4000 | 66,7 | 63,9 [1] |
| 5000 | 62,9 | 60,2 [1] |

[1] too high




Evaluation according to ISO 717-2

$\Delta L_w$ = 26 dB $C_{I,\Delta}$ = -11 dB $C_{I,r}$ = 0 dB

The results are based on measurements, which were performed under laboratory conditions with artificial excitation (standard procedure).

# Impact sound insulation according ISO 10140-1

TS 481331-01

Laboratory measurements of the reduction of transmitted impact noise by floor coverings on a heavyweight reference floor



Evaluation according to ISO 717-2

$\Delta L_w$ = 26 dB $C_{I,\Delta}$ = -11 dB $C_{I,r}$ = 0 dB

The results are based on measurements, which were performed under laboratory conditions with artificial excitation (standard procedure).

Weighted normalized impact sound pressure level $L_{n,0,w}$ = 74 dB

Weighted normalized impact sound pressure level $L_{n,w}$ = 47 dB

Weighted normalized impact sound pressure level $L_{n,r,w}$ = 52 dB

| Frequency [Hz] | $\Delta L$ [dB] | $L_{n,0}$ [dB] | $L_n$ [dB] | $L_{n,r}$ [dB] |
|---|---|---|---|---|
| 50 | 3,7 | 60,3 | 56,6 | |
| 63 | 1,9 | 63,4 | 61,5 | |
| 80 | 3,6 | 61,5 | 57,9 | |
| 100 | 4,5 | 58,4 | 53,9 | 62,5 |
| 125 | 6,1 | 64,0 | 57,9 | 61,4 |
| 160 | 7,5 | 60,3 | 52,8 | 60,5 |
| 200 | 9,7 | 64,1 | 54,4 | 58,8 |
| 250 | 14,6 | 67,9 | 53,3 | 54,4 |
| 315 | 21,5 | 64,8 | 43,3 | 48,0 |
| 400 | 24,9 | 64,5 | 39,6 | 45,1 |
| 500 | 28,0 | 65,9 | 37,9 | 42,5 |
| 630 | 36,5 | 64,9 | 28,4 | 34,5 |
| 800 | 42,4 | 65,5 | 23,1 | 29,1 |
| 1000 | 50,2 | 67,2 | 17,0 | 21,8 |
| 1250 | 50,9 | 67,8 | 16,9 | 21,1 |
| 1600 | 50,6 | 68,2 | 17,6 | 21,4 |
| 2000 | 51,2 | 68,2 | 17,0 | 20,8 |
| 2500 | 56,8 | 67,8 | 11,0 | 15,2 |
| 3150 | 63,4 | 67,7 | 4,3 | 8,6 |
| 4000 | 63,9 | 66,7 | 2,8 | |
| 5000 | 60,2 | 62,9 | 2,7 | |

Receiving room:

Volumen: 53,6 m³

Air temperature: 22,5 °C

Relative air humidity: 72,70 %

Static pressure: 99,3 kPa

Source room:

Volumen: 52,1 m³

Air temperature: 24,5 °C

Relative air humidity: 63,8 %

Type of reference floor: Heavyweight