



Applications in timber construction, roofing and renovation work

Information for the timber trade, timber housing developers, carpenters, roofers and others working with wood

- The benefits of esb panels
- Wall structures
- Building physics calculations
- Sample calculations for static sheet action



The Solution for healthy climate, living and building





Technological advantages and availability

A better solution:

Size: tongue and groove

278.5 cm x 67.5 cm / coverage **)

258 cm x 67.5 cm / coverage

205 cm x 62.5 cm / coverage *)

*) Not including 30 mm thickness

***) 15 mm ex-stock

Size: flush

280 cm x 125 cm **)

259.5 cm x 125 cm *)

*) Not including 30 mm

***) 15 mm ex-stock

Large size: flush

520 cm x 206 cm *) in

9/12/15/18/22/25 mm

*) Supplied from 80 pcs per thickness

Material thickness/ pack quantities

12 mm 75 pcs

15 mm 60 pcs

18 mm 49 pcs

22 mm 40 pcs

25 mm 36 pcs

30 mm 30 pcs

Non-standard dimensions available upon request

Technological advantages:

- ✓ Bending strength and modulus of elasticity same in both directions
- ✓ Greater transverse tensile strength than OSB (approx. 40 % more)
- ✓ Less swelling than OSB

Advantages in application:

- ✓ Very light surface and appearance
- ✓ Domestic green wood with no odour emitted
- ✓ Same weight as OSB
- ✓ Meets IPPC standard ISPM No. 15 for wooden packaging
- ✓ Sanded finish and therefore:
 - Vapour-permeable
 - Adhesives, paints and varnishes can be applied
 - The surface is virtually sealed
 - The decorative and natural character of wood is shown
 - The boards have an extremely precise fit

At a glance:

- ✓ Building physics: vapour-permeable material (see WUFI® database)
- ✓ Excellent static values (complies with EN 12369 Part 1 and ISO/IEC 20000-1) and technical values (complies with EN 13986 and/or EN 312)
- ✓ Extremely precise fit
- ✓ Light sanded surface
- ✓ Green wood; no odour emitted
- ✓ Optimum value for money
- ✓ For general use in load-bearing structural components in humid conditions P5 EN 312

esb blog:

On our [esb blog](http://esb-blog.elka-holzwerke.de)

(esb-blog.elka-holzwerke.de – in German), we regularly publish examples of applications and questions from users.

We particularly welcome your posts with comments, questions and photos of applications.



Technical properties¹⁾

Thickness [mm]	9	12	15	12 / 15		18	22 / 25	18 - 25		30
Type	ESB P5			OSB 2	OSB 3	ESB P5		OSB 2	OSB 3	ESB P5
Transverse tensile strength [N/mm ²]	>0,45	>0,45	>0,45	>0,32		>0,45	>0,40	>0,30		>0,35
Bending strength lengthwise [N/mm ²]	>18	>18	>16	>20		>16	>14	>18		>12
Bending strength crosswise [N/mm ²]	>18	>18	>16	>10		>16	>14	>9		>12
24 hr swelling [%]	<13	<11	<10	<20	<15	<10	<10	<20	<15	<10

¹⁾ The technical properties given for esb are in accordance with EN 312 and for OSB in accordance with DIN 300; the actual values under DIN 300 for esb panels are significantly better. Thermal conductivity $\lambda = 0.10$ W/mK, **Water vapour diffusion resistance factor (μ) dry/humid = 25/25**

The esb panel used as a wood-based material in the construction industry is listed in Section 1.3.2.1 of the German Building Rules B [Bauregelliste B] Part 1 and therefore complies with German building regulations.



5 compelling advantages of esb panels



Why are esb panels better than OSB panels?

Due to their excellent static (EN 12369 Part 1 and ISO/IEC 20000-1) and technical values (EN 13986 and/or EN 312), esb is suitable for constructing floors, wall and roof panelling, hoardings, shop fittings and building trade fair stands, interior fittings, structurally effective ceiling, roof and wall panels in timber frame construction and in packaging.

esb's technical properties in detail:

Bending strength and modulus of elasticity:

The bending strength and modulus of elasticity of esb panels are the same in both directions, unlike OSB panels where the value is halved across the width.

Your advantage: Trade professionals can exploit the blank panel to the optimum extent.

No mistakes as a result of confusing the main and minor axes occur when working with esb panels.

Transverse tensile strength:

The transverse tensile strength is 40 % greater than for an OSB panel.

Your advantage: It produces better screw and nail extraction rates.

Swelling values:

The swelling values are considerably lower than for OSB panels.

Your advantage: The panels provide a high level of dimensional stability for processing.

A superb appearance with a sanded finish:

esb panels have a very bright surface and a clean appearance as a result of using green wood. esb panels are supplied ready sanded.

Your advantage: There's no need for any further processing or sanding.



Can esb panels be varnished?

Yes, certainly. As esb panels are thoroughly sanded and have a virtually impermeable surface, vapour-permeable varnishes - as well as paints and adhesives - can be applied. This is not possible with OSB panels which are not sanded.



Can esb panels cause unpleasant odours indoors?

No, not at all. esb panels are largely odour-neutral and support a healthy home environment.

On the other hand, OSB panels can under certain circumstances release volatile organic compounds such as hydrocarbons, aldehydes, acetones and organic acids into the atmosphere. Unpleasant odours, irritation of the mucous membranes and toxic long-term effects are listed by Germany's environmental protection agency, the Umweltbundesamt, in its research project on the "Measurement of VOC emissions from OSB panels-UMID 1 2013" as possible effects.



What is the significance of the vapour-permeable quality of esb panels?

Just as heat always travels from the warm to the cold side, a process of compensation also takes place between areas with different levels of humidity. In ensuring that this function continues unhindered, a combination of vapour retarders and our vapour-permeable esb panels represents an intelligent solution. The panels prevent condensation from building up - and therefore damage that would otherwise be caused to the building by damp.

esb panels are a vapour-permeable wood-based material that equalises variations in the atmosphere indoors. esb panels have proved to be valuable on external walls as well, e.g. as a support for rear ventilated formwork or used in conjunction with

vapour-permeable heat insulation. When used in this way, esb panels ensure that moisture is transported through the thickness of the wall. For a vapour-impermeable construction, an additional film is fitted on the warmer side to act as a vapour retarder. This technology has been successfully used for decades in the prefabricated housing sector.

We suggest that a review of the building physics is carried out for the structure where esb panels are intended for use without a vapour barrier.



What do esb panels cost?

Normally esb panels are cheaper than OSB panels. The price depends on current timber prices and the quantity ordered.

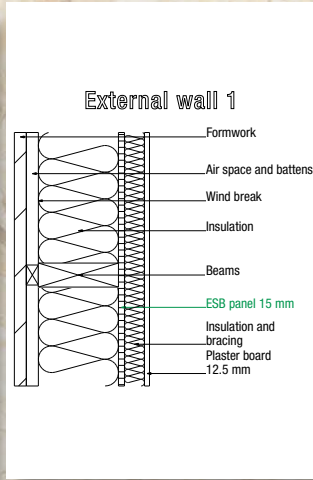
As they have a wide range of application, esb panels can replace particleboards P2, P3, P5, OSB/2, OSB/3 and vapour-permeable wood fibre panels.

IN SHORT: esb – the all-round talent with lots of advantages!

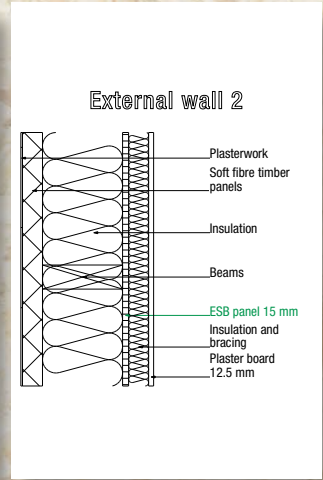
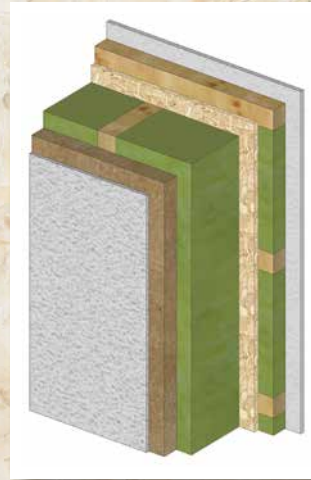
esb panels (P5) are fabricated in accordance with EN 312. They can be supplied in FSC®-certified and/or PEFC-certified quality and carry the CE mark of conformity.



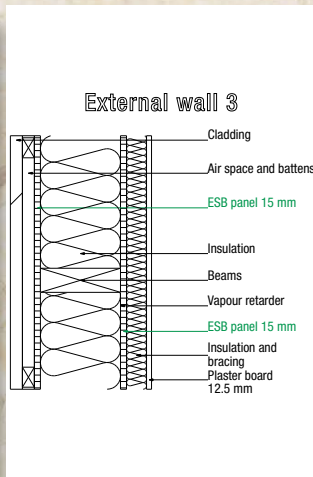
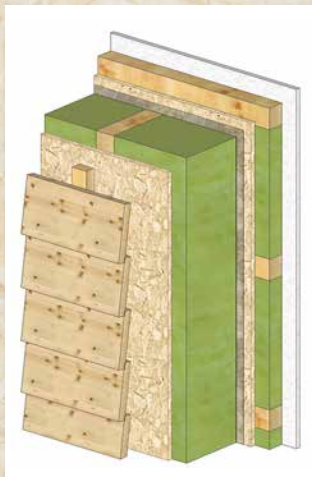
External wall construction applications



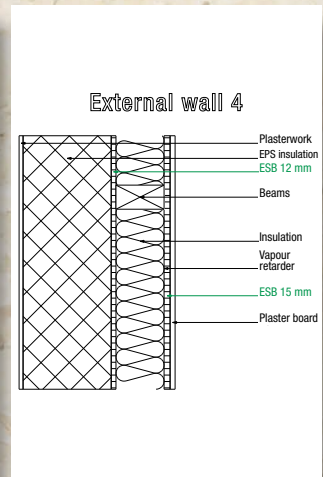
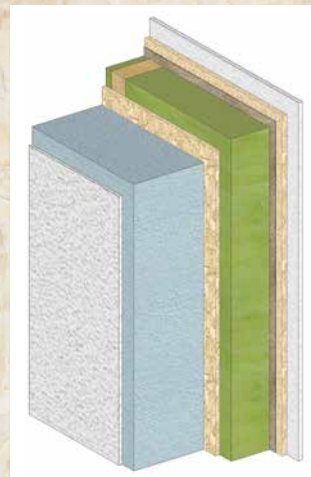
Example: External wall 1 (vapour-permeable structure)





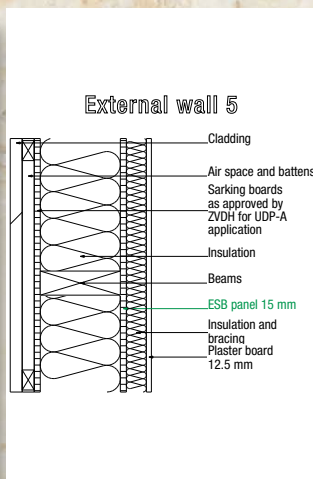
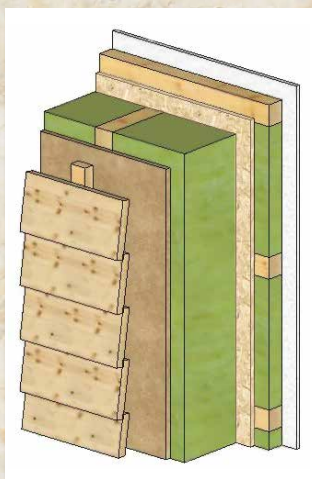
Example: External wall 2 (vapour-permeable structure)



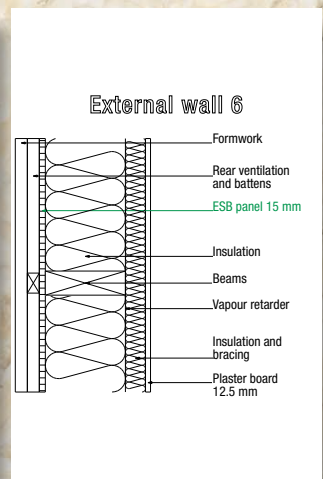
Example: External wall 3



Example: External wall 4 – thermal insulation composite system, e.g. in accordance with approval no. Z-33.47-811 (sto ) or no. Z-33.47-859 () (simplified version) under German general building regulations.

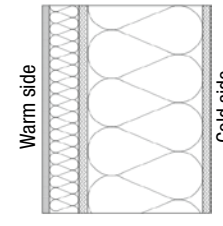


Example: External wall 5



Example: External wall 6

Sample building physics calculation for external wall 3

Material	Density [kg/m³]	Thickness s [mm]	λ W/mK	R [m²K/W]	Diff. res.		
Air transition warm side RSi 0.13							
1 Plaster board DIN 18180	D 900,0	12,50	0,210	0,060	8		
2 Mineral wool insulation 035	D 50,0	50,00	0,035	1,429	1		
3 ESB	D 600,0	15,00	0,140	0,107	24		
4 PE film vapour retarder	1100,0	0,20	0,200	0,001	100 000		
5 Mineral wool insulation 035	D 50,0	200,00	0,035	5,714	1		
6 ESB	D 600,0	12,00	0,140	0,086	24		
Air transition cold side RSe 0.08							
Thickness = 289.7 mm		Surface weight = 40.2 kg/m²		R = 7,40 m²K/W		U-value = 0.131 W/m²K	

Heat transmission calculation

Data calculated:

Thermal resistance R	7.40 [m²K/W]
Thermal resistance R _t	7.61 [m²K/W]

Heat transition coefficient – U-value	0.13 [W/m²K]
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Minimum thermal protection

Assessment of thermal protection in accordance with DIN 4108-2:2003-7 lightweight construction elements (<100 kg/m³): the thermal resistance of the entire element is used for assessment purposes

Surface weight used in calculation	40.2 Kg/m²
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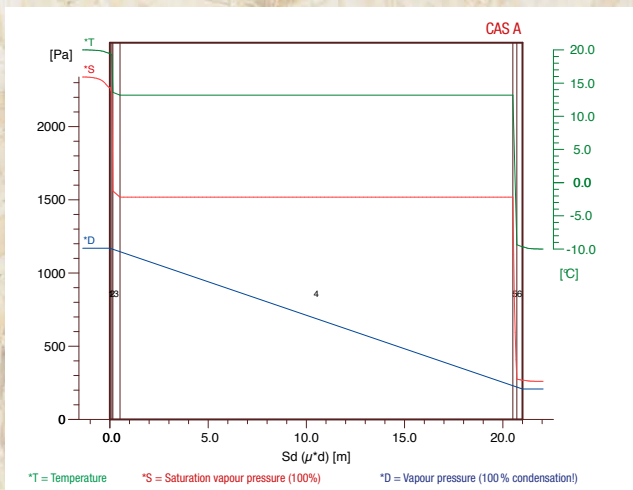
R on least favourable side	7.396 m²K/W
Minimum value for R	1.750 m²K/W

DIN 4108-2:2003-7 requirements are met
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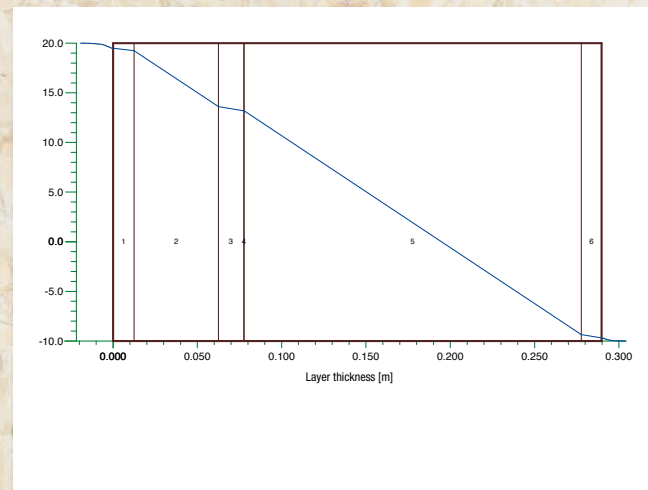
Vapour diffusion parameters

	Warm side	Cold side
Dew period:		
Air temperature	20,0 °C	-10,0 °C
Relative humidity	50,0 %	80,0 %
Length of dew period	1440 hours	
Vapourisation period:		
Air temperature	12,0 °C	12,0 °C
Relative humidity	70,0 %	70,0 %
Length of vapourisation period	2160 hours	
Roof temperature	---- °C	
Element calculated as wall		
Result of DIN 4108-compliant investigation: CASE A		
Structure is OK. No condensation forms		

Verification for individual elements (heat transmission and vapour diffusion calculation) in accordance with DIN 4108 and EN ISO 6946

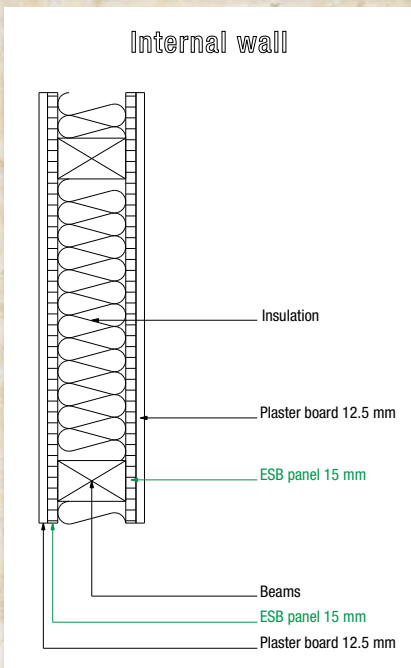


Dew period vapour pressure curve according to Glaser



Temperature curve for layered structure

Internal wall construction applications

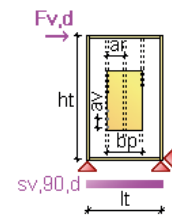


Example: Internal wall structure

Measurement/load-bearing capacity

Detailed evidence

ESB internal wall Wall panels according to EN 1995



Use class = 1 gamma.m timber = 1,30 Exposure time = short
 Board system: Panel edges attached with shear connections on all sides
 Panelling on both sides, butt joints spaced at least one rib apart

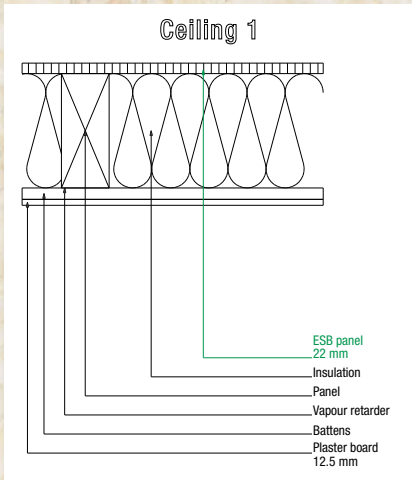
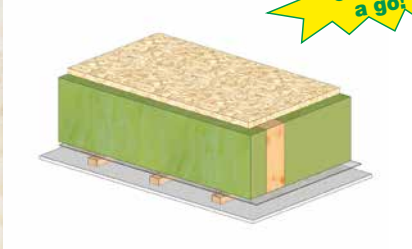
Length of board	lt	=	5.00	m
Height of board	ht	=	2.50	m
Horizontal load	Fv,d	=	10.00	kN
Horizontal shear lag	sv,0,d	=	2.00	N/mm
Normal force in edge rib from horizontal load	Fd	=	5.00	kN
Pressure force edge rib-bottom rib from horizontal load	Fc,r,d	=	-3.35	kN
Pressure force internal rib-bottom rib from horizontal load	Ec,i,d	=	-1.00	kN

External panelling:						
Panel	bp(cm)	tp(mm)	Rho(kg/m³)	kmod		
P5 > 13-20 mm	125.00	15.0	600.00	0.85		
Internal rib	br(cm)	hr(cm)	Rho(kg/m³)	kmod		
C24	6.00	10.0	350.00	0.90		
Nail	My,k(Nmm)	d(mm)	l(mm)			
Na 25x60	1949.47	2.5	60.0			
Nail tolerance:			gamma.m clou =	1.10		
			t,req(cm)	fh,k(N/mm²)		
Panel			1.8	44.87		
Internal rib			2.5	21.80		
	a2(cm)	erf.s(cm)	vh.s(cm)	erf.l(cm)	vh.l(cm)	1,2*Rd,ges(kN)
	1.8	1.0	4.5	2.5	6.0	0.43
	vh.av(cm)	ar(cm)	kv1	kv2	fv,d(N/mm²)	fv,0,d(N/mm²)
	10.0	65.0	1.00	0.50	4.25	4.33
					erf.av =	43.27 cm
					vh.av/erf.av =	0.23

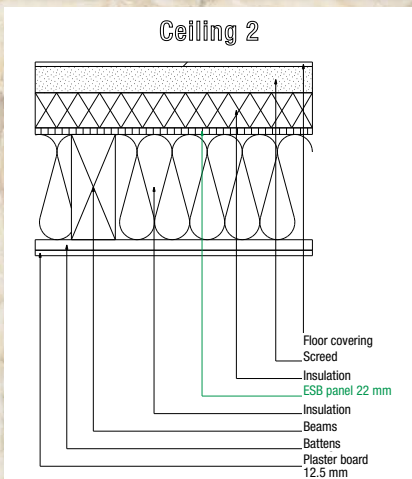
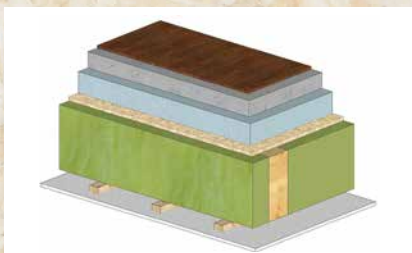
Internal panelling:						
Panel	bp(cm)	tp(mm)	Rho(kg/m³)	kmod		
P5 > 13-20mm	125.00	15.0	600.00	0.85		
Internal rib	br(cm)	hr(cm)	Rho(kg/m³)	kmod		
C24	6.00	10.0	350.00	0.90		
Nail	My,k(Nmm)	d(mm)	l(mm)			
Na 25x60	1949.47	2.5	60.0			
Nail tolerance:			gamma.m clou =	1.10		
			t,req(cm)	fh,k(N/mm²)		
Panel			1.8	44.87		
Internal rib			2.5	21.80		
	a2(cm)	erf.s(cm)	vh.s(cm)	erf.l(cm)	vh.l(cm)	1,2*Rd,ges(kN)
	1.8	1.0	4.5	2.5	6.0	0.43
	vh.av(cm)	ar(cm)	kv1	kv2	fv,d(N/mm²)	fv,0,d(N/mm²)
	10.0	65.0	1.00	0.50	4.25	4.33
					erf.av =	43.27 cm
					vh.av/erf.av =	0.23
					sv,0,d/(fv,0,d,extérieur+fv,0,d,intérieur) =	0.23

Example: Static sheet calculation for internal wall

Ceiling construction applications



Example: Internal ceiling construction in unheated room

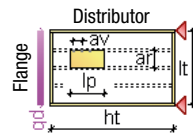


Example: Internal ceiling construction in heated room

Measurement/load-bearing capacity

Detailed evidence

ESB ceiling Roof and ceiling boards in accordance with EN 1995



Use class = 1 gamma.m timber = 1.30 Exposure time = medium
 Board system: Single-span girder, load applied on one side in direction of internal ribs
 Panel edges attached with shear connections not on all sides
 Panelling on one side, butt joints spaced at least one rib apart

Board span	lt	=	5.00 m
Height of board	ht	=	10.00 m
Calculated height of board	htr	=	5.00 m
Load	qd	=	5.00 kN/m
Shearing force	Vd	=	12.50 kN
Shear lag	sv,0,d	=	2.50 N/mm
Moment	Md	=	15.63 kNm
Flange force to be verified (Md/htr)	Zd	=	3.13 kN
Flange force to be transferred (Md/htr)	Gd	=	1.56 kN
Supporting force to be transferred and verified	Ad	=	12.50 kN

Panelling:				
Panel	lp(cm)	tp(mm)	Rho(kg/m ³)	kmod
P5 > 20-25mm	250.00	22.0	550.00	0.65
Internal rib	br(cm)	hr(cm)	Rho(kg/m ³)	kmod
C24	12.00	20.0	350.00	0.80
Nail	My,k(Nmm)	d(mm)	l(mm)	
Na 31x70	3410.46	3.1	70.0	

Nail tolerance:				gamma.m clou =	1.10
				t,req(cm)	Rd(kN)
Panel				2.2	40.11
Internal rib				3.1	20.44
a2(cm)	erf.s(cm)	vh.s(cm)	erf.l(cm)	vh.l(cm)	Rd,ges(kN)
2.8	1.2	4.8	3.4	7.0	0.48
vh.av(cm)	ar(cm)	kv1	kv2	fv,d(N/mm ²)	fv,0,d(N/mm ²)
10.0	62.5	0.66	0.33	2.95	3.19
				erf.av =	19.32 cm
				vh.av/erf.av =	0.52
				sv,0,d/fv,0,d =	0.78
Flange	bg(cm)	hg(cm)	ft,0,d(N/mm ²)		kmod
C24	12.00	20.00	8.62		0.80
				Zd/bg*hg/ft,0,d =	0.02
Distributor	bg(cm)	hg(cm)	fc,0,d(N/mm ²)		kmod
C24	12.00	20.00	12.92		0.80
				Ad/bv*hv/fc,0,d =	0.04

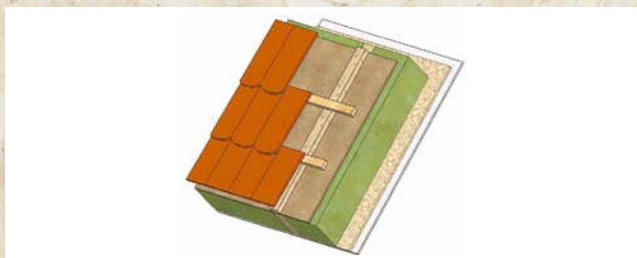
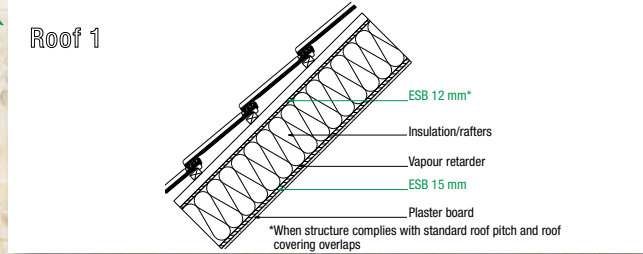
Example: Static sheet calculation for ceiling



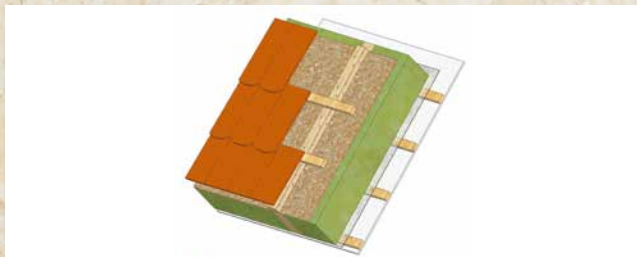
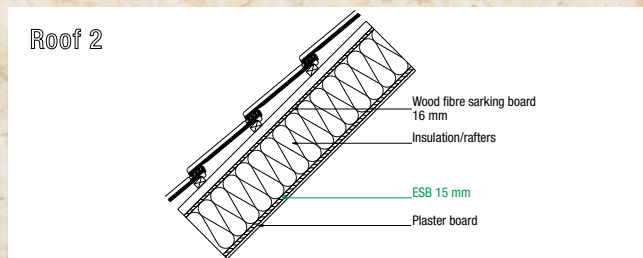
Roof construction applications



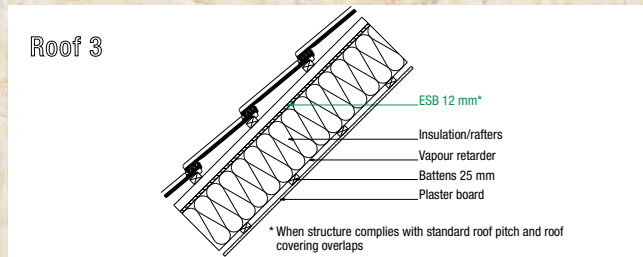
Example: Roof structure 1 (esb panel providing a high degree of reinforcement)



Example: Roof structure 2 (wood fibre sarking board providing no reinforcement)



Example: Roof structure 3 (esb panel providing a high degree of reinforcement)



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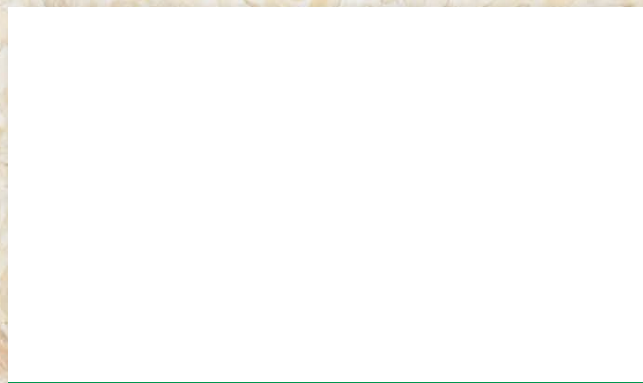
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