

IMPACT SOUND IMPROVEMENT FOR VIBRATEC VT-BAT FLOATING FLOOR SYSTEM

ABSTRACT

The impact sound level and the impact sound improvement have been measured in a laboratory for the floating floor system Vibratec VT-BAT with 50 mm height and with 45 mm mineral wool in the air gap. Two layers of 22 mm cement fibreboard were glued together with a visco-elastic glue and screwed to the steel profiles. The floating floor samples were mounted on a reference heavyweight floor made of 160 mm concrete.

All measurements have been performed according to SS-EN ISO 10140-3:2010 and evaluated according to SS-EN ISO 717-2:2013. Single number values for all measurements can be found in the table below.

Test sample	$L_{n,w}$ (dB)	$C_{1,50-2500}$	ΔL_w (dB)	$C_{1,\Delta}$
1. Vibratec VT-BAT-400, 50 mm height with 45 mm mineral wool, 2 layers of 22 mm cement-bound chipboard on top	36	3	44	-14
2. Vibratec VT-BAT-510, 50 mm height with 45 mm mineral wool, 2 layers of 22 mm cement-bound chipboard on top	37	2	43	-12
3. Vibratec VT-BAT-570, 50 mm height with 45 mm mineral wool, 2 layers of 22 mm cement-bound chipboard on top	39	2	41	-13

1. CLIENT

Vibratec Akustikprodukter AB, Fagernäsvägen 1, 760 17 Blidö, Sweden
Contact: Svante Hägerstrand, 0176 – 20 78 84, svante.hagerstrand@vibratec.se

2. ASSIGNMENT

To measure the impact sound level and the impact sound improvement of the floating floor system Vibratec VT-BAT with 50 mm height. The measurements shall be made according to SS-EN ISO 10140-3:2010 and evaluated according to SS-EN ISO 717-2:2013.

3. TEST SAMPLES

The constructions of the test samples are described in Table 1. The test samples were mounted on Akustikverkstan's 160 mm heavyweight reference concrete floor. The difference between the three tested VT-BAT systems is the load range, which depends on the elastic feet.

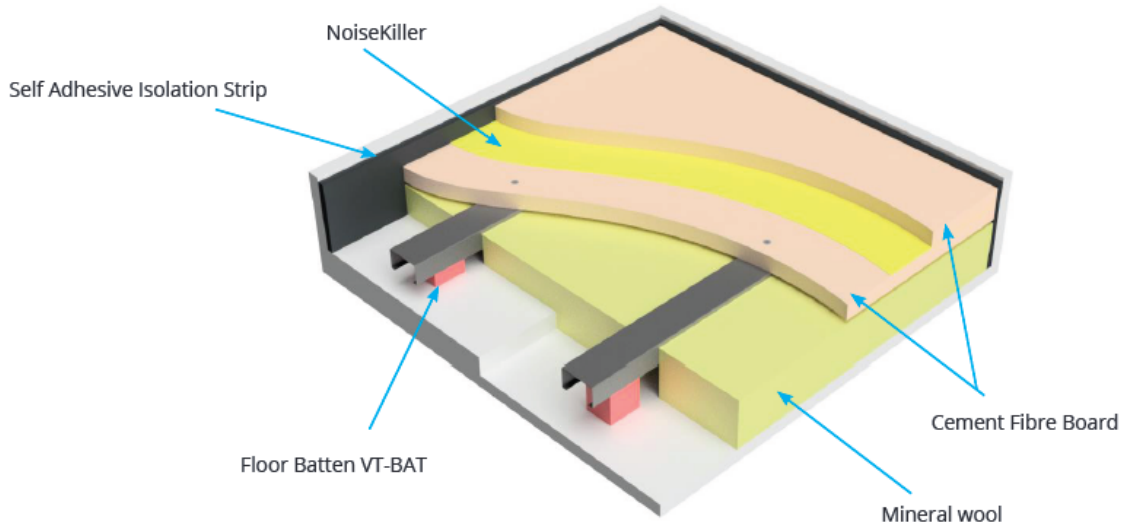


Figure 1: Illustration of a typical installation of the floor system VT-BAT.

Sample	Sample description
1	Vibratec VT-BAT-400, 50 mm height with 45 mm mineral wool, 2 layers of 22 mm cement-bound chipboard (Swiss Pearl Ceminwood) glued together with NoiseKiller Yellow and screwed to the steel profiles. 600 mm between steel profiles and 375 mm between elastic pads
2	Vibratec VT-BAT-510, 50 mm height with 45 mm mineral wool, 2 layers of 22 mm cement-bound chipboard (Swiss Pearl Ceminwood) glued together with NoiseKiller Yellow and screwed to the steel profiles. 600 mm between steel profiles and 375 mm between elastic pads
3	Vibratec VT-BAT-570, 50 mm height with 45 mm mineral wool, 2 layers of 22 mm cement-bound chipboard (Swiss Pearl Ceminwood) glued together with NoiseKiller Yellow and screwed to the steel profiles. 600 mm between steel profiles and 375 mm between elastic pads

Table 1: Description of test samples.

4. MEASUREMENT PROCEDURE

The impact sound level measurements were performed according to SS-EN ISO10140-3:2010 with the tapping machine in 5 positions on the concrete floor. The microphone was placed on a rotating boom and the measurement period was 60 seconds, which corresponds to two full revolutions of the rotating boom. The reverberation time in the receiving room were measured using the rotating boom, 16 measurements in total. The measurements were then evaluated according to SS-EN ISO 717-2:2013.

The measurements were performed by Carl Nyqvist in Akustikverkstan's laboratory in Skultorp, Sweden, 2019-03-07.

5. MEASUREMENT EQUIPMENT

Table 2 presents the equipment that was used during the measurements. The equipment fulfils the requirements of Class 1 according to SS-EN 61672-1, 60942 and 61260. Date for last calibration is kept in Akustikverkstan's instrument journal. The equipment was control calibrated before and after the measurements.

Equipment	Brand and type	Serial number
Analyzer	Norsonic 140	1404198
Speaker	IMA Kub 1	9
Microphone cartridge	Norsonic 1225	215330
Microphone preamplifier	Norsonic 1209	13604
Calibrator	Norsonic 1251	31964
Tapping machine	Norsonic 277	2775763
Equalizer	Monacor MEQ-2152	-
Amplifier	Denon POA-2200	-

Table 2: Equipment that was used in the measurements.

6. MEASUREMENT RESULTS

The measurement results have been evaluated according to SS-EN ISO 717-2:2013. The weighted impact sound level, the weighted impact sound improvement together with selected correction terms are presented in Table 3. The measurement results are presented in detail in the attached measurement protocols 18-718-M13 to M18. The impact sound level of the reference floor is presented in measurement protocol 18-718-M19.

The measurement results are only valid for the tested samples.

Provnr / beskrivning	$L_{n,w}$ (dB)	$C_{1,50-2500}$	ΔL_w (dB)	$C_{1,\Delta}$	Mät- protokoll
1. Vibratec VT-BAT-400, 50 mm height with 45 mm mineral wool, 2 layers of 22 mm cement-bound chipboard (Swiss Pearl Ceminwood) glued together with NoiseKiller Yellow and screwed to the steel profiles. 600 mm between steel profiles and 375 mm between elastic feet	36	3	44	-14	M13, M14
2. Vibratec VT-BAT-510, 50 mm height with 45 mm mineral wool, 2 layers of 22 mm cement-bound chipboard (Swiss Pearl Ceminwood) glued together with NoiseKiller Yellow and screwed to the steel profiles. 600 mm between steel profiles and 375 mm between elastic feet	37	2	43	-12	M15, M16
3. Vibratec VT-BAT-570, 50 mm height with 45 mm mineral wool, 2 layers of 22 mm cement-bound chipboard (Swiss Pearl Ceminwood) glued together with NoiseKiller Yellow and screwed to the steel profiles. 600 mm between steel profiles and 375 mm between elastic feet	39	2	41	-13	M17, M18

Table 3: Selected one-figure measurement results and corresponding measurement protocols.

7. MEASUREMENT PRECISION

The precision of the weighted one-figure numbers is normally within $\pm 2,2$ dB. Typical precisions for each one-third octave band is shown in Table 4. These values corresponds to the repeatability of one standard deviation for this laboratory, based on ten measurements on the heavyweight reference floor during 2004 to 2015.

50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz
$\pm 3,8$ dB	$\pm 3,2$ dB	$\pm 3,1$ dB	$\pm 2,2$ dB	$\pm 2,1$ dB	$\pm 1,5$ dB	$\pm 1,5$ dB
250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz
$\pm 1,1$ dB	$\pm 1,4$ dB	$\pm 0,8$ dB	$\pm 1,1$ dB	$\pm 1,1$ dB	$\pm 1,2$ dB	$\pm 1,3$ dB
1,25 kHz	1,6 kHz	2,0 kHz	2,5 kHz	3,15 kHz	4,0 kHz	5,0 kHz
$\pm 1,5$ dB	$\pm 1,9$ dB	$\pm 1,8$ dB	$\pm 2,3$ dB	$\pm 2,3$ dB	$\pm 2,5$ dB	$\pm 2,8$ dB

Table 4: One standard deviation for impact sound level measurements performed on the 160 mm heavyweight reference floor.

The measurement uncertainties for meteorological parameters are shown in Table 5.

Parameter	Uncertainty
Temperature	$\pm 0,5^\circ$ C
Relative humidity	± 3 percent
Air pressure	$\pm 0,5$ kPa

Table 5: Measurement uncertainty.

8. DEVIATIONS FROM STANDARDS

No deviations from the applicable standards were made during these measurements.

This report may only be reprinted in its entirety. The measurement protocols may however be used separately.

Pontus Thorsson
PhD in acoustics

Reviewed by Johan Jernstedt, 2019-05-13

APPENDIX 1: INFORMATION ABOUT THE LABORATORY

Test room 3 (Impact sound room) on the laboratory's first floor has a rectangular shape with the dimensions $L \times B \times H = 4,96 \times 6,25 \times 3,38$ m. The room's volume is 105 m^3 and the total surface for walls, floor and ceiling is 138 m^2 .

Test room 2 (used as receiving room in impact sound measurements) has a rectangular shape with the dimensions $L \times B \times H = 5,0 \times 6,25 \times 3,93$ m. The room's volume is 123 m^3 and the total surface for walls, floor and ceiling is 151 m^2 .

The reference floor's size is $4,0 \times 2,5$ m.

A section for the two rooms together with the location of the reference floor is shown in Figure B1.1.

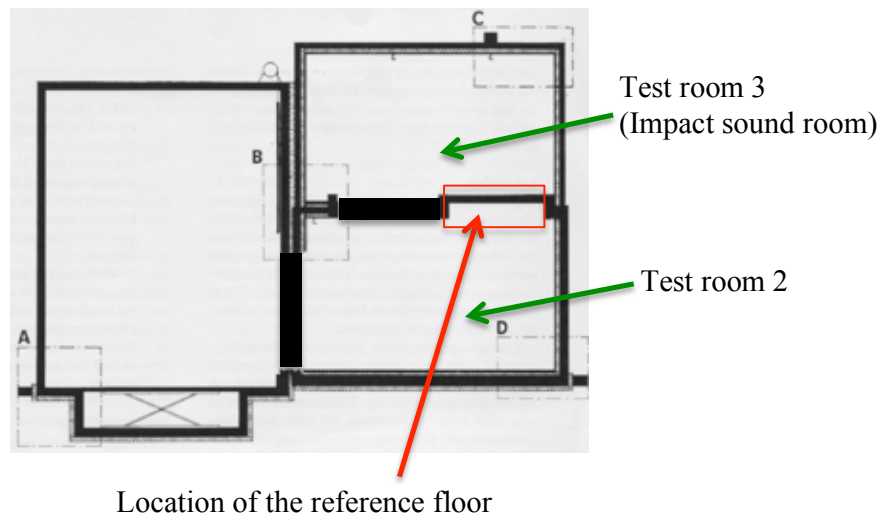


Figure B1.1: Section for Test room 2 and Test room 3 together with the location of the reference floor.

The Laboratory's address is Vallmovägen 11, 541 55 Skövde, Sweden.

APPENDIX 2: PHOTOGRAPHS FROM THE MEASUREMENTS



Normalized impact sound pressure levels according to ISO 10140-3

No. of test report: 18-718-M13
Date of report: 2019-05-13
Date of test: 2019-03-07
Name: Pontus Thorsson

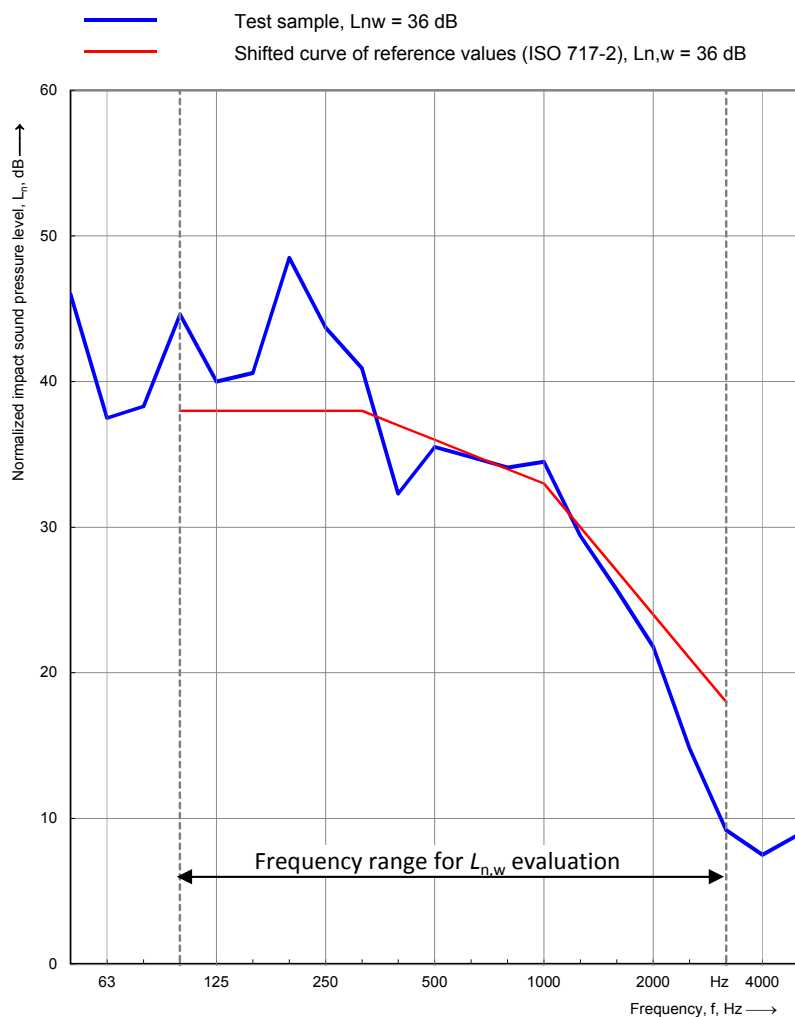
Laboratory measurements of impact sound insulation of floors

Client: Vibratex Akustikprodukter AB
Manufacturer: Vibratex Akustikprodukter AB
Test specimen mounted by: Akustikverkstan
Test room identification:
 Test room 3 (sending room) to Test room 2 (receiving room)
Product identification:
 VT-BAT-400 50 mm height

Description of the specimen:
 VT-BAT-400 50 mm height, c/c 600 mm between profiles, c/c 375 mm between elastic pads, with 2 layers of 22 mm Swiss Pearl Ceminwood boards. The Ceminwood boards were glued together using NoiseKiller Yellow. 45 mm mineral wool between Ceminwood and concrete floor. Mounted on 160 mm heavyweight reference concrete floor.

Mass per unit area: 426 kg/m²
Curing time: 1 days
Barometric pressure: 96,4 kPa
Temperature - source room: 17,9 °C
 - receiving room: 17,9 °C
Air humidity - source room: 36,5 %
 - receiving room: 36,5 %
Source room volume: 105 m³
Receiving room volume: 123,0 m³

Frequency f [Hz]	L _n 1/3 octave [dB]
50	46,0
63	37,5
80	38,3
100	44,6
125	40,0
160	40,6
200	48,5
250	43,7
315	40,9
400	32,3
500	35,5
630	34,8
800	34,1
1000	34,5
1250	29,4
1600	25,7
2000	21,8
2500	14,8
3150	9,2
4000	7,5
5000	8,9



Rating according to ISO 717-2

$$L_{n,w}(C_1) = 36 (1) \text{ dB}$$

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

$$C_{1,50-2500} = 3 \text{ dB}$$

Reduction of impact sound pressure level according to ISO 10140

No. of test report: 18-718-M14
Date of report: 2019-05-13
Date of test: 2019-03-07
Name: Pontus Thorsson

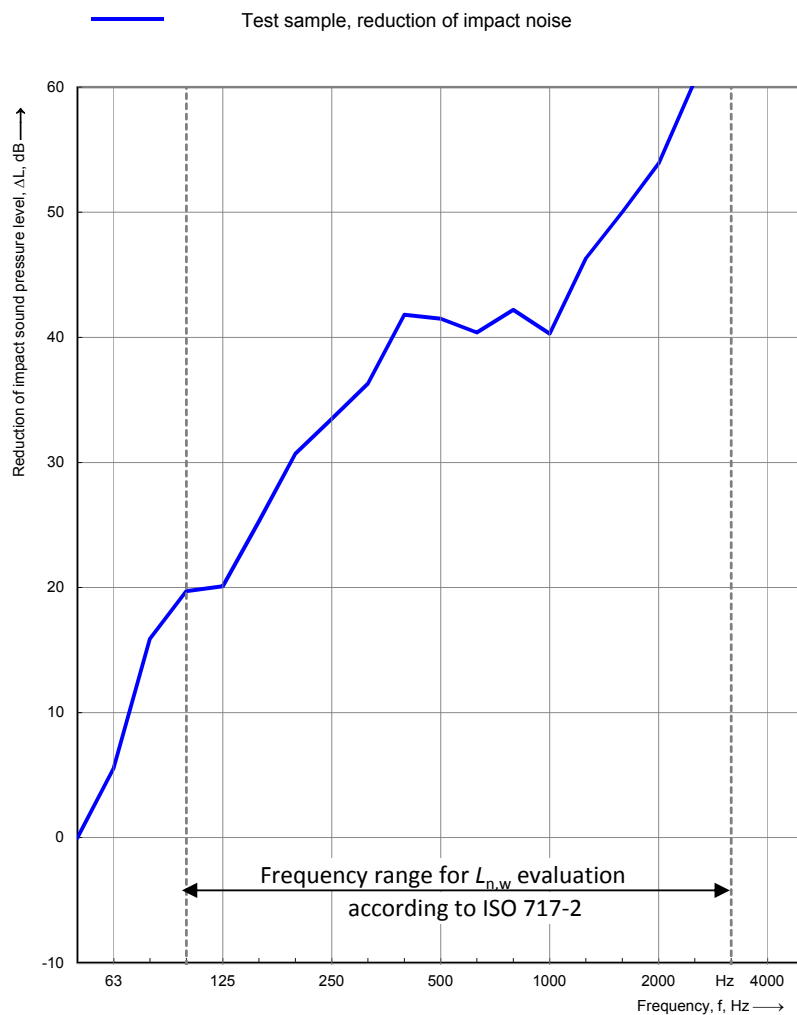
Laboratory measurements of the reduction of transmitted impact noise by floor coverings on a heavyweight standard floor

Client: Vibratec Akustikprodukter AB
Manufacturer: Vibratec Akustikprodukter AB
Test specimen mounted by: Akustikverkstan
Test room identification:
 Test room 3 (sending room) to Test room 2 (receiving room)
Product identification:
 VT-BAT-400 50 mm height

Description of the specimen:
 VT-BAT-400 50 mm height, c/c 600 mm between profiles, c/c 375 mm between elastic pads, with 2 layers of 22 mm Swiss Pearl Ceminwood boards. The Ceminwood boards were glued together using NoiseKiller Yellow. 45 mm mineral wool between Ceminwood and concrete floor. Mounted on 160 mm

Mass per unit area: 61 kg/m²
Curing time: 86400 s
Barometric pressure: 96,4 kPa
Temperature - source room: 17,9 °C
 - receiving room: 17,9 °C
Air humidity - source room: 36,5 %
 - receiving room: 36,5 %
Source room volume: 105 m³
Receiving room volume: 123,0 m³

Frequency f [Hz]	L _{n,0} 1/3 octave [dB]	ΔL 1/3 octave [dB]
50	46,0	
63	43,1	5,6
80	54,2	15,9
100	64,3	19,7
125	60,1	20,1
160	65,9	25,3
200	79,2	30,7
250	77,2	33,5
315	77,2	36,3
400	74,1	41,8
500	77,0	41,5
630	75,2	40,4
800	76,3	42,2
1000	74,8	40,3
1250	75,7	46,3
1600	75,7	50,0
2000	75,7	53,9
2500	75,3	60,5
3150	74,3	65,1
4000	72,6	65,1
5000	69,1	60,2



Rating according to ISO 717-2

ΔL_w = 44 dB

C_{L,Δ} = -14 dB

C_{L,r} = 3 dB

These results are based on test made with an artificial source under laboratory conditions obtained in one-third-octave bands by an engineering method.

Normalized impact sound pressure levels according to ISO 10140-3

No. of test report: 18-718-M15
Date of report: 2019-05-13
Date of test: 2019-03-07
Name: Pontus Thorsson

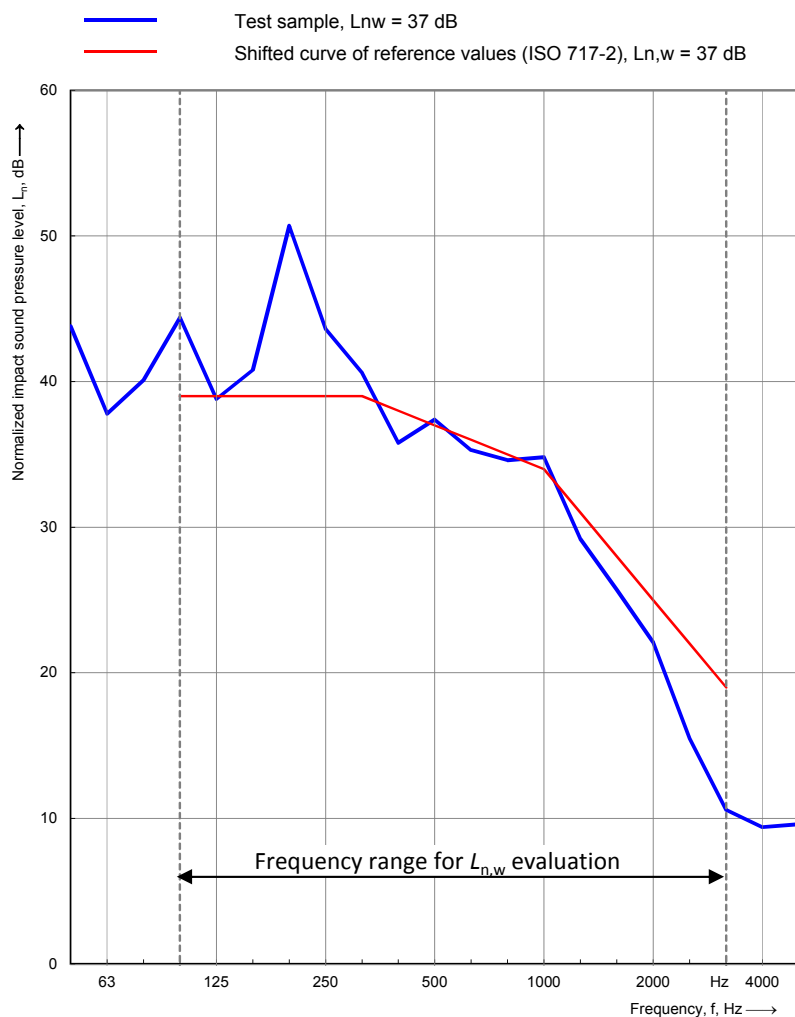
Laboratory measurements of impact sound insulation of floors

Client: Vibratec Akustikprodukter AB
Manufacturer: Vibratec Akustikprodukter AB
Test specimen mounted by: Akustikverkstan
Test room identification:
 Test room 3 (sending room) to Test room 2 (receiving room)
Product identification:
 VT-BAT-510 50 mm height

Description of the specimen:
 VT-BAT-510 50 mm height, c/c 600 mm between profiles, c/c 375 mm between elastic pads, with 2 layers of 22 mm Swiss Pearl Ceminwood boards. The Ceminwood boards were glued together using NoiseKiller Yellow. 45 mm mineral wool between Ceminwood and concrete floor. Mounted on 160 mm heavyweight reference concrete floor.

Mass per unit area: 426 kg/m²
Curing time: 1 days
Barometric pressure: 96,4 kPa
Temperature - source room: 17,9 °C
 - receiving room: 17,9 °C
Air humidity - source room: 36,5 %
 - receiving room: 36,5 %
Source room volume: 105 m³
Receiving room volume: 123,0 m³

Frequency f [Hz]	L _n 1/3 octave [dB]
50	43,8
63	37,8
80	40,1
100	44,4
125	38,8
160	40,8
200	50,7
250	43,6
315	40,6
400	35,8
500	37,4
630	35,3
800	34,6
1000	34,8
1250	29,2
1600	25,7
2000	22,1
2500	15,5
3150	10,6
4000	9,4
5000	9,6



Rating according to ISO 717-2

$$L_{n,w}(C_1) = 37 (1) \text{ dB}$$

$$C_{1,50-2500} = 2 \text{ dB}$$

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

Reduction of impact sound pressure level according to ISO 10140

No. of test report: 18-718-M16
Date of report: 2019-05-13
Date of test: 2019-03-07
Name: Pontus Thorsson

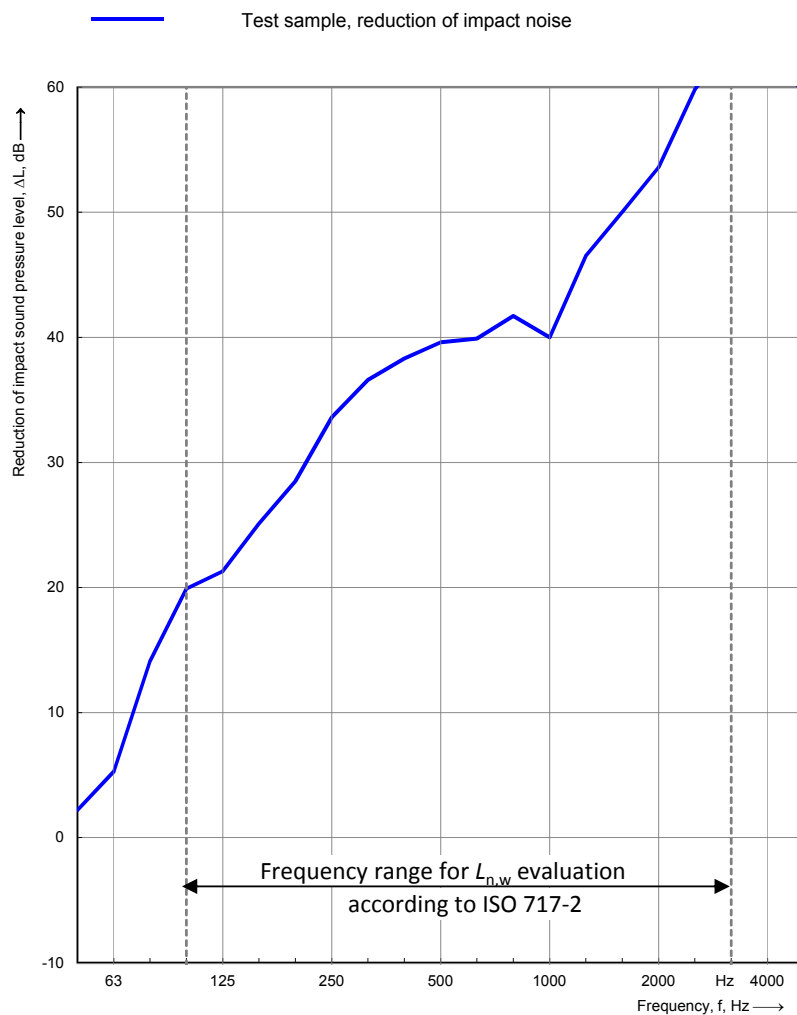
Laboratory measurements of the reduction of transmitted impact noise by floor coverings on a heavyweight standard floor

Client: Vibratec Akustikprodukter AB
Manufacturer: Vibratec Akustikprodukter AB
Test specimen mounted by: Akustikverkstan
Test room identification:
 Test room 3 (sending room) to Test room 2 (receiving room)
Product identification:
 VT-BAT-510 50 mm height

Description of the specimen:
 VT-BAT-510 50 mm height, c/c 600 mm between profiles, c/c 375 mm between elastic pads, with 2 layers of 22 mm Swiss Pearl Ceminwood boards. The Ceminwood boards were glued together using NoiseKiller Yellow. 45 mm mineral wool between Ceminwood and concrete floor. Mounted on 160 mm

Mass per unit area: 61 kg/m²
Curing time: 86400 s
Barometric pressure: 96,4 kPa
Temperature - source room: 17,9 °C
 - receiving room: 17,9 °C
Air humidity - source room: 36,5 %
 - receiving room: 36,5 %
Source room volume: 105 m³
Receiving room volume: 123,0 m³

Frequency f [Hz]	L _{n,0} 1/3 octave [dB]	ΔL 1/3 octave [dB]
50	46,0	2,2
63	43,1	5,3
80	54,2	14,1
100	64,3	19,9
125	60,1	21,3
160	65,9	25,1
200	79,2	28,5
250	77,2	33,6
315	77,2	36,6
400	74,1	38,3
500	77,0	39,6
630	75,2	39,9
800	76,3	41,7
1000	74,8	40,0
1250	75,7	46,5
1600	75,7	50,0
2000	75,7	53,6
2500	75,3	59,8
3150	74,3	63,7
4000	72,6	63,2
5000	69,1	59,5



Rating according to ISO 717-2

ΔL_w = 43 dB

C_{l,Δ} = -12 dB

C_{l,r} = 1 dB

These results are based on test made with an artificial source under laboratory conditions obtained in one-third-octave bands by an engineering method.

Normalized impact sound pressure levels according to ISO 10140-3

No. of test report: 18-718-M17

Date of report: 2019-05-13

Date of test: 2019-03-07

Laboratory measurements of impact sound insulation of floors

Name:

Client: Vibratex Akustikprodukter AB

Manufacturer: Vibratex Akustikprodukter AB

Test specimen mounted by: Akustikverkstan

Test room identification:

Test room 3 (sending room) to Test room 2 (receiving room)

Product identification:

VT-BAT-570 50 mm height

Description of the specimen:

VT-BAT-570 50 mm height, c/c 600 mm between profiles, c/c 375 mm between elastic pads, with 2 layers of 22 mm Swiss Pearl Ceminwood boards. The Ceminwood boards were glued together using NoiseKiller Yellow. 45 mm mineral wool between Ceminwood and concrete floor. Mounted on 160 mm heavyweight reference concrete floor.

Mass per unit area: 426 kg/m²

Curing time: 1 days

Barometric pressure: 96,4 kPa

Temperature - source room: 17,9 °C

- receiving room: 17,9 °C

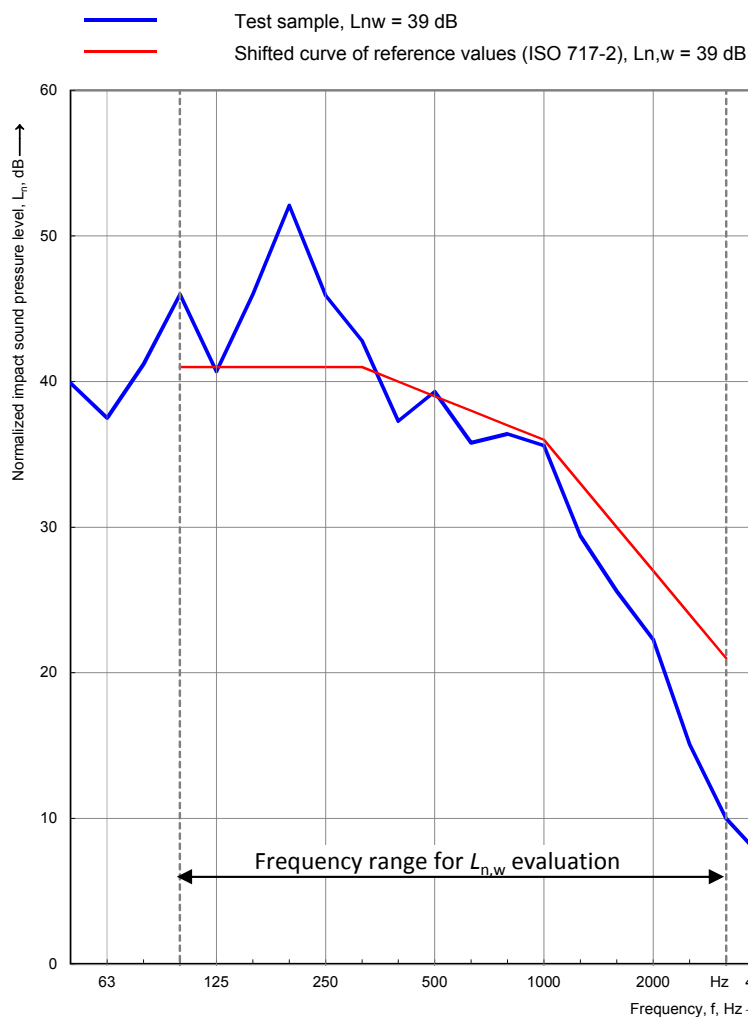
Air humidity - source room: 36,5 %

- receiving room: 36,5 %

Source room volume: 105 m³

Receiving room volume: 123,0 m³

Frequency f [Hz]	L _n 1/3 octave [dB]
50	39,9
63	37,5
80	41,2
100	46,0
125	40,7
160	46,0
200	52,1
250	45,9
315	42,8
400	37,3
500	39,3
630	35,8
800	36,4
1000	35,6
1250	29,4
1600	25,6
2000	22,3
2500	15,1
3150	10,0
4000	7,3
5000	8,9



Rating according to ISO 717-2

$$L_{n,w}(C_1) = 39 (1) \text{ dB}$$

$$C_{1,50-2500} = 2 \text{ dB}$$

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

Reduction of impact sound pressure level according to ISO 10140

No. of test report: 18-718-M18
Date of report: 2019-05-13
Date of test: 2019-03-07
Name: Pontus Thorsson

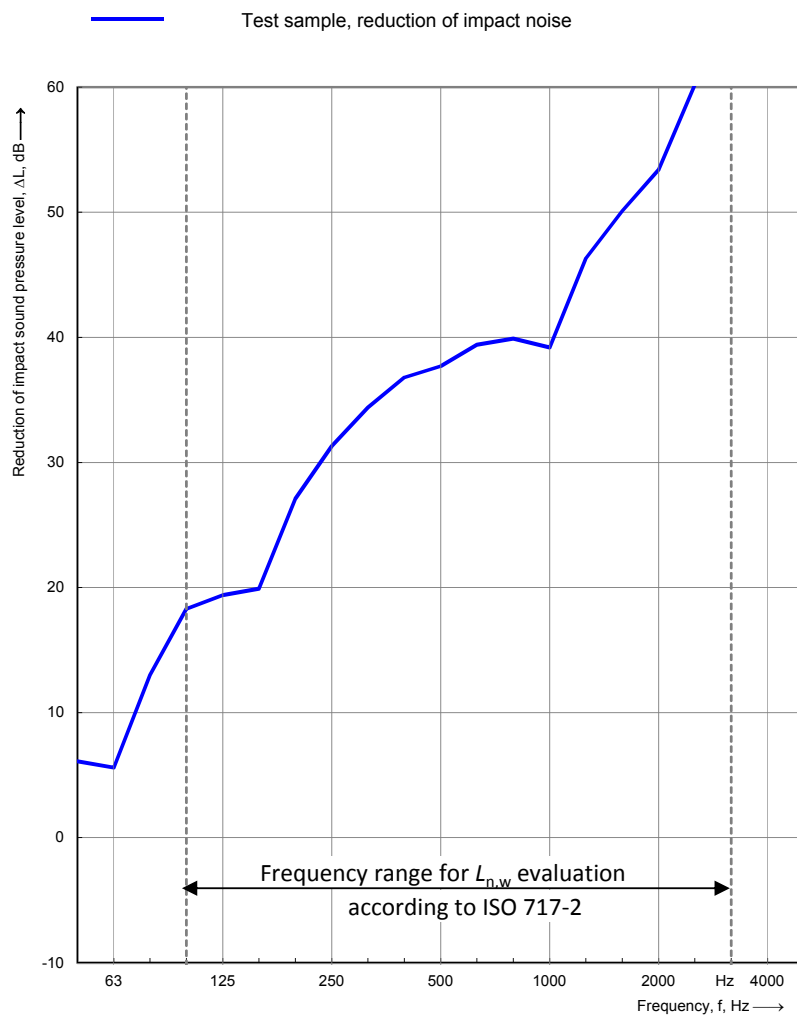
Laboratory measurements of the reduction of transmitted impact noise by floor coverings on a heavyweight standard floor

Client: Vibratex Akustikprodukter AB
Manufacturer: Vibratex Akustikprodukter AB
Test specimen mounted by: Akustikverkstan
Test room identification:
 Test room 3 (sending room) to Test room 2 (receiving room)
Product identification:
 VT-BAT-570 50 mm height

Description of the specimen:
 VT-BAT-570 50 mm height, c/c 600 mm between profiles, c/c 375 mm between elastic pads, with 2 layers of 22 mm Swiss Pearl Ceminwood boards. The Ceminwood boards were glued together using NoiseKiller Yellow. 45 mm mineral wool between Ceminwood and concrete floor. Mounted on 160 mm

Mass per unit area: 81 kg/m²
Curing time: 86400 s
Barometric pressure: 96,4 kPa
Temperature - source room: 17,9 °C
 - receiving room: 17,9 °C
Air humidity - source room: 36,5 %
 - receiving room: 36,5 %
Source room volume: 105 m³
Receiving room volume: 123,0 m³

Frequency f [Hz]	L _{n,0} 1/3 octave [dB]	ΔL 1/3 octave [dB]
50	46,0	6,1
63	43,1	5,6
80	54,2	13,0
100	64,3	18,3
125	60,1	19,4
160	65,9	19,9
200	79,2	27,1
250	77,2	31,3
315	77,2	34,4
400	74,1	36,8
500	77,0	37,7
630	75,2	39,4
800	76,3	39,9
1000	74,8	39,2
1250	75,7	46,3
1600	75,7	50,1
2000	75,7	53,4
2500	75,3	60,2
3150	74,3	64,3
4000	72,6	65,3
5000	69,1	60,2



Rating according to ISO 717-2

ΔL_w = 41 dB

C_{l,Δ} = -13 dB

C_{l,r} = 2 dB

These results are based on test made with an artificial source under laboratory conditions obtained in one-third-octave bands by an engineering method.

Normalized impact sound pressure levels according to ISO 10140-3

No. of test report: 18-718-M19
Date of report: 2019-05-13
Date of test: 2019-02-11
Name: Carl Nyqvist

Laboratory measurements of impact sound insulation of floors

Client: Vibratex Akustikprodukter AB

Manufacturer: Vibratex Akustikprodukter AB

Test specimen mounted by: -

Test room identification:

Test room 3 (sending room) to Test room 2 (receiving room)

Product identification:

Heavyweight reference floor, 160 mm concrete

Description of the specimen:

Heavyweight type 2

Mass per unit area: 365 kg/m²

Curing time: 0 days

Barometric pressure: 99,2 kPa

Temperature - source room: 17,7 °C

- receiving room: 17,7 °C

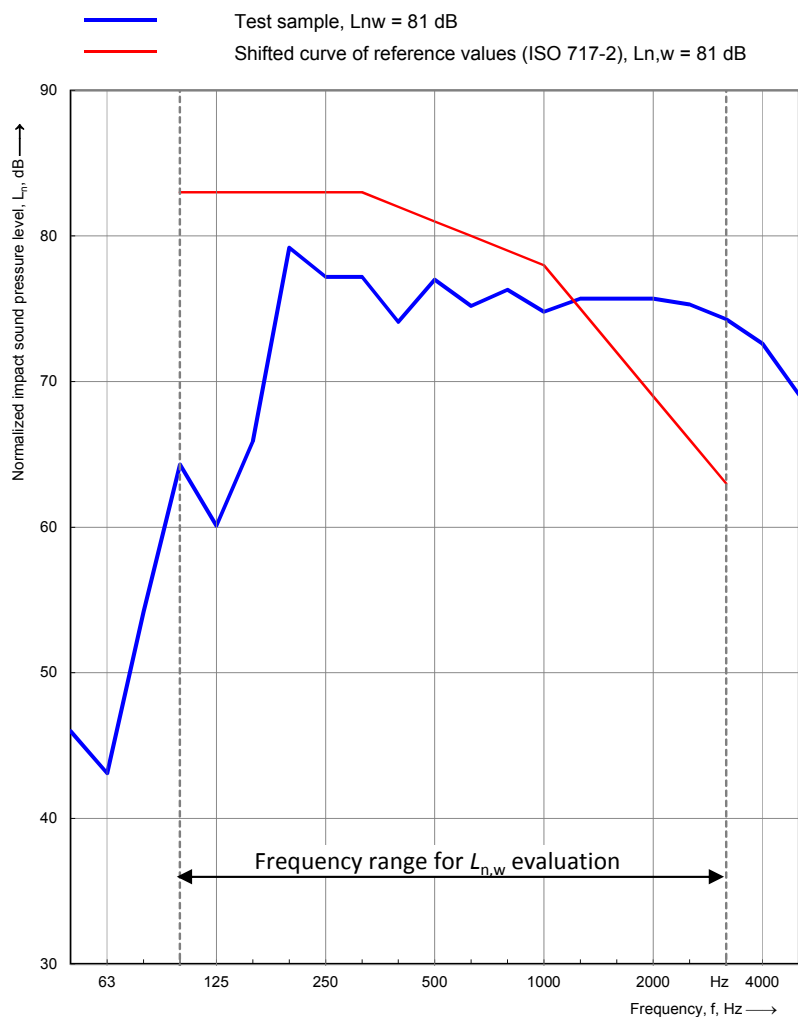
Air humidity - source room: 34,2 %

- receiving room: 34,2 %

Source room volume: 105 m³

Receiving room volume: 123,0 m³

Frequency f [Hz]	L _n 1/3 octave [dB]
50	46,0
63	43,1
80	54,2
100	64,3
125	60,1
160	65,9
200	79,2
250	77,2
315	77,2
400	74,1
500	77,0
630	75,2
800	76,3
1000	74,8
1250	75,7
1600	75,7
2000	75,7
2500	75,3
3150	74,3
4000	72,6
5000	69,1



Rating according to ISO 717-2

$$L_{n,w}(C_1) = 81 \text{ (-9) dB}$$

$$C_{1,50-2500} = -9 \text{ dB}$$

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.