

## Determination of airborne sound insulation of floors in the laboratory according to EN ISO 10140-2

(6 appendices)

*The meaning of this test is to investigate the impact of a special screw on a floor construction. The screws were used to fasten gypsum boards on furring on the underside. The ceilings with the special screws were compared with acoustical steel studs with ordinary screwing.*

### Client

Innovation Skåne AB

### Test object

A joists floor of wooden studs 45x220 at c/c 600 with 95 mm mineral wool and furring 28x70 at c/c 300 or Knauf AP Acoustical studs 25x85 at c/c 300.

On top of the wooden studs 22 mm chipboard were applied.

One or two layers of 12,5 mm gypsum boards (Gyproc GNE) were attached by either ordinary screws against the acoustical studs or by the special screws against the furring.

Pictures on the floors and the special screws are given in the report.

### Arrival of test object

Just before the test

### Date of test

2019-02-20 up to 2019-02-24

### Results

Weighted sound reduction index ( $R_w$ ) is given in Table 1. Complete results can be seen in the enclosures. Higher values are better sound insulation.

A direct comparison between the special screws and ordinary screws in acoustical studs is given in table 2 and in the enclosures 5 and 6.

The test results are valid for the tested specimens only.

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Table 1 - Results

Test object:	Weighted sound reduction index, $R_w$ (dB)	$C_{50-3150}$ (dB)	Enclosure
One layer of gypsum boards with the special screws in the furring	50	-4	1
One layer of gypsum boards with ordinary screws in the acoustical studs	54	-3	2
Two layers of gypsum boards with the special screws in the furring	55	-4	3
Two layers of gypsum boards with ordinary screws in the acoustical studs	57	-3	4

Table 2 – Results of the special screws compared with ordinary screws in acoustical studs. Negative numbers means less sound insulation with the special screws.

	$R_w$ (dB)	$C_{50-3150}$ (dB)	$R_w + C_{50-3150}$ (dB)
One layer of gypsum boards	-4	-1	-5
Two layers of gypsum boards	-2	-1	-3

### Measurement method

The airborne sound insulation measurements have been performed according to the international standard ISO 10140-2:2010.

### Evaluation

The results have been evaluated according to the international standard SS-EN ISO 717-1. In the enclosures,  $R_w$  and the additional spectrum adaptation terms ( $C$ ;  $C_{tr}$ ), ( $C_{50-3150}$ ;  $C_{tr 50-3150}$ ) and ( $C_{50-5000}$ ;  $C_{tr 50-5000}$ ) according to SS-EN ISO 717-1:1996 are given. The spectrum adaptations terms shall be added to the  $R_w$  values to obtain a summary value based on other noise spectra.

### Measurement uncertainty

Measurement U, according to ISO 12999-1:2014, with respect to the reproducibility are given in table 2. The table shows the uncertainty with the coverage factor  $k=2$  (corresponding to 95% confidence level).

Table 2

1/3-octave band (Hz)	Measurement uncertainty, U (dB)
50	11,7
63	6,7
80	5,9
100	5,0
125	5,0
160	3,8
200	3,3
250	3,3
315	3,3
400	3,3
500	3,3
630	3,3
800	3,3
1000	3,3
1250	3,4
1600	3,4
2000	3,4
2500	3,5
3150	3,6
4000	4,0
5000	4,7
$R_w$	2,0

### Pictures of the test objects and their mounting



Picture 1 – The special screw used in the test with the furring in enclosure 1 and 3.



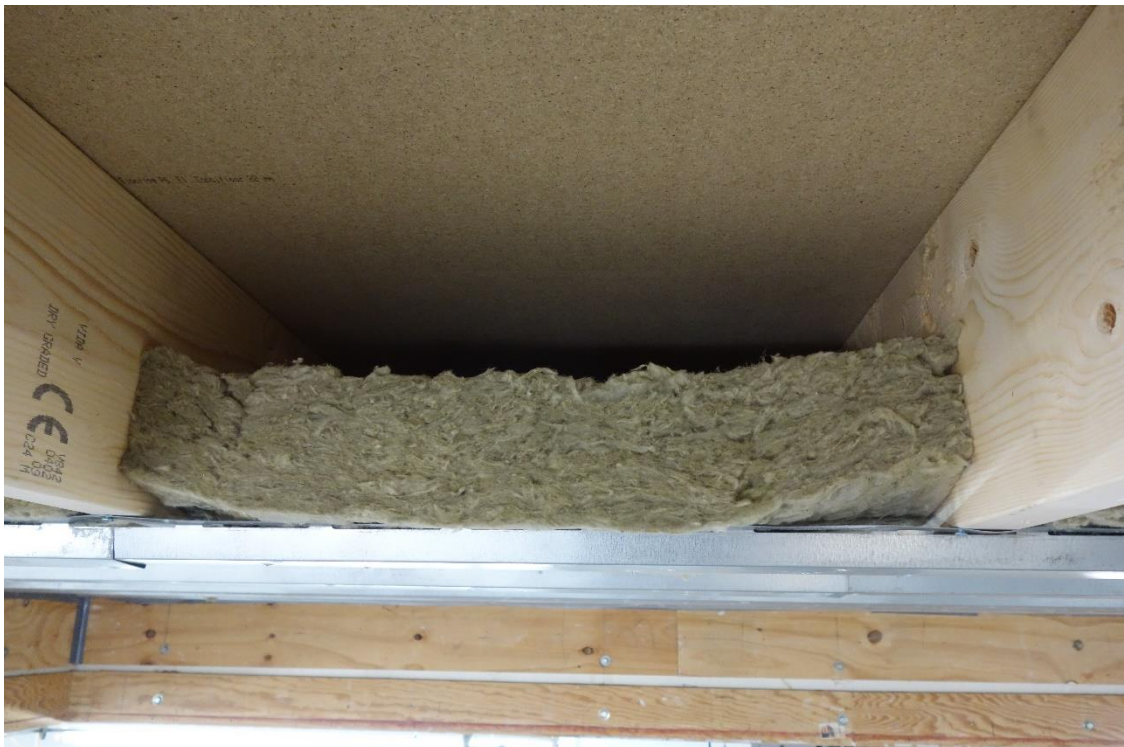
*Picture 2 – The floor from below. The furring 28x70 can be seen.*



*Picture 3 - The Knauf AP Acoustical stud.*



*Picture 4 – The floor from below with the Knauf AP Acoustical studs.*



*Picture 5 – The mineral wool between the wooden studs 45x220.*



*Picture 6 – The floor from above, 22 mm chipboard.*



*Picture 7 - The wooden studs 45x220 where attached by screws into studs 45x145 placed directly on the edges of the test opening on all sides.*



*Picture 8 – The wooden studs on the short side, 45x145 screwed into 45x220.*



*Picture 9 – The gypsum boards from below, an example.*

## Mounting

The floors were built in SP:s sound insulation laboratory for floors (vertical measurements). The wooden studs 45x220 were attached by screws into studs 45x145 placed directly on the edges of the test opening on all sides (see the picture 7 and 8). The edges of the test object in the upper laboratory were covered by several strips of gypsum boards and sealed by tape and model clay.

## Equipment

<i>Instrument</i>	<i>Manufacturer</i>	<i>Type.</i>	<i>Serial no.</i>
Real time analyzer	Norsonic	830	10765
Calibrator	Brüel & Kjær	4230	1411048
Microphone source room	Brüel & Kjær	4166	1011610
Microphone receiving room	Brüel & Kjær	4166	1011722
Microphone preamplifier source room	Brüel & Kjær	2619	726822
Microphone preamplifier receiving room	Brüel & Kjær	2619	970931
Microphone boom source room	Brüel & Kjær	3923	761969
Microphone boom receiving room	Brüel & Kjær	3923	681300
Microphone power supply source room	Brüel & Kjær	2804	1181214
Microphone power supply receiving room	Brüel & Kjær	2804	455245

## **RISE Research Institutes of Sweden AB** **Building Technology - Sound and vibration**

Performed by

Examined by

Joachim Stadig

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## Appendices



Appendix 1

**Determination of sound insulation in a laboratory according to EN ISO 10140-2**

Client: Innovation Skåne AB Date of test: 2019-02-20

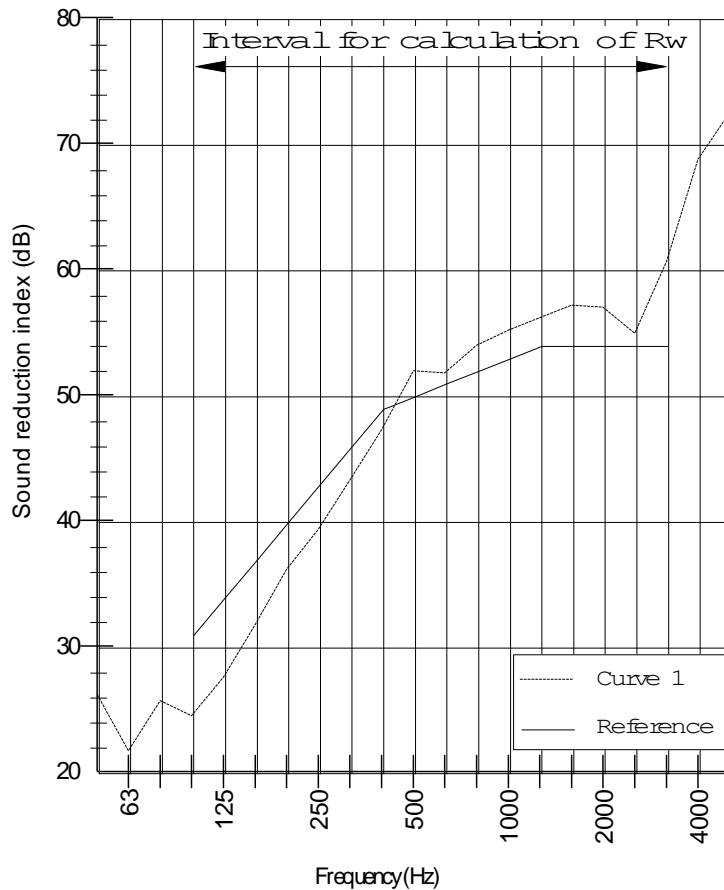
Test object: A joists floor of wooden studs: 45x220 at c/c 600 and 95 m mineral wool and furring 28x70 at c/c 300.

On top: 22 mm floor chipboard.

Under: **One layer of gypsum boards** fastened by **the special screws** at c/c 450 along each furring.

Area of the test opening: 12,00 m<sup>2</sup>

Result: Curve 1 – Test object  
Curve 2 - Reference curve



Frequency (Hz)	Curve 1 (dB)
50	26,1
63	21,7
80	25,6
100	24,4
125	27,5
160	31,7
200	36,1
250	39,3
315	43,2
400	47,2
500	51,9
630	51,7
800	53,9
1000	55,1
1250	56,1
1600	57,1
2000	57
2500	54,9
3150	60,6
4000	68,8
5000	72,5

Rw	50
(C; Ctr)	(-3;-9)
50-3150	(-4;-12)
50-5000	(-3;-12)
Rmean	46,7
Sum. Dev.	30,6
Max. Dev.	6,6
Frequency	100

Appendix 2

**Determination of sound insulation in a laboratory according to EN ISO 10140-2**

Client: Innovation Skåne AB Date of test: 2019-02-24

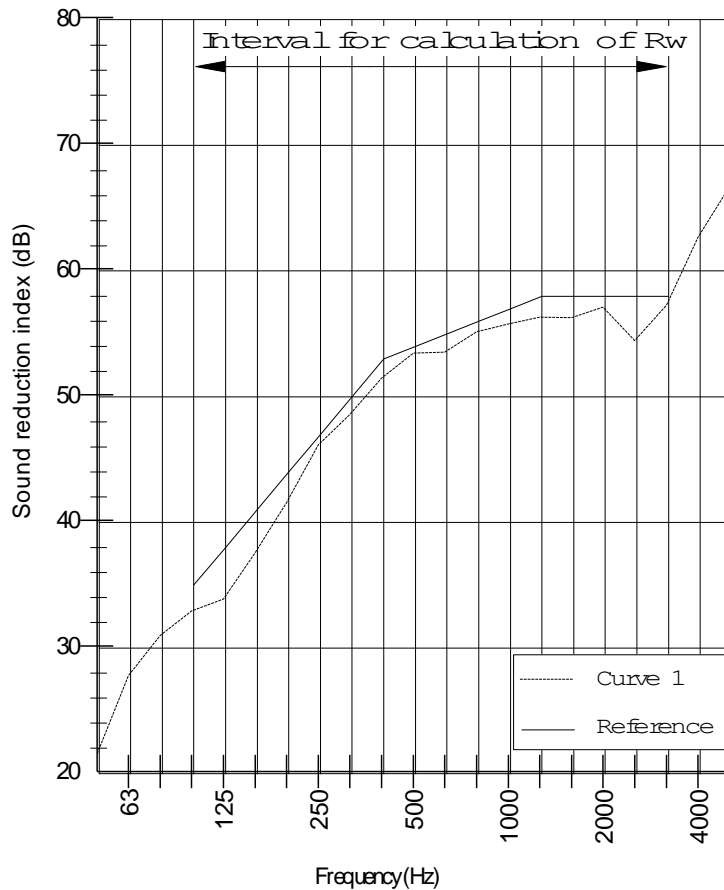
Test object: A joists floor of wooden studs: 45x220 at c/c 600 and 95 mm mineral wool and **Knauf AP acoustical steel studs** 25x85 at c/c 300.

On top: 22 mm floor chipboard.

Under: **One layer of gypsum boards** fastened by screws at c/c 200 along edges and c/c 300 in the middle of boards.

Area of the test opening: 12,00 m<sup>2</sup>

Result: Curve 1 – Test object  
Curve 2 - Reference curve



Frequency (Hz)	Curve 1 (dB)
50	21,4
63	27,6
80	30,8
100	32,8
125	33,7
160	37,4
200	41,4
250	46
315	48,4
400	51,3
500	53,3
630	53,4
800	55
1000	55,6
1250	56,2
1600	56,1
2000	57
2500	54,3
3150	57,1
4000	62,5
5000	66,6

Rw	54
(C; Ctr)	(-2;-7)
50-3150	(-3;-12)
50-5000	(-2;-12)
Rmean	49,3
Sum. Dev.	31
Max. Dev.	4,3
Frequency	125

Appendix 3

**Determination of sound insulation in a laboratory according to EN ISO 10140-2**

Client: Innovation Skåne AB Date of test: 2019-02-21

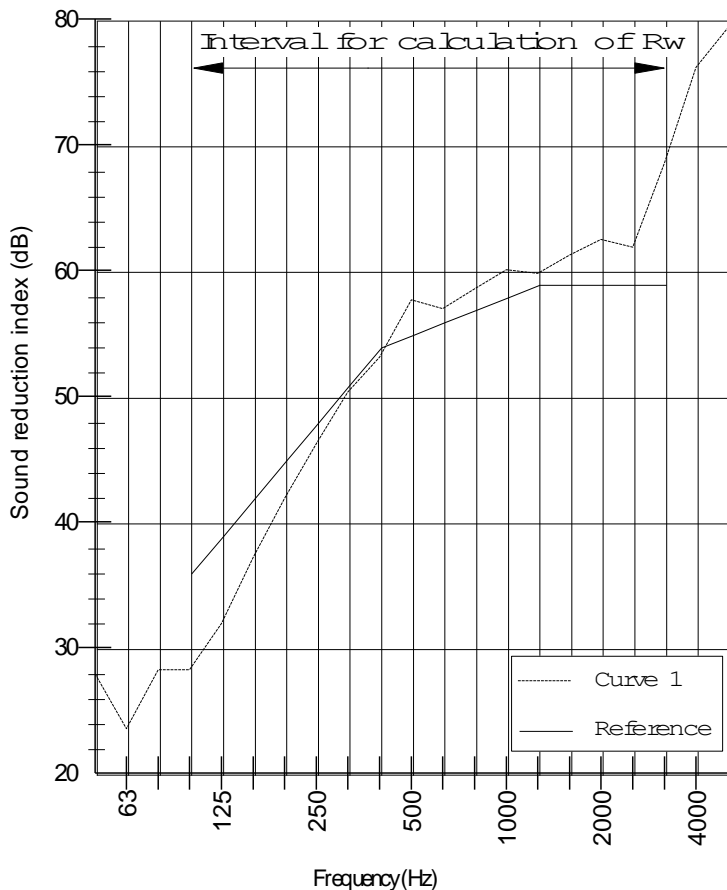
Test object: A joists floor of wooden studs: 45x220 at c/c 600 and 95 mm mineral wool and furring 28x70 at c/c 300.  
On top: 22 mm floor chipboard.  
Under: **Two layers of gypsum boards** with the first fastened by the special screws.

First layer: **The special screws at c/c 450 along each furring.**

Second layer: Screws towards first layer c/c 500 along boards and c/c 300. across boards. The second layer was not screwed into the furring.

Area of the test opening: 12,00 m<sup>2</sup>

Result: Curve 1 – Test object  
Curve 2 - Reference curve



Frequency (Hz)	Curve 1 (dB)
50	27,9
63	23,5
80	28,2
100	28,2
125	31,9
160	37,2
200	41,9
250	46,2
315	50,3
400	53,1
500	57,7
630	57
800	58,5
1000	60,1
1250	59,8
1600	61,2
2000	62,5
2500	61,8
3150	68,6
4000	76,2
5000	79,3

Rw	55
(C; Ctr)	(-3;-10)
50-3150	(-4;-13)
50-5000	(-3;-13)
Rmean	52,3
Sum. Dev.	26,2
Max. Dev.	7,8
Frequency	100

Appendix 4

**Determination of sound insulation in a laboratory according to EN ISO 10140-2**

Client: Innovation Skåne AB Date of test: 2019-02-26

Test object: A joists floor of wooden studs: 45x220 at c/c 600 and 95 mm mineral wool and **Knauf AP acoustical steel studs** 25x85 at c/c 300.  
On top: 22 mm floor chipboard.

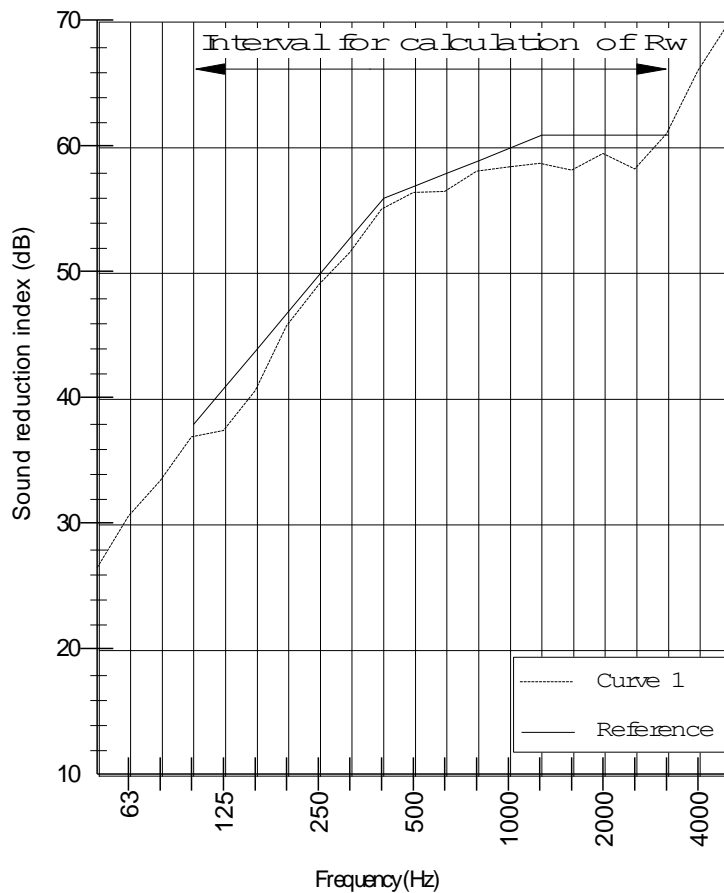
Under: **Two layers of gypsum boards**

First layer: screwed at c/c 600 towards acoustical steel studs.

Second layer: screwed at c/c 200 along edges and c/c 300 in the middle of boards towards the acoustical steel studs.

Area of the test opening: 12,00 m<sup>2</sup>

Result: Curve 1 – Test object  
Curve 2 - Reference curve



Frecuency (Hz)	Curve 1 (dB)
50	26,4
63	30,5
80	33,3
100	36,8
125	37,3
160	40,5
200	45,7
250	48,9
315	51,5
400	54,9
500	56,3
630	56,4
800	58
1000	58,3
1250	58,6
1600	58,1
2000	59,4
2500	58,2
3150	61
4000	66
5000	69,9

Rw	57
(C; Ctr)	(-2;-6)
50-3150	(-3;-11)
50-5000	(-2;-11)
Rmean	52,5
Sum. Dev.	28,1
Max. Dev.	3,7
Frequency	125

Appendix 5

**Determination of sound insulation in a laboratory according to EN ISO 10140-2**

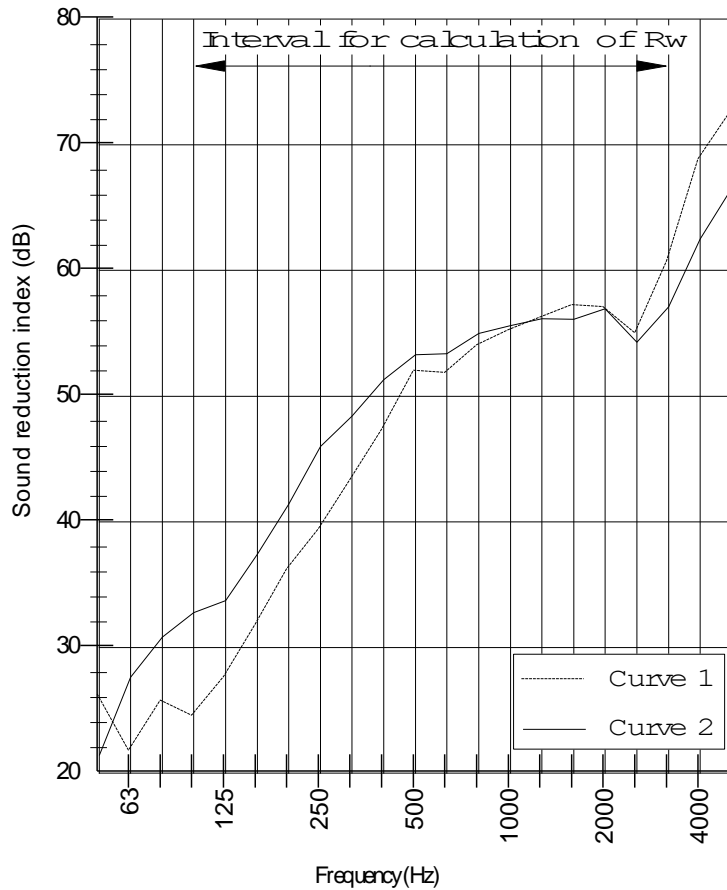
Client: Innovation Skåne AB Date of test: 2019-02-20

Test object: **One layer of gypsum boards** on the underside of the floor - The special screws compared with ordinary screwing on acoustical steel studs.

Higher values are better sound insulation.

Area of the test opening and module: 12,00 m<sup>2</sup>, hela öppningen

Result: Curve 1 – Test with the special screws  
Curve 2 – Ordinary screwing in acoustical studs



Frequency (Hz)	Curve 1 (dB)	Curve 2 (dB)
50	26,1	21,4
63	21,7	27,6
80	25,6	30,8
100	24,4	32,8
125	27,5	33,7
160	31,7	37,4
200	36,1	41,4
250	39,3	46
315	43,2	48,4
400	47,2	51,3
500	51,9	53,3
630	51,7	53,4
800	53,9	55
1000	55,1	55,6
1250	56,1	56,2
1600	57,1	56,1
2000	57	57
2500	54,9	54,3
3150	60,6	57,1
4000	68,8	62,5
5000	72,5	66,6

$R_w$	50	54
(C; Ctr)	(-3;-9)	(-2;-7)
50-3150	(-4;-12)	(-3;-12)
50-5000	(-3;-12)	(-2;-12)
Rmean	46,7	49,3
Sum. Dev.	30,6	31
Max. Dev.	6,6	4,3
Frequency	100	125

Appendix 6

**Determination of sound insulation in a laboratory according to EN ISO 10140-2**

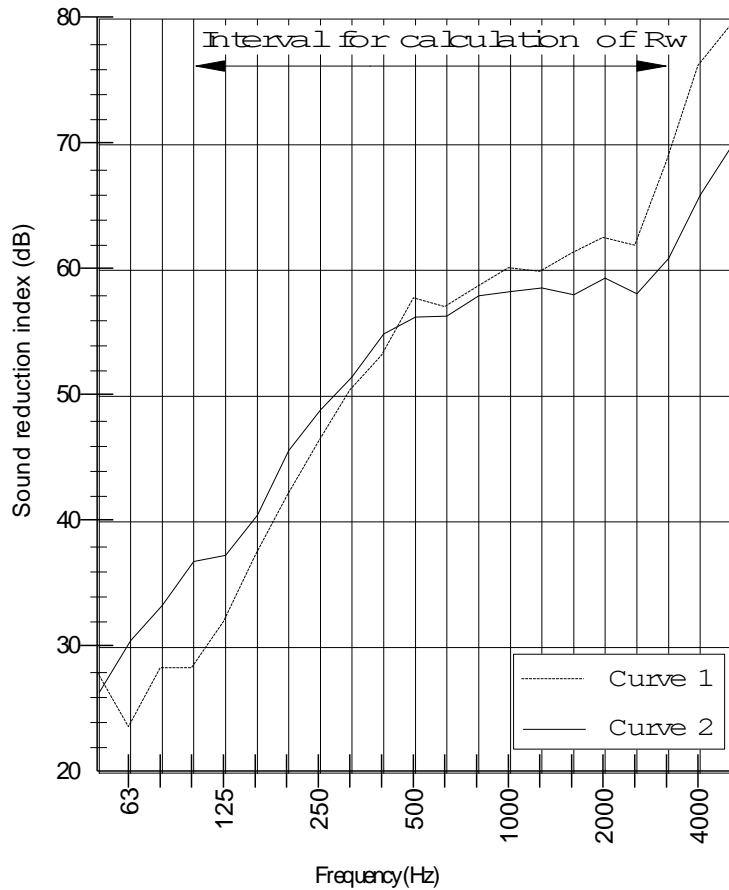
Client: Innovation Skåne AB Date of test: 2019-02-21

Test object: **Two layers of gypsum boards** on the underside of the floor - The special screws compared with ordinary screwing on acoustical steel studs.

Higher values are better sound insulation.

Area of the test opening: 12,00 m<sup>2</sup>

Result: Curve 1 – Test with the special screws  
Curve 2 – Ordinary screwing in acoustical studs



Frequency (Hz)	Curve 1 (dB)	Curve 2 (dB)
50	27,9	26,4
63	23,5	30,5
80	28,2	33,3
100	28,2	36,8
125	31,9	37,3
160	37,2	40,5
200	41,9	45,7
250	46,2	48,9
315	50,3	51,5
400	53,1	54,9
500	57,7	56,3
630	57	56,4
800	58,5	58
1000	60,1	58,3
1250	59,8	58,6
1600	61,2	58,1
2000	62,5	59,4
2500	61,8	58,2
3150	68,6	61
4000	76,2	66
5000	79,3	69,9

$R_w$	55	57
(C; Ctr)	(-3;-10)	(-2;-6)
50-3150	(-4;-13)	(-3;-11)
50-5000	(-3;-13)	(-2;-11)
Rmean	52,3	52,5
Sum. Dev.	26,2	28,1
Max. Dev.	7,8	3,7
Frequency	100	125