

SOUND INSULATION IN TIMBER CONSTRUCTION



PICTURE: BEST WOOD SCHNEIDER

COMPENDIUM FOR MATHEMATICAL
SOUND INSULATION PROOF FOR
WOODEN BEAM / SOLID WOOD CEILINGS

PREAMBLE



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Since 1997 until today he leads in independent activity an engineering office for timber system construction in Königswinter. The essential content of his activities was and is the advice of wood and prefabricated construction companies, the supplier industry for timber construction and some associations of the woodworking and wood processing industry.

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PICTURE: STORA ENSO

SOUND INSULATION

WHY IT IS SO IMPORTANT

Sound insulation is immediate. From the very first minute, a buyer, tenant or resident knows whether his apartment has good sound insulation or whether it is badly soundproofed and it will be getting on his/her nerves their entire life. Sound insulation is therefore the building physics discipline with the highest sensitivity and is thus a risk of complaints. In this respect, it is particularly important in sound insulation to know and comply with the requirements to be met.



PICTURE: BEST WOOD SCHNEIDER

SOUND INSULATION AND CONSTRUCTION LAW

THE REQUIREMENTS

The minimum requirements defined by the building inspectorate represent the minimum health protection and must be strictly adhered to. In no case may this be deviated from, even if the contractor and client should agree and even agree in writing.



PICTURE: BEST WOOD SCHNEIDER

In order to be able to determine the minimum requirements defined by building regulations - especially regarding the standard impact sound level of apartment separating ceilings - the German building law must be considered in **three time periods**.

1stTime period

At the time of issue of this brochure (05-2019), apply the model building regulations (MBO) 2016 in conjunction with the related model administrative regulation Technical Building Regulations (MVV TB), which came into effect in August 2017. The MVV TB indicate in chapter A 5.2 as technical rule DIN 4109-1:2016-07; in the appendix A 5.2/1 of the MVV TB it is stated that the supplementary sheet E DIN 4109-1/A1:2017-01, which is part of the draft, may be used for building inspectorate proof. This supplementary sheet literally states: "In the case of structural changes to existing buildings and the new construction of two-family houses with ceiling structures that refer to DIN 4109-33¹, the requirement is currently $L'_{n,w} \leq 53 \text{ dB}$."

Table 1a: Overview of important construction supervisory minimum requirements for sound insulation according to **DIN 4109-1:2016-07**:

2nd Time period

A new version of the MVV TB will enter into force in the first half of 2019, which will provide for drastic changes for sound insulation. The new version of the MVV TB now shows in chapter A 5.2 DIN 4109-1:2018-01 as technical rule. In this new edition of DIN 4109-1: 2018-01, the exemption regulation - Requirement standard impact sound level for apartment separating ceilings $L'_{n,w} \leq 53 \text{ dB}$ - has been extended to all apartment separating ceilings. This means that there is a temporary mitigation in terms of the standard impact sound level in apartment separating ceilings.

Table 1b: Overview of important construction supervisory minimum requirements for sound insulation according to DIN 4109-1:2018-01:

component	airborn sound R_w [in dB]	impact sound $L'_{n,w}$ [in dB]	remarks
One-family house			
floor	-	-	No minimum requirements defined.
Two-family house / structural alteration Apartment house, office building and shared used building			
party floor	≥ 54	≤ 53	

3rd Time period

In DIN 4109-1:2018-01 it has already been pointed out that with the revision of DIN 4109-33:2016-07 (for wooden, lightweight and drywall separating ceilings) there a general requirement for all apartment ceilings to the standard impact sound level for apartment ceilings $L'_{n,w} \leq 50 \text{ dB}$ will apply. Experts say that this will be the case by 2021 at the latest.



SOUND INSULATION
AND LEGAL CERTAINTY

A CHALLENGE

The jurisprudence of the past years and decades has ensured that the usual triad “Standard met → Acknowledged rules of technology met → Requirements met” does not ensure legal certainty. This also applies to single-family house construction, for which there are no minimum requirements according building law, but according to civil law are not excluded.

Summing up the large number of BGH and other court decisions on sound insulation, the following can be stated:

- There is currently no final judgment showing what concrete values reflect, from a legal point of view, the accepted rules of sound insulation technology. As a recognized rule of technology, according to case law, a “usual comfort” is due.
- This so-called “usual comfort” depends on the overall comfort and the price level of the building. The benchmark is what a buyer / tenant can “expect”. Meaning: Social housing is subject to different standards than a luxury villa. The acknowledged rule of technology is thus not a static value.
- For houses or apartments with “usual quality and comfort standards”, the increased requirements according to the supplement sheet 2 to DIN 4109 (Tab. 2) are often used as a benchmark for the acknowledged rule of technology for use-separating components, according to which the minimum requirement for impact sound insulation would be $L'_{n,w} \leq 50 \text{ dB}$. For condominiums in the luxury sector, the requirements may also be above the level according to Table 2 in Supplement 2.

Table 2: Suggestions for the increased sound insulation according to Supplement 2 to DIN 4109:1989 in new buildings according to DIN 4109-1:2016-07

component	airborn sound R_w [in dB]	impact sound $L'_{n,w}$ [in dB]	remarks
Multi level buildings with apartments and working rooms			
party floor	≥ 55	≤ 46	
floors below common used attic	≥ 55	≤ 46	
party floors between different working rooms respectively comparable used rooms	≥ 55	≤ 46	
floors below terraces or loggia floor above recreation rooms	-	≤ 46	regarding airborne sound insulation from outside noise chapter 7 of this standard applies

TIP: For planners and executing companies, it is absolutely advisable to stipulate the sound insulation in the performance contract. Otherwise, the dynamically adapted, acknowledged rules of technology automatically apply, which - as described above - are not legally certain. The legislator sets strict standards both with regard to the elaboration of the performance contract regulations as well as to the quality of the information to be provided for the purpose of informing the customer. The informative information must be prepared in such a way that a technically unskilled customer can understand which sound insulation level is carried out or not carried out as agreed. In addition, it should be possible to demonstrate through suitable documentation beyond reasonable doubt that the customer has received and understood this information. Both the text of the contract as well as the information and proof procedure should therefore be elaborated with the assistance of a specialist lawyer specializing in construction law and consumer law.

HIGH IMPACT SOUND INSULATION IN TIMBER CONSTRUCTION?

ATTENTION JOINT



The challenge: Secondary sound transmission channels

With the usual constructions, which have so far proven to be technically and economically feasible, the tighter requirements for the impact sound insulation of a separating ceiling can not or only very unsafely be met. The real dilemma: The lower the standard impact sound level of the separating ceiling, the more inexorably the secondary sound channels arrive via the flanking components. Often, this effect is also confirmed in measurements on the construction site. The values measured there often are significantly worse than one would have expected with the excellently upgraded and flawlessly installed separating ceiling.



THE SOLUTION:

It's all about gaining the missing dB with as few changes to existing designs as possible, without it hurting during production or your purse! This is where the so-called joint insulation comes into play.



INFO

The joint insulation thickness K_{ij} [dB] is an important component of the sidewall insulation and characterizes the insulation of structure-borne sound on component joints. It describes the resistance of a joint between the separating and sidewall components of sound propagation, and is higher:

- the more flexible the compound structure;
- the more the mass ratios of the components in question differ



Recently, the alternative "PhoneStrip" entered the market, which works with a completely new principle: The loose quartz sand used in the special plate dampens the vibrations of the sound waves.

For the construction practice, the special plate made of wood and sand has some promising advantages over the known solution with elastomer bearings:

- The price/performance ratio is very attractive.
- The sound decoupling effect is not dependent on the level of the loading.
- Good joint insulation is also given without additional decoupling of the joining means.



- In the low-frequency range is achieved a relatively high joint insulation effect. It is well known that especially the low frequencies are responsible for the well-audible noise.
- The tested final deformation and strength values confirm the high serviceability of the product as joint insulation (decoupling strips) in the area of separating ceiling bearings.

THE RESULTS ARE MORE THAN SATISFYING!

The more sound transmission takes place via the secondary sound transmission channels, the higher the effect of a joint insulation with regard to the impact sound insulation of the separating ceiling. The improvement ranges in conventional constructions from 1 dB (sidewall components with a high degree of noise reduction) to 6 dB (sidewall components with a very low level of noise reduction, for example due to defects in the construction). With gross construction defects and thereby caused very high sound flows over the secondary channels, the effect can be well over 6 dB.

In many cases, it is easier and more economical to worry about effective joint insulation than always just excessively upgrading the separating ceiling.

The positive side effect of a joint insulation is above all the associated higher tolerance to construction errors.

IMPACT SOUND TEST SERIES ON SOLID WOOD CEILINGS

TESTED AT IFT ROSENHEIM



PICTURE: STORA ENSO

As part of a systematically prepared test series, a CLT basic ceiling with varying ceiling structures was tested. On the basis of the tested superstructures the ift Rosenheim has prepared an appraisal, which contains in the appendix an evaluation matrix with different solid wood ceiling structures. Both the floor and the suspended ceiling constructions are systematically varied around the basic ceiling.

HERE ARE SOME IMPORTANT RESULTS AND INSIGHTS AT A GLANCE:



SWISS KRONO MAGNUMBOARD OSB

Basic ceiling:

- The results are valid without deduction for all construction types: CLT cross laminated timber according to EAD 13005-00-0304: 03-2015, GLT glued laminated timber according to DIN EN 14080: 09-2013, LTC laminated timber ceiling according to EAD 130011-00-0304
- Basic ceilings made of SWISS KRONO MAGNUMBOARD OSB (several glued and clamped layers of OSB-4 boards according to general building inspectorate approvals Z-9.1-414 or Z-9.1-503) receive a surcharge of 1 dB in the assessed standard impact sound level $L_{n,w}$ and a deduction of + 1dB for the weighted sound reduction index R_w
- The tested values apply without deduction to all thicknesses of the basic ceiling ≥ 140 mm and for screed thicknesses ≥ 50 mm



CLT (CROSS LAMINATED TIMBER) BY STORA ENSO



INSERTION OF BOUND CHIPPINGS



SOPRO RAPIDUR

Floor structure & Loading:

- Loose and bound chipping fills show approximately the same results.
- In the case of bound chipping fills, cementitious "stiff" binders behave the same or similar to organic "flexible" binders and consequently enter into the evaluation without distinction.
- If the thickness of the weighted bed is reduced from 80 mm to 60 mm, a surcharge of $\Delta L_{n,w} = 3$ dB must be taken into account, and reducing from 80 mm to 40 mm, the surcharge is $\Delta L_{n,w} = 6$ dB. The evaluated sound insulation dimensions R_w must be reduced by the same values.
- Under the following conditions, it is possible to apply line routes without a deduction:
 - The width of the line route must be < 200 mm.
 - The routes must be completely filled with chippings.
 - The filled chippings must have the same area-related mass.



WOLF PROTECT



BEST WOOD FLOOR 220



ISOVER AKUSTIC EP3

Impact sound insulation boards:

Both the thickness and the type of impact sound insulation have a significant impact on the sound insulation level: Compared to the basic equipment made of 4 mm wood fiber insulation board (Wolf Protect 4)

- the assessed standard impact sound level $L_{n,w}$ improves by -5 dB when using a 20 mm wood fiber insulation board (best wood FLOOR 220);
- the assessed standard impact sound level $L_{n,w}$ improves by -8 dB when using a 20 mm mineral wool insulation board (ISOVER Akustic EP 3)



WOLF BAVARIA SYSTEM SOLUTION

Wet screed or dry screed:

The results show that the different requirements can be met with wet and dry screed constructions as well as with structures including underfloor heating:

- A dry screed made of 18 mm Wolf Hugo gypsum fiber finishing screed elements performs 1 dB better than a wet screed; i.e. the assessed standard impact sound level $L_{n,w}$ is 1 dB lower.
- A dry screed construction with underfloor heating - made of 18 mm Wolf Hugo gypsum fiber finishing screed elements on PowerFloor - performs 2 dB better than a wet screed; i.e. the assessed standard impact sound level $L_{n,w}$ is lower by 2 dB.
- A double layer PhoneStar brings an improvement of 3 dB compared to a version with a single layer PhoneStar.

Visible ceilings:

The most important insight in advance: Visible ceilings with a rated standard impact sound level $L'_{n,w} \leq 50$ dB (construction) are possible in several variants.

Suspensions of the suspended ceiling

The type of suspended ceiling suspension - rigid with battens or additionally flexible with TPS 25 - has an extremely large impact on the sound insulation level.

Compared to the visible ceiling, the assessed standard impact sound level $L_{n,w}$ improves by -14 dB and more when using a flexibly suspended ceiling with battens (40/60) + Protektor TPS 25 + PhoneStar + gypsum plasterboard already at a suspension height of 65 mm.



PROTEKTOR TPS 25



IMPORTANT NOTES:

Rigid suspended ceilings only work on solid wood ceilings from certain suspension heights (about 10-20 cm). Below them it can lead to deterioration (air suspension).

The impact point damping is getting better, the more the solid wood ceiling and sidewalls differ in their vibration behavior. Therefore, solid wood ceilings, whose sidewalls are carried out in wood panel design, offer lower standard impact sound levels $L'_{n,w}$ (construction), in other words: perform better.

MATHEMATICAL SOUND INSULATION PROOF OF WOODEN CEILINGS

THE PROOF ACCORDING TO DIN 4109-2:2018

The mathematical proof of sound insulation in building construction is generally regulated in DIN 4109-2. This standard also regulates the method of computational proof for timber construction or wooden beam and solid wood ceilings and provides the necessary values in tables. DIN 4109-33 provides the data for the mathematical proof of sound insulation in the form of a component catalog.

The impact sound transmission is calculated as follows: $L'_{n,w} = L_{n,w} + K1 + K2 + SB$

Whereby:

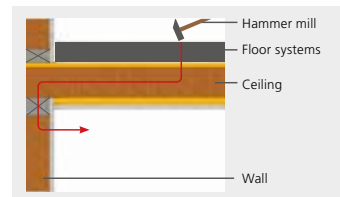
$L'_{n,w}$ the assessed standard impact sound level including the sidewall transmission in dB, so the value on the construction site

$L_{n,w}$ the assessed standard impact sound level without the sidewall transmission in dB, so the value in the laboratory

K1 the correction value for consideration of the sidewall transmission on the distance Df - determined by Table 3 of DIN 4109

K2 the correction value for consideration of the sidewall transmission on the distance Dff - determined by Table 4 of DIN 4109

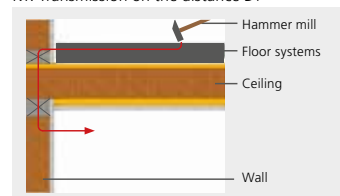
SB the safety factor, which is always 3 dB



Step 1: In the calculation, the test value is first increased by the correction value K1, which is taken from Table 3 of DIN 4109, depending on the existing situation at the construction site.

Step 2: Furthermore, the correction value K2 is determined with the sum of $L_{n,w} + K1$ from Table 4 of DIN 4109.

Step 3: The summed value of $L_{n,w} + K1 + K2$ is then increased by 3 dB security value to obtain the final arithmetical value $L'_{n,w}$.



- REMARK:**
- In wall constructions, no positive sound measures such as installation levels are taken into account
 - Suspensions as a sound technical improvement are increased by a higher K1 value and thus the existing positive effect by the increased K1 value is largely equalized again
 - The better the value $L_{n,w} + K1$, that is, the ceiling, the higher are the transmission values side-wall-side wall on the distance Dff (K2)
 - The K2 values for mineral screed are significantly higher than for dry screed

CONCLUSION:

- The mathematical proof according to DIN 4109 is a rough guideline, which does not take into account the constructional and constructive measures to improve the impact sound level.
- Any decoupling of components to reduce the sidewall transmission is not taken into account.

In principle, there are two possibilities to carry out the mathematical proof of impact sound for the determination of L'_{nw} in wooden ceilings or in timber construction.

Both methods have in common that a laboratory value ($L_{n,w}$) must be available for the ceiling to be calculated. In light-weight construction, which also includes wood construction, this is completely different than in concrete massive construction, where the proof can be calculated entirely without laboratory values only by the masses and impact sound improvement values of the materials.

PROOF ACCORDING TO EN ISO 12354 (CEN MODEL)

The series of standards was developed in order to have a meaningful model, with which the sound insulation can be calculated on the basis of the properties of the individual elements.

The following standards apply:

EN ISO 12354-1: 2017 for airborne sound insulation between rooms

EN ISO 12354-2: 2017 for impact sound insulation between rooms.

Here, especially the joint insulation thickness K_{ij} is taken into account.

This joint insulation thickness is determined by laboratory tests for L and T joints. The measurements are carried out according to or in accordance with EN ISO 10848-1:2006.



The standard impact sound level is calculated according to the following formula:

standard impact sound level:

$$L_{n,d,w} = L_{n,eq,0,w} - \Delta L_w - \Delta L_{d,w}$$

standard impact sound level of sidewall components:

$$L_{n,ij,w} = L_{n,eq,0,w} - \Delta L_w + (R_{i,w} - R_{j,w}) : 2 - \Delta R_{j,w} - K_{ij} - (10 \log S_i / 10 l_{ij})$$

Total impact sound level determined as follows:

$$L'_{nw} = [10 \log (10 L_{n,d,w/10} + \sum 10 L_{n,ij,w/10})] \text{ dB}$$



JOINT INSULATION THICKNESS K_{ij} [dB] MEASUREMENT AT THE TU IN GRAZ

Put simply, the following factors enter into the formula:

- the geometry of the room or the support lengths of the separating components
- The laboratory values of the separating ceiling with regard to impact and airborne sound
- The acoustic properties of each wall or of the separating component
- The joint insulation thickness K_{ij} of the used decoupling strip in the joint to be applied (usually T-joint)

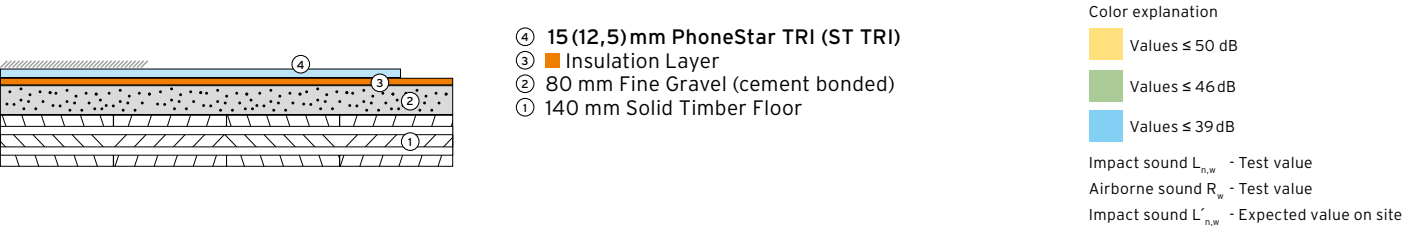
The determined value is then additionally increased by a safety factor of 3 dB.














CONCLUSION:

- The CEN model takes into account the characteristics of a wide variety of improved sound insulation measures of the walls.
- The joint insulation thickness K_{ij} is taken into account and thus the transmission channel sidewall-side wall is taken into account.
- There are much more refined evaluations available to evaluate individual measures of sound technical improvement of individual components.

Calculative Proof for Solid Timber Floors

Execution: Visible ceiling
 Loading: 80 mm Fine Gravel (cement bonded)



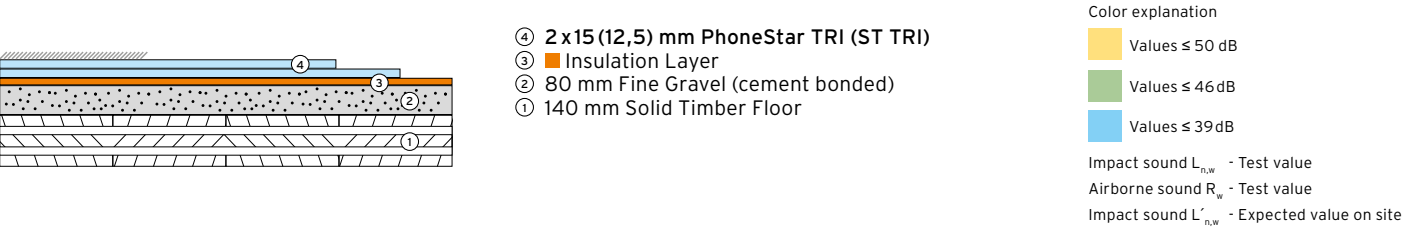
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert 's opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **		
		Weight [kg/m²]	Height [mm]	L _{n,w} [in dB]	R _w [in dB]	L' _{n,w} [in dB]	L' _{n,w} * [in dB]	L' _{n,w} [in dB] with PhoneStrip (Kij=17dB)	
 PB + WBP DIN4109-33 Tab 3 / Row 13 Rw = 43 dB	1 x 15 mm PhoneStar TRI (12,5 mm ST TRI)  4 mm Wolf Protect Wood Fibre Board 80 mm Fine Gravel (cement bonded)	150 (150,2)	99 (96,5)	52	57	56	56,6	55,4	
 GF DIN4109-33 Tab 3 / Row 6 Rw = 44 dB						56	56,5	55,3	
 Timber-/ WBP-Element CLT 100 mm Zero measure- ment 2 Rw = 34 dB						59	58,6	56	
 PB + WBP DIN4109-33 Tab 3 / Row 13 Rw = 43 dB	1 x 15 mm PhoneStar TRI (12,5 mm ST TRI)  20 mm best wood FLOOR 220 Wood Fibre 80 mm Fine Gravel (cement bonded)	154,9 (151,9)	115 (112,5)	47	61	51	52,3	50,6	
 GF DIN4109-33 Tab 3 / Row 6 Rw = 44 dB						51	52,1	50,5	
 Timber-/ WBP-Element CLT 100 mm Zero measure- ment 2 Rw = 34 dB						54	54,8	51,5	
 PB + WBP DIN4109-33 Tab 3 / Row 13 Rw = 43 dB	1 x 15 mm PhoneStar TRI (12,5 mm ST TRI)  20 mm ISOVER Akustic EP3 stone wool insulation board 80 mm Fine Gravel (cement bonded)	153,8 (150,8)	115 (112,5)	44 ¹	61 ¹	49	49,3	47,6	
 GF DIN4109-33 Tab 3 / Row 6 Rw = 44 dB						49	49,1	47,5	
 Timber-/ WBP-Element CLT 100 mm Zero measure- ment 2 Rw = 34 dB						51	51,8	48,5	








PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354. ¹ Report 18-001770-PR02 PB X11-F03-04-de-01

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal). These results are presumed accurate for all CLT / solid plank floors. If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w} + 1$ dB is to be expected. Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables. It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Visible ceiling
 Loading: 80 mm Fine Gravel (cement bonded)



Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert´s opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	L _{n,w} [in dB]	R _w [in dB]	L' _{n,w} [in dB]	L' _{n,w} * [in dB]	L' _{n,w} [in dB] with PhoneStrip (Kij=17dB)
 PB + WBP DIN4109-33 Tab 3 / Row 13 Rw = 43 dB	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) ■ 4 mm Wolf Protect Wood Fibre Board 80 mm Fine Gravel (cement bonded)	168 (165,2)	114 (109)	49 ¹	64 ¹	53	55	52,8
 GF DIN4109-33 Tab 3 / Row 6 Rw = 44 dB						53	54,8	52,7
 Timber-/ WBP-Element CLT 100 mm Zero measure- ment 2 Rw = 34 dB						56	57,9	54
 PB + WBP DIN4109-33 Tab 3 / Row 13 Rw = 43 dB	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) ■ 20 mm best wood FLOOR 220 Wood Fibre 80 mm Fine Gravel (cement bonded)	172,9 (166,9)	130 (125)	44 ²	68 ²	49	51,2	48,2
 GF DIN4109-33 Tab 3 / Row 6 Rw = 44 dB						49	50,8	48,1
 Timber-/ WBP-Element CLT 100 mm Zero measure- ment 2 Rw = 34 dB						52	54,4	49,8
 PB + WBP DIN4109-33 Tab 3 / Row 13 Rw = 43 dB	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) ■ 20 mm ISOVER Akustic EP3 stone wool insulation board 80 mm Fine Gravel (cement bonded)	171,8 (165,8)	130 (125)	41 ³	68 ³	46	48,2	45,2
 GF DIN4109-33 Tab 3 / Row 6 Rw = 44 dB						46	47,8	45,1
 Timber-/ WBP-Element CLT 100 mm Zero measure- ment 2 Rw = 34 dB						49	51,4	46,8









PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354. ¹ Report 18-001770-PR02 PB X01-F03-04-de-01 ² Report 18-001770-PR02 PB X03-F03-04-de-01 ³ Report 18-001770-PR02 PB X07-F03-04-de-01

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal). These results are presumed accurate for all CLT / solid plank floors. If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w} + 1$ dB is to be expected. Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables. It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Visible ceiling
 Loading: 80 mm Fine Gravel (cement bonded)



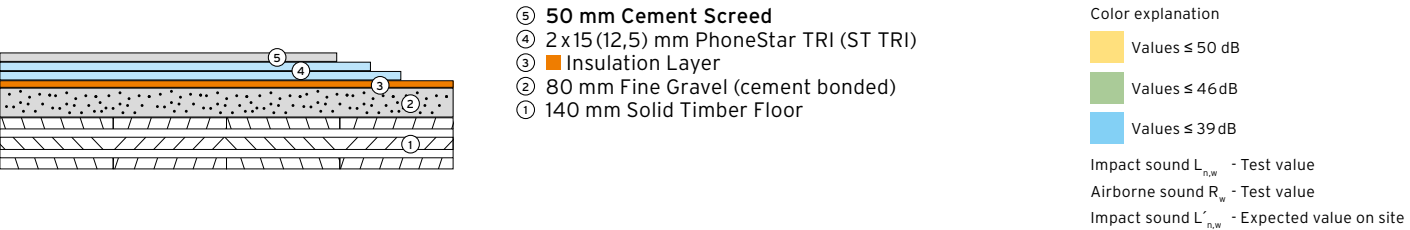
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert 's opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
 PB + WBP DIN4109-33 Tab 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI)  4 mm Wolf Protect Wood Fibre Board 80 mm Fine Gravel (cement bonded)	194,6 (188,6)	132 (127)	52	62	56	57,6	55,6
 GF DIN4109-33 Tab 3 / Row 6 Rw = 44 dB						56	57,3	55,6
 Timber-/ WBP-Element CLT 100 mm Zero measure- ment 2 Rw = 34 dB						59	60,1	56,6
 PB + WBP DIN4109-33 Tab 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI)  20 mm best wood FLOOR 220 Wood Fibre 80 mm Fine Gravel (cement bonded)	196,3 (190,3)	148 (143)	47	66	51	53,6	51
 GF DIN4109-33 Tab 3 / Row 6 Rw = 44 dB						51	53,3	50,9
 Timber-/ WBP-Element CLT 100 mm Zero measure- ment 2 Rw = 34 dB						55	56,6	52,3
 PB + WBP DIN4109-33 Tab 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI)  20 mm ISOVER Akustic EP3 stone wool insulation board 80 mm Fine Gravel (cement bonded)	195,2 (189,2)	148 (143)	44 ¹	66 ¹	49	50,6	48
 GF DIN4109-33 Tab 3 / Row 6 Rw = 44 dB						49	50,3	47,9
 Timber-/ WBP-Element CLT 100 mm Zero measure- ment 2 Rw = 34 dB						52	53,6	49,3



PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354. ¹ Report 18-001770-PR02 PB X17-F03-04-de-01

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal). These results are presumed accurate for all CLT / solid plank floors. If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w} + 1$ dB is to be expected. Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables. It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Visible ceiling
 Loading: 80 mm Fine Gravel (cement bonded)



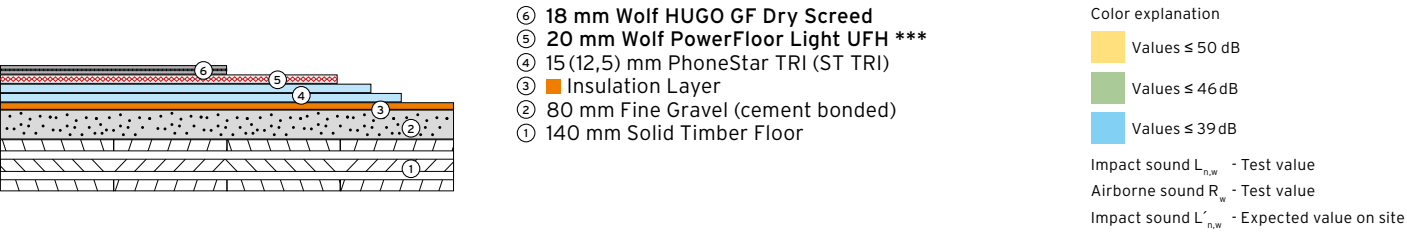
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert´s opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **		
		Weight [kg/m²]	Height [mm]	L _{n,w} [in dB]	R _w [in dB]		L' _{n,w} [in dB]	L' _{n,w} [*] [in dB]	
 DIN4109-33 Tab 3 / Row 13 Rw = 43 dB PB + WBP	50 mm Cement Screed 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI)  4 mm Wolf Protect Wood Fibre Board 80 mm Fine Gravel (cement bonded)	271,2 (265,2)	164 (159)	53	66	57	59,6	57	
 DIN4109-33 Tab 3 / Row 6 Rw = 44 dB GF						57	59,3	56,9	
 CLT 100 mm Zero measurement 2 Rw = 34 dB Timber-/ WBP-Element						60	62,6	58,3	
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	50 mm Cement Screed 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI)  20 mm best wood FLOOR 220 Wood Fibre 80 mm Fine Gravel (cement bonded)	272,9 (266,9)	180 (175)	48	70	53	55,8	52,5	
 DIN4109-33 Tab 3 / Row 6 Rw = 44 dB GF						53	55,5	52,3	
 CLT 100 mm Zero measurement 2 Rw = 34 dB Timber-/ WBP-Element						56	59,2	54,3	
 DIN4109-33 Tab 3 / Row 13 Rw = 43 dB PB + WBP	50 mm Cement Screed 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI)  20 mm ISOVER Akustic EP3 stone wool insulation board 80 mm Fine Gravel (cement bonded)	271,8 (265,8)	180 (175)	45 ¹	70 ¹	50	52,8	49,5	
 DIN4109-33 Tab 3 / Row 6 Rw = 44 dB GF						50	52,5	49,3	
 CLT 100 mm Zero measurement 2 Rw = 34 dB Timber-/ WBP-Element						53	56,2	51,3	

* Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354. ¹ Report 18-001770-PR02 PB X13-F03-04-de-01

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal). These results are presumed accurate for all CLT / solid plank floors. If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w} + 1$ dB is to be expected. Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables. It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Visible ceiling
 Loading: 80 mm Fine Gravel (cement bonded)

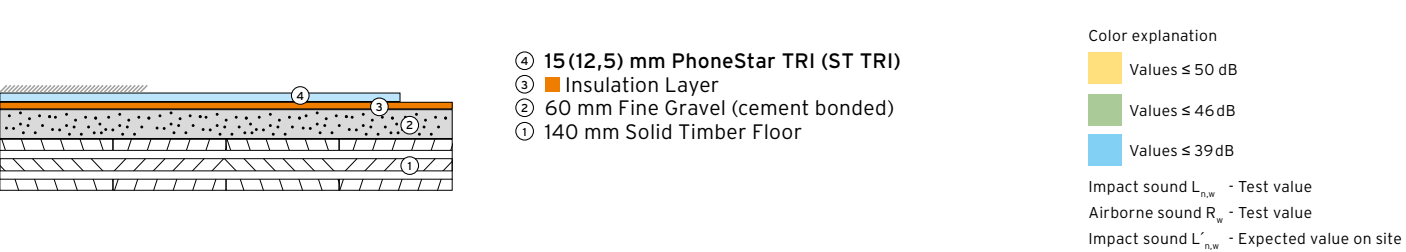


Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
DIN4109-33 Tab 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light UFH *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 4 mm Wolf Protect Wood Fibre Board 80 mm Fine Gravel (cement bonded)	200 (194)	152 (147)	51	62	55	56,6	54,6
DIN4109-33 Tab 3 / Row 13 Rw = 43 dB						55	56,3	54,6
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						58	59,1	55,6
DIN4109-33 Tab 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light UFH *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm best wood FLOOR 220 Wood Fibre 80 mm Fine Gravel (cement bonded)	201,7 (195,7)	168 (163)	46	66	51	52,6	50
DIN4109-33 Tab 3 / Row 6 Rw = 44 dB						51	52,3	49,9
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						53	55,6	51,3
DIN4109-33 Tab 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light UFH *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm ISOVER Akustic EP3 stone wool insulation board 80 mm Fine Gravel (cement bonded)	200,6 (194,6)	168 (163)	43 ¹	66 ¹	48	49,6	47
DIN4109-33 Tab 3 / Row 6 Rw = 44 dB						48	49,3	46,9
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						51	52,6	48,3

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal). * Calculated with Kij = 10 dB (butt solid timber joint)
 These results are presumed accurate for all CLT / solid plank floors. ** Calculation of timber frame walls is executed follow-
 If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w}$ + 1dB is to be expected. ing the calculated proof indicated in EN 12354
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables. ***24 mm Wolf PowerFloor Öko Plus can also be used
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Visible ceiling
 Loading: 60 mm Fine Gravel (cement bonded)



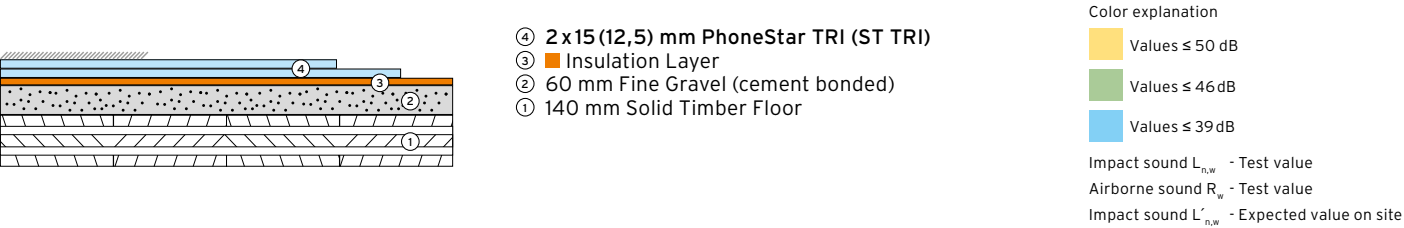
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
DIN 4109-33 Tab 3 / Row 13 Rw = 43 dB	1 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	120,2 (117,2)	79 (76,5)	55	54	59	59,2	58,3
DIN 4109-33 Tab 3 / Row 6 Rw = 44 dB						59	59,1	58,2
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						62	60,8	58,7
DIN 4109-33 Tab 3 / Row 13 Rw = 43 dB	1 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm best wood FLOOR 220 Wood Fibre 60 mm Fine Gravel (cement bonded)	121,9 (118,9)	95 (92,5)	50	58	54	54,8	53,4
DIN 4109-33 Tab 3 / Row 6 Rw = 44 dB						54	54,6	53,4
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						57	56,8	54,1
DIN 4109-33 Tab 3 / Row 13 Rw = 43 dB	1 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 60 mm Fine Gravel (cement bonded)	120,8 (117,8)	95 (92,5)	47	58	51	51,8	50,4
DIN 4109-33 Tab 3 / Row 6 Rw = 44 dB						51	51,6	50,4
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						54	53,8	51,1

PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal).
 These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w}$ + 1dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Visible ceiling
 Loading: 60 mm Fine Gravel (cement bonded)



Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert´s opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}^*$ [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
DIN 4109-33 Tab 3 / Row 13 Rw = 43 dB	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	138,2 (132,2)	94 (89)	52	61	56	57,3	55,6
DIN 4109-33 Tab 3 / Row 6 Rw = 44 dB						56	57,1	55,5
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						59	59,8	56,5
DIN 4109-33 Tab 3 / Row 13 Rw = 43 dB	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm best wood FLOOR 220 Wood Fibre 60 mm Fine Gravel (cement bonded)	139,9 (133,9)	110 (105)	47	65	51	53,3	50,9
DIN 4109-33 Tab. 3 / Row 6 Rw = 44 dB						51	53	50,8
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						54	56,2	52,1
DIN 4109-33 Tab 3 / Row 13 Rw = 43 dB	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 60 mm Fine Gravel (cement bonded)	138,8 (132,8)	110 (105)	43	65	48	49,3	46,9
DIN 4109-33 Tab 3 / Row 6 Rw = 44 dB						48	49	46,8
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						51	52,2	48,1

PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal). These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w} + 1$ dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Visible ceiling
 Loading: 60 mm Fine Gravel (cement bonded)



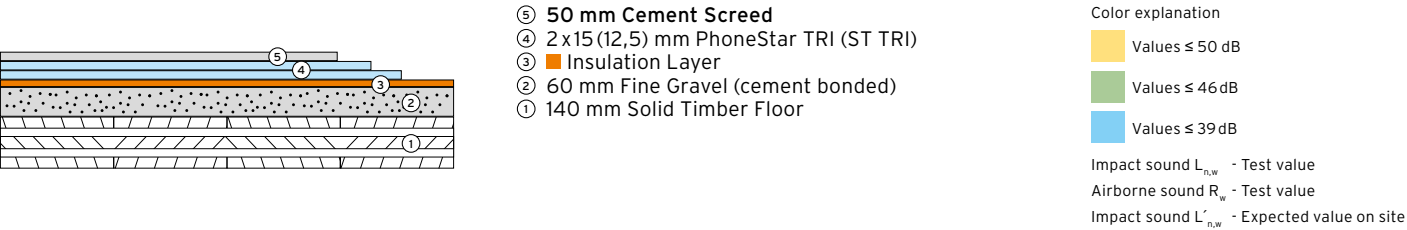
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert´s opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}^*$ [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
DIN 4109-33 Tab 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	161,6 (155,6)	112 (107)	55	59	59	60	58,5
DIN 4109-33 Tab 3 / Row 6 Rw = 44 dB						59	59,8	58,4
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						62	62,2	59,2
DIN 4109-33 Tab 3 / Zeile 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm best wood FLOOR 220 Wood Fibre 60 mm Fine Gravel (cement bonded)	163,3 (157,3)	128 (123)	50	63	54	55,8	53,7
DIN 4109-33 Tab 3 / Row 6 Rw = 44 dB						54	55,6	53,6
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						57	58,5	54,8
DIN 4109-33 Tab 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 60 mm Fine Gravel (cement bonded)	162,2 (156,2)	128 (123)	47	63	51	52,8	50,7
DIN 4109-33 Tab 3 / Row 6 Rw = 44 dB						51	52,6	50,6
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						54	55,5	51,8

* Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal). These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w} + 1$ dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Visible ceiling
 Loading: 60 mm Fine Gravel (cement bonded)



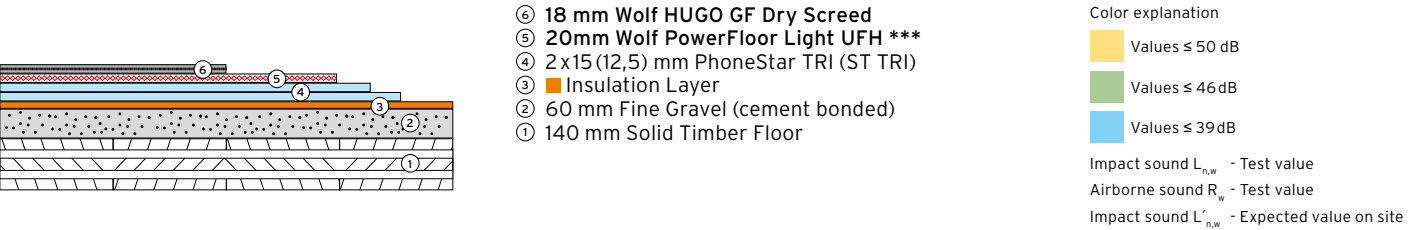
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m ²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
DIN 4109-33 Tab 3 / Row 13 Rw = 43 dB	50 mm Cement Screed 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	238,2 (232,2)	144 (139)	56	63	60	61,8	59,7
DIN 4109-33 Tab 3 / Row 6 Rw = 44 dB						60	61,6	59,6
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						63	64,5	60,8
DIN 4109-33 Tab 3 / Row 13 Rw = 43 dB	50 mm Cement Screed 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm best wood FLOOR 220 Wood Fibre 60 mm Fine Gravel (cement bonded)	239,9 (233,9)	160 (155)	51	67	55	57,8	55,1
DIN 4109-33 Tab. 3 / Zeile 6 Rw = 44 dB						55	57,6	55
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						58	61	56,6
DIN 4109-33 Tab 3 / Row 13 Rw = 43 dB	50 mm Cement Screed 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 60 mm Fine Gravel (cement bonded)	238,8 (232,8)	160 (155)	48	67	52	54,8	52,1
DIN 4109-33 Tab 3 / Row 6 Rw = 44 dB						52	54,6	52
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						55	58	53,6

* Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal).
 These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w}$ + 1 dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Visible ceiling
 Loading: 60 mm Fine Gravel (cement bonded)

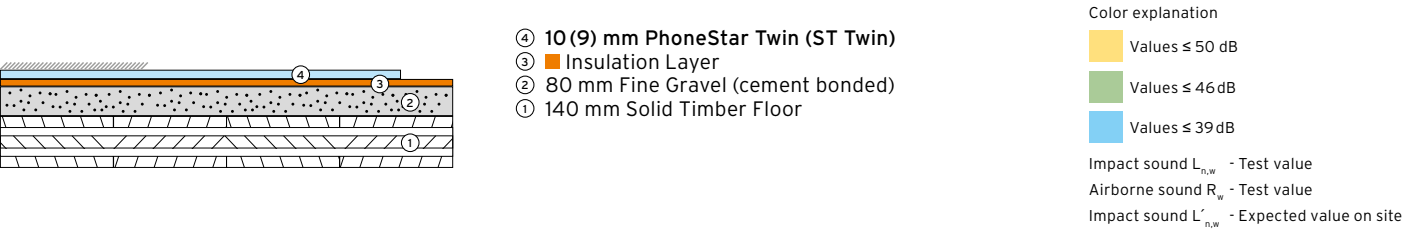


Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m ²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
DIN 4109-33 Tab 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light UFH *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	167 (161)	132 (127)	54	59		58	59
DIN 4109-33 Tab 3 / Row 6 Rw = 43 dB							58	58,8
CLT 100 mm Zero measure- ment 2 Rw = 34 dB							61	61,2
DIN 4109-33 Tab 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light UFH *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm best wood FLOOR 220 Wood Fibre 60 mm Fine Gravel (cement bonded)	168,7 (162,7)	148 (143)	49	63		53	54,8
DIN 4109-33 Tab 3 / Row 6 Rw = 44 dB							53	54,6
CLT 100 mm Zero measure- ment 2 Rw = 34 dB							56	57,5
DIN 4109-33 Tab 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light UFH *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 60 mm Fine Gravel (cement bonded)	167,6 (161,6)	148 (143)	46	63		51	51,8
DIN 4109-33 Tab 3 / Row 6 Rw = 44 dB							51	51,6
CLT 100 mm Zero measure- ment 2 Rw = 34 dB							53	54,5

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal). * Calculated with Kij = 10 dB (butt solid timber joint)
 These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w}$ + 1dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.
 ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354
 ***24 mm Wolf PowerFloor 0ko Plus can also be used

Calculative Proof for Solid Timber Floors

Execution: Visible ceiling
 Loading: 80 mm Fine Gravel (cement bonded)



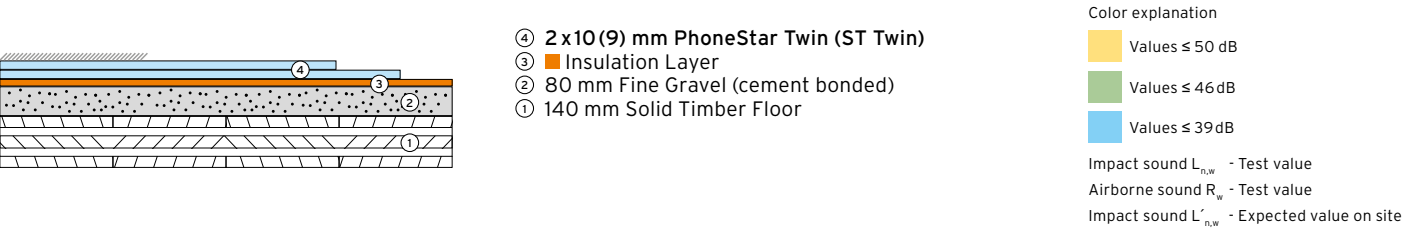
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert´s opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	1 x 10 mm PhoneStar Twin (9 mm ST Twin) 4 mm Wolf Protect Wood Fibre Board 80 mm Fine Gravel (cement bonded)	147,2 (146)	94 (93)	54	52	58	58	57,2
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						58	57,9	57,2
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						61	59,3	57,6
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	1 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm best wood FLOOR 220 Wood Fibre 80 mm Fine Gravel (cement bonded)	148,9 (147,7)	110 (109)	49	56	53	53,5	52,3
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						53	53,3	52,3
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						56	55,3	52,9
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	1 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 80 mm Fine Gravel (cement bonded)	147,8 (146,6)	110 (109)	46	56	51	50,9	49,3
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						51	50,3	49,3
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						54	52,3	49,9

PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal). These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w} + 1$ dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Visible ceiling
 Loading: 80 mm Fine Gravel (cement bonded)



Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert´s opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 10 mm PhoneStar Twin (9 mm ST Twin) 4 mm Wolf Protect Wood Fibre Board 80 mm Fine Gravel (cement bonded)	159,2 (156,8)	104 (102)	51	59	55	56	54,5
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						55	55,8	54,4
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						58	58,2	55,2
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm best wood FLOOR 220 Wood Fibre 80 mm Fine Gravel (cement bonded)	160,9 (158,5)	120 (118)	46	63	51	51,8	49,7
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						51	51,6	49,6
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						54	54,5	50,8
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 80 mm Fine Gravel (cement bonded)	159,8 (157,4)	130 (118)	43	63	48	48,8	46,7
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						48	48,6	46,6
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						51	51,5	47,8

PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal). These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w} + 1$ dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Visible ceiling
 Loading: 80 mm Fine Gravel (cement bonded)



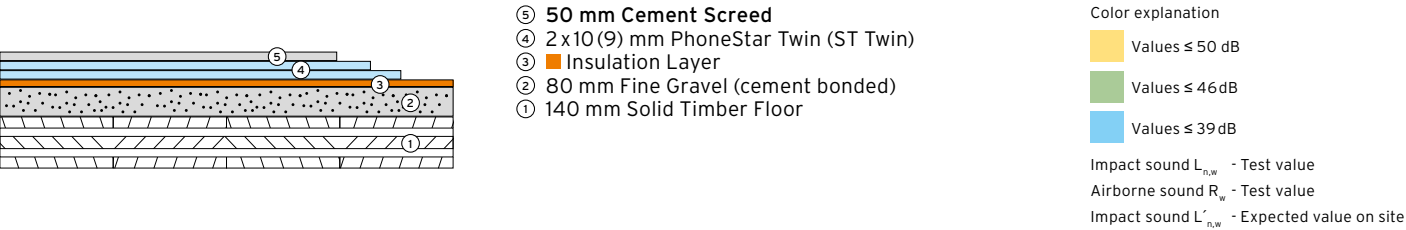
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert´s opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)		Calculated proof according to European EN 12354 **
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 4 mm Wolf Protect Wood Fibre Board 80 mm Fine Gravel (cement bonded)	182,6 (180,2)	122 (120)	54	57	58	58,6	57,4
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						58	58,5	57,3
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						61	60,6	58
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm best wood FLOOR 220 Wood Fibre 80 mm Fine Gravel (cement bonded)	184,3 (181,9)	138 (136)	49	61	53	54,3	52,6
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						53	54,1	52,5
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						56	56,8	53,5
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 80 mm Fine Gravel (cement bonded)	183,2 (180,8)	138 (136)	46	61	51	51,3	49,6
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						51	51,1	49,5
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						54	53,8	50,5

* Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal).
 These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w}$ + 1 dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Visible ceiling
 Loading: 80 mm Fine Gravel (cement bonded)



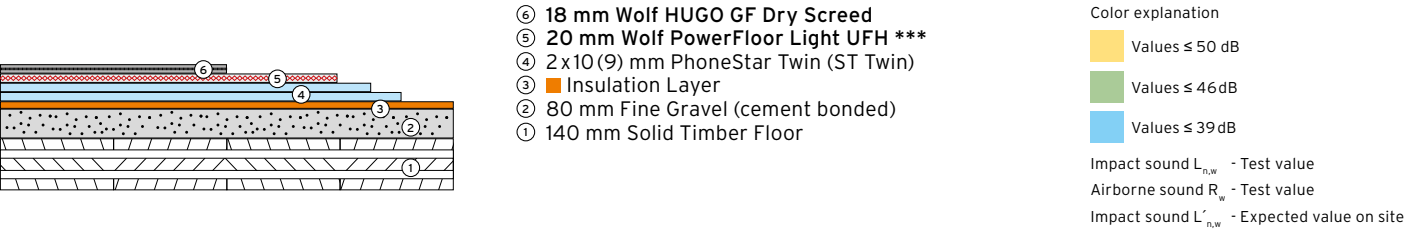
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert´s opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)		Calculated proof according to European EN 12354 **
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	50 mm Cement Screed 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 4 mm Wolf Protect Wood Fibre Board 80 mm Fine Gravel (cement bonded)	259,2 (256,8)	154 (152)	55	61	59	60,3	58,6
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						59	60,1	58,5
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						62	62,8	59,5
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	50 mm Cement Screed 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm best wood FLOOR 220 Wood Fibre 80 mm Fine Gravel (cement bonded)	260,9 (258,5)	170 (168)	50	65	54	56,3	53,9
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						54	56	53,8
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						57	59,2	55,1
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	50 mm Cement Screed 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 80 mm Fine Gravel (cement bonded)	259,8 (257,4)	170 (168)	47	65	51	53,3	50,9
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						51	53	50,8
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						55	56,2	52,1

* Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal).
 These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w}$ + 1 dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Visible ceiling
 Loading: 80 mm Fine Gravel (cement bonded)



Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert´s opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light UFH *** 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 4 mm Wolf Protect Wood Fibre Board 80 mm Fine Gravel (cement bonded)	188 (185,6)	142 (140)	53	57	57	57,6	56,4
DIN4109-33 Tab. 3 / Row 6 Rw = 43 dB						57	57,5	56,3
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						60	59,6	57
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light UFH *** 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm best wood FLOOR 220 Wood Fibre 80 mm Fine Gravel (cement bonded)	186,7 (187,3)	158 (156)	48	61	52	53,3	51,6
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						52	53,1	51,5
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						55	55,8	52,5
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light UFH *** 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 80 mm Fine Gravel (cement bonded)	188,6 (186,2)	158 (156)	45	61	50	50,3	48,6
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						50	50,1	48,5
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						53	52,8	49,5

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal). * Calculated with Kij = 10 dB (butt solid timber joint)
 These results are presumed accurate for all CLT / solid plank floors. ** Calculation of timber frame walls is executed follow-
 If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w}$ + 1dB is to be expected. ing the calculated proof indicated in EN 12354
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables. *** 24 mm Wolf PowerFloor Öko Plus can also be used
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Visible ceiling
 Loading: 60 mm Fine Gravel (cement bonded)



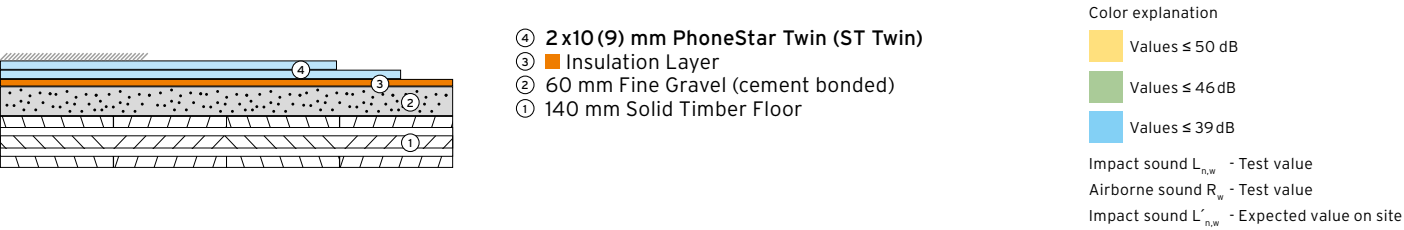
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert´s opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	1 x 10 mm PhoneStar Twin (9 mm ST Twin) 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	114,2 (109,8)	74 (73)	57	49	61	60,7	60,2
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						61	60,6	60,1
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						64	61,8	60,4
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	1 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm best wood FLOOR 220 Wood Fibre 60 mm Fine Gravel (cement bonded)	115,9 (114,7)	90 (89)	52	53	56	56,1	55,2
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						56	56	55,2
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						59	57,6	55,6
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	1 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 60 mm Fine Gravel (cement bonded)	114,8 (113,6)	90 (89)	49	53	53	53,1	52,2
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						53	53	52,2
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						56	54,6	52,6

PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal).
 These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w}$ + 1dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Visible ceiling
 Loading: 60 mm Fine Gravel (cement bonded)



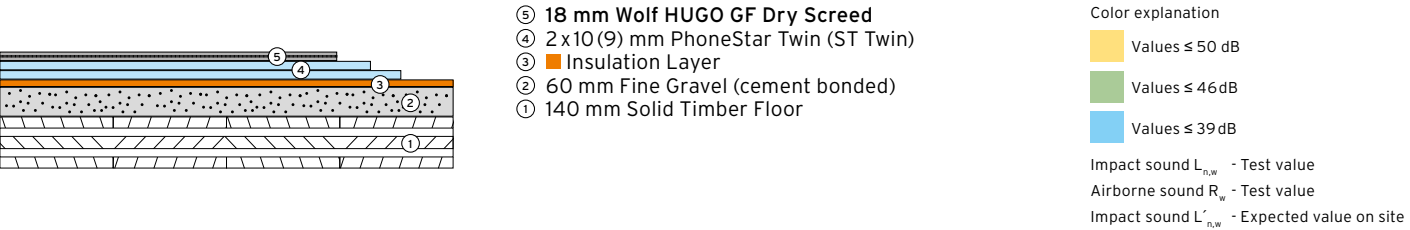
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert´s opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 10 mm PhoneStar Twin (9 mm ST Twin) 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	126,2 (123,8)	84 (82)	54	56	58	58,5	57,3
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						58	58,3	57,3
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						61	60,3	57,9
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm best wood FLOOR 220 Wood Fibre 60 mm Fine Gravel (cement bonded)	127,9 (125,5)	100 (98)	49	60	53	54,1	52,5
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						53	54	52,5
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						56	56,5	53,3
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 60 mm Fine Gravel (cement bonded)	126,8 (124,4)	100 (98)	46	60	51	51,1	49,5
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						51	51	49,5
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						54	53,5	50,3

PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal). These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w} + 1$ dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Visible ceiling
 Loading: 60 mm Fine Gravel (cement bonded)



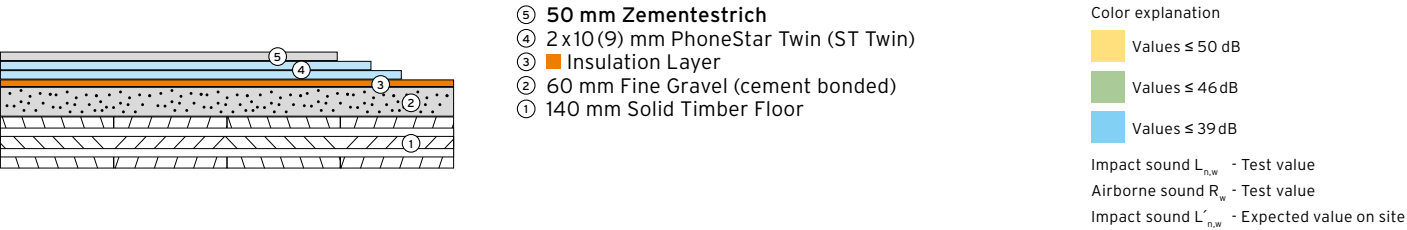
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert´s opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	149,6 (147,2)	102 (100)	57	54	61	61,2	60,3
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						61	61,1	60,2
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						64	62,8	60,7
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm best wood FLOOR 220 Wood Fibre 60 mm Fine Gravel (cement bonded)	151,3 (148,9)	118 (116)	52	58	56	56,8	55,4
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						56	56,6	55,4
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						59	58,8	56,1
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 60 mm Fine Gravel (cement bonded)	150,2 (147,8)	118 (116)	49	58	53	53,8	52,4
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						53	53,6	52,4
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						56	55,8	53,1

* Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal). These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w} + 1$ dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Visible ceiling
 Loading: 60 mm Fine Gravel (cement bonded)



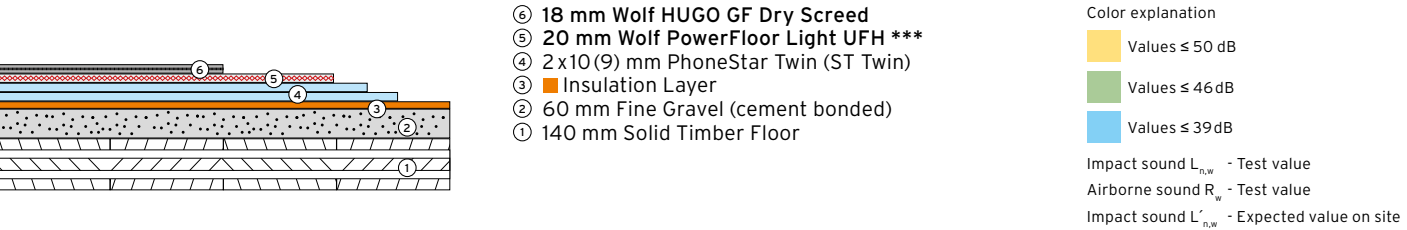
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m ²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	50 mm Zementestrich 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	226,2 (223,8)	134 (132)	58	58	62	62,8	61,4
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						52	62,6	61,4
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						65	64,8	62,1
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	50 mm Zementestrich 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm best wood FLOOR 220 Wood Fibre 60 mm Fine Gravel (cement bonded)	227,9 (225,5)	150 (148)	53	62	57	58,6	56,6
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						57	58,3	56,6
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						60	61,1	57,6
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	50 mm Zementestrich 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 60 mm Fine Gravel (cement bonded)	226,8 (224,4)	150 (148)	50	62	54	55,6	53,6
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						54	55,3	53,6
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						57	58,1	54,6

* Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.
 † Report 18-001770-PR02 PB X13-F03-04-de-01

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal).
 These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w}$ + 1 dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Visible ceiling
 Loading: 60 mm Fine Gravel (cement bonded)



Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m ²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light UFH *** 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	155 (152,6)	122 (120)	56	54	60	60,2	59,3
DIN4109-33 Tab. 3 / Row 6 Rw = 43 dB						60	60,1	59,2
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						63	61,8	59,7
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light UFH *** 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm best wood FLOOR 220 Wood Fibre 60 mm Fine Gravel (cement bonded)	156,7 (154,3)	138 (136)	51	58	55	55,8	54,4
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						55	55,6	54,4
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						58	57,8	55,1
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light UFH *** 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 60 mm Fine Gravel (cement bonded)	156,7 (155,6)	138 (136)	48	58	52	52,8	51,4
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						52	52,6	51,4
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						55	54,8	52,1

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal). * Calculated with Kij = 10 dB (butt solid timber joint)
 These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w}$ + 1dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.
 ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354
 ***24 mm Wolf PowerFloor 0ko Plus can also be used

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: 80 mm Fine Gravel (cement bonded)



Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert´s opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	L _{n,w} [in dB]	R _w [in dB]	L' _{n,w} [in dB]	L' _{n,w} * [in dB]	L' _{n,w} [in dB] with PhoneStrip (Kij=17dB)
DIN4109-33 Tab 3 / Row 13 Rw = 43 dB	1 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 4 mm Wolf Protect Wood Fibre Board 80 mm Fine Gravel (cement bonded)	150 (150,2)	99 (94)	38	68	48	45,2	42,2
DIN4109-33 Tab 3 / Row 6 Rw = 44 dB						49	44,8	42,1
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						51	48,4	43,8
DIN4109-33 Tab 3 / Row 13 Rw = 43 dB	1 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm best wood FLOOR 220 Wood Fibre 80 mm Fine Gravel (cement bonded)	154,9 (151,9)	115 (112,5)	33	72	45	41,5	37,8
DIN4109-33 Tab 3 / Row 6 Rw = 44 dB						45	41,1	37,6
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						46	45,1	39,8
DIN4109-33 Tab 3 / Row 13 Rw = 43 dB	1 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm ISOVER Akustic EP3 stone wool insulation board 80 mm Fine Gravel (cement bonded)	153,8 (150,8)	115 (112,5)	30	72	43	38,5	34,8
DIN4109-33 Tab 3 / Row 6 Rw = 44 dB						44	38,1	34,6
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						45	42,1	36,8

PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal). These results are presumed accurate for all CLT / solid plank floors. If wood based panel boards (Magnum Board) is used a reduction of L_{nw} + 1 dB is to be expected. Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables. It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: 80 mm Fine Gravel (cement bonded)



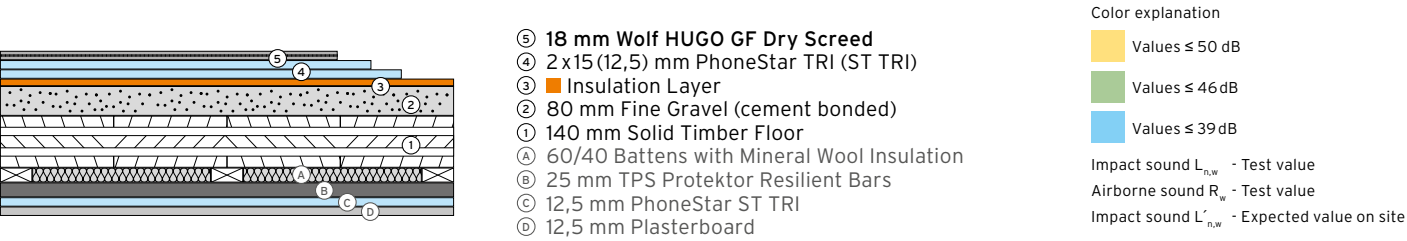
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert´s opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	L _{n,w} [in dB]	R _w [in dB]	L' _{n,w} [in dB]	L' _{n,w} * [in dB]	L' _{n,w} [in dB] with PhoneStrip (Kij=17dB)
DIN4109-33 Tab 3 / Row 13 Rw = 43 dB	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 4 mm Wolf Protect Wood Fibre Board 80 mm Fine Gravel (cement bonded)	168 (165,2)	115 (110)	35	75	46	44,6	40,3
DIN4109-33 Tab 3 / Row 6 Rw = 44 dB						46	44,2	40,1
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						48	48,5	42,8
DIN4109-33 Tab 3 / Row 13 Rw = 43 dB	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm best wood FLOOR 220 Wood Fibre 80 mm Fine Gravel (cement bonded)	172,9 (166,9)	130 (125)	30	≥ 75	43	39,6	35,3
DIN4109-33 Tab 3 / Row 6 Rw = 44 dB						44	39,2	35,1
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						45	43,5	37,8
DIN4109-33 Tab 3 / Row 13 Rw = 43 dB	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm ISOVER Akustic EP3 stone wool insulation board 80 mm Fine Gravel (cement bonded)	171,8 (165,8)	130 (125)	27 ¹	79 ¹	41	38,2	33,3
DIN4109-33 Tab 3 / Row 6 Rw = 44 dB						42	37,8	33
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						43	42,3	36,2

PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354. ¹ Report 18-001770-PR02 PB X01-F03-04-de-01

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal). These results are presumed accurate for all CLT / solid plank floors. If wood based panel boards (Magnum Board) is used a reduction of L_{nw} + 1 dB is to be expected. Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables. It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: 80 mm Fine Gravel (cement bonded)



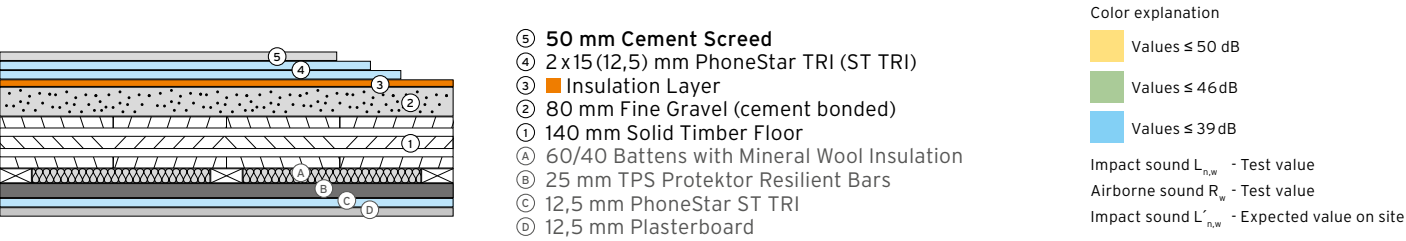
Wall build up in receiving room	Floor build up	Weight [kg/m²]	Height [mm]	Test values according to expert's opinion (18-001770-PR03)	Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **
DIN4109-33 Tab 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed					
DIN4109-33 Tab 3 / Row 6 Rw = 44 dB	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI)	194,6 (188,6)	132 (127)	35	75	46 44,6 40,3
CLT 100 mm Zero measure- ment 2 Rw = 34 dB	4 mm Wolf Protect Wood Fibre Board					48 48,5 42,8
DIN4109-33 Tab 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed					43 39,6 35,3
DIN4109-33 Tab 3 / Row 6 Rw = 44 dB	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI)	196,3 (190,3)	148 (143)	30	≥ 75	44 39,2 35,1
CLT 100 mm Zero measure- ment 2 Rw = 34 dB	20 mm best wood FLOOR 220 Wood Fibre					45 43,5 37,8
DIN4109-33 Tab 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed					41 38,2 33,3
DIN4109-33 Tab 3 / Row 6 Rw = 44 dB	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI)	195,2 (189,2)	148 (143)	27	79	42 37,8 33
CLT 100 mm Zero measure- ment 2 Rw = 34 dB	20 mm ISOVER Akustic EP3 stone wool insulation board					43 42,3 36,2

* Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal).
 These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L'_{n,w}$ + 1 dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: 80 mm Fine Gravel (cement bonded)



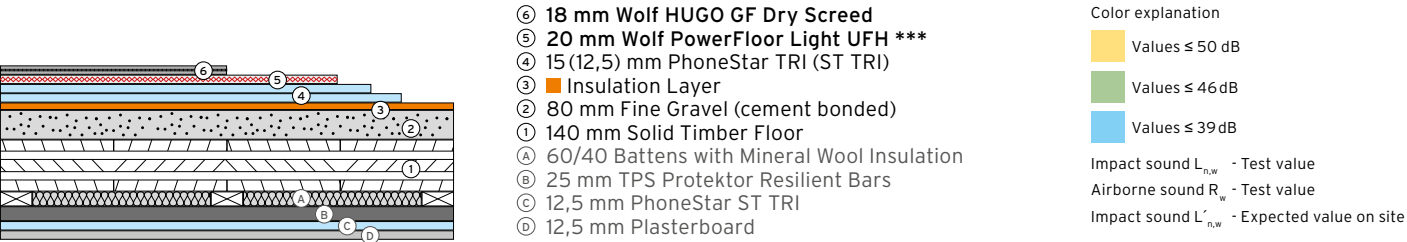
Wall build up in receiving room	Floor build up	Weight [kg/m²]	Height [mm]	Test values according to expert's opinion (18-001770-PR03)	Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **
DIN4109-33 Tab 3 / Row 13 Rw = 43 dB	50 mm Cement Screed					49 48,6 44,3
DIN4109-33 Tab 3 / Row 6 Rw = 44 dB	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI)	271,2 (265,2)	164 (159)	39	≥ 75	50 48,2 44,1
CLT 100 mm Zero measure- ment 2 Rw = 34 dB	4 mm Wolf Protect Wood Fibre Board					52 52,5 46,8
DIN4109-33 Tab 3 / Row 13 Rw = 43 dB	50 mm Cement Screed					46 43,6 39,3
DIN4109-33 Tab 3 / Row 6 Rw = 44 dB	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI)	272,9 (266,9)	180 (175)	34	≥ 75	47 53,2 39,1
CLT 100 mm Zero measure- ment 2 Rw = 34 dB	20 mm best wood FLOOR 220 Wood Fibre					48 47,5 41,8
DIN4109-33 Tab 3 / Row 13 Rw = 43 dB	50 mm Cement Screed					45 40,6 36,3
DIN4109-33 Tab 3 / Row 6 Rw = 44 dB	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI)	271,8 (265,8)	180 (175)	31	≥ 75	45 40,2 36,1
CLT 100 mm Zero measure- ment 2 Rw = 34 dB	20 mm ISOVER Akustic EP3 stone wool insulation board					46 44,5 38,8

* Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal).
 These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L'_{n,w}$ + 1 dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: 80 mm Fine Gravel (cement bonded)

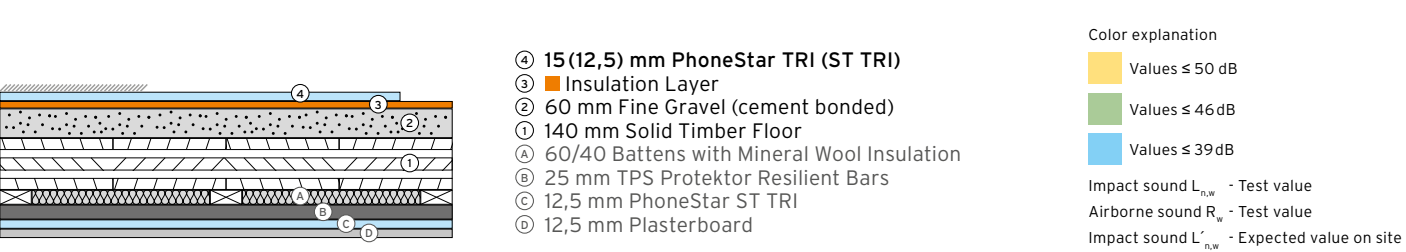


Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	L _{n,w} [in dB]	R _w [in dB]	L' _{n,w} [in dB]	L' _{n,w} * [in dB]	L' _{n,w} [in dB] with PhoneStrip (Kij=17dB)
DIN4109-33 Tab 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 4 mm Wolf Protect Wood Fibre Board 80 mm Fine Gravel (cement bonded)	200 (194)	152 (147)	36	73	46	44,9	41
DIN4109-33 Tab 3 / Row 6 Rw = 44 dB						47	44,5	40,8
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						49	48,6	43,2
DIN4109-33 Tab 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm best wood FLOOR 220 Wood Fibre 80 mm Fine Gravel (cement bonded)	201,7 (195,7)	168 (163)	31	≥ 75	44	40,6	36,3
DIN4109-33 Tab 3 / Row 6 Rw = 44 dB						44	40,2	36,1
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						45	44,5	38,8
DIN4109-33 Tab 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 80 mm Fine Gravel (cement bonded)	200,6 (194,6)	168 (163)	28	≥ 75	42	37,6	33,3
DIN4109-33 Tab 3 / Row 6 Rw = 44 dB						43	37,2	33,1
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						44	41,5	35,8

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal). * Calculated with Kij = 10 dB (butt solid timber joint)
 These results are presumed accurate for all CLT / solid plank floors. ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354
 If wood based panel boards (Magnum Board) is used a reduction of L_{n,w} + 1dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.
 *** 24 mm Wolf PowerFloor Öko Plus can also be used

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: 60 mm Fine Gravel (cement bonded)



Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	L _{n,w} [in dB]	R _w [in dB]	L' _{n,w} [in dB]	L' _{n,w} * [in dB]	L' _{n,w} [in dB] with PhoneStrip (Kij=17dB)
DIN 4109-33 Tab 3 / Row 13 Rw = 43 dB	1 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	120,2 (117,2)	79 (76,5)	41	65	51	47,3	44,9
DIN 4109-33 Tab 3 / Row 6 Rw = 44 dB						51	47	44,8
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						54	50,2	46,1
DIN 4109-33 Tab 3 / Row 13 Rw = 43 dB	1 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm best wood FLOOR 220 Wood Fibre 60 mm Fine Gravel (cement bonded)	121,9 (118,9)	95 (92,5)	36	69	46	43,5	40,3
DIN 4109-33 Tab 3 / Row 6 Rw = 44 dB						47	43,2	40,2
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						50	46,8	42
DIN 4109-33 Tab 3 / Row 13 Rw = 43 dB	1 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 60 mm Fine Gravel (cement bonded)	120,8 (117,8)	95 (92,5)	33	69	45	40,5	37,3
DIN 4109-33 Tab 3 / Row 6 Rw = 44 dB						45	40,2	37,2
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						48	43,8	39

PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal).
 These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of L_{n,w} + 1dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: 60 mm Fine Gravel (cement bonded)



Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}^*$ [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
DIN 4109-33 Tab 3 / Row 13 Rw = 43 dB	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	138,2 (132,2)	94 (89)	38	72	48	46,5	42,8
DIN 4109-33 Tab 3 / Row 6 Rw = 44 dB						49	46,1	42,6
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						51	50,1	44,8
DIN 4109-33 Tab 3 / Row 13 Rw = 43 dB	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm best wood FLOOR 220 Wood Fibre 60 mm Fine Gravel (cement bonded)	139,9 (133,9)	110 (105)	33	≥ 72	45	41,5	37,8
DIN 4109-33 Tab 3 / Row 6 Rw = 44 dB						45	41,1	37,6
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						48	45,1	39,8
DIN 4109-33 Tab 3 / Row 13 Rw = 43 dB	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 60 mm Fine Gravel (cement bonded)	138,8 (132,8)	110 (105)	30	76	43	40	35,6
DIN 4109-33 Tab 3 / Row 6 Rw = 44 dB						44	39,6	35,3
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						47	43,9	38,1

PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal). These results are presumed accurate for all CLT / solid plank floors. If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w} + 1$ dB is to be expected. Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables. It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: 60 mm Fine Gravel (cement bonded)



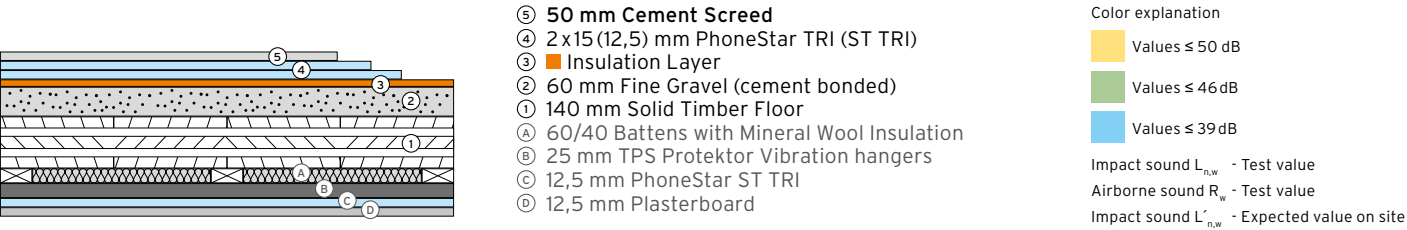
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}^*$ [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
DIN 4109-33 Tab 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	161,6 (155,6)	112 (107)	38	72	48	46,5	42,8
DIN 4109-33 Tab 3 / Row 6 Rw = 44 dB						49	46,1	42,6
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						51	50,1	44,8
DIN 4109-33 Tab 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm best wood FLOOR 220 Wood Fibre 60 mm Fine Gravel (cement bonded)	163,3 (157,3)	128 (123)	33	≥ 72	45	41,5	37,8
DIN 4109-33 Tab 3 / Row 6 Rw = 44 dB						45	41,1	37,6
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						48	45,1	39,8
DIN 4109-33 Tab 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 60 mm Fine Gravel (cement bonded)	162,2 (156,2)	128 (123)	30	76	43	40	35,6
DIN 4109-33 Tab 3 / Row 6 Rw = 44 dB						44	39,6	35,3
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						47	43,9	38,1

* Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal). These results are presumed accurate for all CLT / solid plank floors. If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w} + 1$ dB is to be expected. Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables. It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: 60 mm Fine Gravel (cement bonded)



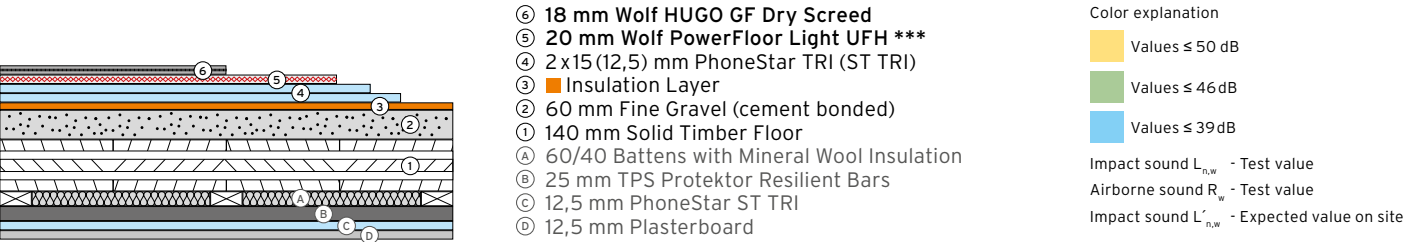
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m ²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
DIN 4109-33 Tab 3 / Row 13 Rw = 43 dB	50 mm Cement Screed 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	238,2 (232,2)	144 (139)	42	≥ 72		51	46,8
DIN 4109-33 Tab 3 / Row 6 Rw = 44 dB							52	46,6
CLT 100 mm Zero measure- ment 2 Rw = 34 dB							55	48,8
DIN 4109-33 Tab 3 / Row 13 Rw = 43 dB	50 mm Cement Screed 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm best wood FLOOR 220 Wood Fibre 60 mm Fine Gravel (cement bonded)	239,9 (233,9)	160 (155)	37	≥ 72		48	41,8
DIN 4109-33 Tab 3 / Row 6 Rw = 44 dB							48	41,6
CLT 100 mm Zero measure- ment 2 Rw = 34 dB							50	43,8
DIN 4109-33 Tab 3 / Row 13 Rw = 43 dB	50 mm Cement Screed 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 60 mm Fine Gravel (cement bonded)	238,8 (232,8)	160 (155)	34	≥ 72		46	38,8
DIN 4109-33 Tab 3 / Row 6 Rw = 44 dB							47	38,6
CLT 100 mm Zero measure- ment 2 Rw = 34 dB							50	40,8

* Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal).
 These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w}$ + 1 dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: 60 mm Fine Gravel (cement bonded)

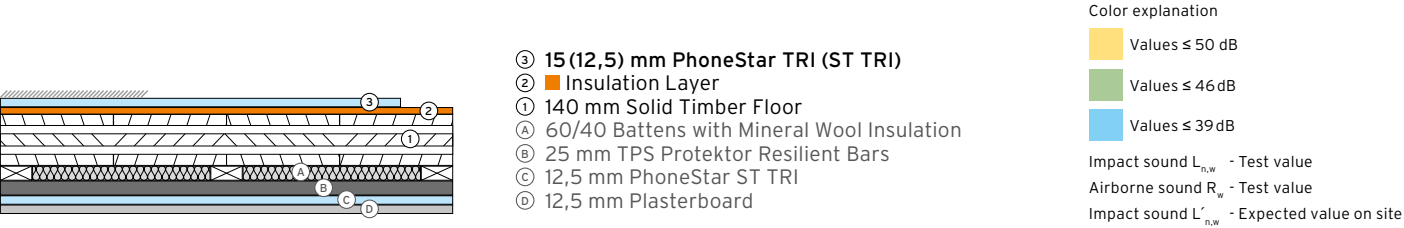


Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m ²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
DIN 4109-33 Tab 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	167 (161)	132 (127)	39	70		49	43,5
DIN 4109-33 Tab 3 / Row 6 Rw = 44 dB							50	43,3
CLT 100 mm Zero measure- ment 2 Rw = 34 dB							52	45,3
DIN 4109-33 Tab 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm best wood FLOOR 220 Wood Fibre 60 mm Fine Gravel (cement bonded)	168,7 (162,7)	148 (143)	34	≥ 72		45	38,8
DIN 4109-33 Tab 3 / Row 6 Rw = 44 dB							46	38,6
CLT 100 mm Zero measure- ment 2 Rw = 34 dB							50	40,8
DIN 4109-33 Tab 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 60 mm Fine Gravel (cement bonded)	167,6 (161,6)	148 (143)	31	≥ 72		43	35,8
DIN 4109-33 Tab 3 / Row 6 Rw = 44 dB							44	35,6
CLT 100 mm Zero measure- ment 2 Rw = 34 dB							47	37,8

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal). * Calculated with Kij = 10 dB (butt solid timber joint)
 These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w}$ + 1dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.
 ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354
 ***24 mm Wolf PowerFloor 0ko Plus can also be used

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: no



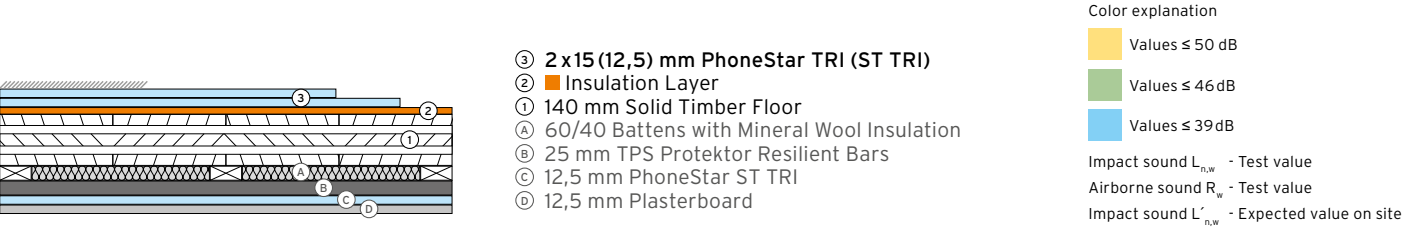
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert´s opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	1 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 4 mm Wolf Protect Wood Fibre Board	21,2 (18,2)	19 (17,5)	53	54	62	57,2	56,3
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						63	57,1	56,2
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						65	58,8	56,7
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	1 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm best wood FLOOR 220 Wood Fibre	22,9 (19,9)	35 (32,5)	48	58	57	52,8	51,4
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						58	52,6	51,4
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						60	54,8	52,1
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	1 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board	21,8 (18,8)	35 (32,5)	45	58	54	49,8	48,4
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						55	49,6	48,4
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						57	51,8	49,1

PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal). These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L_{nw} + 1$ dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: no



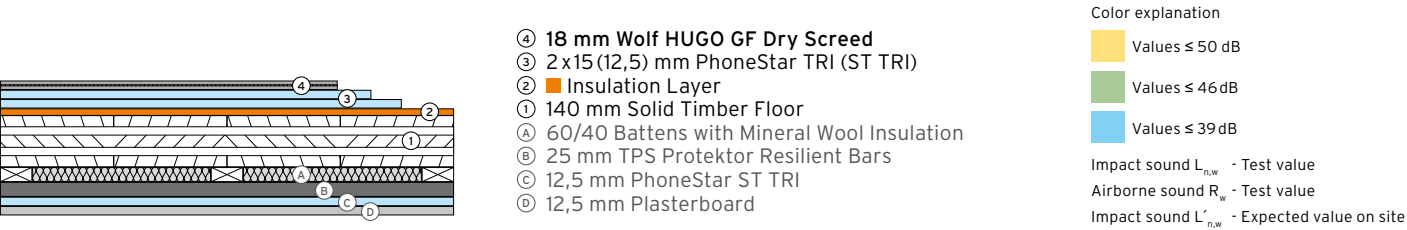
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert´s opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 4 mm Wolf Protect Wood Fibre Board	39,2 (33,2)	34 (29)	50	61	59	55,3	53,6
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						60	55,1	53,5
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						62	57,8	54,5
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm best wood FLOOR 220 Wood Fibre	40,9 (34,9)	50 (45)	45	≥ 61	54	50,3	48,6
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						55	50,1	48,5
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						57	52,8	49,5
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board	39,8 (33,8)	50 (45)	42	64	51	48	45,8
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						52	47,8	45,7
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						55	50,9	47











PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal). These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L_{nw} + 1$ dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: no



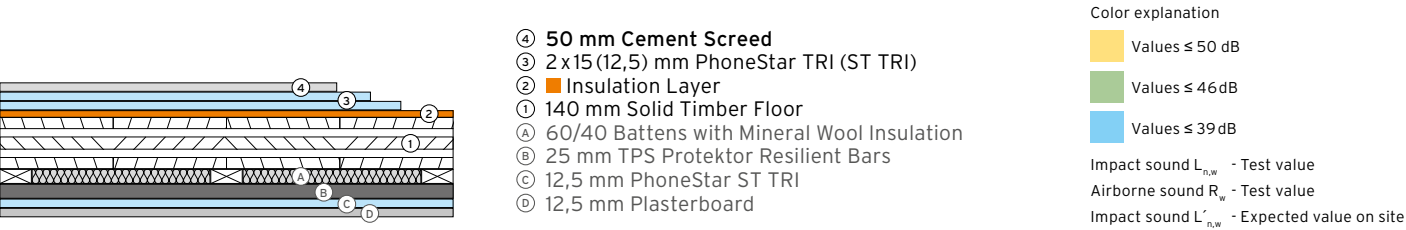
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert 's opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **		
		Weight [kg/m²]	Height [mm]	L _{n,w} [in dB]	R _w [in dB]		L' _{n,w} [in dB]	L' _{n,w} * [in dB]	
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	18 mm Wolf HUGO GF Dry Screed 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 4 mm Wolf Protect Wood Fibre Board	62,2 (56,6)	52 (47)	50	61	59	55,3	53,6	
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						60	55,1	53,5	
 CLT 100 mm Zero measurement 2 Rw = 34 dB Timber-/ WBP-Element						62	57,8	54,5	
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	18 mm Wolf HUGO GF Dry Screed 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm best wood FLOOR 220 Wood Fibre	64,3 (58,3)	68 (63)	45	≥ 61	54	50,3	48,6	
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						55	50,1	48,5	
 CLT 100 mm Zero measurement 2 Rw = 34 dB Timber-/ WBP-Element						57	52,8	49,5	
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	18 mm Wolf HUGO GF Dry Screed 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board	63,2 (57,2)	68 (63)	42	64	51	48	45,8	
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						52	47,8	45,7	
 CLT 100 mm Zero measurement 2 Rw = 34 dB Timber-/ WBP-Element						55	50,9	47	











* Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal).
 These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w} + 1$ dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: no



Wall build up in receiving room	Floor build up	Weight [kg/m²]	Height [mm]	Test values according to expert´s opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **		
				$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)	
 PB + WBP DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	50 mm Cement Screed 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) ■ 4 mm Wolf Protect Wood Fibre Board	139,2 (133,2)	84 (79)	54	≥ 61	63	59,3	57,6	
 GF DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						64	59,1	57,5	
 Timber-/ WBP-Element CLT 100 mm Zero measure- ment 2 Rw = 34 dB						66	61,8	58,5	
 PB + WBP DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	50 mm Cement Screed 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) ■ 20 mm best wood FLOOR 220 Wood Fibre	140,9 (134,9)	100 (95)	49	≥ 61	58	54,3	52,6	
 GF DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						59	54,1	52,5	
 Timber-/ WBP-Element CLT 100 mm Zero measure- ment 2 Rw = 34 dB						61	56,8	53,5	
 PB + WBP DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	50 mm Cement Screed 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) ■ 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board	139,8 (133,8)	100 (95)	46	≥ 61	55	51,3	49,6	
 GF DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						56	51,1	49,5	
 Timber-/ WBP-Element CLT 100 mm Zero measure- ment 2 Rw = 34 dB						58	53,8	50,5	

* Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal).
 These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w} + 1$ dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: no












⑤ 18 mm Wolf HUGO GF Dry Screed
 ④ 20 mm Wolf PowerFloor Light UFH ***
 ③ 2x15(12,5) mm PhoneStar TRI (ST TRI)
 ② Insulation Layer
 ① 140 mm Solid Timber Floor
 A 60/40 Battens with Mineral Wool Insulation
 B 25 mm TPS Protektor Resilient Bars
 C 12,5 mm PhoneStar ST TRI
 D 12,5 mm Plasterboard

Color explanation

Values ≤ 50 dB
 Values ≤ 46 dB
 Values ≤ 39 dB

Impact sound $L'_{n,w}$ - Test value
 Airborne sound R_w - Test value
 Impact sound $L'_{n,w}$ - Expected value on site

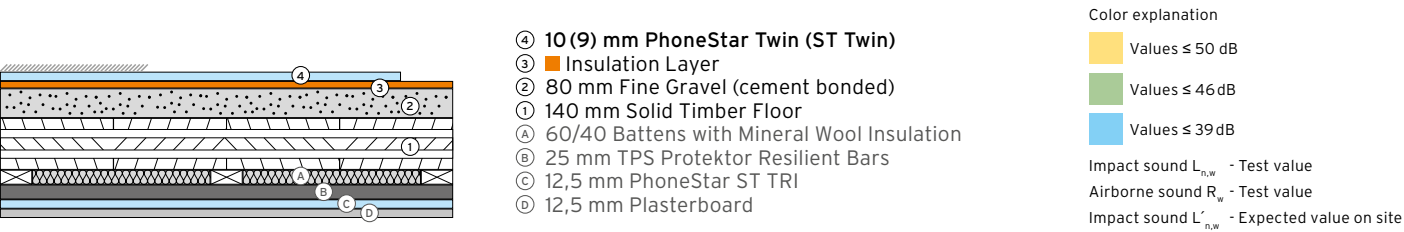
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert´s opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 4 mm Wolf Protect Wood Fibre Board	68 (62)	72 (67)	51	59	60	56	54,5
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						61	55,8	54,4
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB Timber-/ WBP-Element						63	58,2	55,2
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm best wood FLOOR 220 Wood Fibre	69,7 (63,7)	88 (83)	46	≥ 61	55	51,3	49,6
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						56	51,1	49,5
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB Timber-/ WBP-Element						58	53,8	50,5
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board	68,6 (62,2)	88 (83)	43	≥ 61	52	48,3	46,6
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						53	48,1	46,5
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB Timber-/ WBP-Element						55	50,8	47,5









All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal).
 These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L'_{n,w}$ + 1dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

* Calculated with Kij = 10 dB (butt solid timber joint)
 ** Calculation of timber frame walls is executed follow-
 ing the calculated proof indicated in EN 12354
 ***24 mm Wolf PowerFloor Öko Plus can also be used

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: 80 mm Fine Gravel (cement bonded)



Wall build up in receiving room	Floor build up	Weight [kg/m²]	Height [mm]	Test values according to expert 's opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
				$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
 PB + WBP DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	1 x 10 mm PhoneStar Twin (9 mm ST Twin) ■ 4 mm Wolf Protect Wood Fibre Board 80 mm Fine Gravel (cement bonded)	147,2 (146)	94 (93)	40	63	50	45,8	43,7
 GF DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						51	45,6	43,6
 Timber-/ WBP-Element CLT 100 mm Zero measure- ment 2 Rw = 34 dB						53	48,5	44,8
 PB + WBP DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	1 x 10 mm PhoneStar Twin (9 mm ST Twin) ■ 20 mm best wood FLOOR 220 Wood Fibre 80 mm Fine Gravel (cement bonded)	148,9 (147,7)	110 (109)	35	67	46	41,8	39,1
 GF DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						46	41,6	39
 Timber-/ WBP-Element CLT 100 mm Zero measure- ment 2 Rw = 34 dB						49	45	40,6
 PB + WBP DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	1 x 10 mm PhoneStar Twin (9 mm ST Twin) ■ 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 80 mm Fine Gravel (cement bonded)	147,8 (146,6)	110 (109)	32	67	44	38,8	36,1
 GF DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						45	38,6	36
 Timber-/ WBP-Element CLT 100 mm Zero measure- ment 2 Rw = 34 dB						48	42	37,6










PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal).
 These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w} + 1$ dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: 80 mm Fine Gravel (cement bonded)



Wall build up in receiving room	Floor build up	Weight [kg/m²]	Height [mm]	Test values according to expert 's opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
				$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
 PB + WBP DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 10 mm PhoneStar Twin (9 mm ST Twin) ■ 4 mm Wolf Protect Wood Fibre Board 80 mm Fine Gravel (cement bonded)	159,2 (156,8)	104 (103)	37	70	47	44,8	41,5
 GF DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						48	44,5	41,3
 Timber-/ WBP-Element CLT 100 mm Zero measure- ment 2 Rw = 34 dB						50	48,2	43,3
 PB + WBP DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 10 mm PhoneStar Twin (9 mm ST Twin) ■ 20 mm best wood FLOOR 220 Wood Fibre 80 mm Fine Gravel (cement bonded)	160,9 (158,5)	120 (128)	32	74	44	41,2	37,1
 GF DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						45	40,9	37
 Timber-/ WBP-Element CLT 100 mm Zero measure- ment 2 Rw = 34 dB						48	45	39,5
 PB + WBP DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 10 mm PhoneStar Twin (9 mm ST Twin) ■ 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 80 mm Fine Gravel (cement bonded)	159,8 (157,4)	120 (108)	29	74	43	38,2	34,1
 GF DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						43	37,9	34
 Timber-/ WBP-Element CLT 100 mm Zero measure- ment 2 Rw = 34 dB						46	42	36,5

PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal).
 These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w} + 1$ dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: 80 mm Fine Gravel (cement bonded)



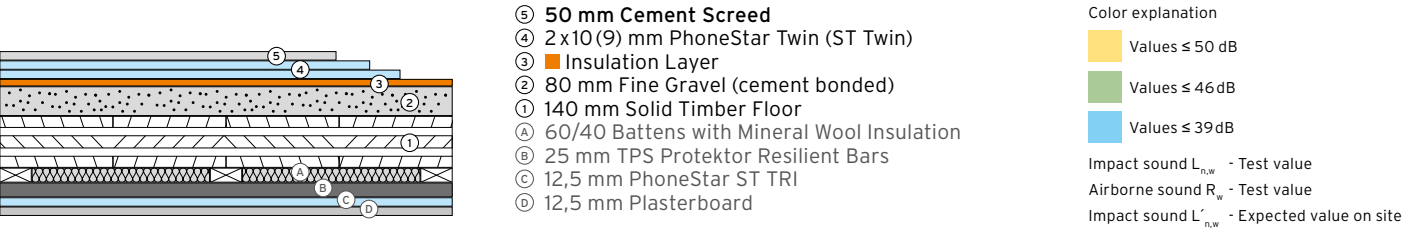
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert´s opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	L _{n,w} [in dB]	R _w [in dB]	L' _{n,w} [in dB]	L' _{n,w} * [in dB]	L' _{n,w} [in dB] with PhoneStrip (Kij=17dB)
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 4 mm Wolf Protect Wood Fibre Board 80 mm Fine Gravel (cement bonded)	182,6 (180,2)	122 (120)	37	70	47	44,8	41,5
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						48	44,5	41,3
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						50	48,2	43,3
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm best wood FLOOR 220 Wood Fibre 80 mm Fine Gravel (cement bonded)	184,3 (181,9)	138 (136)	32	74	44	41,2	37,1
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						45	40,9	37
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						48	45	38,5
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 80 mm Fine Gravel (cement bonded)	183,2 (180,8)	138 (136)	29	74	43	38,2	34,1
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						43	37,9	34
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						46	42	36,5

PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal). These results are presumed accurate for all CLT / solid plank floors. If wood based panel boards (Magnum Board) is used a reduction of L_{n,w} + 1 dB is to be expected. Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables. It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: 80 mm Fine Gravel (cement bonded)



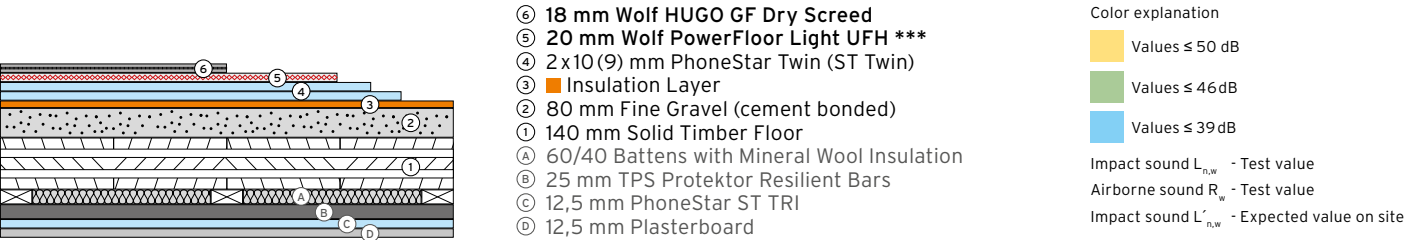
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert´s opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	L _{n,w} [in dB]	R _w [in dB]	L' _{n,w} [in dB]	L' _{n,w} * [in dB]	L' _{n,w} [in dB] with PhoneStrip (Kij=17dB)
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	50 mm Cement Screed 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 4 mm Wolf Protect Wood Fibre Board 80 mm Fine Gravel (cement bonded)	259,2 (256,8)	154 (152)	41	72	51	49,5	45,8
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						52	49,1	45,6
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						53	53,1	47,8
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	50 mm Cement Screed 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm best wood FLOOR 220 Wood Fibre 80 mm Fine Gravel (cement bonded)	260,9 (258,5)	170 (168)	36	75	47	45,6	41,3
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						48	45,2	41,1
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						51	49,5	43,8
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	50 mm Cement Screed 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 80 mm Fine Gravel (cement bonded)	259,8 (257,4)	170 (168)	33	75	46	42,6	38,2
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						46	42,2	38,1
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						50	46,5	40,8

PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal). These results are presumed accurate for all CLT / solid plank floors. If wood based panel boards (Magnum Board) is used a reduction of L_{n,w} + 1 dB is to be expected. Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables. It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: 80 mm Fine Gravel (cement bonded)

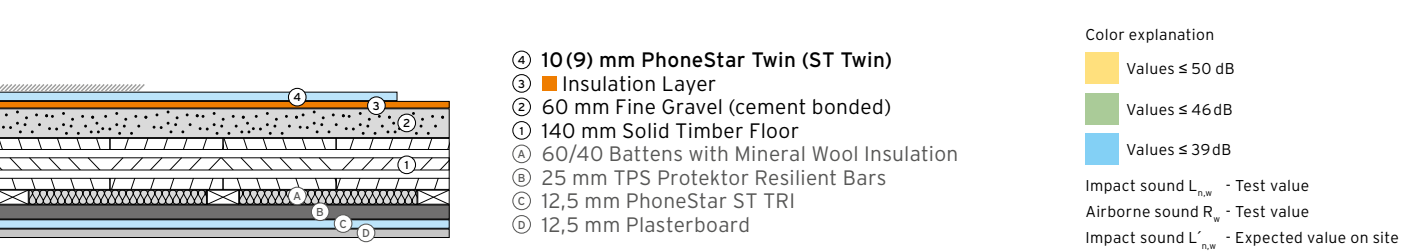


Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	L _{n,w} [in dB]	R _w [in dB]	L' _{n,w} [in dB]	L' _{n,w} * [in dB]	L' _{n,w} [in dB] with PhoneStrip (Kij=17dB)
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 4 mm Wolf Protect Wood Fibre Board 80 mm Fine Gravel (cement bonded)	188 (185,6)	142 (140)	38	68	48	45,2	42,2
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						49	44,8	42,1
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						51	48,4	43,8
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm best wood FLOOR 220 Wood Fibre 80 mm Fine Gravel (cement bonded)	186,7 (187,3)	158 (156)	33	72	45	41,5	37,8
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						45	41,1	37,6
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						48	45,1	39,8
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 80 mm Fine Gravel (cement bonded)	188,6 (186,2)	158 (156)	30	72	43	38,5	34,8
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						44	38,1	34,6
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						47	42,1	36,8

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal). * Calculated with Kij = 10 dB (butt solid timber joint)
 These results are presumed accurate for all CLT / solid plank floors. ** Calculation of timber frame walls is executed follow-
 If wood based panel boards (Magnum Board) is used a reduction of L_{n,w} + 1dB is to be expected. ing the calculated proof indicated in EN 12354
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables. *** 24 mm Wolf PowerFloor Öko Plus can also be used
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: 60 mm Fine Gravel (cement bonded)



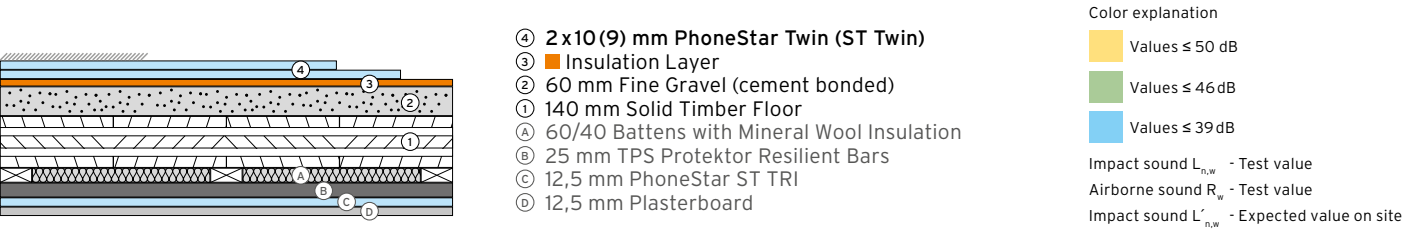
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	L _{n,w} [in dB]	R _w [in dB]	L' _{n,w} [in dB]	L' _{n,w} * [in dB]	L' _{n,w} [in dB] with PhoneStrip (Kij=17dB)
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	1 x 10 mm PhoneStar Twin (9 mm ST Twin) 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	114,2 (109,8)	74 (73)	43	60	52	48,1	46,5
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						53	48	46,5
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						55	50,5	47,3
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	1 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm best wood FLOOR 220 Wood Fibre 60 mm Fine Gravel (cement bonded)	115,9 (114,7)	90 (89)	38	64	48	44	41,8
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						49	43,8	41,7
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						51	46,9	43
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	1 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 60 mm Fine Gravel (cement bonded)	114,8 (113,6)	90 (89)	35	64	46	41	38,8
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						46	40,8	38,7
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						49	43,9	40

PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal).
 These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of L_{n,w} + 1dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: 60 mm Fine Gravel (cement bonded)



Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert´s opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	L _{n,w} [in dB]	R _w [in dB]	L' _{n,w} [in dB]	L' _{n,w} * [in dB]	L' _{n,w} [in dB] with PhoneStrip (Kij=17dB)
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 10 mm PhoneStar Twin (9 mm ST Twin) 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	126,2 (123,8)	84 (82)	40	67	50	46,8	44,1
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						51	46,6	44
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						53	50	45,6
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm best wood FLOOR 220 Wood Fibre 60 mm Fine Gravel (cement bonded)	127,9 (125,5)	100 (98)	35	71	46	43,1	39,6
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						46	42,8	39,5
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						49	46,7	41,6
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 60 mm Fine Gravel (cement bonded)	126,8 (124,4)	100 (98)	32	71	44	40,1	36,6
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						45	39,8	36,5
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						48	43,7	38,6

PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal). These results are presumed accurate for all CLT / solid plank floors. If wood based panel boards (Magnum Board) is used a reduction of L_{n,w} + 1 dB is to be expected. Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables. It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: 60 mm Fine Gravel (cement bonded)



Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert´s opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	L _{n,w} [in dB]	R _w [in dB]	L' _{n,w} [in dB]	L' _{n,w} * [in dB]	L' _{n,w} [in dB] with PhoneStrip (Kij=17dB)
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	149,6 (147,2)	102 (100)	40	67	50	46,8	44,1
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						51	46,6	44
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						53	50	45,6
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm best wood FLOOR 220 Wood Fibre 60 mm Fine Gravel (cement bonded)	151,3 (148,9)	118 (116)	35	71	46	43,1	39,6
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						46	42,8	39,5
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						49	46,7	41,6
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 60 mm Fine Gravel (cement bonded)	150,2 (147,8)	118 (116)	29	71	44	37,1	33,6
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						45	36,8	33,5
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						48	40,7	35,6

* Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal). These results are presumed accurate for all CLT / solid plank floors. If wood based panel boards (Magnum Board) is used a reduction of L_{n,w} + 1 dB is to be expected. Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables. It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: 60 mm Fine Gravel (cement bonded)



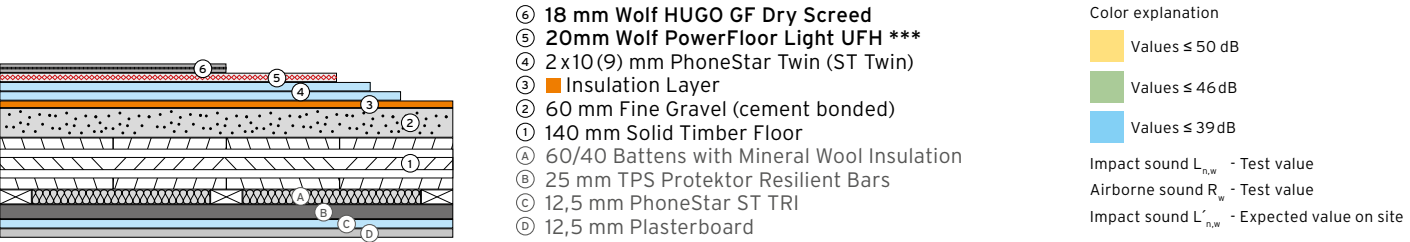
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m ²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	50 mm Zementestrich 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	226,2 (223,8)	134 (132)	44	69	53	51,5	48,3
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						54	51,2	48,2
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						56	54,8	50
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	50 mm Zementestrich 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm best wood FLOOR 220 Wood Fibre 60 mm Fine Gravel (cement bonded)	227,9 (225,5)	150 (148)	39	72	49	47,5	43,8
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						50	47,1	43,6
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						53	51,1	45,8
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	50 mm Zementestrich 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 60 mm Fine Gravel (cement bonded)	226,8 (224,4)	150 (148)	36	72	47	44,5	40,8
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						47	44,1	40,6
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						51	48,1	42,8

* Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal).
 These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w}$ + 1 dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: 60 mm Fine Gravel (cement bonded)



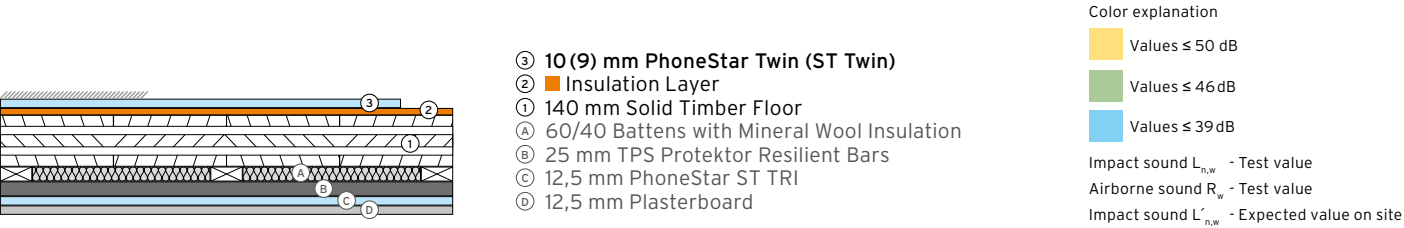
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m ²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	155 (152,6)	122 (120)	41	65	51	47,3	44,9
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						51	47	44,8
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						54	50,2	46,1
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm best wood FLOOR 220 Wood Fibre 60 mm Fine Gravel (cement bonded)	156,7 (154,3)	138 (136)	36	69	46	43,5	40,3
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						46	43,2	40,2
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						49	46,8	42
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board 60 mm Fine Gravel (cement bonded)	156,7 (155,6)	138 (136)	33	69	45	40,5	37,3
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						45	40,2	37,2
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						48	43,8	39

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal). * Calculated with Kij = 10 dB (butt solid timber joint)
 These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w}$ + 1dB is to be expected.
 Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
 It was found out, that loose Fine Gravel fill is to be seen equal as bonded Fine Gravel loading.

** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354
 ***24 mm Wolf PowerFloor 0ko Plus can also be used

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: no



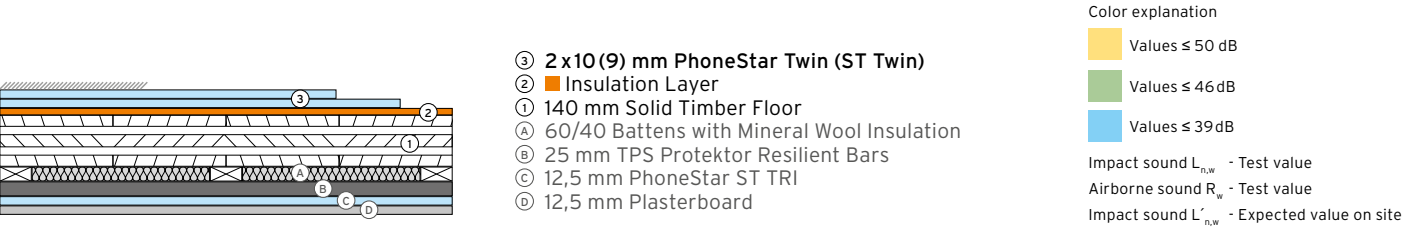
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert´s opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}^*$ [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	1 x 10 mm PhoneStar Twin (9 mm ST Twin) 4 mm Wolf Protect Wood Fibre Board	15,2 (14)	14 (13)	55	49	64	58,7	58,2
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						65	58,6	58,1
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						67	59,8	58,4
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	1 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm best wood FLOOR 220 Wood Fibre	16,9 (15,7)	30 (29)	50	53	59	54,1	53,2
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						60	54	53,2
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						62	55,6	53,6
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	1 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board	15,8 (14,6)	30 (28)	47	53	56	51,1	50,2
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						57	51	50,2
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						59	52,6	50,6

PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal).
 These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w} + 1$ dB is to be expected.
 Routed out areas (width <200mm) can be filled in with fine gravel after installation of cables.
 It was found out, that loose fine gravel fill is to be seen equal as bonded fine gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: no



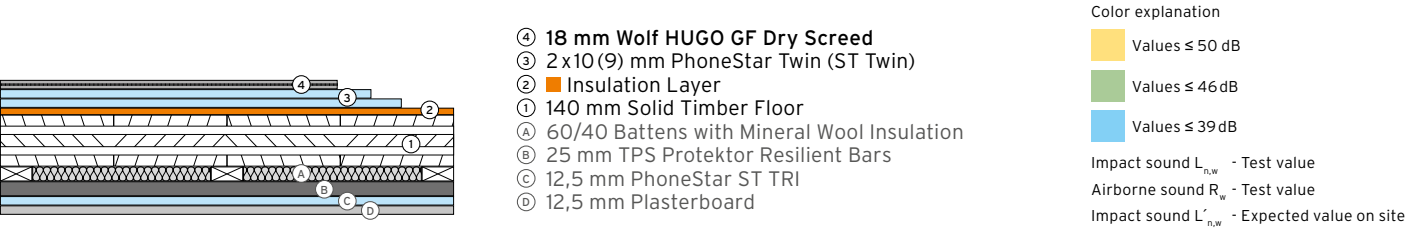
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert´s opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}^*$ [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 10 mm PhoneStar Twin (9 mm ST Twin) 4 mm Wolf Protect Wood Fibre Board	27,2 (24,8)	24 (22)	52	56	61	56,5	55,3
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						62	56,3	55,3
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						64	58,3	55,9
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm best wood FLOOR 220 Wood Fibre	28,9 (26,5)	40 (38)	47	60	56	52,1	50,5
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						57	52	50,5
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						59	54,5	51,3
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board	27,8 (25,4)	40 (38)	44	60	53	49,1	47,5
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						54	49	47,5
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						56	51,5	48,3










PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal).
 These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w} + 1$ dB is to be expected.
 Routed out areas (width <200mm) can be filled in with fine gravel after installation of cables.
 It was found out, that loose fine gravel fill is to be seen equal as bonded fine gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: no



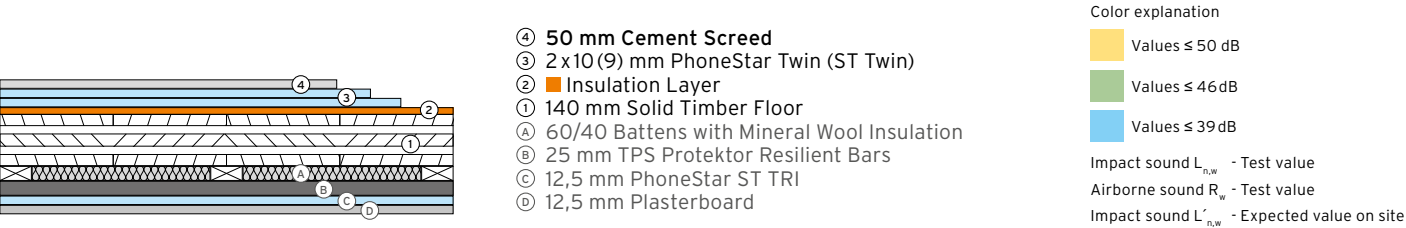
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert 's opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	L _{n,w} [in dB]	R _w [in dB]	L' _{n,w} [in dB]	L' _{n,w} * [in dB]	L' _{n,w} [in dB] with PhoneStrip (Kij=17dB)
 PB + WBP DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 2 x 10 mm PhoneStar Twin (9 mm ST Twin) ■ 4 mm Wolf Protect Wood Fibre Board	50,6 (48,2)	42 (40)	52	56	61	56,5	55,3
 GF DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						62	56,3	55,3
 Timber-/ WBP-Element CLT 100 mm Zero measure- ment 2 Rw = 34 dB						64	58,3	55,9
 PB + WBP DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 2 x 10 mm PhoneStar Twin (9 mm ST Twin) ■ 20 mm best wood FLOOR 220 Wood Fibre	52,3 (49,9)	58 (56)	47	60	56	52,1	50,5
 GF DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						57	52	50,5
 Timber-/ WBP-Element CLT 100 mm Zero measure- ment 2 Rw = 34 dB						59	54,5	51,3
 PB + WBP DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 2 x 10 mm PhoneStar Twin (9 mm ST Twin) ■ 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board	51,2 (48,8)	58 (56)	44	60	53	49,1	47,5
 GF DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						54	49	47,5
 Timber-/ WBP-Element CLT 100 mm Zero measure- ment 2 Rw = 34 dB						56	51,5	48,3










* Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal).
 These results are presumed accurate for all CLT / solid plank floors.
 If wood based panel boards (Magnum Board) is used a reduction of $L_{n,w}$ + 1 dB is to be expected.
 Routed out areas (width <200mm) can be filled in with fine gravel after installation of cables.
 It was found out, that loose fine gravel fill is to be seen equal as bonded fine gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: no



Wall build up in receiving room	Floor build up	Weight [kg/m²]	Height [mm]	Test values according to expert´s opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
				$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	50 mm Cement Screed 2 x 10 mm PhoneStar Twin (9 mm ST Twin) ■ 4 mm Wolf Protect Wood Fibre Board	127,2 (124,8)	74 (72)	55	58	64	59,8	58,4
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						65	59,6	58,4
 CLT 100 mm Zero measurement 2 Rw = 34 dB Timber-/ WBP-Element						67	61,8	59,1
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	50 mm Cement Screed 2 x 10 mm PhoneStar Twin (9 mm ST Twin) ■ 20 mm best wood FLOOR 220 Wood Fibre	128,9 (126,5)	90 (88)	51	≥ 61	59	56,3	54,6
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						60	56,1	54,5
 CLT 100 mm Zero measurement 2 Rw = 34 dB Timber-/ WBP-Element						63	58,8	55,5
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	50 mm Cement Screed 2 x 10 mm PhoneStar Twin (9 mm ST Twin) ■ 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board	127,8 (125,4)	90 (88)	48	≥ 61	57	53,3	51,6
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						58	53,1	51,5
 CLT 100 mm Zero measurement 2 Rw = 34 dB Timber-/ WBP-Element						60	55,8	52,5

* Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

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 It was found out, that loose fine gravel fill is to be seen equal as bonded fine gravel loading.

Calculative Proof for Solid Timber Floors

Execution: Suspended ceiling
 Loading: no












⑤ 18 mm Wolf HUGO GF Dry Screed
 ④ 20mm Wolf PowerFloor Light UFH ***
 ③ 2x10(9) mm PhoneStar Twin (ST Twin)
 ② Insulation Layer
 ① 140 mm Solid Timber Floor
 A 60/40 Battens with Mineral Wool Insulation
 B 25 mm TPS Protektor Resilient Bars
 C 12,5 mm PhoneStar ST TRI
 D 12,5 mm Plasterboard

Color explanation

Values ≤ 50 dB
 Values ≤ 46 dB
 Values ≤ 39 dB

Impact sound $L'_{n,w}$ - Test value
 Airborne sound R_w - Test value
 Impact sound $L'_{n,w}$ - Expected value on site

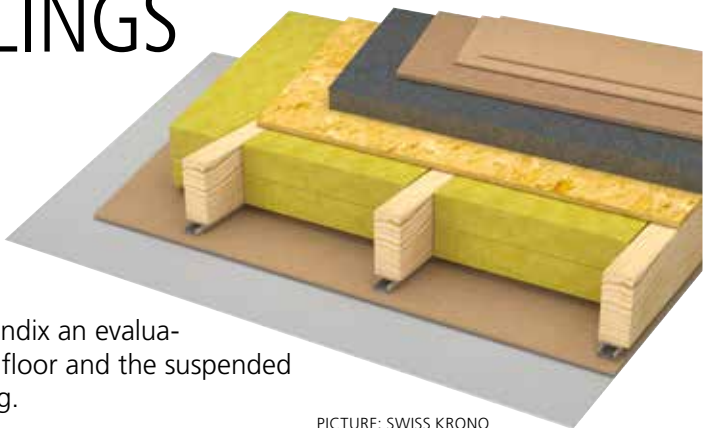
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert´s opinion (18-001770-PR03)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 4 mm Wolf Protect Wood Fibre Board	56 (53,6)	62 (60)	53	54	62	57,2	56,3
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						63	57,1	56,2
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB Timber-/ WBP-Element						65	58,8	56,7
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm best wood FLOOR 220 Wood Fibre	57,7 (55,3)	78 (76)	48	58	57	52,8	51,4
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						58	52,6	51,4
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB Timber-/ WBP-Element						60	54,8	52,1
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm ISOVER Akustic EP3 Stone Wool Insulation Board	56,6 (54,2)	78 (76)	45	58	54	49,8	48,4
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						55	49,6	48,4
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB Timber-/ WBP-Element						57	51,8	49,1

All values can be to used without deduction for thicker sold timber floors and thicker wet Screed (if other feature of the constructions are equal). * Calculated with Kij = 10 dB (butt solid timber joint)
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IMPACT SOUND MEASUREMENT SERIES ON WOODEN BEAM CEILINGS

TESTED AT IFT ROSENHEIM

As part of a systematically prepared test series, a wooden frame basic ceiling with varying ceiling structures was tested at the ift in Rosenheim. On the basis of the tested superstructures the ift Rosenheim has prepared an appraisal, which contains in the appendix an evaluation matrix with different wooden beam ceiling structures. Both the floor and the suspended ceiling constructions are systematically varied around the basic ceiling.



PICTURE: SWISS KRONO

IN THE FOLLOWING ARE SOME IMPORTANT RESULTS AND INSIGHTS AT A GLANCE:

SUSPENSIONS OR LOADING OF THE SUSPENDED CEILING

- Loading of the suspended ceiling on battens**
 If a weighted panel layer of 12.5 mm PhoneStar ST Tri is additionally installed between gypsum plasterboard fire protection board GKF and rigid battens, the impact sound level $L_{n,w}$ (test facility) is reduced by 14 to 17 dB to a standard impact sound level of $L_{n,w} = 41$ dB. Thus can be produced wooden beam ceilings with prefabrication-friendly rigid battens, which comply with the increased impact sound insulation of $L'_{n,w} = 46$ dB.

Structure for the increased impact sound insulation of $L'_{n,w} = 46$ dB

The ceiling structure sketched in Fig. 2 reaches a test value of $L_{n,w} = 41$ dB in the test facility.
 Taking into account the correction values $K1 = 1$ dB and $K2 = 1$ dB and the safety factor $SB = 3$ dB, the assessed standard impact sound level is $L'_{n,w} = 46$ dB (construction situation). This ceiling construction thus meets the building supervisory requirements of increased sound insulation according to Supplement sheet 2 of DIN 4109.

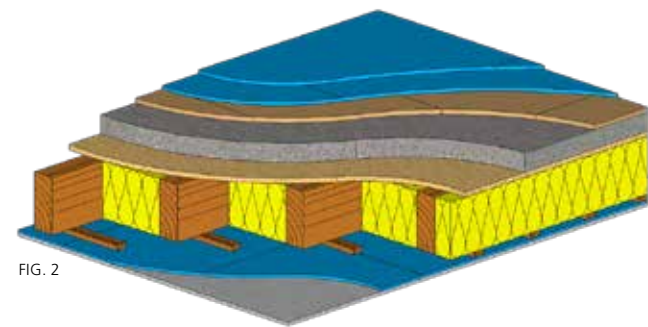


FIG. 2

Ceiling structure:

- Floor structure: 2 x 15 mm PhoneStar Tri + 20 mm wood-fiber insulating board (160 kg/m³) + 80 mm bound lime chippings filling
- Suspended ceiling: rigid suspension with battens + 12.5 mm PhoneStar ST Tri + 12.5 mm GKF

- Flexible suspension of the suspended ceiling**
 For a flexible suspension with TPS 25 profile PD 100 (PROTEKTOR) (instead of rigid with battens) the assessed standard impact sound level $L_{n,w}$ (test facility) is reduced in the case of a single-layer planking with gypsum plasterboard fire protection board GKF by 18 to 23 dB.
 If the cladding of the suspended ceiling is additionally carried out with 12.5 mm PhoneStar ST Tri under the GKF panel, the assessed standard impact sound level (test facility) is reduced by up to 25 dB.



PICTURE: PIXABAY

INFLUENCE OF THE INSULATION LAYER

Thicknesses of soft wood fiber boards:
 In the test series it has been shown that the standard impact sound level $L_{n,w}$ improves by 3 dB, when increasing the thickness of the wood fiber insulation boards from 4 mm to 20 mm. A further increase in the insulation thickness to 40 mm causes only a slight improvement.

FLOOR STRUCTURE & LOADING

- Loose and bound chipping fills show approximately the same results.
- In the case of bound chipping fills, cementitious "stiff" binders behave the same or similar to organic "flexible" binders and consequently enter into the evaluation without distinction.
- If the thickness of the weighted bed is reduced from 80 mm to 60 mm, a surcharge of $\Delta L_{n,w} = 3$ dB must be taken into account, and reducing from 80 mm to 40 mm, the surcharge is $\Delta L_{n,w} = 6$ dB. The evaluated sound insulation dimensions R_w must be reduced by the same values.
- If the total lime chipping load is omitted, a deterioration must be considered for the superstructures with battens in the evaluated standard impact sound level $L_{n,w}$ of +14 dB and in the rated sound reduction index R_w of -14 dB. For structures with a TPS suspension system, a deduction / or surcharge of 20 dB must be applied accordingly.
- Under the following conditions, line routes can be used without deduction:
 - The width of the lines must be < 200 mm.
 - The lines are to be completely filled with chippings.
 - The filled chippings must have a weight per unit area in accordance with Table 1 (GAS 01-F03-04-DE-01) as a minimum weight.

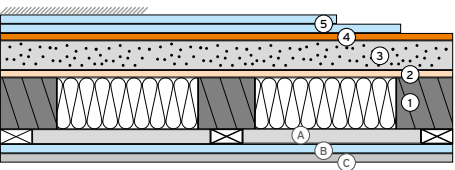


PICTURE: WOLF BAVARIA - LOOSE CHIPPINGS FILLING

NOTE: The measures mentioned for optimizing the suspended ceiling - loading or flexible suspension of the suspended ceiling - have approximately the same effect on the assessed standard impact sound level $L'_{n,w}$ (construction situation). In the test facility, the flexible suspension achieves better values by 3-7 dB. Due to the relatively high correction values $K1$, which are to be used for the flexible suspension, this advantage is compensated.







Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens
Loading: 80 mm Fine Gravel (cement bonded)



⑤ 2x15(12,5) mm PhoneStar TRI (ST TRI)
④ Insulation Layer
③ 80 mm Fine Gravel (cement bonded)
② 22 mm SWISS KRONO OSB
① 100/240 mm Wooden Beam Floor with Mineral Wool
A 60/40 Battens
B 12,5 mm PhoneStar ST TRI
C 12,5 mm Plasterboard

Color explanation
Values ≤ 50 dB
Values ≤ 46 dB
Values ≤ 39 dB
Impact sound L_{n,w} - Test value
Airborne sound R_w - Test value
Impact sound L' _{n,w} - Expected value on site

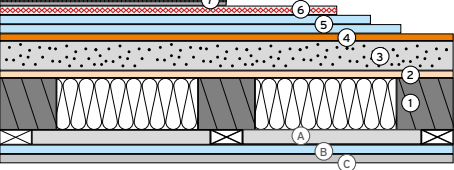
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **		
		Weight [kg/m²]	Height [mm]	L _{n,w} [in dB]	R _w [in dB]	L' _{n,w} [in dB]	L' _{n,w} * [in dB]	L' _{n,w} [in dB] with PhoneStrip (Kij=17dB)	
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 4 mm Wolf Protect Wood Fibre Board 80 mm Fine Gravel (cement bonded)	171,2 (165,2)	136 (131)	42	70		47	49,8	46,5
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB							47	49,5	46,3
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB							50	53,2	48,3
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm HWF Gutex / Steico Base Wood Fibre Board 80 mm Fine Gravel (cement bonded)	172,9 (166,9)	152 (147)	41¹	78¹		46	48,8	45,5
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB							46	48,5	45,3
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB							50	52,2	47,3

PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.
¹ Report 17-001670-PR01 (PB X25-F03-O4-de-01)

Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
It could be determined that loose fine gavel fill do not perform worse than bonded Fine Gravel fill.







Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens
Loading: 80 mm Fine Gravel (cement bonded)



⑦ 18 mm Wolf HUGO GF Dry Screed
⑥ 20 mm Wolf PowerFloor Light UFH ***
⑤ 2 x15(12,5) mm PhoneStar TRI (ST TRI)
④ Insulation Layer
③ 80 mm Fine Gravel (cement bonded)
② 22 mm SWISS KRONO OSB
① 100/240 mm Wooden Beam Floor with Mineral Wool
A 60/40 Battens
B 12,5 mm PhoneStar ST TRI
C 12,5 mm Plasterboard

Color explanation
Values ≤ 50 dB
Values ≤ 46 dB
Values ≤ 39 dB
Impact sound L_{n,w} - Test value
Airborne sound R_w - Test value
Impact sound L' _{n,w} - Expected value on site

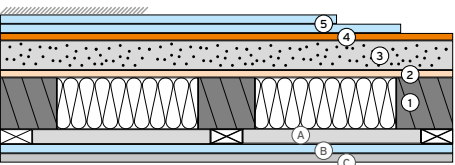
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **		
		Weight [kg/m²]	Height [mm]	L _{n,w} [in dB]	R _w [in dB]	L' _{n,w} [in dB]	L' _{n,w} * [in dB]	L' _{n,w} [in dB] with PhoneStrip (Kij=17dB)	
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 4 mm Wolf Protect Wood Fibre Board 80 mm Fine Gravel (cement bonded)	200 (194)	174 (173)	41	70		46	48,8	45,5
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB							46	48,5	45,3
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB							50	52,2	47,3
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm HWF Gutex / Steico Base Wood Fibre Board 80 mm Fine Gravel (cement bonded)	201,7 (195,7)	190 (189)	40	70		46	47,8	44,5
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB							46	47,5	44,3
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB							49	51,2	46,3

* Calculated with Kij = 10 dB (butt solid timber joint). ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.
*** 24 mm Wolf PowerFloor Öko Plus can also be used.

Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
It could be determined that loose fine gavel fill do not perform worse than bonded Fine Gravel fill.

Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens
Loading: 60 mm Fine Gravel (cement bonded)



⑤ 2x15 (12,5) mm PhoneStar TRI (ST TRI)
④ Insulation Layer
③ 60 mm Fine Gravel (cement bonded)
② 22 mm SWISS KRONO OSB
① 100/240 mm Wooden Beam Floor with Mineral Wool
A 60/40 Battens
B 12,5 mm PhoneStar ST TRI
C 12,5 mm Plasterboard







Color explanation

Values ≤ 50 dB

Values ≤ 46 dB

Values ≤ 39 dB

Impact sound $L'_{n,w}$ - Test value
Airborne sound R_w - Test value
Impact sound $L'_{n,w}$ - Expected value on site

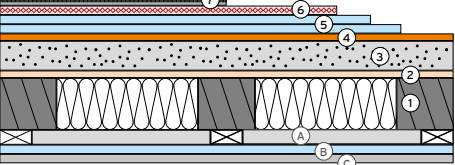
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
 <div>DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB</div>	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	138,2 (132,2)	116 (111)	45	67	50	51,8	49,1
 <div>DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB</div>						50	51,6	49
 <div>CLT 100 mm Zero measure- ment 2 Rw = 34 dB</div>						53	55	50,6
 <div>DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB</div>	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm Gutex / Steico Base Wood Fibre Board 60 mm Fine Gravel (cement bonded)	139,9 (133,9)	132 (127)	44	67	49	50,8	48,1
 <div>DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB</div>						49	50,6	48
 <div>CLT 100 mm Zero measure- ment 2 Rw = 34 dB</div>						52	54	49,6

PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
It could be determined that loose fine gavel fill do not perform worse than bonded Fine Gravel fill.

Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens
Loading: 60 mm Fine Gravel (cement bonded)



⑦ 18 mm Wolf HUGO GF Dry Screed
⑥ 20 mm Wolf PowerFloor Light UFH ***
⑤ 2 x 15 (12,5) mm PhoneStar TRI (ST TRI)
④ Insulation Layer
③ 60 mm Fine Gravel (cement bonded)
② 22 mm SWISS KRONO OSB
① 100/240 mm Wooden Beam Floor with Mineral Wool
A 60/40 Battens
B 12,5 mm PhoneStar ST TRI
C 12,5 mm Plasterboard







Color explanation

Values ≤ 50 dB

Values ≤ 46 dB

Values ≤ 39 dB

Impact sound $L'_{n,w}$ - Test value
Airborne sound R_w - Test value
Impact sound $L'_{n,w}$ - Expected value on site

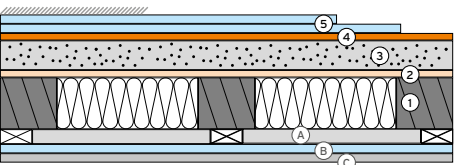
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
 <div>DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB</div>	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light UFH *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	167 (161)	154 (149)	44	67	49	50,8	48,1
 <div>DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB</div>						49	50,6	48
 <div>CLT 100 mm Zero measure- ment 2 Rw = 34 dB</div>						53	54	49,6
 <div>DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB</div>	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light UFH *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm Gutex / Steico Base Wood Fibre Board 60 mm Fine Gravel (cement bonded)	168,7 (162,7)	150 (149)	43	67	48	49,8	47,1
 <div>DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB</div>						48	49,6	47
 <div>CLT 100 mm Zero measure- ment 2 Rw = 34 dB</div>						51	53	48,6

* Calculated with Kij = 10 dB (butt solid timber joint). ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.
*** 24 mm Wolf PowerFloor Öko Plus can also be used.

Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
It could be determined that loose fine gavel fill do not perform worse than bonded Fine Gravel fill.

Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens
Loading: 80 mm Fine Gravel (cement bonded)



⑤ 2 x10 mm PhoneStar Twin
④ Insulation Layer
③ 80 mm Fine Gravel (cement bonded)
② 22 mm SWISS KRONO OSB
① 100/240 mm Wooden Beam Floor with Mineral Wool
A 60/40 Battens
B 12,5 mm PhoneStar ST TRI
C 12,5 mm Plasterboard







Color explanation

Values ≤ 50 dB

Values ≤ 46 dB

Values ≤ 39 dB

Impact sound $L_{n,w}$ - Test value
Airborne sound R_w - Test value
Impact sound $L'_{n,w}$ - Expected value on site

Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert 's opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	L _{n,w} [in dB]	R _w [in dB]	L' _{n,w} [in dB]	L' _{n,w} * [in dB]	L' _{n,w} [in dB] with PhoneStrip (Kij=17dB)
 PB + WBP DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 10 mm PhoneStar Twin ■ 4 mm Wolf Protect Wood Fibre Board 80 mm Fine Gravel (cement bonded)	159,2	126	42	70	47	49,8	46,5
 GF DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						47	49,5	46,3
 Timber-/ WBP-Element CLT 100 mm Zero measure- ment 2 Rw = 34 dB						50	53,2	48,3
 PB + WBP DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 10 mm PhoneStar Twin ■ 20 mm Gutex / Steico Base Wood Fibre Board 80 mm Fine Gravel (cement bonded)	160,9	122	40	70	46	47,8	44,5
 GF DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						46	47,5	44,3
 Timber-/ WBP-Element CLT 100 mm Zero measure- ment 2 Rw = 34 dB						49	51,2	46,3

PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
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Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens
Loading: 80 mm Fine Gravel (cement bonded)



⑦ 18 mm Wolf HUGO GF Dry screed
⑥ 20 mm Wolf PowerFloor Light UFH ***
⑤ 2 x10 mm PhoneStar Twin
④ Insulation Layer
③ 80 mm Fine Gravel (cement bonded)
② 22 mm SWISS KRONO OSB
① 100/240 mm Wooden Beam Floor with Mineral Wool
A 60/40 Battens
B 12,5 mm PhoneStar ST TRI
C 12,5 mm Plasterboard



Color explanation

Values ≤ 50 dB

Values ≤ 46 dB

Values ≤ 39 dB

Impact sound $L_{n,w}$ - Test value
Airborne sound R_w - Test value
Impact sound $L'_{n,w}$ - Expected value on site

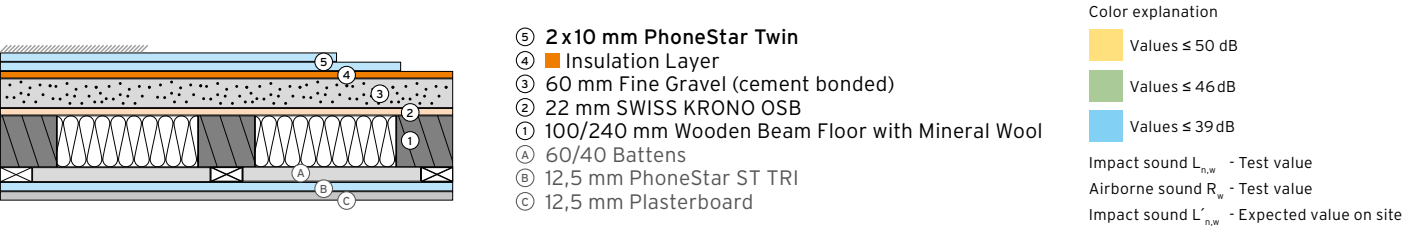
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert´s opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	L _{n,w} [in dB]	R _w [in dB]	L' _{n,w} [in dB]	L' _{n,w} * [in dB]	L' _{n,w} [in dB] with PhoneStrip (Kij=17dB)
 PB + WBP DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry screed 20 mm Wolf PowerFloor Light UFH *** 2 x 10 mm PhoneStar Twin ■ 4 mm Wolf Protect Wood Fibre Board 80 mm Fine Gravel (cement bonded)	188	164	42	70	47	49,8	46,5
 GF DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						47	49,5	46,3
 Timber-/ WBP-Element CLT 100 mm Zero measure- ment 2 Rw = 34 dB						50	53,2	48,3
 PB + WBP DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry screed 20 mm Wolf PowerFloor Light UFH *** 2 x 10 mm PhoneStar Twin ■ 20 mm Gutex / Steico Base Wood Fibre Board 80 mm Fine Gravel (cement bonded)	189,7	180	40	70	46	47,8	44,5
 GF DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						46	47,5	44,3
 Timber-/ WBP-Element CLT 100 mm Zero measure- ment 2 Rw = 34 dB						49	51,2	46,3

* Calculated with Kij = 10 dB (butt solid timber joint). ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.
*** 24 mm Wolf PowerFloor Öko Plus can also be used.

Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
It could be determined that loose fine gavel fill do not perform worse than bonded Fine Gravel fill.

Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens
Loading: 60 mm Fine Gravel (cement bonded)



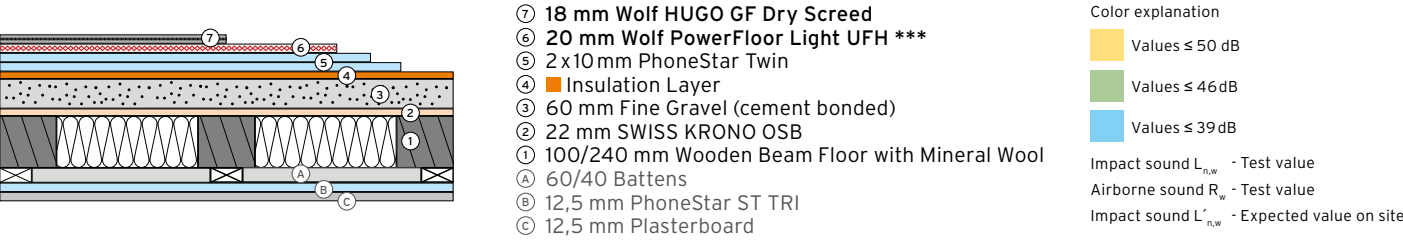
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 10 mm PhoneStar Twin 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	126,2	106	45	67	50	51,8	49,1
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						50	51,6	49
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						53	55	50,6
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 10 mm PhoneStar Twin 20 mm Gutex / Steico Base Wood Fibre Board 60 mm Fine Gravel (cement bonded)	127,9	122	43	67	48	49,8	47,1
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						48	49,6	47
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						51	53	48,6

PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
It could be determined that loose fine gavel fill do not perform worse than bonded Fine Gravel fill.

Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens
Loading: 60 mm Fine Gravel (cement bonded)



Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light UFH *** 2 x 10 mm PhoneStar Twin 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	155	144	45	67	50	51,8	49,1
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						50	51,6	49
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						53	55	50,6
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light UFH *** 2 x 10 mm PhoneStar Twin 20 mm Gutex / Steico Base Wood Fibre Board 60 mm Fine Gravel (cement bonded)	156,7	160	43	67	48	49,8	47,1
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						48	49,6	47
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						51	53	48,6

* Calculated with Kij = 10 dB (butt solid timber joint). ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.
*** 24 mm Wolf PowerFloor Öko Plus can also be used.

Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
It could be determined that loose fine gavel fill do not perform worse than bonded Fine Gravel fill.

Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens with Resilient Bars
Loading: 80 mm Fine Gravel (cement bonded)

⑤ 2x15 (12,5) mm PhoneStar TRI (ST TRI)
④ Insulation Layer
③ 80 mm Fine Gravel (cement bonded)
② 22 mm SWISS KRONO OSB
① 100/240 mm Wooden Beam Floor with Mineral Wool
A 60/40 Battens
B 25 mm TPS Protektor Resilient Bars
C 12,5 mm Plasterboard







Color explanation

Values ≤ 50 dB

Values ≤ 46 dB

Values ≤ 39 dB

Impact sound $L'_{n,w}$ - Test value
Airborne sound R_w - Test value
Impact sound $L'_{n,w}$ - Expected value on site

Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert 's opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	L _{n,w} [in dB]	R _w [in dB]	L' _{n,w} [in dB]	L' _{n,w} * [in dB]	L' _{n,w} [in dB] with PhoneStrip (Kij=17dB)
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) ■ 4 mm Wolf Protect wood fibre board 80 mm Fine Gravel (cement bonded)	171,2 (165,2)	136 (131)	36	75	45	45,6	41,3
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						45	45,2	41,1
 CLT 100 mm Zero measurement 2 Rw = 34 dB Timber-/ WBP-Element						46	49,5	43,8
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) ■ 20 mm Gutex / Steico Base wood fibre board 80 mm Fine Gravel (cement bonded)	172,9 (166,9)	152 (147)	37	75	45	46,6	42,3
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						46	46,2	42,1
 CLT 100 mm Zero measurement 2 Rw = 34 dB Timber-/ WBP-Element						46	50,5	44,8

PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
It could be determined that loose fine gavel fill do not perform worse than bonded Fine Gravel fill.

Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens with Resilient Bars
Loading: 80 mm Fine Gravel (cement bonded)

⑦ 18 mm Wolf HUGO GF Dry Screed
⑥ 20 mm Wolf PowerFloor Light UFH ***
⑤ 2x15 (12,5) mm PhoneStar TRI (ST TRI)
④ Insulation Layer
③ 80 mm Fine Gravel (cement bonded)
② 22 mm SWISS KRONO OSB
① 100/240 mm Wooden Beam Floor with Mineral Wool
A 60/40 Battens
B 25 mm TPS Protektor Resilient Bars
C 12,5 mm Plasterboard







Color explanation

Values ≤ 50 dB

Values ≤ 46 dB

Values ≤ 39 dB

Impact sound $L'_{n,w}$ - Test value
Airborne sound R_w - Test value
Impact sound $L'_{n,w}$ - Expected value on site

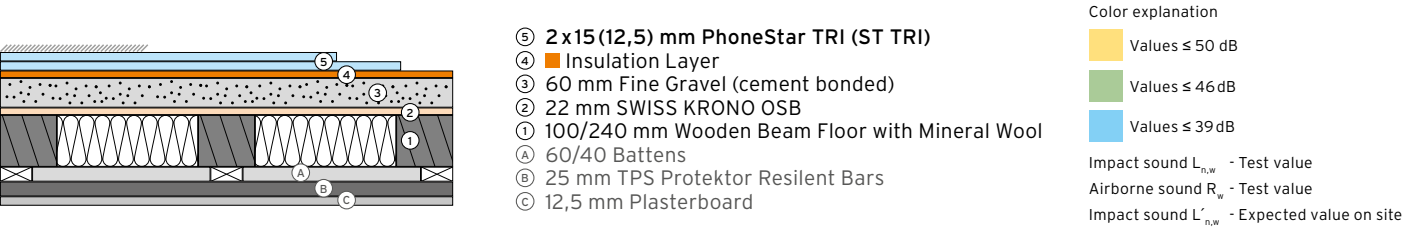
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert´s opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	L _{n,w} [in dB]	R _w [in dB]	L' _{n,w} [in dB]	L' _{n,w} * [in dB]	L' _{n,w} [in dB] with PhoneStrip (Kij=17dB)
 PB + WBP DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light UFH *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) ■ 4 mm Wolf Protect Wood Fibre Board 80 mm Fine Gravel (cement bonded)	200 (194)	174 (173)	36	75	45	45,6	41,3
 GF DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						45	45,2	41,1
 Timber-/ WBP-Element CLT 100 mm Zero measure- ment 2 Rw = 34 dB						46	49,5	43,8
 PB + WBP DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light UFH *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) ■ 20 mm Gutex / Steico Base Wood Fibre Board 80 mm Fine Gravel (cement bonded)	201,7 (195,7)	190 (189)	37	75	45	46,6	42,3
 GF DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						46	46,2	42,8
 Timber-/ WBP-Element CLT 100 mm Zero measure- ment 2 Rw = 34 dB						46	50,5	44,8

* Calculated with Kij = 10 dB (butt solid timber joint). ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.
*** 24 mm Wolf PowerFloor Öko Plus can also be used.

Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
It could be determined that loose fine gavel fill do not perform worse than bonded Fine Gravel fill.

Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens with Resilient Bars
Loading: 60 mm Fine Gravel (cement bonded)



Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **		
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)	
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	138,2 (132,2)	116 (111)	39	73	46	47,9	44	
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						47	47,5	43,8	
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						48	51,6	46,2	
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm Gutex / Steico Base Wood Fibre Board 60 mm Fine Gravel (cement bonded)	139,9 (133,9)	132 (127)	40	73	47	48,9	45	
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						48	48,5	44,8	
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						48	52,6	47,2	

PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
It could be determined that loose fine gavel fill do not perform worse than bonded Fine Gravel fill.

Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens with Resilient Bars
Loading: 60 mm Fine Gravel (cement bonded)



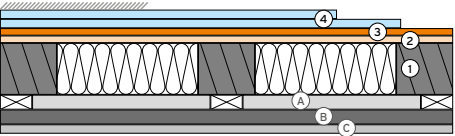
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **		
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)	
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light UFH *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	167 (161)	154 (149)	39	73	46	47,9	44	
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						47	47,5	43,8	
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						48	51,6	46,2	
DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light UFH *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm Gutex / Steico Base Wood Fibre Board 60 mm Fine Gravel (cement bonded)	168,7 (162,7)	170 (169)	40	73	47	48,9	45	
DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						48	48,5	44,8	
CLT 100 mm Zero measure- ment 2 Rw = 34 dB						48	52,6	47,2	

* Calculated with Kij = 10 dB (butt solid timber joint). ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.
*** 24 mm Wolf PowerFloor Öko Plus can also be used.

Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
It could be determined that loose fine gavel fill do not perform worse than bonded Fine Gravel fill.

Calculated Proof for Closed Wooden Beam Floors







Execution: Suspended ceiling - Battens with Resilient Bars
Loading: no



④ 2x15(12,5) mm PhoneStar TRI (ST TRI)
③ Insulation Layer
② 22 mm SWISS KRONO OSB
① 100/240 mm Wooden Beam Floor with Mineral Wool
Ⓐ 60/40 Battens
Ⓑ 25 mm TPS Protektor Resilient Bars
Ⓒ 12,5 mm Plasterboard

Color explanation
Values ≤ 50 dB
Values ≤ 46 dB
Values ≤ 39 dB

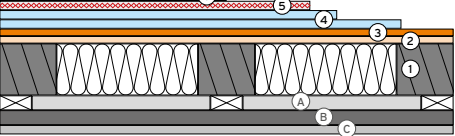
Impact sound $L_{n,w}$ - Test value
Airborne sound R_w - Test value
Impact sound $L'_{n,w}$ - Expected value on site

Wall build up in receiving room	Floor build up	Weight [kg/m²]	Height [mm]	Test values according to expert 's opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
				$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) ■ 4 mm Wolf Protect Wood Fibre Board	39,4 (33,2)	24 (22)	53	61	59	58,3	56,6
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						60	58,1	56,5
 CLT 100 mm Zero measurement 2 Rw = 34 dB Timber-/ WBP-Element						61	60,8	57,5
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) ■ 20 mm Gutex / Steico Base Wood Fibre Board	40,9 (34,9)	30 (28)	54	61	60	59,3	54,6
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						61	59,1	57,5
 CLT 100 mm Zero measurement 2 Rw = 34 dB Timber-/ WBP-Element						62	61,8	58,5

PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

Calculated Proof for Closed Wooden Beam Floors







Execution: Suspended ceiling - Battens with Resilient Bars
Loading: no



⑥ 18 mm Wolf HUGO GF Dry Screed
⑤ 20 mm Wolf PowerFloor Light UFH ***
④ 2x15(12,5) mm PhoneStar TRI (ST TRI)
③ Insulation Layer
② 22 mm SWISS KRONO OSB
① 100/240 mm Wooden Beam Floor with Mineral Wool
Ⓐ 60/40 Battens
Ⓑ 25 mm TPS Protektor Resilient Bars
Ⓒ 12,5 mm Plasterboard

Color explanation
Values ≤ 50 dB
Values ≤ 46 dB
Values ≤ 39 dB

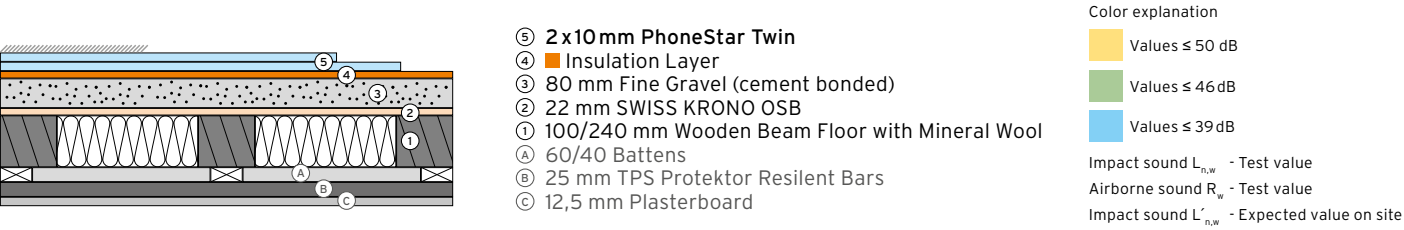
Impact sound $L_{n,w}$ - Test value
Airborne sound R_w - Test value
Impact sound $L'_{n,w}$ - Expected value on site

Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert´s opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	L _{n,w} [in dB]	R _w [in dB]	L' _{n,w} [in dB]	L' _{n,w} * [in dB]	L' _{n,w} [in dB] with PhoneStrip (Kij=17dB)
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light UFH *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) ■ 4 mm Wolf Protect Wood Fibre Board	68 (62)	72 (67)	53	61	59	58,3	56,6
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						60	58,1	56,5
 CLT 100 mm Zero measurement 2 Rw = 34 dB Timber-/ WBP-Element						61	60,8	57,5
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light UFH *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) ■ 20 mm Gutex / Steico Base Wood Fibre Board	69,7 (63,7)	88 (83)	54	61	60	59,3	57,6
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						61	59,1	57,5
 CLT 100 mm Zero measurement 2 Rw = 34 dB Timber-/ WBP-Element						62	61,8	58,5

* Calculated with Kij = 10 dB (butt solid timber joint). ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.
*** 24 mm Wolf PowerFloor Öko Plus can also be used.

Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens with Resilient Bars
Loading: 80 mm Fine Gravel (cement bonded)



Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L'_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	2 x 10 mm PhoneStar Twin 4 mm Wolf Protect Wood Fibre Board 80 mm Fine Gravel (cement bonded)	159,2	126	37	75	45	46,6	42,3
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						46	46,2	42,1
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB Timber-/ WBP-Element						48	50,5	44,8
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	2 x 10 mm PhoneStar Twin 20 mm Gutex / Steico Base Wood Fibre Board 80 mm Fine Gravel (cement bonded)	160,9	142	36	75	45	45,6	41,3
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						45	45,2	41,1
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB Timber-/ WBP-Element						47	49,5	43,8

PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
It could be determined that loose fine gavel fill do not perform worse than bonded Fine Gravel fill.

Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens with Resilient Bars
Loading: 80 mm Fine Gravel (cement bonded)



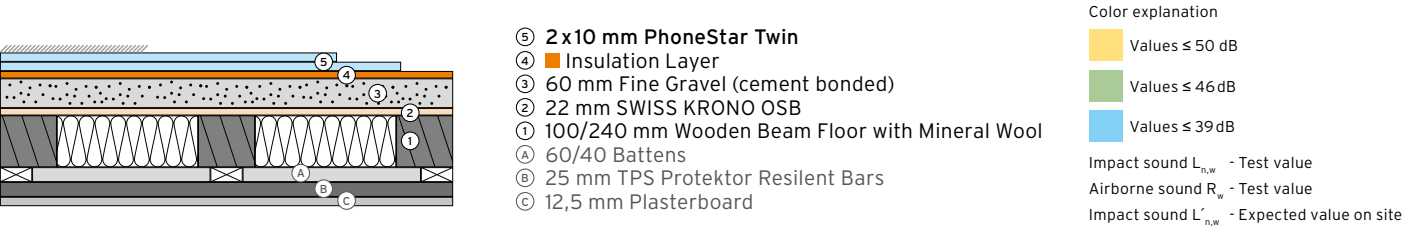
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L'_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light UFH *** 2 x 10 mm PhoneStar Twin 4 mm Wolf Protect Wood Fibre Board 80 mm Fine Gravel (cement bonded)	188	164	37	75	45	46,6	42,3
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						46	46,2	42,1
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB Timber-/ WBP-Element						48	50,5	44,8
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light UFH *** 2 x 10 mm PhoneStar Twin (9 mm ST Twin) 20 mm Gutex / Steico Base Wood Fibre Board 80 mm Fine Gravel (cement bonded)	189,7	180	36	75	45	45,6	41,3
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						45	45,2	41,1
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB Timber-/ WBP-Element						47	49,5	43,8







* Calculated with Kij = 10 dB (butt solid timber joint). ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.
*** 24 mm Wolf PowerFloor Öko Plus can also be used.

Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
It could be determined that loose fine gavel fill do not perform worse than bonded Fine Gravel fill.

Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens with Resilient Bars
Loading: 60 mm Fine Gravel (cement bonded)



Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert 's opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	L _{n,w} [in dB]	R _w [in dB]	L' _{n,w} [in dB]	L' _{n,w} * [in dB]	L' _{n,w} [in dB] with PhoneStrip (Kij=17dB)
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 10 mm PhoneStar Twin ■ 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	126,2	106	40	72	47	48,5	44,8
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						48	48,1	44,6
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB						50	52,1	46,8
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 10 mm PhoneStar Twin ■ 20 mm Gutex / Steico Base Wood Fibre Board 60 mm Fine Gravel (cement bonded)	127,9	122	39	72	46	47,5	43,8
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						47	47,1	43,6
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB						49	51,1	45,8







PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
It could be determined that loose fine gavel fill do not perform worse than bonded Fine Gravel fill.

Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens with Resilient Bars
Loading: 60 mm Fine Gravel (cement bonded)



Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert 's opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	L _{n,w} [in dB]	R _w [in dB]		L' _{n,w} [in dB]	L' _{n,w} * [in dB]
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light UFH *** 2 x 10 mm PhoneStar Twin ■ 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	155	144	40	72	47	48,5	44,8
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						48	48,1	44,6
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB Timber-/ WBP-Element						50	52,1	46,8
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light UFH *** 2 x 10 mm PhoneStar Twin ■ 20 mm Gutex / Steico Base Wood Fibre Board 60 mm Fine Gravel (cement bonded)	156,7	160	39	72	46	47,5	43,8
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						47	47,1	43,6
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB Timber-/ WBP-Element						49	51,1	45,8

* Calculated with Kij = 10 dB (butt solid timber joint). ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.
*** 24 mm Wolf PowerFloor Öko Plus can also be used.

Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
It could be determined that loose fine gavel fill do not perform worse than bonded Fine Gravel fill.







Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens with Resilient Bars
Loading: no

④ 2 x 10 mm PhoneStar Twin
③ Insulation Layer
② 22 mm SWISS KRONO OSB
① 100/240 mm Wooden Beam Floor with Mineral Wool
⑥ 60/40 Battens
⑦ 25 mm TPS Protektor Resilient Bars
⑧ 12,5 mm Plasterboard

Color explanation
Values ≤ 50 dB
Values ≤ 46 dB
Values ≤ 39 dB

Impact sound $L_{n,w}$ - Test value
Airborne sound R_w - Test value
Impact sound $L'_{n,w}$ - Expected value on site

Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 10 mm PhoneStar Twin 4 mm Wolf Protect Wood Fibre Board	27,2	24	51	61	57	56,3	54,6
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						58	56,1	54,5
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB						59	58,8	55,5
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 10 mm PhoneStar Twin 20 mm Gutex / Steico Base Wood Fibre Board	28,9	40	50	61	56	55,3	53,6
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						57	55,1	53,5
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB						58	57,8	54,5

//////// PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.







Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens with Resilient Bars
Loading: no

⑥ 18 mm Wolf HUGO GF Dry Screed
⑤ 20 mm Wolf PowerFloor Light UFH ***
④ 2 x 10 (9) mm PhoneStar Twin
③ Insulation Layer
② 22 mm SWISS KRONO OSB
① 100/240 mm Wooden Beam Floor with Mineral Wool
⑨ 60/40 Battens
⑩ 25 mm TPS Protektor Resilient Bars
⑪ 12,5 mm Plasterboard

Color explanation
Values ≤ 50 dB
Values ≤ 46 dB
Values ≤ 39 dB

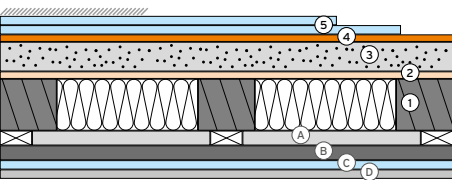
Impact sound $L_{n,w}$ - Test value
Airborne sound R_w - Test value
Impact sound $L'_{n,w}$ - Expected value on site

Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light UFH *** 2 x 10 mm PhoneStar Twin 4 mm Wolf Protect Wood Fibre Board	56	62	51	61	57	56,3	54,6
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						58	56,1	54,5
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB						59	58,8	55,5
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf PowerFloor Light UFH *** 2 x 10 mm PhoneStar Twin 20 mm Gutex / Steico Base Wood Fibre Board	55,3	78	50	61	56	55,3	53,6
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						57	55,1	53,5
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB						58	57,8	54,5

* Calculated with Kij = 10 dB (butt solid timber joint). ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.
*** 24 mm Wolf PowerFloor Öko Plus can also be used.







Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens with Resilient Bars
Loading: 80 mm Fine Gravel (cement bonded)



5 2x12,5(15) mm PhoneStar TRI (ST TRI)
4 Insulation Layer
3 80 mm Fine Gravel (cement bonded)
2 22 mm SWISS KRONO OSB
1 100/240 mm Wooden Beam Floor with Mineral Wool
A 60/40 Battens
B 25 mm TPS Protektor Resilient Bars
C 12,5 mm PhoneStar ST TRI
D 12,5 mm Plasterboard

Color explanation
Values ≤ 50 dB
Values ≤ 46 dB
Values ≤ 39 dB
Impact sound L_{n,w} - Test value
Airborne sound R_w - Test value
Impact sound L' _{n,w} - Expected value on site

Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert 's opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	L _{n,w} [in dB]	R _w [in dB]	L' _{n,w} [in dB]	L' _{n,w} * [in dB]	L' _{n,w} [in dB] with PhoneStrip (Kij=17dB)
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) ■ 4 mm Wolf Protect Wood Fibre Board 80 mm Fine Gravel (cement bonded)	171,2 (165,2)	114 (109)	33	75	45	42,6	38,3
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						45	42,2	38,1
 CLT 100 mm Zero measurement 2 Rw = 34 dB Timber-/ WBP-Element						48	46,5	40,8
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) ■ 20 mm Gutex / Steico Base Wood Fibre Board 80 mm Fine Gravel (cement bonded)	172,9 (166,9)	130 (125)	31	84	44	44,5	38,8
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						44	44	38,5
 CLT 100 mm Zero measurement 2 Rw = 34 dB Timber-/ WBP-Element						47	48,7	42,2

PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
It could be determined that loose fine gavel fill do not perform worse than bonded Fine Gravel fill.







Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens with Resilient Bars
Loading: 80 mm Fine Gravel (cement bonded)



7 18 mm Wolf HUGO GF Dry Screed
6 20 mm Wolf PowerFloor Light UFH ***
5 12,5(15) mm PhoneStar TRI (ST TRI)
4 Insulation Layer
3 80 mm Fine Gravel (cement bonded)
2 22 mm SWISS KRONO OSB
1 100/240 mm Wooden Beam Floor with Mineral Wool
A 60/40 Battens
B 25 mm TPS Protektor Resilient Bars
C 12,5 mm PhoneStar ST TRI
D 12,5 mm Plasterboard

Color explanation
Values ≤ 50 dB
Values ≤ 46 dB
Values ≤ 39 dB
Impact sound L_{n,w} - Test value
Airborne sound R_w - Test value
Impact sound L' _{n,w} - Expected value on site

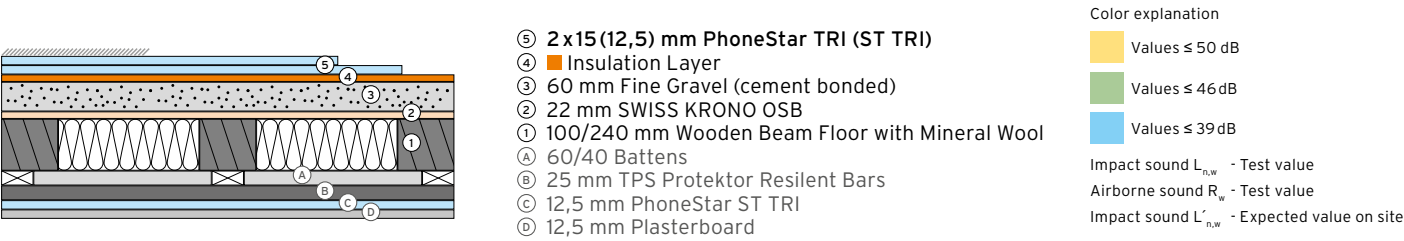
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert 's opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	L _{n,w} [in dB]	R _w [in dB]	L' _{n,w} [in dB]	L' _{n,w} * [in dB]	L' _{n,w} [in dB] with PhoneStrip (Kij=17dB)
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) ■ 4 mm Wolf Protect Wood Fibre Board 80 mm Fine Gravel (cement bonded)	200 (194)	152 (147)	32	75	44	41,6	37,3
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						45	41,2	37,1
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB Timber-/ WBP-Element						48	45,5	39,8
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) ■ 20 mm Gutex / Steico Base Wood Fibre Board 80 mm Fine Gravel (cement bonded)	201,7 (195,7)	168 (163)	30	84	43	43,5	37,8
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						44	43	37,5
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB Timber-/ WBP-Element						47	47,7	41,2

* Calculated with Kij = 10 dB (butt solid timber joint). ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.
*** 24 mm Wolf PowerFloor Öko Plus can also be used.

Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
It could be determined that loose fine gavel fill do not perform worse than bonded Fine Gravel fill.

Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens with Resilent Bars
Loading: 60 mm Fine Gravel (cement bonded)



Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert´s opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	138,2 (132,2)	94 (89)	36	72	46	44,5	40,8
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						47	44,1	40,6
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB Timber-/ WBP-Element						50	48,1	42,8
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm Gutex / Steico Base Wood Fibre Board 60 mm Fine Gravel (cement bonded)	139,9 (133,9)	110 (105)	34	81	45	46,1	40,8
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						46	45,7	40,6
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB Timber-/ WBP-Element						49	50,3	44

PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
It could be determined that loose fine gavel fill do not perform worse than bonded Fine Gravel fill.

Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens with Resilent Bars
Loading: 60 mm Fine Gravel (cement bonded)



Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert´s opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	167 (161)	132 (127)	35	72	46	43,5	39,8
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						46	43,1	39,6
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB Timber-/ WBP-Element						49	47,1	41,8
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB PB + WBP	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm Gutex / Steico Base Wood Fibre Board 60 mm Fine Gravel (cement bonded)	168,7 (162,7)	148 (143)	33	81	45	45,1	39,8
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB GF						45	44,7	39,6
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB Timber-/ WBP-Element						48	49,3	43

* Calculated with Kij = 10 dB (butt solid timber joint). ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.
*** 24 mm Wolf PowerFloor Öko Plus can also be used.

Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
It could be determined that loose fine gavel fill do not perform worse than bonded Fine Gravel fill.







Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens with Resilient Bars
Loading: no

④ 2x15(12,5) mm PhoneStar TRI (ST TRI)
③ Insulation Layer
② 22 mm SWISS KRONO OSB
① 100/240 mm Wooden Beam Floor with Mineral Wool
④ 60/40 Battens
② 25 mm TPS Protektor Resilient Bars
③ 12,5 mm PhoneStar ST TRI
⑤ 12,5 mm Plasterboard

Color explanation
Values ≤ 50 dB
Values ≤ 46 dB
Values ≤ 39 dB

Impact sound $L_{n,w}$ - Test value
Airborne sound R_w - Test value
Impact sound $L'_{n,w}$ - Expected value on site

Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 4 mm Wolf Protect Wood Fibre Board	39,2 (33,2)	34 (29)	47	61	56	53,8	51,5
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						57	53,6	51,3
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB						59	57	52,6
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm Gutex / Steico Base Wood Fibre Board	40,9 (34,9)	50 (45)	45	70	54	51,8	49,5
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						55	51,6	49,3
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB						57	55	51,3

//////// PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.







Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens with Resilient Bars
Loading: no

⑥ 18 mm Wolf HUGO GF Dry Screed
⑤ 20mm Wolf PowerFloor Light UFH ***
④ 2x15(12,5) mm PhoneStar TRI (ST TRI)
③ Insulation Layer
② 22 mm SWISS KRONO OSB
① 100/240 mm Wooden Beam Floor with Mineral Wool
④ 60/40 Battens
② 25 mm TPS Protektor Resilient Bars
③ 12,5 mm PhoneStar ST TRI
⑤ 12,5 mm Plasterboard

Color explanation
Values ≤ 50 dB
Values ≤ 46 dB
Values ≤ 39 dB

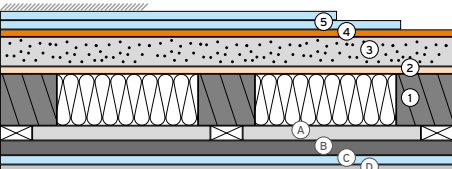
Impact sound $L_{n,w}$ - Test value
Airborne sound R_w - Test value
Impact sound $L'_{n,w}$ - Expected value on site

Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 4 mm Wolf Protect Wood Fibre Board	68 (62)	72 (67)	46	61	55	51,3	49,6
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						56	51,1	49,5
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB						58	53,8	50,5
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 15 mm PhoneStar TRI (12,5 mm ST TRI) 20 mm Gutex / Steico Base Wood Fibre Board	69,7 (63,7)	88 (83)	44	70	53	51,8	48,5
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						54	51,2	48,3
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB						56	55,2	50,3

* Calculated with Kij = 10 dB (butt solid timber joint). ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.
*** 24 mm Wolf PowerFloor Öko Plus can also be used.

Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens with Resilient Bars
Loading: 80 mm Fine Gravel (cement bonded)



⑤ 2 x10 mm PhoneStar Twin
④ Insulation Layer
③ 80 mm Fine Gravel (cement bonded)
② 22 mm SWISS KRONO OSB
① 100/240 mm Wooden Beam Floor with Mineral Wool
A 60/40 Battens
B 25 mm TPS Protektor Resilient Bars
C 12,5 mm PhoneStar ST TRI
D 12,5 mm Plasterboard







Color explanation

Values ≤ 50 dB

Values ≤ 46 dB

Values ≤ 39 dB

Impact sound $L_{n,w}$ - Test value
Airborne sound R_w - Test value
Impact sound $L'_{n,w}$ - Expected value on site

Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 10 mm PhoneStar Twin 4 mm Wolf Protect Wood Fibre Board 80 mm Fine Gravel (cement bonded)	159,2 (156,8)	104 (103)	33	75	45	42,6	38,3
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						45	42,2	38,1
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB						48	46,5	40,8
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 10 mm PhoneStar Twin 20 mm Gutex / Steico Base Wood Fibre Board 80 mm Fine Gravel (cement bonded)	160,9 (158,5)	120 (118)	32	84	44	45,5	39,8
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						45	45	39,5
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB						48	49,7	43,2

PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
It could be determined that loose fine gavel fill do not perform worse than bonded Fine Gravel fill.

Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens with Resilient Bars
Loading: 80 mm Fine Gravel (cement bonded)



⑦ 18 mm Wolf HUGO GF Dry Screed
⑥ 20 mm Wolf PowerFloor Light UFH ***
⑤ 2 x10 mm PhoneStar Twin
④ Insulation Layer
③ 80 mm Fine Gravel (cement bonded)
② 22 mm SWISS KRONO OSB
① 100/240 mm Wooden Beam Floor with Mineral Wool
A 60/40 Battens
B 25 mm TPS Protektor Resilient Bars
C 12,5 mm PhoneStar ST TRI
D 12,5 mm Plasterboard







Color explanation

Values ≤ 50 dB

Values ≤ 46 dB

Values ≤ 39 dB

Impact sound $L_{n,w}$ - Test value
Airborne sound R_w - Test value
Impact sound $L'_{n,w}$ - Expected value on site

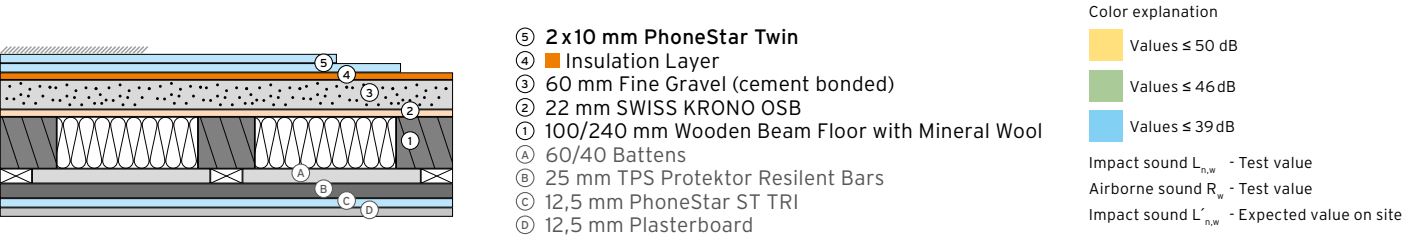
Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 10 mm PhoneStar Twin 4 mm Wolf Protect Wood Fibre Board 80 mm Fine Gravel (cement bonded)	188	142	32	75	44	41,6	37,3
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						45	41,2	37,1
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB						48	45,5	39,8
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 10 mm PhoneStar Twin 20 mm Gutex / Steico Base Wood Fibre Board 80 mm Fine Gravel (cement bonded)	189,7	158	31	75	44	40,6	36,3
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						44	40,2	36,1
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB						47	44,5	38,8







* Calculated with Kij = 10 dB (butt solid timber joint). ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.
*** 24 mm Wolf PowerFloor Öko Plus can also be used.

Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
It could be determined that loose fine gavel fill do not perform worse than bonded Fine Gravel fill.

Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens with Resilient Bars
Loading: 60 mm Fine Gravel (cement bonded)



Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 10 mm PhoneStar Twin 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	126,2	84	36	72	46	44,5	40,8
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						47	44,1	40,6
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB						50	48,1	42,8
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 10 mm PhoneStar Twin 20 mm Gutex / Steico Base Wood Fibre Board 60 mm Fine Gravel (cement bonded)	127,9	100	35	81	46	47,1	41,8
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						46	46,7	41,6
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB						49	51,3	45







PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.

Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
It could be determined that loose fine gavel fill do not perform worse than bonded Fine Gravel fill.

Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens with Resilient Bars
Loading: 60 mm Fine Gravel (cement bonded)



Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 10 mm PhoneStar Twin 4 mm Wolf Protect Wood Fibre Board 60 mm Fine Gravel (cement bonded)	155	122	35	72	46	43,5	39,8
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						46	43,1	39,6
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB						49	47,1	41,8
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 10 mm PhoneStar Twin 20 mm Gutex / Steico Base Wood Fibre Board 60 mm Fine Gravel (cement bonded)	156,7	138	34	72	45	42,5	38,8
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						46	42,1	38,6
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB						49	46,1	40,8

* Calculated with Kij = 10 dB (butt solid timber joint). ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.
*** 24 mm Wolf PowerFloor Öko Plus can also be used.

Routed out areas (width <200mm) can be filled in with Fine Gravel after installation of cables.
It could be determined that loose fine gavel fill do not perform worse than bonded Fine Gravel fill.







Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens with Resilient Bars
Loading: no

④ 2 x10 mm PhoneStar Twin
③ Insulation Layer
② 22 mm SWISS KRONO OSB
① 100/240 mm Wooden Beam Floor with Mineral Wool
④ 60/40 Battens
② 25 mm TPS Protektor Resilient Bars
⑤ 12,5 mm PhoneStar ST TRI
⑥ 12,5 mm Plasterboard

Color explanation
Values ≤ 50 dB
Values ≤ 46 dB
Values ≤ 39 dB

Impact sound $L_{n,w}$ - Test value
Airborne sound R_w - Test value
Impact sound $L'_{n,w}$ - Expected value on site

Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 10 mm PhoneStar Twin 4 mm Wolf Protect Wood Fibre Board	27,2	24	47	61	56	53,8	50,6
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						57	53,6	50,5
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB						59	57	51,5
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	2 x 10 mm PhoneStar Twin 20 mm Gutex / Steico Base Wood Fibre Board	28,9	40	46	70	55	53,8	50,5
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						56	53,5	50,3
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB						58	57,2	52,3

////////// PhoneStar is suitable for using below floating finished flooring such as laminate or parquet flooring (Wolf Bavaria installation guidelines must be adhered to). This final flooring Layer can affect the indicated values. * Calculated with Kij = 10 dB (butt solid timber joint) ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.







Calculated Proof for Closed Wooden Beam Floors

Execution: Suspended ceiling - Battens with Resilient Bars
Loading: no

⑥ 18 mm Wolf HUGO GF Dry Screed
⑤ 20mm Wolf PowerFloor Light UFH ***
④ 2 x10 mm PhoneStar Twin
③ Insulation Layer
② 22 mm SWISS KRONO OSB
① 100/240 mm Wooden Beam Floor with Mineral Wool
④ 60/40 Battens
② 25 mm TPS Protektor Resilient Bars
⑤ 12,5 mm PhoneStar ST TRI
⑥ 12,5 mm Plasterboard

Color explanation
Values ≤ 50 dB
Values ≤ 46 dB
Values ≤ 39 dB

Impact sound $L_{n,w}$ - Test value
Airborne sound R_w - Test value
Impact sound $L'_{n,w}$ - Expected value on site

Wall build up in receiving room	Floor build up	Floor build up		Test values according to expert's opinion (17-001670-PR02)		Calculated proof according to German DIN 4109 (Part 2)	Calculated proof according to European EN 12354 **	
		Weight [kg/m²]	Height [mm]	$L_{n,w}$ [in dB]	R_w [in dB]	$L'_{n,w}$ [in dB]	$L'_{n,w}$ * [in dB]	$L'_{n,w}$ [in dB] with PhoneStrip (Kij=17dB)
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 10 mm PhoneStar Twin 4 mm Wolf Protect Wood Fibre Board	56	62	46	61	55	51,3	49,6
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						56	51,1	49,5
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB						58	53,8	50,5
 DIN4109-33 Tab. 3 / Row 13 Rw = 43 dB	18 mm Wolf HUGO GF Dry Screed 20 mm Wolf Power FLOOR Light UFH *** 2 x 10 mm PhoneStar Twin 20 mm Gutex / Steico Base Wood Fibre Board	57,7	78	45	61	54,6	50,3	48,6
 DIN4109-33 Tab. 3 / Row 6 Rw = 44 dB						55	50,1	48,5
 CLT 100 mm Zero measure- ment 2 Rw = 34 dB						57	52,8	49,5

* Calculated with Kij = 10 dB (butt solid timber joint). ** Calculation of timber frame walls is executed following the calculated proof indicated in EN 12354.
*** 24 mm Wolf PowerFloor Öko Plus can also be used.



PICTURE: STORA ENSO

INFORMATION

Products and Partners

The mathematical sound insulation proof was tested at the ift Rosenheim GmbH with products of the following industrial partners:
best wood SCHNEIDER GmbH, Protektorwerk Florenz Maisch GmbH & Co. KG, SAINT-GOBAIN ISOVER G+H AG, Sopro Bauchemie GmbH, Stora Enso WP Bad St. Leonhard GmbH, SWISS KRONO GmbH and Wolf Bavaria GmbH.

Note for planners

If proof of sound insulation is required and decoupling bearings are to be installed, we recommend using the calculation basis according to EN 12354.
All further planning can be verified by the simplified procedure according to DIN 4109.

No end coating was listed in these calculations. Please note the current installation instructions of Wolf Bavaria GmbH.

LIST OF ABBREVIATIONS

GAS	Advisory opinion
PB	Plasterboard
WPF	Wood based panel
GF	Gypsum Fiberboard
CLT	Cross-Laminated-Timber
WBP Elements	Wood based panel Elements
PhoneStar	Sound Insulation Boards (Wolf Bavaria)
PowerFloor	Underfloor Heating (Wolf Bavaria)
PhoneStrip	Decoupling strips for timber frame (Wolf Bavaria)

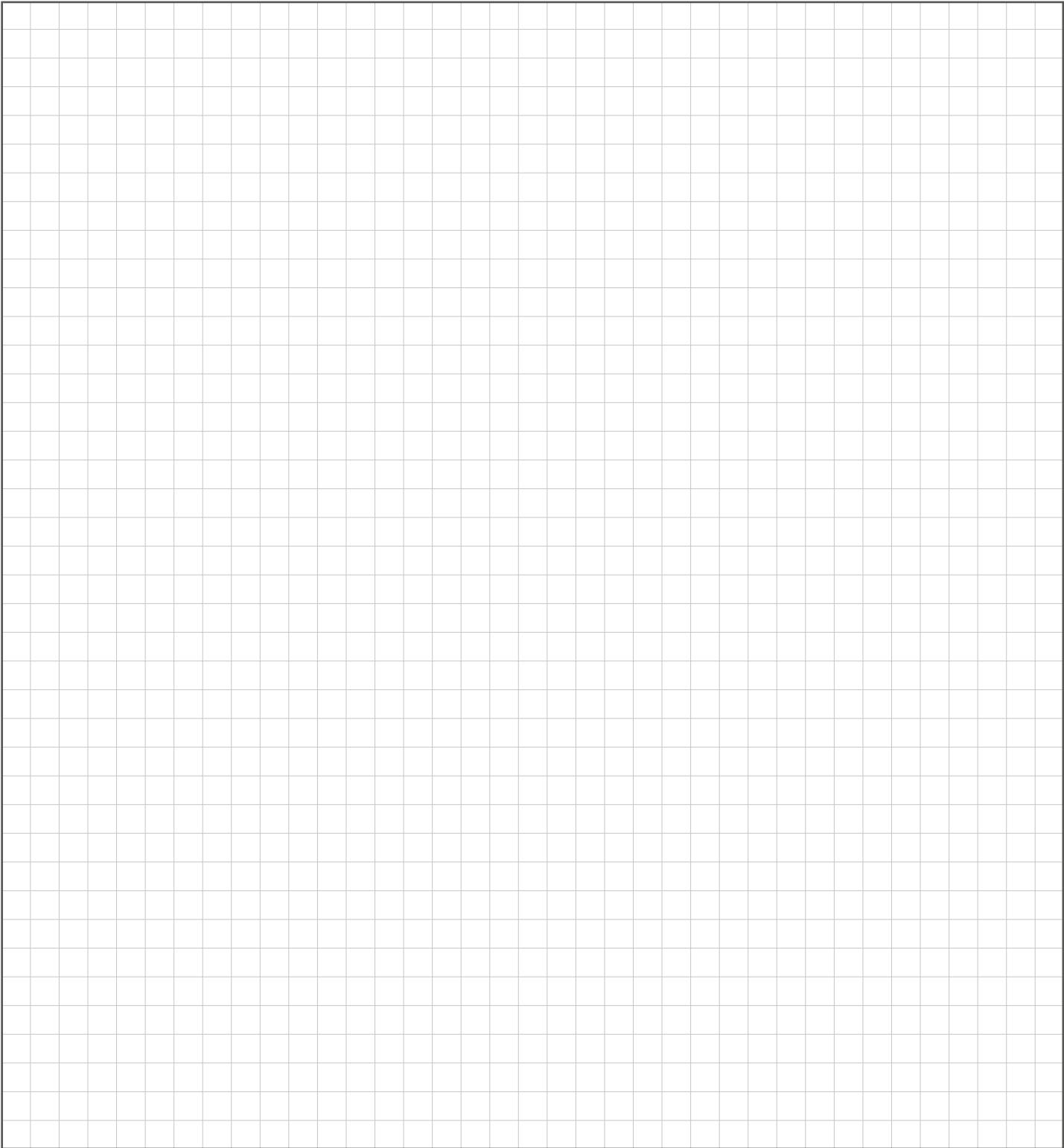
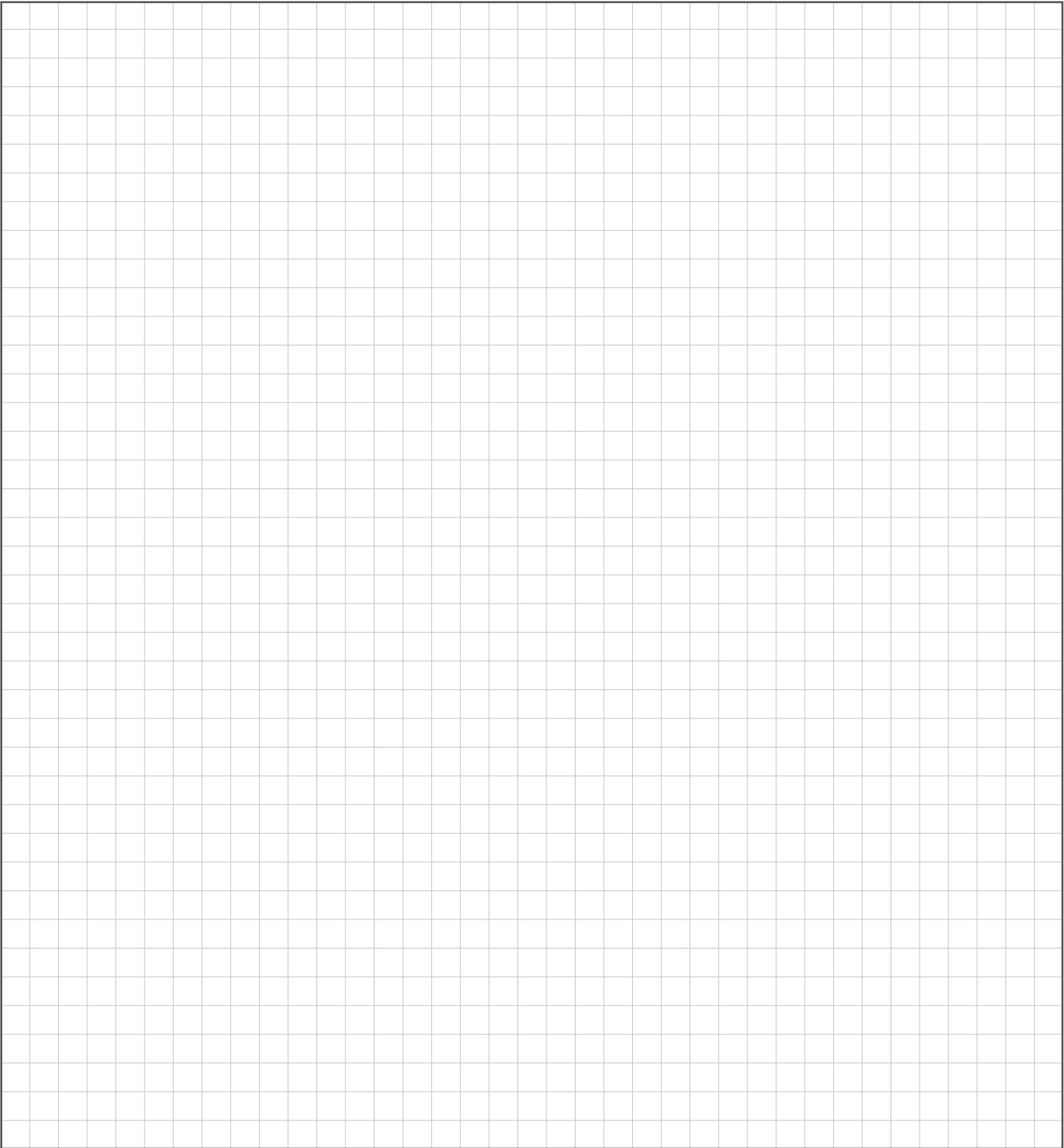
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The information in this brochure corresponds to the current knowledge and experience to the best of our knowledge. The data listed are guidelines and not contract data. These guide values may vary depending on the type of the structure. We accept no liability for calculation and printing errors.
Changes in the context of technical progress and operational development are reserved. The customer is not exempt from a careful examination of the functions or applications of the products by qualified personnel.

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Intro best wood SCHNEIDER GmbH, Protektorwerk Florenz Maisch GmbH & Co. KG, SAINT-GOBAIN ISOVER G+H AG, Sopro Bauchemie GmbH, Stora Enso WP Bad St. Leonhard GmbH, SWISS KRONO GmbH, Wolf Bavaria GmbH



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