Ruukki
Building your tomorrow.

Ruukki® Sound Environment solutions

Embedded sound environment in a building envelope

Product Description

Ruukki® Sound Environment solution benefits

- Optimized sound environment with lightweight solutions
- High value at economical price
- Improve occupants' wellbeing, efficiency, and productivity
- Design freedom thanks to embedded noise absorption
- Spaces that adhere to good acoustic principles
- Adaptability for different building use
- Fewer work phases for increased efficiency and safety
- Easy and quick installation
- Embedded in envelope: No need to worry about the expenses of retrofitting solutions once the building is ready

Sound so good you don´t even think about it

Our range of profiled load bearing roofing sheets and cladding products come now up to class A sound absorption properties, cutting out background noise, reducing echoes and reverberation. Our solutions improve the sound environment of a space by using strategic perforations, combined with sound absorptive materials like mineral wool, acoustic infill, and acoustic layers. Together they absorb sound reflections, reduce unnecessary spread of noise and noise level inside the space and improve the overall acoustics making the space more enjoyable for its occupants and visitors.

You benefit from safer work environment, lower stress levels and improved productivity. It may not always be possible to control the sources of noise but using both sound insulation and sound absorption in the building envelope can improve the acoustics of a space to suit its purpose.

Short guide to good sound environment

BUILDING ENVELOPE EFFECT

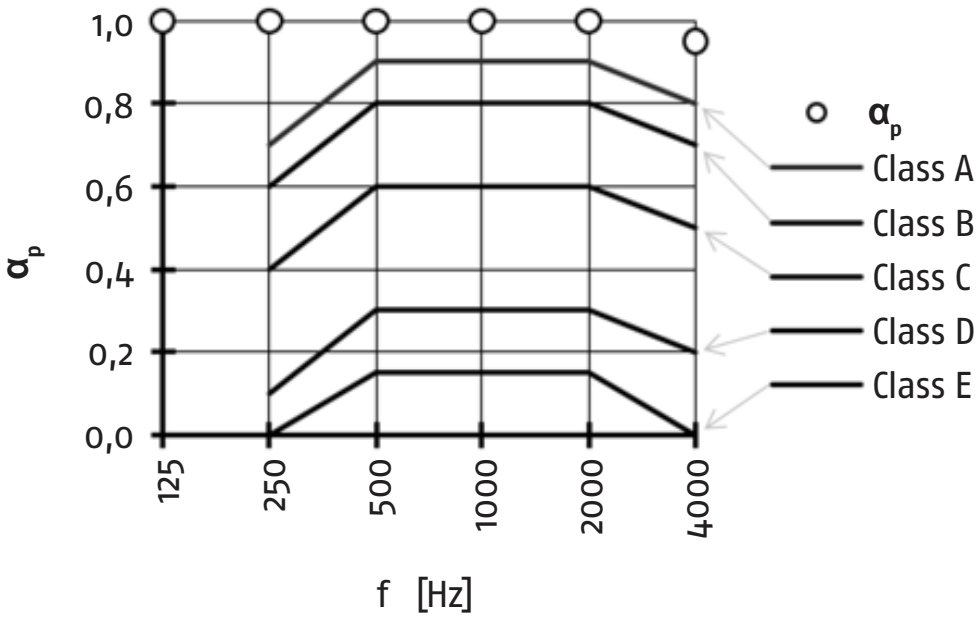
In any enclosed rooms, sound energy can´t escape easily to surroundings. Instead, it tends to stay indoors by bouncing back from reflective surfaces attenuating slowly. These multiple reflections indoors in fact amplifies the original sound energy level in room by 5 to 6 dB.

Result is generally long sound reverberation time, increased background noise, spread of noise and low speech intelligibility.

Building envelope effect can be compensated by adding sound attenuation to building envelope to reduce amount of sound reflections. Ruukki roof and wall acoustic solutions with appropriate thermal insulation layers can offer solutions for all sound absorption classes.

SOUND ABSORPTION CLASS

Sound absorptive materials are many times measured and characterized with sound absorption classes from E to A from sound reflecting to extremely sound absorbing. Sound absorption class is suitable measure to compare different materials and solutions to each other relative to human hearing.



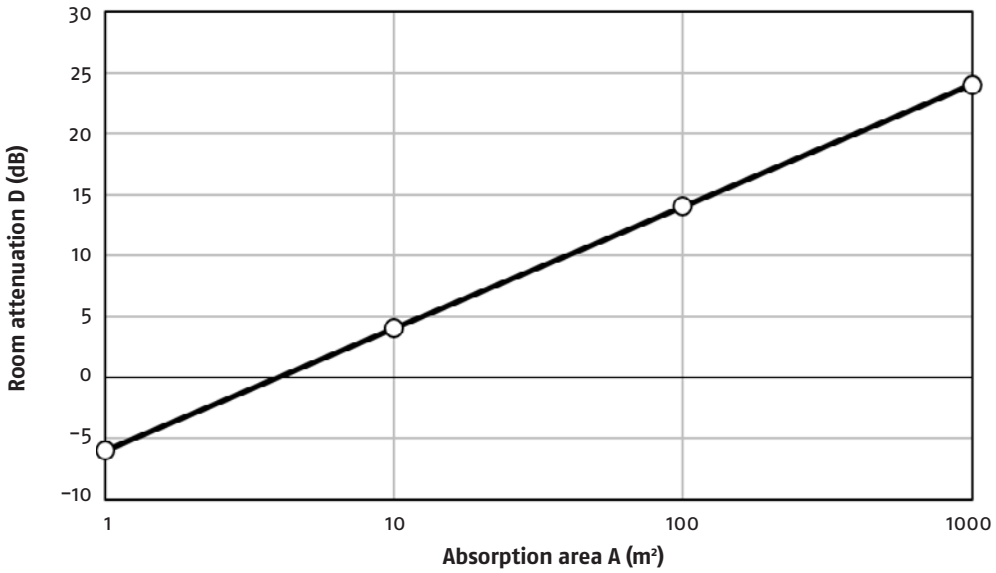
Sound absorption class is suitable measure to compare different materials and solutions to each other relative to human hearing. Classification is based on standard EN ISO 11654:1997. Annex B defines also textual naming of these acoustic material classes: E: hardly absorbing, D: absorbing, C: highly absorbing and B-A: extremely absorbing

ROOM ATTENUATION AND BACKGROUND NOISE

Sound and noise attenuation inside a room is depended on indoor surface materials and their sound absorption capability. Room absorption area A is amount of total surface area of a perfect sound absorption material.

Practical material sound absorption area is less than its material real area: [material area] x [material´s coefficient of sound absorption]. Coefficient is value between fully sound reflective to fully sound absorptive; 0.0–1.0. Coefficient is defined and measured in sound laboratory in a several sound frequency ranges and method is standardized.

There is relation with sound level in a room and sound absorption area. This is called room attenuation D [dB].



Room attenuation *D* as a function of absorption area *A*.

Note: Scale is logarithmic. Doubling the sound absorption area A improves room attenuation D by 3 dB. Observe the negative decibel numbers on left side – room works as an acoustic amplifier with low amount of sound absorption.

SOUND REVERBERATION TIME

Useful acoustic quality measures of building space comfort and wellbeing are room attenuation and sound reverberation time in seconds. These main room acoustic parameters give basic hints about room acoustic quality, and how room will react with changing situation, like increasing noise levels.

Sound reverberation time can be estimated using material sound absorption measurements and with Sabine equation (Wallace Clement Sabine 1868–1919).

T60 = 0,161 * (V/A)

T60 is time in seconds when original sound is attenuated 60dB, V is room volume of space in m3, A is calculated sound absorption area of total surfaces in m². It's a sum of each materials surface area × each material measured sound absorption coefficient. Calculation is done for each frequency range. For large halls distances, air humidity and temperature level influence how well the highest frequencies travel in air medium itself from source to listener.

Sound reverberation time estimation calculations with user room parameters and using Ruukki acoustic solutions is available as WEB-tool at **www.ruukki.com/acoustic-estimator**

WHAT IS SUITABLE TARGET FOR SOUND REVERBERATION TIME FOR A ROOM?

National building codes may have recommendations for appropriate sound reverberation times for some usages as useful guide – however they usually lack guidance for workplaces or for large spaces.

From long history of case studies, it can be concluded that for spoken communication cases, sound reverberation time needs to be around 1 to 2 seconds. The time should be around 1 second in case of accurate spoken communication such as monitoring, presenting, learning, concentrating or teaching. In addition, reverberation time of 2 seconds or less can be acceptable for larger spaces, where customer face-to-face services or group coaching type situations occur, e.g. in shopping centers and sports halls.

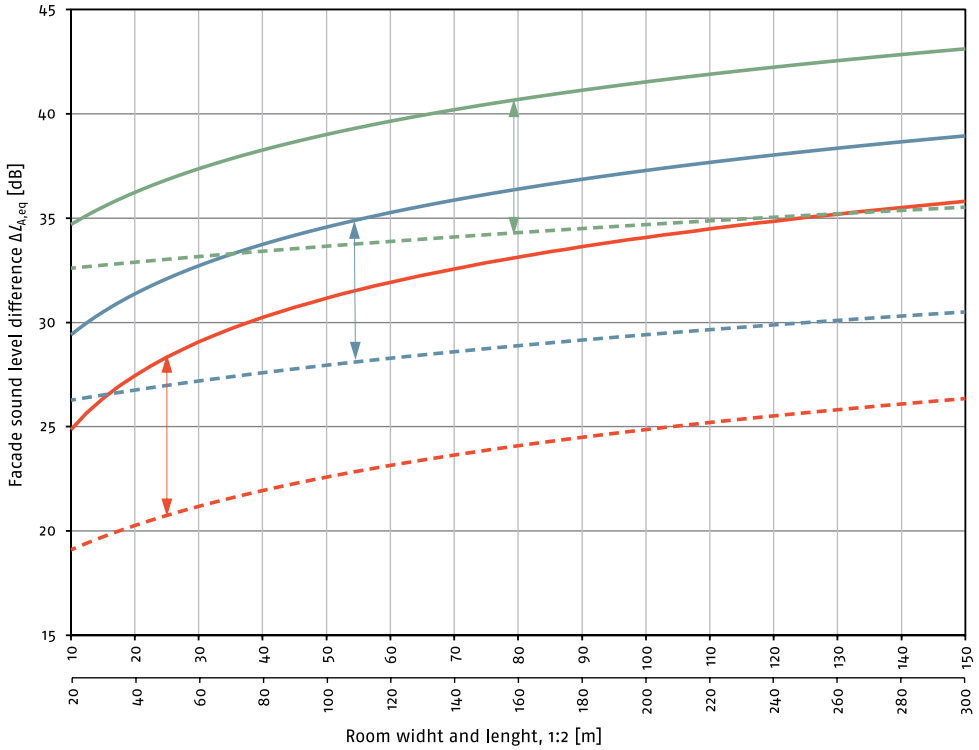
SOUND INSULATION AND SOUND LEVEL DIFFERENCE BENEFIT DUE TO GOOD ENVELOPE SOUND ABSORPTION

Sound absorption in walls reduces echoing between the facing wall surfaces. It improves sound insulation value (R_w) of light-weight walls.

Wall structure	R_w dB	Ruukki sound absorption solution type	Combined R_w
Light weight sandwich panel	30	50mm sound absorption	~ +6dB
Light weight sandwich panel	30	100mm sound absorption	~ +10dB
Light weight sandwich panel – usage as internal wall	30	100mm sound absorption –installed on both sides	~ +16dB

Added sound absorption layer increase sandwich panel airborne sound insulation property. Typical sandwich panel sound insulation level is R_w 29 – 31dB. Panel surfaces are sound reflective. Amount of Combined R_w-value is very similar when used with another type of sandwich panel.

Overall good sound absorption in envelope increases also the sound level difference between outdoors and indoors. Sound absorption in ceiling decreases sound reflections and reduces the spread of noise level more far away in a room decreasing background noise. An example below shows roof importance on façade sound level difference against traffic noise. Figure shows influence of both wall and roof absorption variations. More design instructions on www.ruukki.com.



Ceiling type	Sound absorption, α_w
Dashed line: Sound reflective ceiling (board, concrete, LBS...)	0,10
Solid line: Sound absortive Ruukki LBS T153 AcuB + acoustic infill	0,90
Light weight sandwich walls	**Sound absorption, α_w**
SPA 150E: R_w+Ctr = 27 dB	0,15
SPA 150E + 50mm sound absorption: R_w+Ctr = 30 dB	0,50
SPA 150E + 100mm sound absorption: R_w+Ctr = 34 dB	0,90

Ruukki load bearing acoustic roof solutions

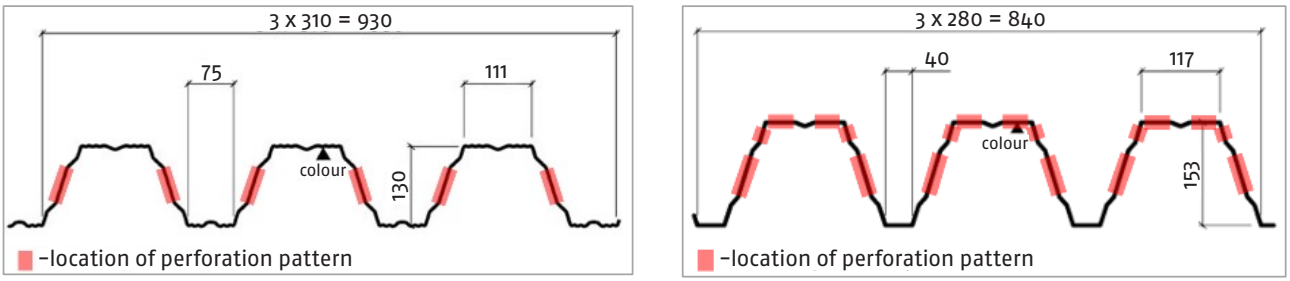
Our range of profiled load bearing roofing sheets come up to class A sound absorption properties, cutting out background noise, reducing echoes and reverberations.

You can choose from two main load bearing profile types and sound absorption perforations:

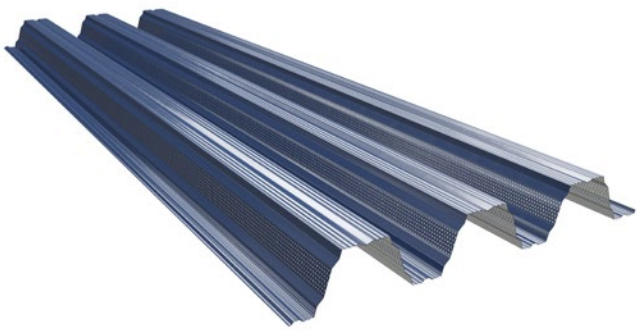
- T130M and T153 with web perforation; Sound absorption class D and C
- T153 with web and upper flange perforation; Sound absorption class B and A

Load bearing roof profiles with appropriate thermal insulation layers creates effective, embedded sound absorption solutions for indoors.

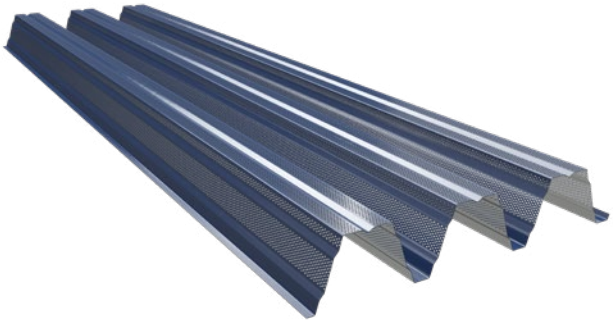
Structural design of perforated load bearing sheets is made by Ruukki® Poimu design program available in **Ruukki Design Tools Portal**. All necessary, laboratory verified, acoustic properties are stated in this document. The thickness of the profile is selected based on the load bearing capacity and has no effect on acoustic properties.



Locations of web perforation and web- and flange perforation



Web perforation available to T130M (in picture) and T153

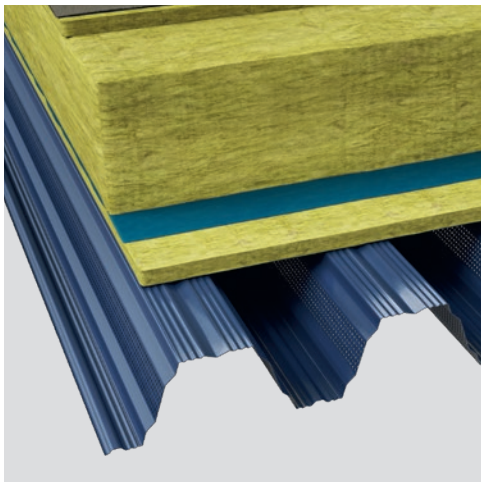


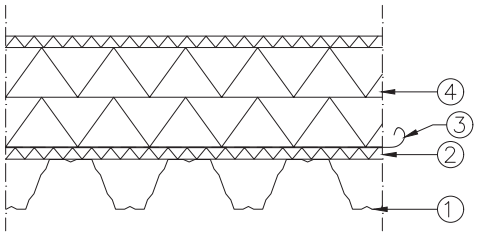
Web and flange perforation available to T153

ACOUSTIC LOAD BEARING SHEET T130M–75L–930 3/15 SOLUTIONS

Ruukki T130M 3/15 (web perforated)

Sound absorption class D, α_w 0,35





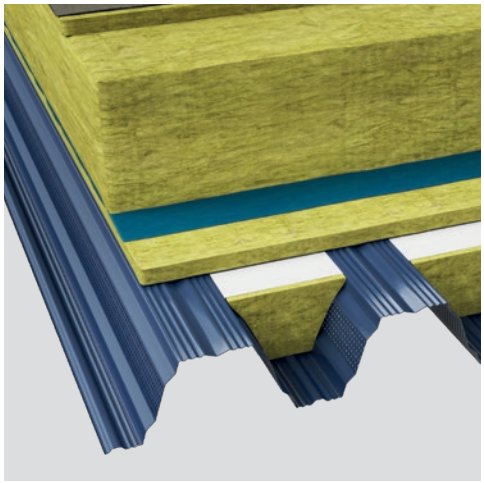
1. T130M 3/15 (Perforation 15%)
2. Mineral wool (30mm)
3. Vapor barrier
4. Mineral wool (total of 290)

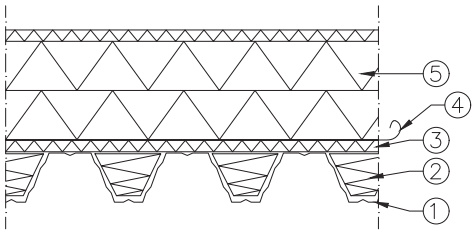
Sound absorption values apply with insulation thickness 130mm–400mm

T130M 3/15% Class D, α_w 0,35			
f(Hz)	α_s 1/3	α_s 1/1	α_p 1/1
100	0,60		
125	0,72	0,70	0,70
160	0,79		
200	0,77		
250	0,91	0,87	0,85
315	0,93		
400	1,04		
500	0,94	0,91	0,90
630	0,73		
800	0,52		
1000	0,37	0,42	0,40
1250	0,36		
1600	0,33		
2000	0,26	0,28	0,30
2500	0,26		
3150	0,28		
4000	0,25	0,26	0,25
5000	0,25		

Ruukki T130M 3/15 (web perforated) + acoustic infill

Sound absorption class D, α_w 0,45





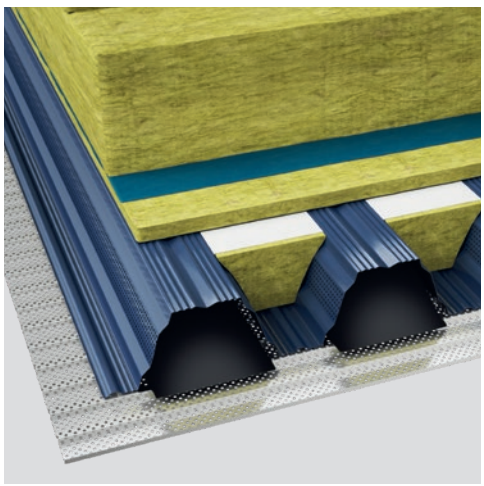
1. T130M 3/15 (Perforation 15%) .
2. Acoustic infill with dustproof
3. Mineral wool (30mm)
4. Vapor barrier
5. Mineral wool (total of 290)

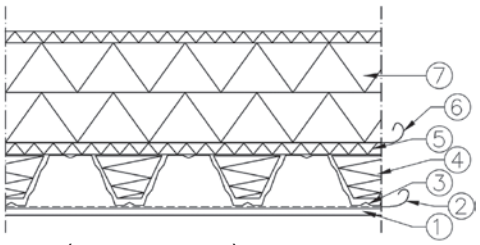
Sound absorption values apply with insulation thickness 130mm–400mm

T130M 3/15% Class D, α_w 0,45 with acoustic infill			
f(Hz)	α_s 1/3	α_s 1/1	α_p 1/1
100	0,76		
125	0,94	0,96	0,95
160	1,18		
200	1,12		
250	1,11	1,14	1,00
315	1,18		
400	1,13		
500	1,07	1,05	1,00
630	0,96		
800	0,76		
1000	0,59	0,62	0,60
1250	0,51		
1600	0,49		
2000	0,36	0,42	0,40
2500	0,38		
3150	0,35		
4000	0,33	0,33	0,35
5000	0,32		

Ruukki T130M 3/15 (web perforated) + acoustic infill +Ruukki T20 3/30 profile with light non-woven layer

Sound absorption class C, α_w 0,70





1. T20 (perforation 30%)
2. Nonwoven fabric
3. T130M (Perforation 15%)
4. Acoustic infill with dustproof
5. Mineral wool (30mm)
6. Vapor barrier
7. Mineral wool (total of 290)

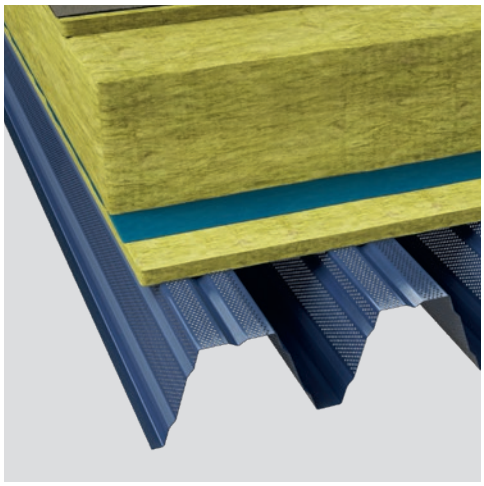
Sound absorption values apply with insulation thickness 130mm–400mm

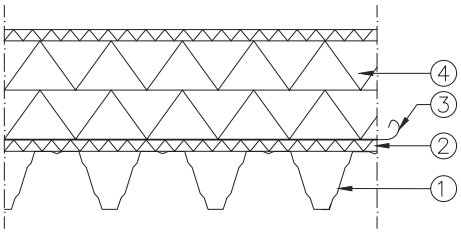
T130M 3/15% Class C, α_w 0,70 acoustic infill, thin fabric and perforated T20 3/30 for visual surface			
f(Hz)	α_s 1/3	α_s 1/1	α_p 1/1
100	0,74		
125	0,88	0,90	0,90
160	1,11		
200	1,01		
250	1,05	1,04	1,00
315	1,05		
400	1,06		
500	1,02	1,00	1,00
630	0,91		
800	0,78		
1000	0,68	0,69	0,70
1250	0,60		
1600	0,59		
2000	0,57	0,60	0,60
2500	0,64		
3150	0,63		
4000	0,63	0,63	0,65
5000	0,62		

ACOUSTIC LOAD BEARING SHEET T153-40L-840 4/30 SOLUTIONS

Ruukki LBS T153 4/30 (web and flange perforated)

Sound absorption class B, αw 0,8





1. T153 (Perforation 30%)
2. Mineral wool (30mm)
3. Vapor barrier
4. Mineral wool (total of 290)

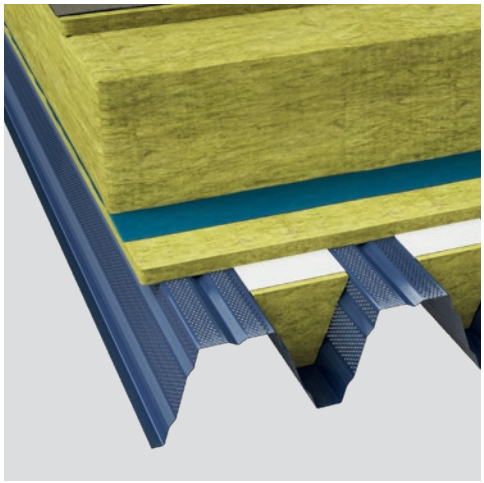
Sound absorption values apply with insulation thickness 130mm–400mm

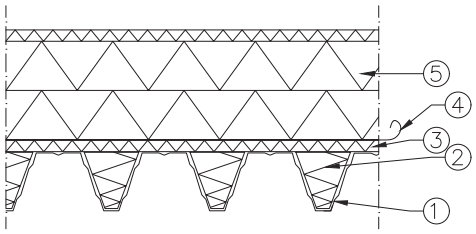
T153 4/30%
Absorption class B, α_w 0,80
without acoustic infill

f(Hz)	α_s 1/3	α_s 1/1	α_p 1/1
100	0,57		
125	0,63	0,61	0,60
160	0,64		
200	0,69		
250	0,75	0,76	0,75
315	0,83		
400	0,85		
500	0,88	0,84	0,85
630	0,80		
800	0,76		
1000	0,73	0,75	0,75
1250	0,75		
1600	0,76		
2000	0,76	0,77	0,75
2500	0,78		
3150	0,75		
4000	0,74	0,72	0,70
5000	0,66		

Ruukki LBS T153 4/30 (web and flange perforated) + acoustic infill

Sound absorption class A, αw 0,9





1. T153 (Perforation 30%)
2. Acoustic infill with dustproof
3. Mineral wool (30mm)
4. Vapor barrier
5. Mineral wool (total of 290)

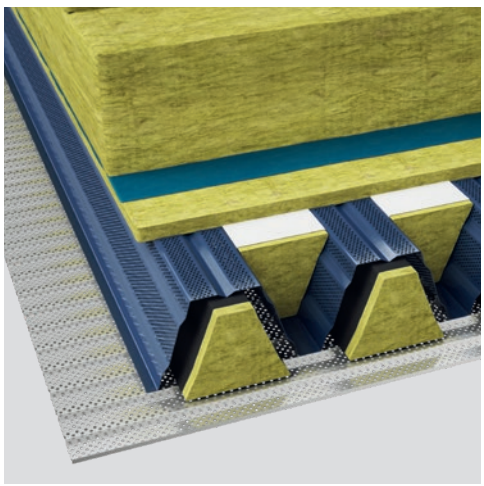
Sound absorption values apply with insulation thickness 130mm–400mm

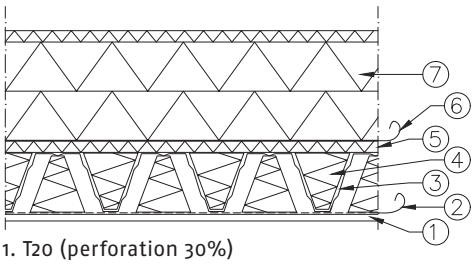
T153 4/30%
Absorption class A, α_w 0,90
with acoustic infill

f(Hz)	α_s 1/3	α_s 1/1	α_p 1/1
100	0,79		
125	0,89	0,93	0,95
160	1,11		
200	1,01		
250	1,10	1,08	1,00
315	1,12		
400	1,15		
500	1,12	1,11	1,00
630	1,06		
800	0,96		
1000	0,94	0,94	0,95
1250	0,91		
1600	0,94		
2000	0,93	0,91	0,90
2500	0,87		
3150	0,81		
4000	0,77	0,76	0,75
5000	0,70		

Ruukki LBS T153 4/30 (web and flange perforated) + acoustic infills +Ruukki T20 3/30 profile with light non-woven layer

Sound absorption class A, α_w 1,00





1. T20 (perforation 30%)
2. Nonwoven fabric
3. T153 4/30 (Perforation 30%)
4. Acoustic infill with dustproof
5. Mineral wool (30mm)
6. Vapor barrier
7. Mineral wool (total of 290)

Sound absorption values apply with insulation thickness 130mm–400mm

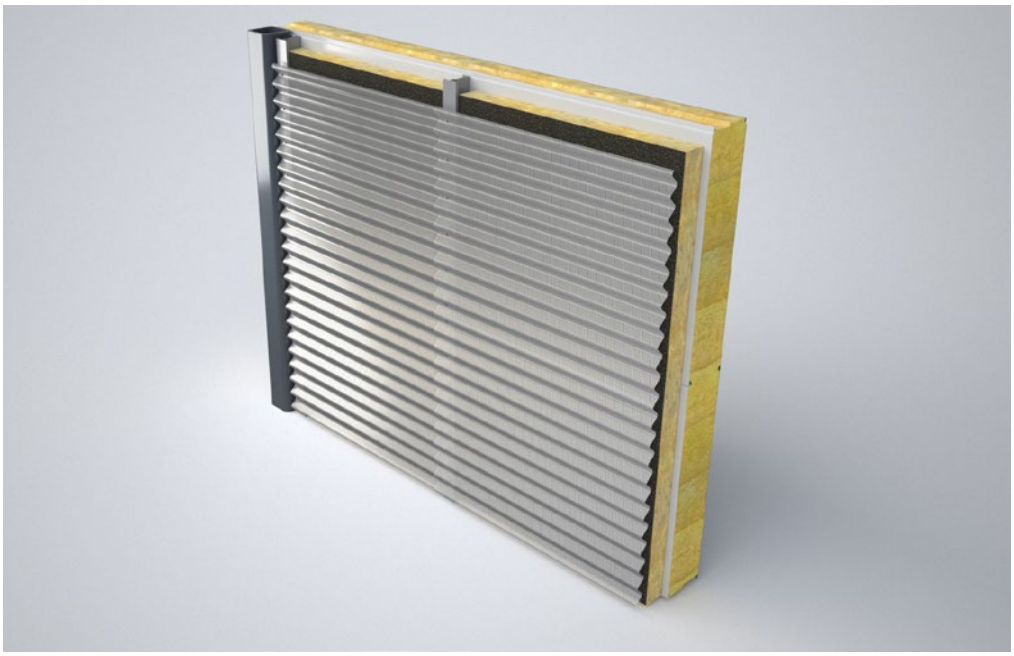
T153 4/30%
Absorption class A, α_w 1,00
Both acoustic infills, thin dust proof fabric and full perforated T20 3/30 for visual surface.

f(Hz)	α_s 1/3	α_s 1/1	α_p 1/1
100	0,94		
125	1,12	1,11	1,00
160	1,27		
200	1,03		
250	1,15	1,09	1,00
315	1,09		
400	1,06		
500	1,04	1,06	1,00
630	1,07		
800	1,05		
1000	1,00	1,01	1,00
1250	0,98		
1600	0,99		
2000	1,00	0,99	1,00
2500	1,00		
3150	0,99		
4000	0,95	0,96	0,95
5000	0,94		

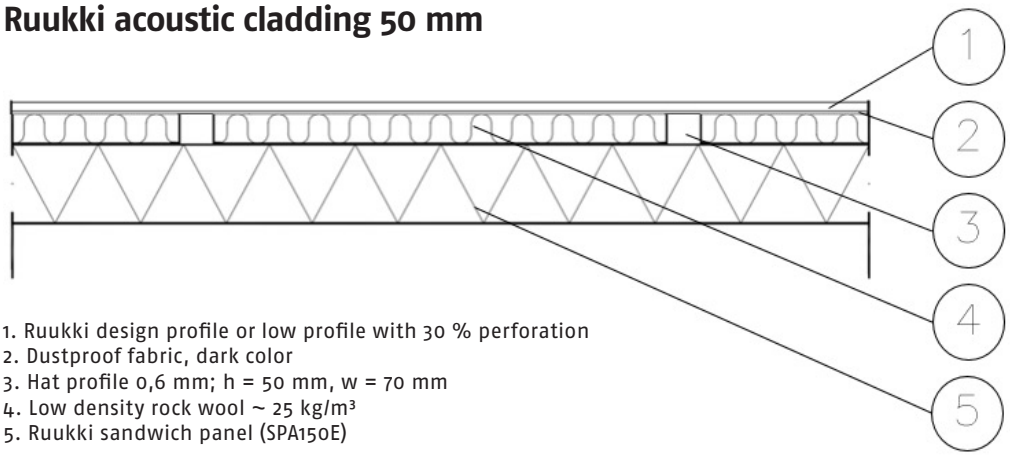
Ruukki acoustic claddings and ceilings

We offer Ruukki® Sound Environment solution also for wall and ceiling applications. Sound absorption solution is compatible with all Ruukki design and low profiles with 30% open area perforation. For design freedom and stunning interior look, you can choose from various profile forms and colors. Our solution is easy to install on any base wall or roof structure.

Solution is available with 50 mm or 100 mm absorption layers based on lightweight profiles as supporting structure.



Ruukki acoustic cladding 50 mm



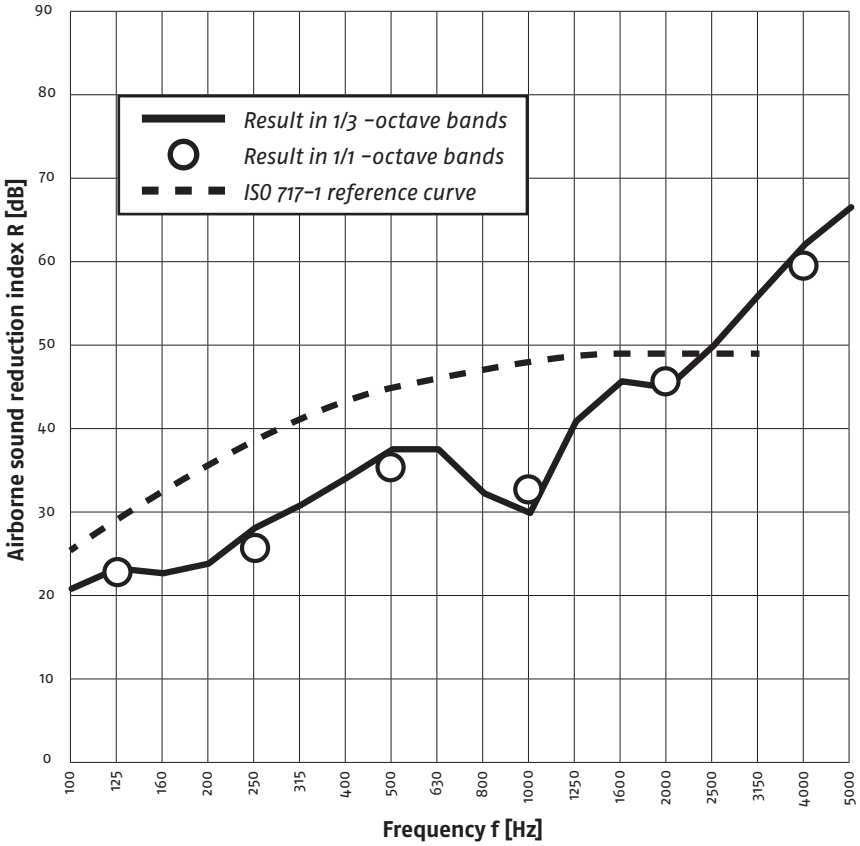
1. Ruukki design profile or low profile with 30 % perforation
2. Dustproof fabric, dark color
3. Hat profile 0,6 mm; h = 50 mm, w = 70 mm
4. Low density rock wool ~ 25 kg/m³
5. Ruukki sandwich panel (SPA150E)

Sound coefficient α_s, center frequency octave range						
0,05	0,05	0,22	0,49	0,90	0,98	0,90
63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz

Airborne sound insulation value improvement with typical SP-wall: +6dB

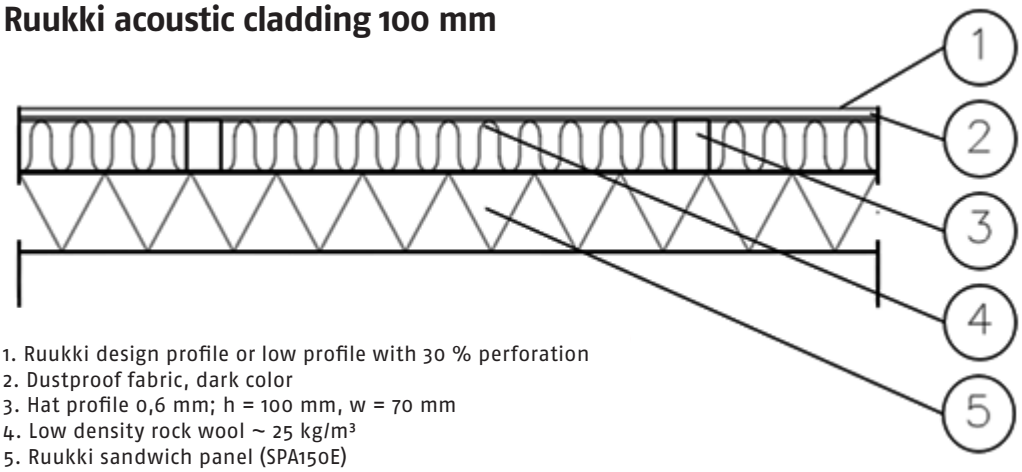
	1/3	1/1	
f [Hz]	R [dB]	R [dB]	
50	32,2		
63	28,2	19,4	
80	14,9		
100	21,1		
125	23,0	22,1	
160	22,3		
200	23,9		
250	27,9	26,6	
315	30,7		
400	34,2		
500	37,2	36,0	
630	37,5		
800	32,7		
1000	30,0	32,7	
1250	40,5		
1600	46,1		
2000	45,5	46,8	
2500	49,9		
3150	56,3		F
4000	62,2	59,8	F
5000	66,6		F B

Signs F and B indicate that the declared result is an underestimate in this frequency band. The true value is larger.



SPA 150E (low weight R_w = 29 dB) + Ruukki acoustic cladding 50mm: Airborne sound insulation value ***R_w (C,Ctr) = 35 dB (-2,-5)***

Ruukki acoustic cladding 100 mm



1. Ruukki design profile or low profile with 30 % perforation
2. Dustproof fabric, dark color
3. Hat profile 0,6 mm; h = 100 mm, w = 70 mm
4. Low density rock wool ~ 25 kg/m³
5. Ruukki sandwich panel (SPA150E)

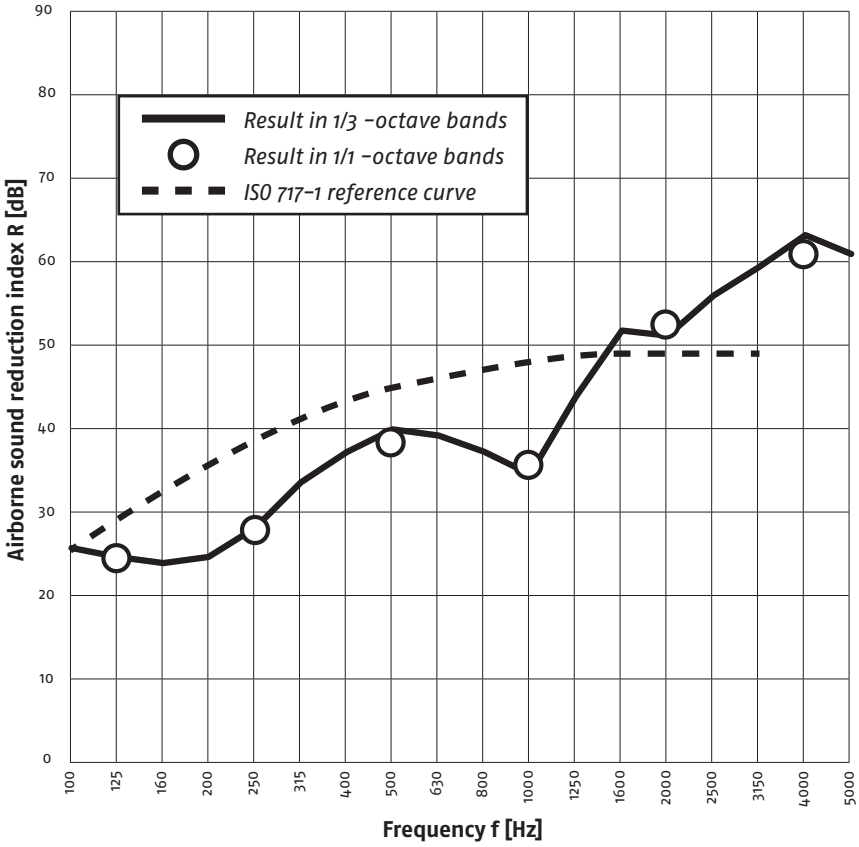
Sound coefficient α_s, center frequency octave range						
0,18	0,32	0,59	0,94	0,91	0,96	0,96
63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz

Airborne sound insulation value improvement with typical Sandwich panel: ~ +10dB

	1/3	1/1	
f [Hz]	R [dB]	R [dB]	
50	21,3		
63	31,4	18,6	
80	14,8		
100	25,8		
125	24,4	24,5	
160	23,6		
200	24,5		
250	28,1	27,3	
315	33,1		
400	37,0		
500	39,8	38,4	
630	39,0		
800	37,2		
1000	34,0	36,7	
1250	43,0		
1600	51,4		
2000	50,7	52,1	
2500	55,8		
3150	59,1		F
4000	62,5	60,7	F
5000	61,1		

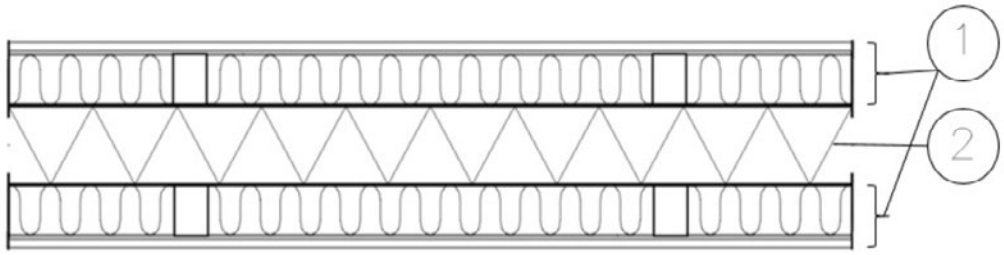
Signs F and B indicate that the declared result is an underestimate in this frequency band. The true value is larger.

Note 50–60dB airborne sound insulation at 2000Hz – 5000 Hz that is important for speech intelligibility. In normal situation speech is not clear and hard to understand behind the light wall.



SPA 150E (low weight R_w = 29 dB) + Ruukki acoustic cladding 100mm: Airborne sound insulation value ***R_w (C,Ctr) = 39 dB (-1,-5)***

Ruukki acoustic cladding 100 mm on both sides of wall



1. Ruukki acoustic cladding 100 mm on both sides
2. Ruukki sandwich panel (SPA 150E) used as internal wall

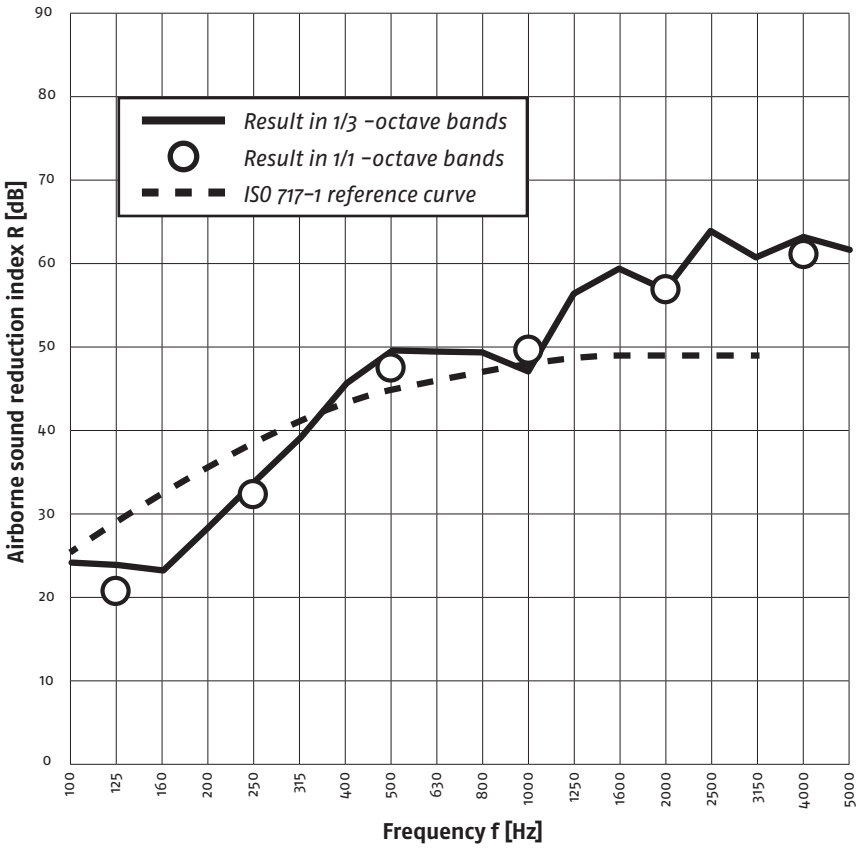
For internal wall usage in both sides, sound absorption coefficients (α_s) for rooms are same as with single 100 mm surface.

Airborne sound insulation value improvement with typical SP-wall: ~ +16dB

	1/3	1/1	
f [Hz]	R [dB]	R [dB]	
50	31,0		
63	28,7	21,1	
80	16,8		
100	24,1		
125	23,7	23,7	
160	23,3		
200	28,5		
250	34,3	32,0	
315	39,3		
400	45,3		
500	49,8	47,6	
630	49,3		
800	49,1		
1000	47,3	49,6	
1250	56,6		
1600	59,0		
2000	57,0	57,0	
2500	63,7		
3150	60,7		F
4000	63,0	61,6	F
5000	61,4		F B

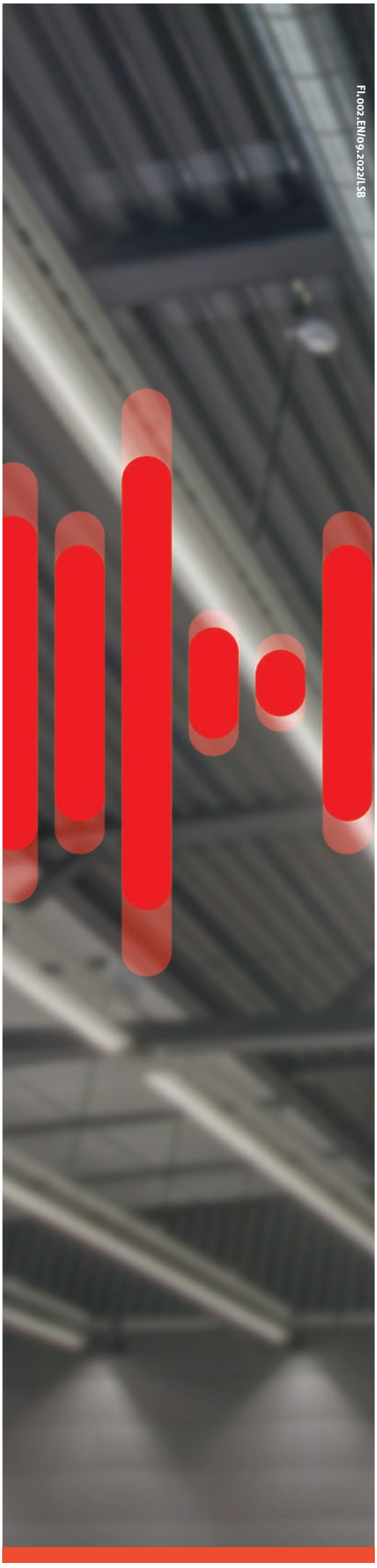
Signs F and B indicate that the declared result is an underestimate in this frequency band. The true value is larger.

Note 60-70dB airborne sound insulation at 1000Hz – 5000 Hz area that is important for speech intelligibility. In normal situations speech is hard to heard or understand behind the wall.



SPA 150E (low weight R_w = 29 dB) + Ruukki acoustic cladding 100mm: Airborne sound insulation value ***R_w (C,Ctr) = 45 dB (-3,-8)***

We make steel-based products for walls and roofs, for both commercial buildings and private homes. We're a supplier of high-quality products, systems and solutions, developed sustainably and to live up to the highest demands on durability in harsh conditions.



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