DOCUMENTATION

FIRE - SOUND - U-VALUE

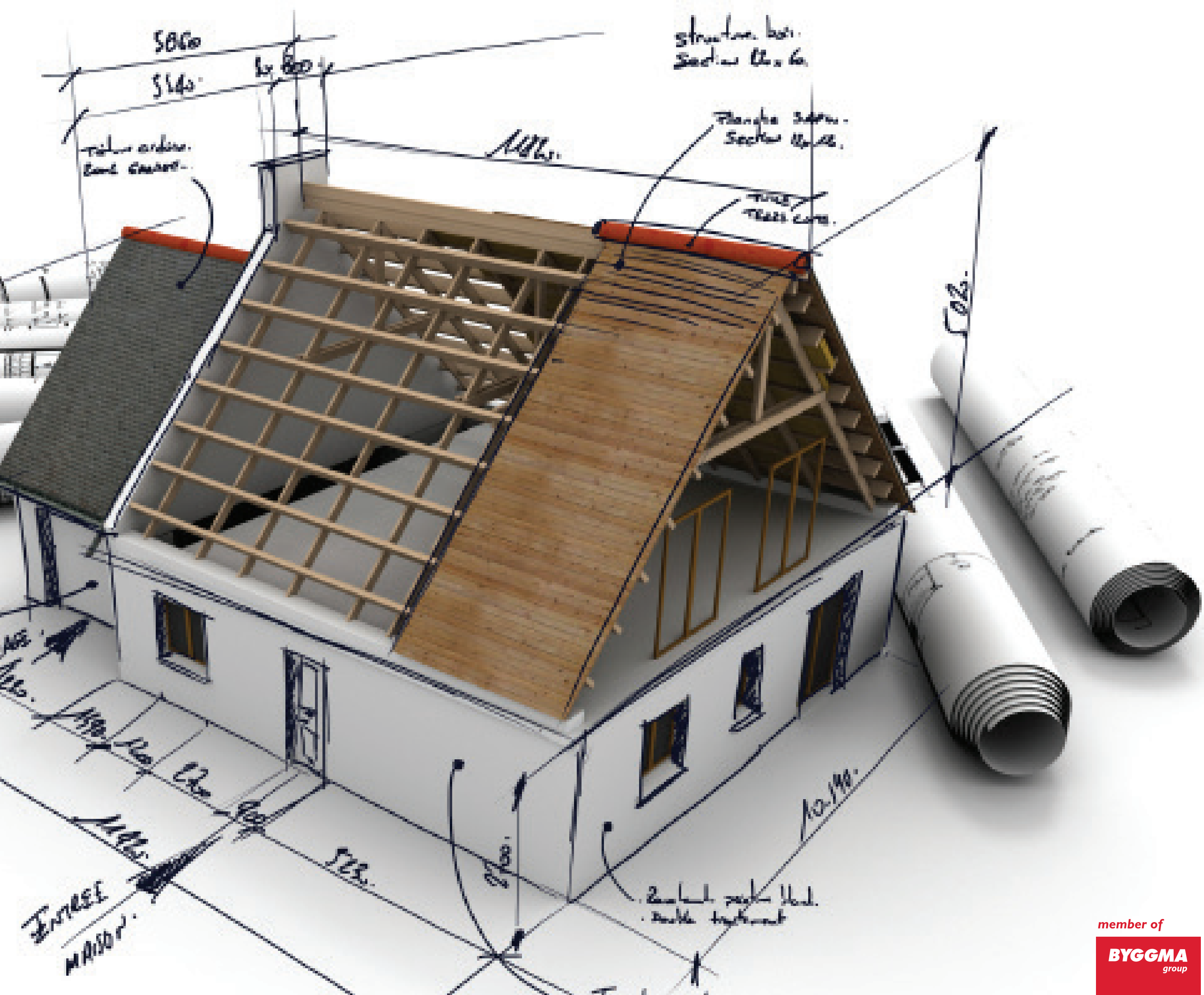
B230 01.2021

MASONITE BEAMS

HUNTONIT

ULDAL

FORESTIA



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CONTENT

IN GENERAL

Assumptions

The structures shown are produced with Byggma products from Forestia AS for chipboard, Huntonit AS for wood fibreboard and MDF boards, Masonite Beams AB for I-beams and I-uprights and Uldal AS for windows. All structures will include products from other manufacturers. For these products, if the manufacturer and product are not stated, minimum values for product characteristics from product standards are used in the tables for fire, sound and U value. If test results are available, these are used, while for structures that have not been tested, calculated values are applied in accordance with the current standard, and from the SINTEF Building Research Design Guides.

Structural solutions describing installation and documented construction details are described in the construction details for the Masonite beam at www.masonite.no
For the board products, there are installation guides and other documentation at: www.forestia.no (chipboard) and www.huntonit.no (wood fibreboard and MDF boards).

Fire

For structures, the documented fire resistance is described, such as REI30, in beam structures, walls and roofs. The fire class and requirements of the structural surfaces are assumed to be described by the consulting engineer. Tables for the various structures show their fire resistance. Suppliers of other insulation types than mineral wool must document their fire properties.

Sound

For structures where this is relevant, the current sound insulation values are stated. For beam structures, values for airborne and impact sound are stated, while for exterior and interior walls the air/sound reduction is stated. Suppliers of other insulation types than mineral wool must document their sound properties.

U value

The U values of beam structures, and wall and roof structures, are calculated in accordance with NS-EN ISO 10211 and NS-EN-ISO 6946 in cooperation with SINTEF Building Research and follow the same principles as presented in their Building Research Design Guides.

The tables take account of the better λ value for the OSB step of Masonite beams and uprights, compared to the value used for other manufacturers' I profiles in the SINTEF Building Research construction details. The U values are calculated on the basis of the material types and qualities from which the structures are constructed, and this is described for each structure. Where not otherwise stated for the individual structure, mineral wool is assumed to be the insulation used. No other requirements are made of the supplier/product than that the λ value requirement is fulfilled with regard to U value.

Characteristics	U values (W/m²K)		
	TEK10	Passive house	Low-energy house, class 1
Exterior wall*	0,18	0,10-0,12	0,15-0,16
Roof*	0,13	0,08-0,09	0,10-0,12
Floor*	0,10	0,08	0,10-0,12
Window and door	0,80	0,80	1,2
Sealing	0,6	0,6	1,0
Thermal bridge	0,05	0,03	0,05

Table showing U values for TEK10, passive house and low-energy house, class 1.
*The U values for passive and low-energy house are from NS 3700:2013 and are average values.

For TEK10, re-distribution between the structures is permitted, so that e.g. walls can be made thinner than the U value would indicate, while the roof and/or window, for example, are above the minimum requirement.

FORESTIA HUNTONIT ULDAL MASONITE BEAMS

IN GENERAL

TEK10			
Construction	Insulation quality λ_d (W/mK)		
	0,032	0,034	0,037
	Minimum dimentions		
Exterior wall	R250	R250	R250
Roof	H300	H300	H350
Floor	H350	H400	H400

Passive house			
Construction	Insulation quality λ_d (W/mK)		
	0,032	0,034	0,037
	Minimum dimentions		
Exterior wall	R350-R400	R350-400	R350-R400
Roof	H400-H450	H400-H450	H450-H500
Floor	H450	H450	H500

Low-energy house, class 1			
Construction	Insulation quality λ_d (W/mK)		
	0,032	0,034	0,037
	Minimum dimentions		
Exterior wall	R250	R250-R300	R250-R300
Roof	H300-H350	H350-H400	H350-H400
Floor	H300-H350	H350-H400	H350-H400

The tables present an overview with proposed minimum dimensions, depending on the insulation's quality, the wall structure and the regulations' requirements concerning U value. For walls, a detached house with a normal door and window area with a wood ratio of L”=3.5m/m2 is assumed. The relevant structure must nonetheless be controlled against Byggma's U-value tables or by own calculations.

Energy efficiency and thermal bridge values

In most cases, there will be a greater heat loss in transitions between structural elements than in the actual wall, e.g. between wall and beam structure/covering/roof structures, and against wall columns, etc. This extra heat loss is calculated with the help of "thermal bridge values" and must be considered on calculating the building's energy efficiency. The thermal bridge value can be found in several ways:

1. Select the standard value from table A.4 in NS 3031:2014
2. Find in the SINTEF Building Research thermal bridge atlas.
3. Perform own calculations, which requires a lot of skill.

In most cases, alternative 1 or 2 will be selected. For I-profiles such as Masonite beams and uprights, thermal bridge values are calculated for a number of structures in the SINTEF Building Research thermal bridge atlas.

ROOF

Roof structures with rafters, purlins or top flanges of Masonite beams or timber. Timber is solid wood, glued laminated wood and LVL (laminated veneer lumber).

U value

The tables are developed in collaboration with SINTEF Building Research. Material properties for chipboard with a minimum thickness of 12 mm, and wood fibreboard and MDF boards with a minimum thickness of 11 mm, are used. If other ceiling materials are to be used, they must have minimum the same characteristics with regard to U value as the aforementioned chipboard, wood fibreboard and MDF boards.

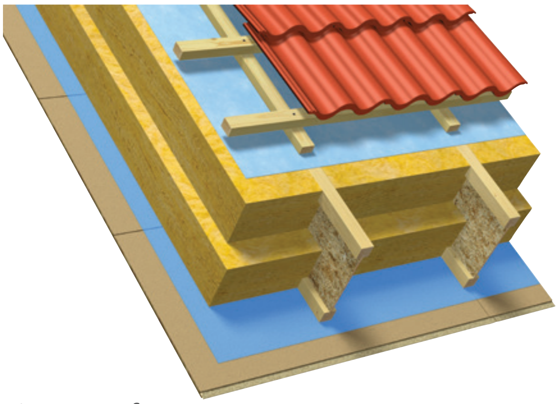


Fig. 1 Roof
Ventilated roof with foil underlay for roof tiles.

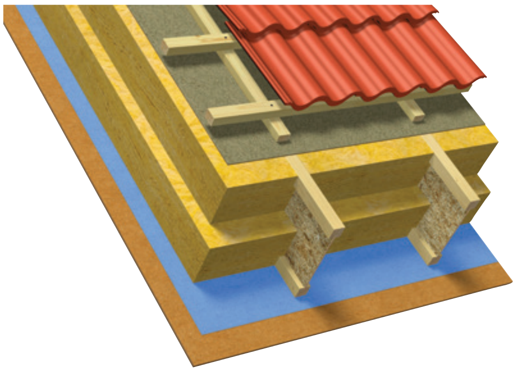


Fig. 2 Roof
Ventilated roof with wood fibreboard for roof tiles.

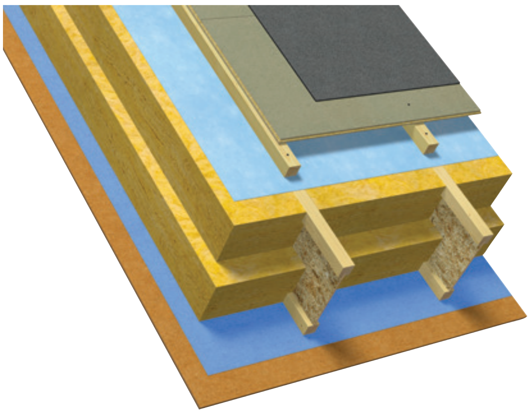


Fig. 3 Roof
Ventilated roof with roof sheathing and roofing felt/foil.

Beam height and insulation thickness	U-values (W/m^2K)			
	Insulation with heat conductivity			
	λ_d=0,032	λ_d=0,034	λ_d=0,037	λ_d=0,038
200	0,176	0,185	0,198	0,202
220	0,161	0,169	0,181	0,184
250	0,142	0,149	0,160	0,163
300	0,119	0,125	0,134	0,137
350	0,102	0,108	0,115	0,118
400	0,090	0,094	0,101	0,104
450	0,080	0,084	0,090	0,092
500	0,072	0,076	0,081	0,083

VENTILATED ROOF WITH RAFTERS/TOP FLANGES OF SOLID WOOD, GLUED LAMINATED WOOD OR LVL

The same structure is assumed as shown in Figures 1-3 Roof, but rafters/top flanges are replaced with solid wood, glued laminated wood or LVL. The rafter thickness is 48 mm.

Beam height and insulation thickness	U-values (W/m²K)			
	Insulation with heat conductivity			
	λ_d=0,032	λ_d=0,034	λ_d=0,037	λ_d=0,038
200	0,181	0,190	0,202	0,206
220	0,166	0,173	0,185	0,189
250	0,147	0,154	0,164	0,167
300	0,124	0,129	0,138	0,141

COMPACT ROOF WITH MASONITE BEAMS

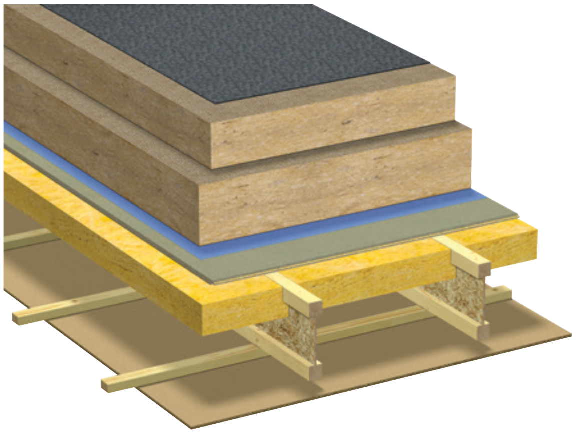


Fig. 4 Roof
Compact roof
Compressive insulation and diffusion barrier on the underlay.
Maximum 1/4 of the insulation below the underlay.

Beam height and insulation thickness	U-values (W/m²K)					
	Insulation with heat conductivity					
	λ_d=0,032	λ_d=0,034	λ_d=0,035	λ_d=0,036	λ_d=0,037	λ_d=0,038
300	0,114	0,116	0,117	0,118	0,119	0,119
350	0,099	0,100	0,101	0,102	0,102	0,103
400	0,087	0,088	0,089	0,089	0,090	0,090
450	0,078	0,079	0,079	0,080	0,080	0,080
500	0,071	0,071	0,072	0,072	0,072	0,073

CEILING AGAINST COLD ATTIC

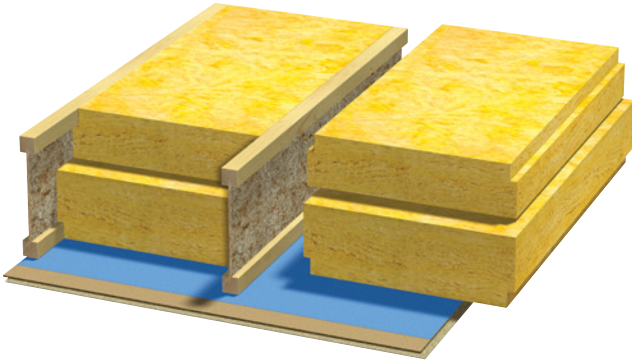


Fig. 5 Roof
Ceiling against cold attic.

Beam height and insulation thickness	U-values (W/m²K)			
	Insulation with heat conductivity			
	λ_d=0,032	λ_d=0,034	λ_d=0,037	λ_d=0,038
200	0,169	0,177	0,189	0,193
220	0,155	0,162	0,173	0,177
250	0,137	0,144	0,154	0,157
300	0,116	0,121	0,130	0,133
350	0,100	0,105	0,112	0,115
400	0,088	0,092	0,099	0,101
450	0,078	0,082	0,088	0,090
500	0,071	0,074	0,080	0,082

INTERIOR WALLS

Interior walls with uprights and sills of timber or steel profiles, insulated with mineral wool. Timber-based boards, chipboard from Forestia AS, wood fibreboard and MDF boards, Huntonit. The boards are installed in one or several layers.

Fire resistance
Wood-based boards must have a minimum thickness of 9 mm and a density of at least 600 kg/m3. Wood fibreboard and MDF boards must have a minimum thickness of 11 mm. If a different thickness is required, this is described for the relevant detail/figure.
All board types classified in "K210 A2-s1,d0" (K1-A), "K210 B-s1,d0" (K1) and "K210 D-s2, d0" (K2).

Sound reduction
Chipboard must be minimum 12 mm thick, while wood fibreboard and MDF boards must be minimum 11 mm thick. If a different thickness is required, this is described for the relevant detail/figure.

Alternative materials
Some of the interior walls have alternative materials. For these, there are remarks in the tables and a related table showing the change in materials and its consequences for sound and fire properties.

Insulation thickness (mm)	Upright dimensions (mm)	Sound reduction (dB)	Fire resistance	Remark
70	36x73	37-39	EI30	
100	48x98	40-43	EI30	1)

Remark	Change	Sound reduction (dB)	Fire resistance
1)	Stone wool insulation	40-43	EI60/REI30

Fig. 1 Interior wall
Continuous timber upright. One layer of board.

INTERIOR WALL

Insulation thick-ness (mm)	Upright dimensions (mm)	Sound reduction (dB)	Fire resistance
100	36x73	45	EI30
120	36x98	46	EI30

Fig. 2 Interior wall
Displaced timber upright on timber sill.
Two board layers.

Insulation thick-ness (mm)	Upright dimensions (mm)	Sound reduction (dB)	Fire resistance
100	36x73	50	EI30
120	36x98	50-51	EI30

Fig. 3 Interior wall
Displaced timber upright on timber sill.
Two board layers.

INTERIOR WALL

Fig. 4 Interior wall
Double timber upright. Two board layers.

Insulation thickness (mm)	Upright dimensions (mm)	Sound reduction (dB)	Fire resistance	Remark
2x70	48x73	54	REI30	1), 3)
2x100	48x98	55	REI30	2)

Remark	Change	Sound reduction (dB)	Fire resistance
1)	2x70 mm stone wool One layer of 16 mm chipboard and one layer of 12/11 mm boards on each side	56	REI60
2)	13 mm gypsum board and 12 mm Forestia, possibly 11 mm Huntonit or 11 mm Focus MDF board outermost	55	REI60
3)	2x70 mm mineral wool. One layer of 16 mm chipboard and one layer of 12/11 mm boards on each side	54	EI60

INTERIOR WALL

Insulation thick-ness (mm)	Upright dimen-sions (mm)	Sound reduction (dB)	Fire resistance	Remark
70	75	42	EI30	1)
100	95	43	EI30	2)

Remark	Change	Sound reduction (dB)	Fire resistance
1)	Two layers of panel on both sides	47	EI30
2)	Two layers of panel on both sides	48	EI30

Fig. 5 Interior wall
Continuous steel upright with one board layer.

INTERIOR WALL

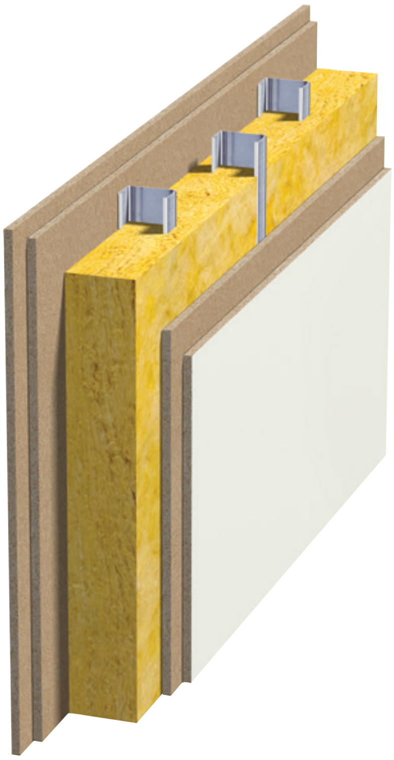


Fig. 6 Interior wall
Displaced steel upright with two board layers.

Insulation thickness (mm)	Upright dimensions (mm)	Sound reduction (dB)	Fire resistance	Remark
100	2x75	52	EI30	1)

Remark	Change	Sound reduction (dB)	Fire resistance
1)	One layer of panel	47	EI30

EXTERIOR WALLS

U value

In the tables for Masonite uprights, upright quality (type R) is used. The tables are developed in collaboration with SINTEF Building Research and the same calculation assumptions are used as described in their Building Research Design Series, construction detail 471.231.
The U values stated in the tables are calculated for walls with different numbers of metres of studwork per m2 of net wall area, L”. If own calculations of L” give another value that specified in the tables, interpolation between the U values can be used. See the calculation method and examples in the Building Research Design Series.

The table for the timber ratio, L”, is taken from construction detail 471.231 and shows examples of structures and related L”.

Table for timber ratio, L”

Type of façade		L” (m/m2) Studwork 2)
Area ratio windows and doors in façade (%)	Example of wall/building 1)	
0	Wall with a height of 2.4 m outside windows and doors	2,45
17	Detached home, room height 2.4 m	3,50
30	Residential block, terraced house, nursery school, room height 2.4 m	4,50
39	Large commercial building, room height 3.5 m	5,50
46	Large commercial building, room height 2.6m	6,50
51	Large building with a room height of 2.6 m and windows with non-standard geometry in the studwork	7,50

1) The same building carcass and geometry are assumed as the technical requirements of building structures (TEK10) are based on, with a total window area of 20% of area used and typical window size.
2) Uprights with c/c 0.6 m, with single base and top sills, supplemented with extra uprights and noggings as reinforcement around windows and doors, in the same material as the uprights.

Sound reduction
Sound reduction, $R`_w$, is indicative and based on the laboratory-measured sound reduction figure $R_w$ in SINTEF Building Research, construction detail 523.422. $R`_w$ is the field-measured figure and is set 5 dB lower than R_w. For walls that are to insulate from road traffic noise, account should be taken of the reversal figure C_{tr}, which reduces the size of $R`_w$.

Fire resistance
Fire resistance is based on calculations and tests.

EXTERIOR WALL

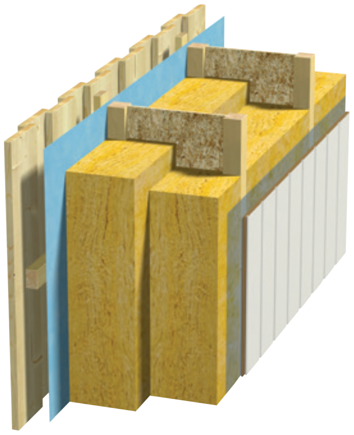


Fig. 1 Exterior wall
Masonite upright. Foil wind barrier.

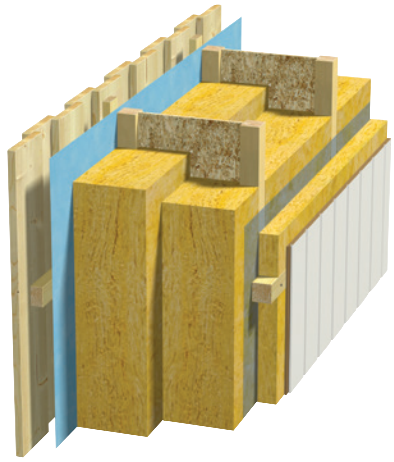


Fig. 2 Exterior wall
Masonite upright, foil wind barrier with interior crosser liner.

Insulation (mm)	Stud-work + feed	U-values [W/(m²K)] – Insulation with heat conductivity (λ_d), [W/(mK)] – λ_d=0,032 – Area-specific length, I-beam (L”), [m/m²]						λ_d=0,034 – Area-specific length, I-beam (L”), [m/m²]						λ_d=0,037 – Area-specific length, I-beam (L”), [m/m²]						Sound reduction R`w (dB)
		L”=2,45	*L”=3,5*	*L”=5,5*	*L”=7,5*	*L”=9,5*	*L”=12*	*L”=2,45*	*L”=3,5*	*L”=5,5*	*L”=7,5*	*L”=9,5*	*L”=12*	*L”=2,45*	*L”=3,5*	*L”=5,5*	*L”=7,5*	*L”=9,5*	*L”=12*	
200	200	0,184	0,199	0,226	0,254	0,282	0,316	0,192	0,207	0,234	0,261	0,288	0,322	0,205	0,219	0,246	0,273	0,300	0,334	ca. 40
250	200+48	0,149	0,162	0,187	0,211	0,236	0,266	0,156	0,169	0,194	0,220	0,245	0,277	0,166	0,179	0,203	0,227	0,251	0,281	
	250	0,149	0,161	0,182	0,204	0,226	0,253	0,156	0,167	0,189	0,210	0,231	0,258	0,166	0,177	0,199	0,220	0,241	0,268	
300	250+48	0,125	0,136	0,156	0,177	0,198	0,223	0,131	0,141	0,161	0,181	0,201	0,226	0,139	0,150	0,170	0,190	0,210	0,235	
	300	0,125	0,135	0,153	0,171	0,189	0,212	0,131	0,141	0,159	0,177	0,195	0,218	0,140	0,149	0,167	0,184	0,201	0,223	
350	300+48	0,108	0,117	0,134	0,151	0,168	0,189	0,113	0,122	0,138	0,155	0,172	0,192	0,120	0,129	0,145	0,162	0,179	0,199	
	350	0,108	0,116	0,133	0,149	0,165	0,186	0,113	0,121	0,137	0,152	0,167	0,187	0,120	0,129	0,144	0,159	0,174	0,194	
400	350+48	0,094	0,102	0,117	0,132	0,147	0,166	0,099	0,107	0,121	0,136	0,151	0,169	0,106	0,113	0,128	0,142	0,156	0,174	
	400	0,095	0,102	0,115	0,128	0,141	0,157	0,099	0,106	0,120	0,133	0,146	0,163	0,106	0,113	0,126	0,140	0,153	0,170	

EXTERIOR WALL

Fig. 3 Masonite upright, wind barrier, 12 mm wood fibreboard.

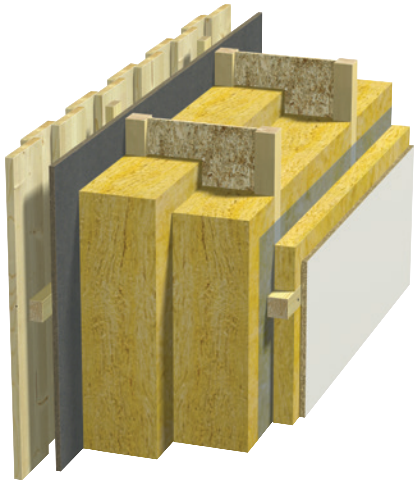


Fig. 4 Exterior wall
Masonite upright, wind barrier of 12 mm wood fibreboard with interior crosser liner.

Insulation (mm)	Stud-work + feed	U-values [W/(m²K)]																		Soundreduction R`w (dB)
		Insulation with heat conductivity (λ_d), [W/(mK)]																		
		λ_d=0,032						λ_d=0,034						λ_d=0,037						
		Area-specific length, I-beam (L”), [m/m²]						Area-specific length, I-beam (L”), [m/m²]						Area-specific length, I-beam (L”), [m/m²]						
		L”=2,45	*L”*=3,5	*L”*=5,5	*L”*=7,5	*L”*=9,5	*L”*=12	*L”*=2,45	*L”*=3,5	*L”*=5,5	*L”*=7,5	*L”*=9,5	*L”*=12	*L”*=2,45	*L”*=3,5	*L”*=5,5	*L”*=7,5	*L”*=9,5	*L”*=12	
200	200	0,177	0,190	0,214	0,238	0,263	0,294	0,184	0,197	0,221	0,245	0,269	0,299	0,196	0,208	0,232	0,255	0,278	0,307	ca. 41
250	200+48	0,144	0,156	0,178	0,200	0,222	0,250	0,150	0,162	0,184	0,205	0,227	0,254	0,160	0,171	0,193	0,215	0,237	0,264	
	250	0,144	0,155	0,175	0,195	0,215	0,240	0,150	0,161	0,181	0,201	0,220	0,245	0,160	0,170	0,189	0,209	0,228	0,252	
300	250+48	0,121	0,131	0,150	0,169	0,188	0,212	0,127	0,136	0,155	0,173	0,191	0,214	0,135	0,145	0,163	0,181	0,199	0,222	
	300	0,121	0,131	0,148	0,166	0,182	0,203	0,127	0,136	0,152	0,169	0,175	0,207	0,135	0,144	0,160	0,177	0,193	0,213	
350	300+48	0,105	0,113	0,129	0,145	0,161	0,181	0,110	0,118	0,133	0,149	0,164	0,184	0,117	0,125	0,141	0,157	0,173	0,193	
	350	0,105	0,113	0,128	0,143	0,157	0,175	0,110	0,118	0,132	0,147	0,161	0,179	0,117	0,125	0,139	0,154	0,167	0,185	
400	350+48	0,092	0,100	0,114	0,129	0,134	0,149	0,097	0,104	0,118	0,132	0,146	0,163	0,103	0,110	0,124	0,137	0,150	0,167	
	400	0,092	0,099	0,113	0,126	0,139	0,155	0,097	0,104	0,117	0,130	0,142	0,158	0,103	0,110	0,123	0,135	0,147	0,181	

EXTERIOR WALL

Fig. 5 Exterior wall
Timber upright, foil wind barrier.

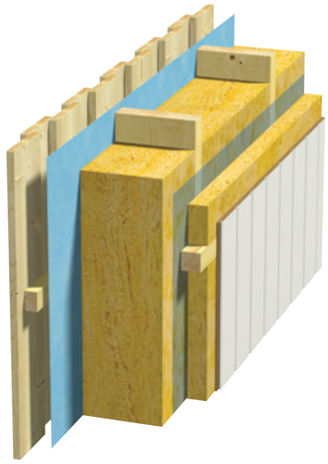


Fig. 6 Exterior wall
Timber upright, foil wind barrier with interior crosser liner.

Insulation (mm)	Studwork + feed		U-values [W/(m²K)]																		Sound reduction R'w (dB)	Fire resistance
			Insulation with heat conductivity (λ_d), [W/(m²K)]																			
			λ_d=0,032						λ_d=0,034						λ_d=0,037							
			Area-specific length, I-beam (L”), [m/m²]						Area-specific length, I-beam (L”), [m/m²]						Area-specific length, I-beam (L”), [m/m²]							
	d	t	L”=2,45	L”=3,5	L”=4,5	L”=5,5	L”=6,5	L”=7,5	L”=2,45	L”=3,5	L”=4,5	L”=5,5	L”=6,5	L”=7,5	L”=2,45	L”=3,5	L”=4,5	L”=5,5	L”=6,5	L”=7,5		
150	148	36	0,239	0,255	0,271	0,286	0,302	0,317	0,249	0,265	0,279	0,294	0,308	0,323	0,270	0,284	0,298	0,312	0,326	0,340	Without crossings 38 dB With crossings 43dB	REI30
200	148+48	36	0,182	0,197	0,212	0,226	0,240	0,255	0,191	0,205	0,219	0,233	0,247	0,261	0,207	0,221	0,235	0,248	0,261	0,275		
	198	36	0,184	0,197	0,210	0,222	0,235	0,247	0,192	0,205	0,217	0,229	0,241	0,253	0,208	0,220	0,231	0,243	0,254	0,265		
250	198+48	36	0,148	0,160	0,172	0,184	0,195	0,207	0,155	0,167	0,179	0,190	0,201	0,213	0,169	0,180	0,191	0,202	0,213	0,224		
	246	36	0,150	0,161	0,172	0,182	0,193	0,203	0,157	0,168	0,178	0,188	0,198	0,209	0,170	0,180	0,190	0,199	0,209	0,219		
300	246+48	36	0,126	0,136	0,146	0,156	0,165	0,175	0,131	0,142	0,152	0,161	0,171	0,181	0,143	0,153	0,162	0,171	0,180	0,190		
	296	36	0,127	0,136	0,145	0,154	0,163	0,172	0,132	0,141	0,150	0,159	0,167	0,176	0,143	0,152	0,160	0,168	0,177	0,185		
350	296+48	36	0,109	0,117	0,126	0,134	0,143	0,151	0,114	0,122	0,131	0,139	0,147	0,156	0,123	0,132	0,140	0,148	0,156	0,163		
150	148	48	0,251	0,273	0,294	0,314	0,335	0,355	0,261	0,282	0,302	0,322	0,341	0,361	0,281	0,301	0,319	0,338	0,357	0,375	Without crossings 38 dB With crossings 43dB	REI30
200	148+48	48	0,189	0,208	0,226	0,244	0,262	0,280	0,197	0,216	0,233	0,250	0,268	0,285	0,213	0,231	0,247	0,264	0,281	0,297		
	198	48	0,194	0,211	0,228	0,244	0,261	0,277	0,201	0,219	0,235	0,251	0,267	0,284	0,217	0,233	0,248	0,263	0,278	0,294		
250	198+48	48	0,154	0,170	0,184	0,199	0,214	0,228	0,161	0,176	0,190	0,204	0,219	0,233	0,174	0,189	0,203	0,216	0,230	0,244		
	246	48	0,159	0,173	0,187	0,201	0,215	0,229	0,165	0,180	0,193	0,207	0,221	0,234	0,178	0,191	0,204	0,217	0,230	0,242		
300	246+48	48	0,131	0,145	0,157	0,170	0,183	0,196	0,137	0,150	0,163	0,175	0,188	0,200	0,148	0,161	0,172	0,184	0,196	0,208		
	296	48	0,134	0,146	0,157	0,169	0,180	0,192	0,139	0,151	0,162	0,174	0,185	0,196	0,150	0,161	0,172	0,182	0,193	0,203		
350	296+48	48	0,114	0,125	0,137	0,148	0,159	0,170	0,118	0,130	0,141	0,151	0,162	0,173	0,128	0,139	0,150	0,160	0,170	0,181		

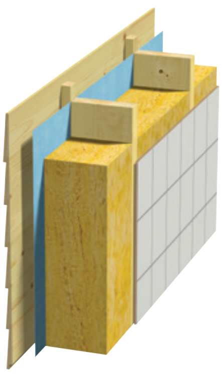


Fig. 7 Exterior wall
Timber upright. If bathroom panels from Fibo-Trespo are used, no diffusion barrier must be used behind this.

FORESTIA HUNTONIT ULDAL MASONITE BEAMS

EXTERIOR WALL

Fig. 8 Exterior wall
Timber upright, wind barrier, 12 mm wood fibre-board.

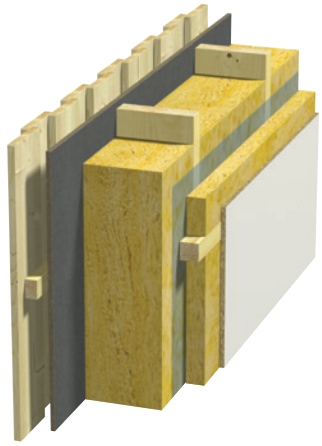


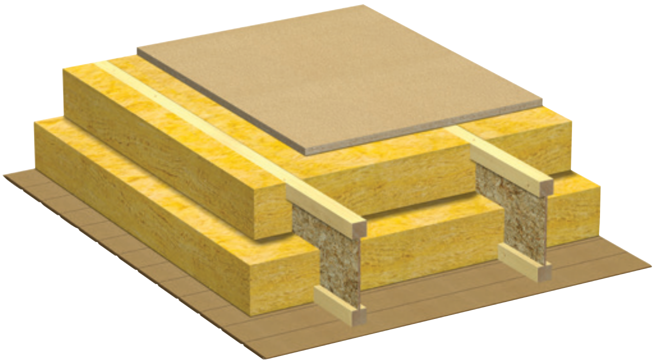
Fig. 9 Exterior wall
Timber upright, wind barrier of 12 mm wood fibre-board with interior crosser liner.

Insulation (mm)	Studwork		U-values [W/(m²K)] – Insulation with heat conductivity (λ_d), [W/(m²K)]																		Sound reduction R'w (dB)	Fire resistance
			λ_d=0,032 Area-specific length, I-beam (L”), [m/m²]						λ_d=0,034 Area-specific length, I-beam (L”), [m/m²]						λ_d=0,037 Area-specific length, I-beam (L”), [m/m²]							
	d	t	L”=2,45	L”=3,5	L”=4,5	L”=5,5	L”=6,5	L”=7,5	L”=2,45	L”=3,5	L”=4,5	L”=5,5	L”=6,5	L”=7,5	L”=2,45	L”=3,5	L”=4,5	L”=5,5	L”=6,5	L”=7,5		
150	148	36	0,226	0,240	0,253	0,267	0,280	0,293	0,236	0,249	0,262	0,275	0,288	0,301	0,254	0,267	0,279	0,292	0,304	0,316	Without crossings 38 dB With crossings 43dB	REI30
200	148+48	36	0,175	0,188	0,201	0,214	0,227	0,240	0,183	0,195	0,208	0,220	0,232	0,245	0,198	0,210	0,222	0,234	0,246	0,258		
	198	36	0,176	0,188	0,199	0,210	0,221	0,232	0,184	0,195	0,206	0,217	0,228	0,238	0,198	0,209	0,219	0,229	0,239	0,249		
250	198+48	36	0,143	0,154	0,165	0,176	0,186	0,197	0,149	0,160	0,171	0,181	0,192	0,202	0,162	0,173	0,183	0,193	0,203	0,213		
	246	36	0,145	0,155	0,165	0,174	0,184	0,193	0,151	0,161	0,171	0,180	0,189	0,199	0,164	0,173	0,182	0,190	0,199	0,207		
300	246+48	36	0,122	0,132	0,141	0,150	0,160	0,169	0,128	0,137	0,146	0,155	0,164	0,173	0,138	0,147	0,156	0,164	0,172	0,181		
	296	36	0,123	0,132	0,140	0,148	0,157	0,165	0,128	0,137	0,145	0,153	0,161	0,169	0,139	0,147	0,155	0,163	0,170	0,178		
350	296+48	36	0,106	0,114	0,122	0,130	0,138	0,147	0,111	0,119	0,127	0,135	0,142	0,150	0,120	0,128	0,135	0,143	0,150	0,158		
150	148	48	0,237	0,255	0,273	0,291	0,308	0,326	0,246	0,264	0,281	0,298	0,315	0,332	0,264	0,281	0,296	0,312	0,328	0,344	Without crossings 38 dB With crossings 43dB	REI30
200	148+48	48	0,189	0,198	0,214	0,230	0,246	0,262	0,188	0,205	0,220	0,235	0,251	0,266	0,203	0,219	0,234	0,249	0,264	0,279		
	198	48	0,194	0,201	0,216	0,231	0,246	0,261	0,192	0,207	0,221	0,236	0,250	0,264	0,206	0,221	0,234	0,247	0,261	0,274		
250	198+48	48	0,149	0,163	0,176	0,190	0,203	0,217	0,155	0,169	0,182	0,195	0,208	0,221	0,168	0,181	0,193	0,205	0,218	0,230		
	246	48	0,153	0,166	0,179	0,192	0,205	0,218	0,159	0,172	0,184	0,196	0,209	0,221	0,171	0,183	0,195	0,206	0,218	0,230		
300	246+48	48	0,127	0,139	0,151	0,163	0,175	0,186	0,132	0,145	0,156	0,167	0,179	0,190	0,143	0,155	0,166	0,177	0,188	0,199		
	296	48	0,130	0,141	0,152	0,163	0,174	0,185	0,135	0,146	0,156	0,167	0,178	0,188	0,145	0,156	0,166	0,176	0,186	0,196		
350	296+48	48	0,111	0,121	0,132	0,142	0,152	0,163	0,115	0,126	0,136	0,146	0,156	0,166	0,124	0,135	0,144	0,154	0,163	0,173		

BEAM STRUCTURE

Beam structure above uninsulated room of Masonite beam or timber. Timber is solid wood, glued laminated wood and LVL (laminated veneer lumber).

Beam structure
The beam structures are shown in the tables for each figure.



BEAM STRUCTURE	
Underfloor	22 mm Forestia chipboard floor
Floor beam	Masonite I-beam
Insulation	I-beam insulation with a thickness as the beam height of mineral wool, with U values in accordance with the table; other insulation must have documented fire characteristics.
Ceiling	23x48 laths, c/c 600 mm attached directly under the floor beams. One layer of 11 mm Focus MDF board, alternatively a layer of 12 mm Forestia chipboard, or a layer of 11 mm Huntonit wood fibreboard. 1) If 13 mm standard gypsum boards and rockwool insulation are used, the fire resistance is increased to REI30.

Fig. 1 Beam structure
Masonite floor beams, fully insulated with ceiling attached directly to the floor beams 1).

Above ground

Beam height and insulation thickness	U-values (W/m²K)				Fire resistance
	Insulation with heat conductivity				
	λ_d=0,032	λ_d=0,034	λ_d=0,037	λ_d=0,038	
200	0,172	0,180	0,192	0,196	REI15 1)
220	0,157	0,164	0,176	0,180	
250	0,139	0,146	0,156	0,159	
300	0,117	0,123	0,131	0,134	
350	0,101	0,106	0,113	0,116	
400	0,089	0,093	0,100	0,102	
450	0,079	0,083	0,089	0,091	
500	0,071	0,075	0,080	0,082	

Above cold room

Beam height and insulation thickness	U-values (W/m²K)				Fire resistance
	Insulation with heat conductivity				
	λ_d=0,032	λ_d=0,034	λ_d=0,037	λ_d=0,038	
200	0,168	0,175	0,187	0,191	REI15 1)
220	0,154	0,161	0,172	0,175	
250	0,136	0,143	0,153	0,156	
300	0,115	0,121	0,129	0,132	
350	0,099	0,104	0,112	0,114	
400	0,087	0,092	0,098	0,101	
450	0,078	0,082	0,088	0,090	
500	0,071	0,074	0,080	0,081	

BEAM STRUCTURE

BEAM STRUCTURE	
Underfloor	22 mm Forestia chipboard floor
Floor beam	Timber, glued laminated wood or LVL
Insulation	Insulation with a thickness as the beam height of mineral wool, with U values in accordance with the table; other insulation must have documented fire characteristics
Ceiling	23x48 laths, c/c 600 mm attached directly under the floor beams. One layer of 11 mm Focus MDF board, alternatively a layer of 12 mm Forestia chipboard, or a layer of 11 mm Huntonit wood fibreboard. 1) If 13 mm standard gypsum boards are used, the fire resistance is increased to REI30.

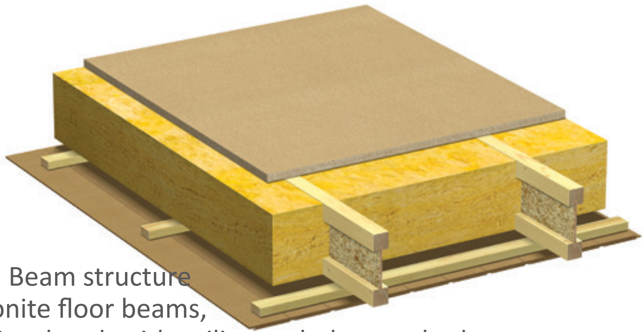


Fig. 2 Beam structure
Masonite floor beams, fully insulated, with ceiling on laths attached directly to the floor beams 1).

Above ground

Beam height and insulation thickness	U-values (W/m^{2}K)				Fire resistance
	Insulation with heat conductivity				
	λ_d=0,032	λ_d=0,034	λ_d=0,037	λ_d=0,038	
200	0,166	0,174		0,189	REI15 1)
220	0,152	0,159		0,174	
250	0,135	0,142		0,155	
300	0,114	0,120		0,131	
350	0,099	0,104		0,113	
400	0,087	0,091		0,100	
450	0,078	0,082		0,090	
500	0,070	0,074		0,081	

Above cold room

Beam height and insulation thickness	U-values (W/m^{2}K)				Fire resistance
	Insulation with heat conductivity				
	λ_d=0,032	λ_d=0,034	λ_d=0,037	λ_d=0,038	
200	0,162	0,170	0,181	0,185	REI15 1)
220	0,149	0,156	0,166	0,170	
250	0,133	0,139	0,149	0,152	
300	0,113	0,118	0,126	0,129	
350	0,098	0,102	0,109	0,112	
400	0,086	0,090	0,097	0,099	
450	0,077	0,081	0,087	0,088	
500	0,070	0,073	0,078	0,080	

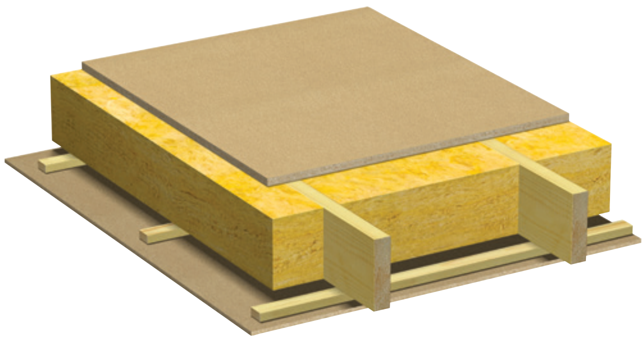


Fig. 3 Beam structure
Beam structure of timber floor beams, fully insulated with ceiling on laths directly to the floor beams 1).

BEAM STRUCTURE	
Underfloor	22 mm Forestia chipboard floor
Floor beam	Timber, glued laminated wood or LVL
Insulation	Insulation with a thickness as the beam height of mineral wool, with U values in accordance with the table; other insulation must have documented fire characteristics
Ceiling	23x48 laths, c/c 600 mm attached directly under the floor beams. One layer of 11 mm Focus MDF board, alternatively a layer of 12 mm Forestia chipboard, or a layer of 11 mm Huntonit wood fibreboard. 1) If 13 mm standard gypsum boards are used, the fire resistance is increased to REI30.

Above cold room

Beam height and insulation thickness	U-values (W/m^{2}K)				Fire resistance
	Insulation with heat conductivity				
	λ_d=0,032	λ_d=0,034	λ_d=0,037	λ_d=0,038	
200	0,168	0,175	0,186	0,189	REI15 1)
220	0,154	0,161	0,171	0,174	
250	0,138	0,144	0,153	0,156	
300	0,117	0,122	0,130	0,133	
350	0,102	0,106	0,113	0,115	
400	0,090	0,094	0,100	0,102	

1) Remark to Figure 1-3 beam structure.
If this is solely to fulfil fire requirements, 150 mm mineral wool is sufficient. The mineral wool must enclose the sides of the Masonite beam's bottom flange. When timber floor beams are used, or profiled I-beam insulation resting on the bottom flange is not used, the insulation must have steel wire protection to prevent it from falling down.

SOUND BEAM STRUCTURE

Airborne sound

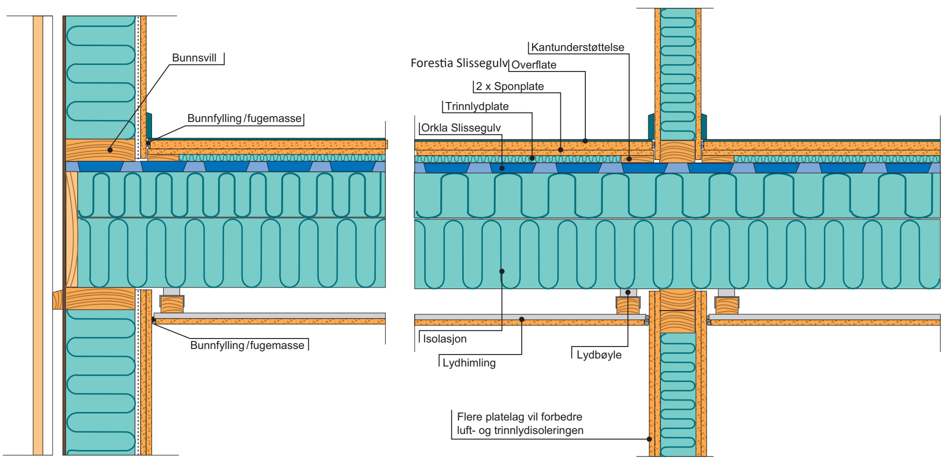
Airborne sound insulation for sound beam structure R`w, measured in dB. Airborne sound insulation is the field-measured reduction of airborne sound that can be expected through the separating floor in a final building. The higher the value, the better the airborne sound insulation. The field-measured value is subject to the requirements in the regulations. In the regulations, the airborne sound insulation is recommended not to be lower than 55 dB for separating floors in timber buildings with several storeys.

Impact sound

Impact sound insulation for sound beam structure, L`n,w, measured in dB. Impact sound insulation is the field-measured value of e.g. foot traffic on the separating floor that can be expected to penetrate through the structure in the final building. The lower the value, the better the reduction of impact sound. The field-measured value is subject to the requirements in the regulations. In the regulations, impact sound insulation is recommended to be equivalent to or less than 53 dB for separating floors in timber buildings with several storeys.

Fire resistance

Fire resistance is based on tests.



Airborne sound insulation, $R`_{w}+C_{50-5000}$	Impact sound insulation, $L`_{n,w}+C_{I,50-5000}$
≥55dB	≤53dB

Table showing limit values for sound class C according to NS 8175.

Fig. 1 Sound beam structure
General text/images about sound beam structures showing and describing requirements of sealing, edge support, minimum quality of standard gypsum boards and fire gypsum boards, etc.

The following should be observed in order to achieve the best possible sound prevention structure:

- The beam structure is recommended to be dimensioned in accordance with the beam structure table for the Comfort criterion, and account should be taken of any reduction factors for ceiling and underlay type.
- Light metering from beam structure tables should not be reduced because more rigid beam structures are better than less rigid, on audio-technical grounds.
- Follow the manufacturers' installation instructions on installing the ceiling, with the help of audio brackets and laths, or acoustic profiles. This is important so that these are subject to the right load/area, in order to function optimally.
- The ceiling must be built up with soundwave-reducing panels in minimum two layers.
- A floating floor on an impact-sound reducing underlay gives minimal flank transmission.
- An air-open subfloor (Forestia sound-reduction floor) is necessary to achieve maximum effect from the dampening layer (impact sound panels).
- In addition to the sound properties of the actual beam structure, account must also be taken of how other sound transmission routes may be limiting factors. There should be special focus on the link between the beam structure and other bearing structures. Very accurate sealing is required. This and other important elements are described in SINTEF Building Research, construction detail 522.511.

SOUND BEAM STRUCTURE

Beam structure

The beam structures are shown in the tables for each figure.

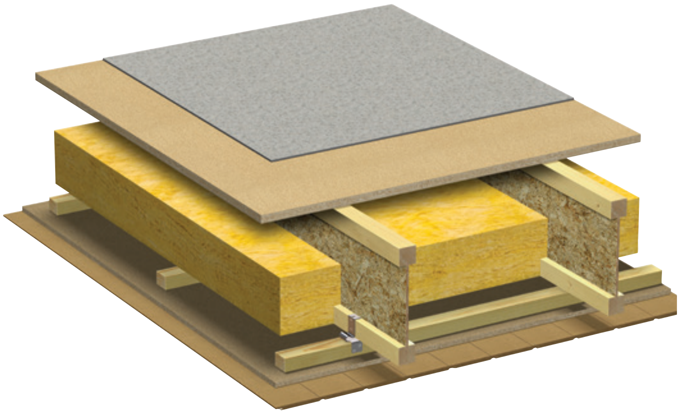


Fig. 2 Sound beam structure
Masonite floor beams with ceiling of two panel layers, see structure.

BEAM STRUCTURE	
Above underfloor	Surfacing
Underfloor	22 mm Forestia chipboard floor
Floor beam	Masonite I-beam
Insulation	Minimum 150 mm mineral wool. The mineral wool must enclose the sides of the Masonite beam's bottom flange. If profiled I-beam insulation resting on the bottom flange is not used, the insulation must be protected with steel wire from falling down.
Ceiling	Audio brackets, 30x48 laths c/c 600, one layer of 12 mm Forestia chipboard and one layer of 11 mm Huntonit wood fibreboard below. The bottom layer may alternatively be 12 mm Forestia chipboard or 11 mm Huntonit MDF.

Fire: REI 30
Impact sound: 65 dB
Airborne sound: 55 dB

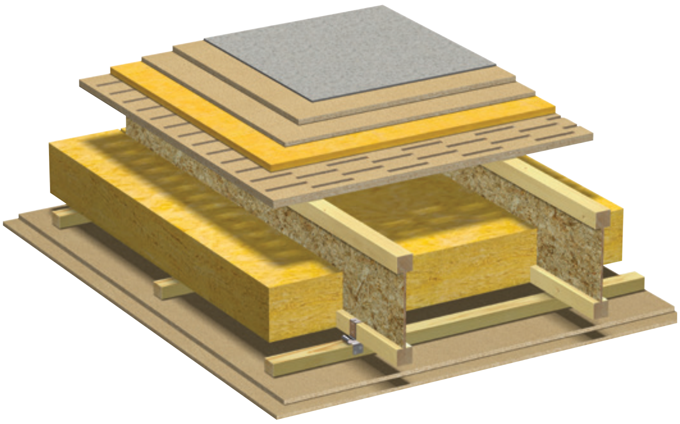


Fig. 3 Sound beam structure
Masonite floor beams with ceiling of two panel layers, see structure.

BEAM STRUCTURE	
Above underfloor	20 mm impact sound panel, 12 mm + 16 mm Forestia Chipboard and surfacing.
Underfloor	22 mm Forestia sound-reduction floor
Floor beam	Masonite I-beam
Insulation	Minimum 150 mm mineral wool. The mineral wool must enclose the sides of the Masonite beam's bottom flange. If profiled I-beam insulation resting on the bottom flange is not used, the insulation must be protected with steel wire from falling down.
Ceiling	Audio brackets, 30x48 laths c/c 600, one layer of 12 mm Forestia chipboard and one layer of 11 mm Huntonit wood fibreboard below.

Fire: REI 30
Impact sound: 48-50 dB
Airborne sound: 55 dB

SOUND BEAM STRUCTURE

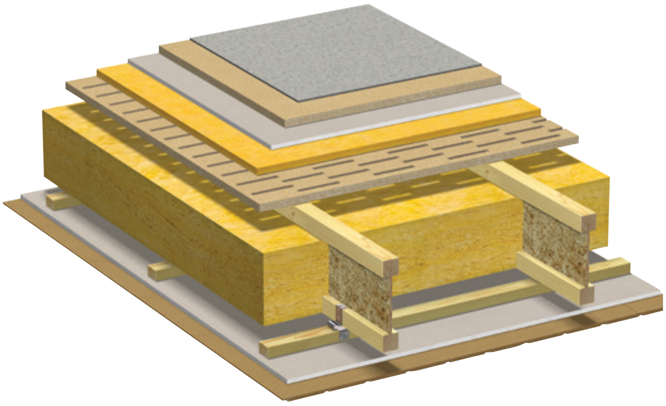


Fig. 4 Sound beam structure
Masonite floor beams with ceiling of two panel layers, see structure.

BEAM STRUCTURE	
Above underfloor	20 mm impact sound panel, 13 mm gypsum board panel, 22 mm Forestia Chipboard and surfacing.
Underfloor	22 mm Forestia sound-reduction floor
Floor beam	Masonite I-beam
Insulation	Minimum 150 mm mineral wool. The mineral wool must enclose the sides of the Masonite beam's bottom flange. If profiled I-beam insulation resting on the bottom flange is not used, the insulation must be protected with steel wire from falling down.
Ceiling	Audio brackets, 30x48 laths c/c 600, one layer of 13 mm gypsum board panel, and one layer of 11 mm Huntonit wood fibreboard below.

Fire: REI 30
Impact sound: 48-50 dB
Airborne sound: 55 dB

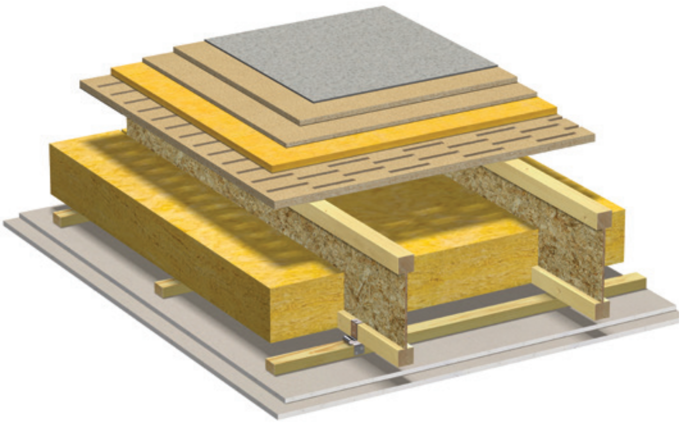


Fig. 5 Sound beam structure
Masonite floor beams with ceiling of two panel layers, see structure.

BEAM STRUCTURE	
Above underfloor	20 mm impact sound panel, 12 mm + 16 mm Forestia Chipboard and surfacing.
Underfloor	22 mm Forestia sound-reduction floor
Floor beam	Masonite I-beam
Insulation	Minimum 150 mm mineral wool. The mineral wool must enclose the sides of the Masonite beam's bottom flange. If profiled I-beam insulation resting on the bottom flange is not used, the insulation must be protected with steel wire from falling down.
Ceiling	Audio brackets, 30x48 laths c/c 400, one layer of 13 mm gypsum board panels and one layer of 15 mm fire gypsum boards below.

Fire: REI 60
Impact sound: 48-50 dB
Airborne sound: 55 dB

SOUND BEAM STRUCTURE

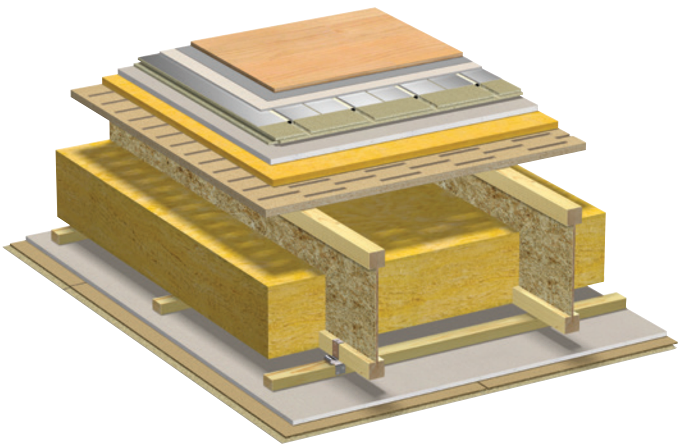


Fig. 6 Sound beam structure
Masonite floor beams with ceiling of two panel layers, see structure.

BEAM STRUCTURE	
Above underfloor	20 mm impact sound panel, 12 mm renovation floor, 22 mm Forestia Thermofloor, 3 mm Etafoam and parquet/laminate.
Underfloor	22 mm Forestia sound-reduction floor
Floor beam	Masonite I-beam
Insulation	Minimum 200 mm mineral wool. The mineral wool must enclose the sides of the Masonite beam's bottom flange. If profiled I-beam insulation resting on the bottom flange is not used, the insulation must be protected with steel wire from falling down.
Ceiling	Audio brackets, 30x48 laths c/c 600, one layer of 13 mm gypsum board panels and one layer of 12 mm Forestia Tak-Ess below.

Fire: REI 30
Impact sound: 50 dB
Airborne sound: 62 dB

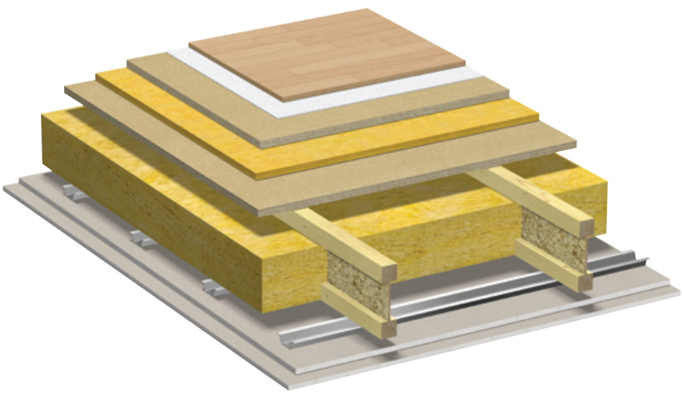


Fig. 7 Sound beam structure
Masonite floor beams with ceiling of two panel layers, see structure.

BEAM STRUCTURE	
Above underfloor	20 mm impact sound panel, 22 mm Forestia standard chipboard floor, 3 mm Etafoam, 14 mm parquet
Underfloor	22 mm Forestia standard chipboard floor
Floor beam	Masonite I-beam
Insulation	Minimum 150 mm mineral wool. The mineral wool must enclose the sides of the Masonite beam's bottom flange. If profiled I-beam insulation resting on the bottom flange is not used, the insulation must be protected with steel wire from falling down.
Ceiling	25 mm acoustic rail/c 400, one layer of 13 mm gypsum board, and one layer of fire gypsum board below.

Fire: REI 60
Impact sound: 48-50 dB
Airborne sound: 58 dB

SOUND BEAM STRUCTURE

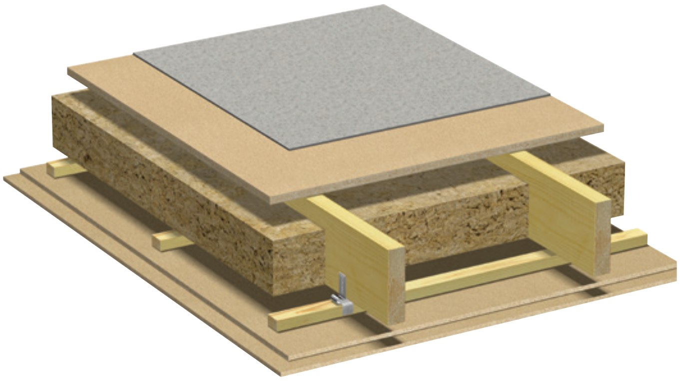


Fig. 8 Sound beam structure
Timber floor beams with ceiling of two panel layers, see structure.

BEAM STRUCTURE	
Above underfloor	Surfacing
Underfloor	22 mm Forestia chipboard floor
Floor beam	Timber floor beam, 48x198 mm
Insulation	Minimum 150 mm Rockwool mineral wool. The insulation is protected with steel wire from falling down.
Ceiling	Audio brackets, 30x48 laths c/c 600, two layers of 12 mm Forestia chipboard.

Fire: REI 60
Impact sound: 65 dB
Airborne sound: 55 dB

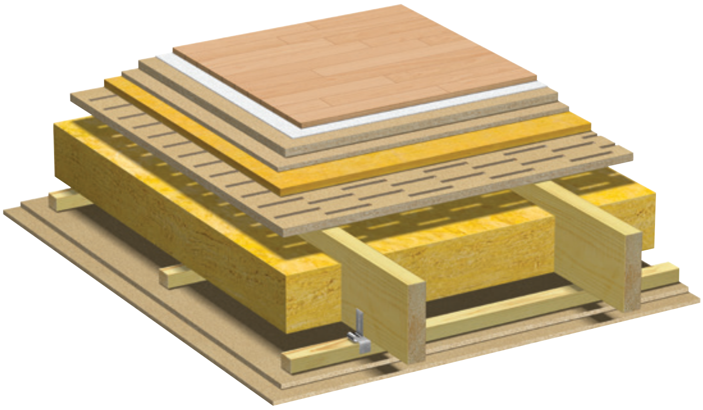


Fig. 9 Sound beam structure
Timber floor beams with ceiling of two panel layers, see structure.

BEAM STRUCTURE	
Above underfloor	20 mm impact sound panel, 22 mm Forestia standard chipboard floor, 3 mm Etafoam, 14 mm parquet
Underfloor	22 mm Forestia chipboard floor
Floor beam	Timber floor beam 48x198 mm
Insulation	Minimum 150 mm mineral wool. The insulation is protected with steel wire from falling down.
Ceiling	Audio brackets, 30x48 laths c/c 600, two layers of 12 mm Forestia chipboard.

Fire: REI 60
Impact sound: 48-50 dB
Airborne sound: 58 dB

SOUND BEAM STRUCTURE

A change in the execution described in the figures for sound beam structures would entail changes in the structures' fire and sound characteristics.

Two tables showing changes in the structure and consequences of this for the sound beam structure characteristics.

Figure nr.	Sound insulation (db)		Fire resistance	Remark
	Impact sound L`nw	Airborne sound R`w		
2	65	55	REI30	2), 3)
3	48-50	55	REI30	1), 2), 3)
4	48-50	55	REI30	1), 2), 3), 4)
5	48-50	55	REI60	
6	50	62	REI30	1), 2), 3), 5)
7	48-50	58	REI60	
8	65	55	REI60	3)
9	48-50	58	REI60	3)

Remark	Change	Impact sound L`nw	Airborne sound R`w	Fire resistance
1)	30x48 laths c/c 400. One layer of 13 mm gypsum board, and one layer of 15 mm fire gypsum board below.	As figure	As figure	REI60
2)	Change from the described timber-based panels in the ceiling to other panels of the Forestia chipboard, Huntonit wood fibreboard or Focus MDF type.	As figure	As figure	As figure
3)	Change from the described panels in the ceiling whereby one or both layers are standard gypsum boards.	As figure	As figure	As figure
4)	Impact sound moulding between double top sills.	48-51 dB	61 dB	As figure
5)	12 mm Forestia renovation floor and felt instead of 13 mm gypsum.	As figure	As figure	As figure

Example of changes in figure 6 sound beam structure:
Requirement to fulfil fire requirement REI60.
Footnote 1) Change to 30x48 laths c/c 400. One layer of 13 mm gypsum board, and one layer of 15 mm fire gypsum board below.

Example of changes in figure 2 sound beam structure:
Requirement to change ceiling panels to standard gypsum.
Footnote 3) the change gives no changes in relation to documented sound or fire characteristics.

COVERING

Sound and fire prevention characteristics of heavy separating floors of light clinker, cavity covering and concrete

The characteristics of heavy separating floors with floating floors of board materials on impact-sound dampening mineral wool layers are described in Building Research Design Guides 522.513 and 522.515. These details include tables and examples for calculation of impact sound and airborne sound, which also show the fire resistance.

Fig 1. Covering gives an example of a floating floor without panels in the fire resistant ceiling, and sound characteristics obtained from the Building Research Design Guides' construction details.

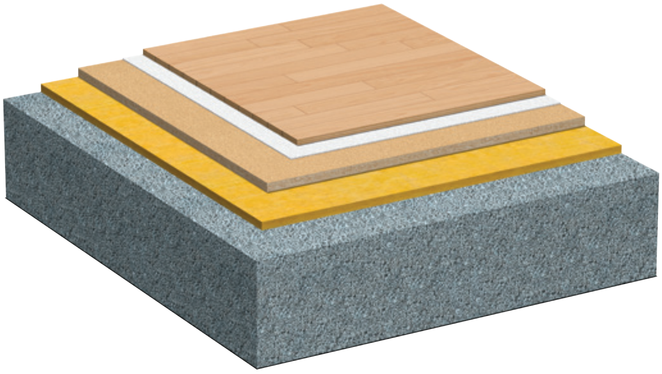


Fig. 1 Covering.
Floating floor on lightweight clinker.

BEAM STRUCTURE	
Upper covering	20 mm impact sound panel, 22 mm Forestia standard chipboard floor, 3 mm Etafoam and 14 mm parquet
Covering	Lightweight clinker, thickness of 200 mm + slurry. Small/ medium flank transmission.

Fire: REI 90
Impact sound: 53-57 dB
Airborne sound: 47-55 dB

WINDOW

Uldal windows and doors

EI-30 and EI-60 (fire retardant window)
Uldal produces fire retardant windows in class EI-30 as fixed sill, top swing and a combination of fixed and top swing in the same sill. EI-60 is produced ac fixed sill. The products are manufactured in the same sill/frame execution as our standard products.

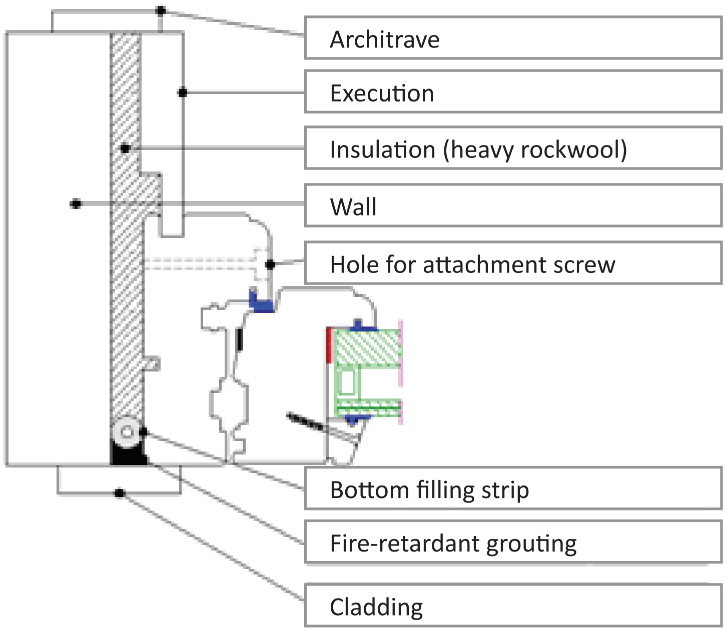
All products can be delivered with aluminium cladding as a supplement.

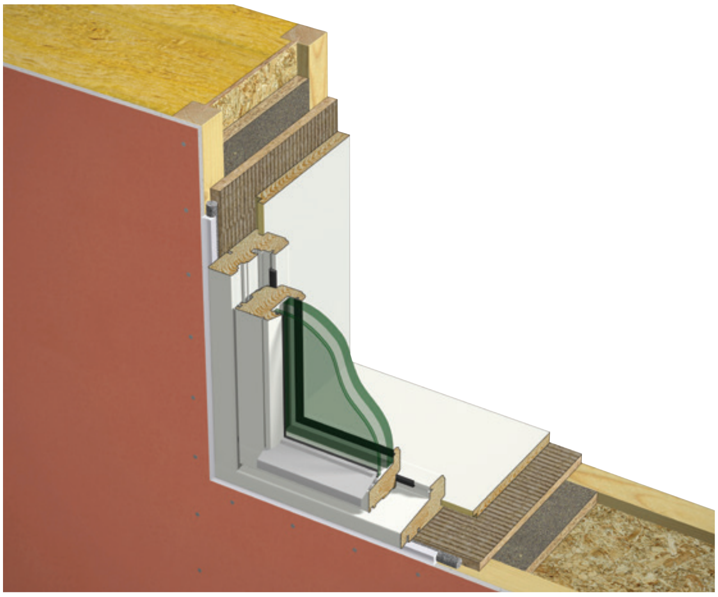
It must not be possible to open fire-resistant windows in ordinary use conditions.

A top-swing window in fire class EI-30 must not be used as a ventilation window. It must be possible to open an opening window with EI-30 approval for maintenance purposes.

Our top-swing windows are delivered with a lockable handle.

Outline drawing for correct sealing around an Uldal fire retardant window.





See Building Research Design Guides, construction details 523.701, concerning sealing of windows.

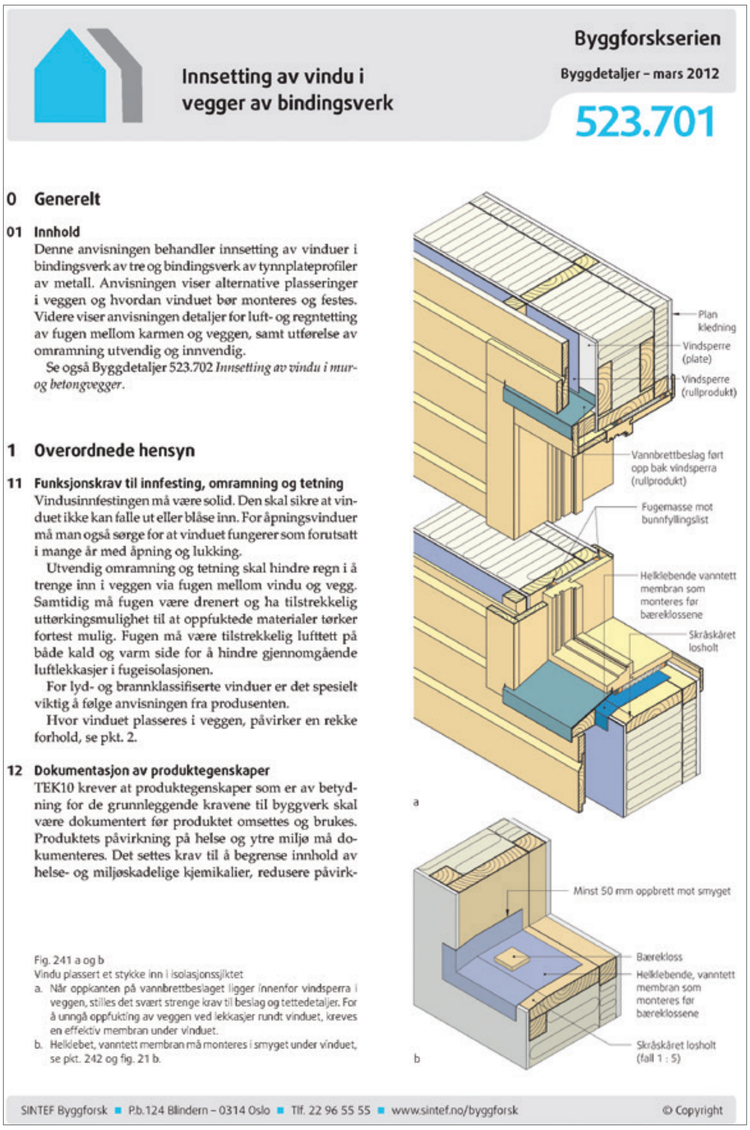
WINDOW

U value

Since 2009, Uldal has delivered windows with U values which are good enough for them to be used in passive buildings (u-0.8) without using extra sealing. Today, we use a laminated sill with a thickness of 115 mm.

A fixed sill can be delivered with a U value of 0.64 and the top-swing window can be delivered with a U value of 0.74. This is far better than the passive building requirement of 0.8.

(The figures are based on a reference window with the dimensions 1230x1480)



Innsetting av vindu i vegger av bindingsverk

Byggforskserien

Byggdetaljer – mars 2012

523.701

0 Generelt

01 Innhold

Denne anvisningen behandler innsetting av vinduer i bindingsverk av tre og bindingsverk av tynnplateprofiler av metall. Anvisningen viser alternative plasseringer i veggen og hvordan vinduet bør monteres og festes. Videre viser anvisningen detaljer for luft- og regntetting av fugen mellom karmen og veggen, samt utførelse av omramning utvendig og innvendig.

Se også Byggdetaljer 523.702 *Innsetting av vindu i mur- og betongvegger*.

1 Overordnede hensyn

11 Funksjonskrav til innfesting, omramning og tetning

Vindusinnfestingen må være solid. Den skal sikre at vinduet ikke kan falle ut eller blåse inn. For åpningsvinduer må man også sørge for at vinduet fungerer som forutsatt i mange år med åpning og lukking.

Utvendig omramning og tetning skal hindre regn i å trenge inn i veggen via fugen mellom vindu og vegg. Samtidig må fugen være drenert og ha tilstrekkelig uttørkingsmulighet til at oppfuktede materialer tørker fortest mulig. Fugen må være tilstrekkelig lufttett på både kald og varm side for å hindre gjennomgående luftlekkasjer i fugeisolasjonen.

For lyd- og brannklassifiserte vinduer er det spesielt viktig å følge anvisningen fra produsenten.

Hvor vinduet plasseres i veggen, påvirker en rekke forhold, se pkt. 2.

12 Dokumentasjon av produktegenskaper

TEK10 krever at produktegenskaper som er av betydning for de grunnleggende kravene til byggverk skal være dokumentert før produktet omsettes og brukes. Produktets påvirkning på helse og ytre miljø må dokumenteres. Det settes krav til å begrense innhold av helse- og miljøskadelige kjemikalier, redusere påvirk-

Fig. 241 a og b
Vindu plassert et stykke inn i isolasjonssjiktet
a. Når oppkanten på vannbrettbeslaget ligger innenfor vindsperra i veggen, stilles det svært strenge krav til beslag og tettedetaljer. For å unngå oppfukting av veggen ved lekkasjer rundt vinduet, kreves en effektiv membran under vinduet.
b. Helklebet, vanntett membran må monteres i smyget under vinduet, se pkt. 242 og fig. 21 b.

SINTEF Byggforsk ■ P.b.124 Blindern – 0314 Oslo ■ Tlf. 22 96 55 55 ■ www.sintef.no/byggforsk

See Building Research Design Guides, construction details 523.701, concerning sealing of windows.

WINDOW

Sound reduction

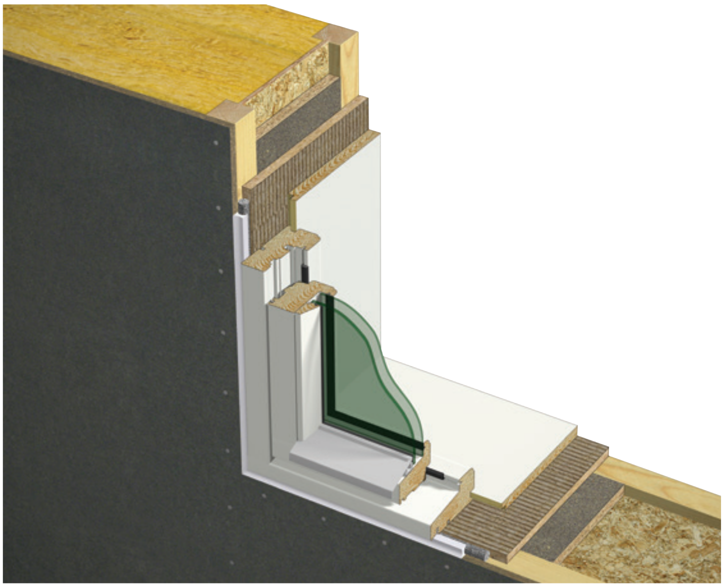
Sound reduction for windows is more and more common today since we often build more densely and closer to roads.

Uldal's standard window fulfils 32dB (C;-1dB, Ctr;-5dB)

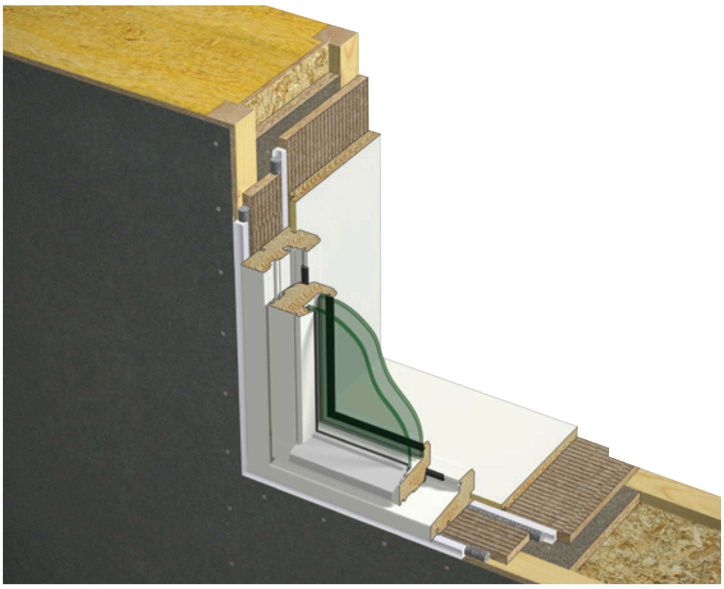
Windows can be delivered up to 43dB (C;-1dB, Ctr;-3dB)

Balcony doors can be delivered up to 42dB (C;-2dB, Ctr;-4dB)

(All values in accordance with reference sizes)



When the requirement of the window's sound insulation Rw+Ctr is lower than 32dB, it is recommended to insert the window and seal around it in accordance with Sintef construction details 523.701. (Standard installation).



When the requirement of the window's sound insulation Rw+Ctr is greater than 32dB, it is recommended to insert the window and seal around it in accordance with Sintef construction details 533.109.

FORESTIA HUNTONIT ULDAL MASONITE BEAMS