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Solid Structural Timber (KVH®) and Glued Solid Timber (Duobalken®, Triobalken®)

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1 _ A high-precision material

Building with wood has a very long tradition. Man has used wood for his buildings and structures for thousands of years. Buildings and structures from bygone centuries and still used today prove the durability as well as the high residential value of wooden structures.

Better than required by the standard

Residential structures have to meet high requirements concerning safety and comfort. The buildings are expected to provide good thermal insulation in winter, heat protection in summer as well as noise protection at any time. The building materials used are to be harmless under ecological and health aspects, while building elements that remain visible are to create an aesthetically pleasing appearance which need little maintenance. Besides, modern timber construction nowadays requires dimensionally stable and accurate as well as kiln-dried solid timber products. The changed production technology in the carpentry businesses that often employs CNC-controlled assembly systems requires a clearly defined material for a smooth production process.

The above-mentioned requirements concerning solid timber products are reflected in stricter standards. The requirements set out in the agreements on solid structural timber (KVH®) [1] and glued solid timber (Duobalken®/Triobalken®) [2] are clearly far more stringent than those in the related standards, as will be shown below.

Technological advantage

The development of (KVH®) Structural Timber along with the glued solid timber (Duobalken® and Triobalken®) has led to the availability of precise materials that are dried gently, are dimensionally accurate, planed or levelled and are available off the shelf in many different dimensions and lengths. KVH® as well as Duobalken® and Triobalken® are protected trademarks.

Monitored quality

The internal quality control of solid structural timber KVH® is governed by the stringent rules of the Überwachungsgemeinschaft KVH® (KVH® quality surveillance organization), while the individual companies are additionally and regularly supervised by external and independent inspection bodies. The supervision conditions of the Überwachungsgemeinschaft KVH are laid down in the agreement with Holzbau Deutschland (Holzbau Deutschland – Bund Deutscher Zimmermeister [Association of German Carpenters]).

KVH® solid structural timber (structural finger-jointed timber) pursuant to EN 15497:2014 [3]

Visually or automatically strength-graded, kiln-dried and planed or levelled [1] solid timber with defined dimensional accuracy for use in visible and concealed areas. KVH® is usually finger-jointed and 13 m long. Larger sizes are available on request. KVH® satisfies the requirements of EN 15497 (for structural finger-jointed timber) or of EN 14081-1 [4] (for structural solid timber not finger-jointed). Moreover, the compliance with the additional requirements stipulated in the agreement about solid structural timber is monitored by internal and external inspection.

1) levelled:
after drying brought to the required dimensions by planing, without guaranteeing a smooth surface

Duobalken® and Triobalken® (glued solid timber) pursuant to EN 14080:2013 [5] or the general technical approval Z-9.1-440 [6]

Cross section of the solid timber combined from two to nine single boards with identical cross sections glued together. The lamellas are usually finger-jointed. The Duobalken® and Triobalken® beams are usually 13 m long. Larger sizes are available on request. Duobalken® and Triobalken® are produced pursuant to EN 14080:2013 with a height of up to 280 mm and up to six individual cross sections, or in accordance with the German general technical approval Z-9.1-440 [6] with a height of up to 420 mm up to nine individual cross sections. Inquiries about quality requirements exceeding the standard, such as requirements concerning the surface, can be addressed in accordance with the agreement about Duobalken® and Triobalken® to Holzbau Deutschland. As is the case with KVH®, the compliance with these additional quality requirements is monitored in the course of internal and external inspections by independent institutions.

Sustainability

Wood has exhibits significant ecological advantages compared to other building materials. Apart from the unique feature of wood being the only very renewable structural building material, it is reasons such as the short haulage distances, the easy processing and zero-waste production that render the manufacture of a structural timber element far less energy-intensive than functionally equivalent building elements made of other materials.

More detailed information can be found in the environmental product declarations (EPD) [7], [8] on the homepage www.kvh.eu

Precise pre-fabrication and energy-saving construction

The small dimensional tolerances of KVH®, Duobalken ® and Triobalken® (see also Tables 3.1 through 3.4) is an important prerequisite for the efficient machining of timber in the wood construction industry. It would not be possible without these types of timber products to employ cost-saving CNC-controlled machines and to achieve such a high degree of pre-fabrication.

Well insulated buildings require a permanent air-tightness of the building shell. The building elements must therefore be produced in such a way that they fit accurately. Dimensional changes due to moisture must not affect the air-tightness. High-tech timber, such as KVH® and glued solid timber (Duobalken® and Triobalken®), ensure air-tight and thus energy-saving timber structures with a high level of heat insulation.

2 _ Production and technical characteristics

For the production of KVH® and glued solid timber (Duobalken® and Triobalken®), softwood, usually spruce, is converted to rough beams on state-of-the-art chipper and circular saw lines. The waste wood from the processing, such as bark, chopped wood and chips, is completely recycled and used for the generation of power, in the paper production or for producing derived timber materials.

After having been dried in fully automatic computer-controlled kilns, the timber is strength graded. Growth non-conformities which could reduce the strength of the product are cut out of the beams. The individual cross-sections thus generated are then re-joined with so-called finger joints at the ends, so that, theoretically, infinitely long strings can be obtained. After the finger jointing (subject to length, this can be dispensed with on request), the pieces of timber are cut to length and planed or levelled to an exact size.

For glued solid timber (Duobalken® and Triobalken®) this is followed by gluing two to nine single lamellas together, so that an overall cross-section is achieved; all this is planed once more. The products thus gained are cured and stored in air-conditioned storage facilities, so as to ensure that the beams are dry and dimensionally stable, before they are delivered. Every stage of production is subject to permanent quality controls (internal and external inspections by independent institutions).

Table 2.1

Species, strength classes and building physics characteristics

Technical characteristics	Solid structural timber (KVH®)	Glued solid timber (Duobalken®/ Triobalken®)
Species	Spruce also fir, pine, larch, Douglas fir on request	Spruce also fir, pine, larch, Douglas fir on request
Strength class pursuant to DIN EN 338 [9] Grading class pursuant to DIN 4074-1 [10][1]	C24/S10 TS[2] or C24/S10 K[3] TS[2] or C24 M[4] TS[2]	C24/S10 TS[2] or C24/S10 K[3] TS[2] or C24 M[4] TS[2]
Moisture content u_m [5]	15 % ± 3 %	≤ 15 %
Swelling and shrinkage ratio	0,24 % per 1 % change of moisture content	0,24 % per 1 % change of moisture content
Reaction to fire class pursuant to DIN EN 13501-1 [11]	D-s2, d0	D-s2, d0
Thermal conductivity λ pursuant to DIN 4108-4 [12]	0,13 W/(mK)	0,13 W/(mK)
Water vapour diffusion resistance factor μ pursuant to DIN 4108-4 [12]	40	40

1) For other European grading standards an allocation of the national grading classes to strength class C24 can be taken from EN 1912:2013 [13]. The note concerning the grading standard can be disregarded for the machine strength grading.
2) The identifier "TS" stands for "dry-graded", i.e. for the grading at a moisture content of $u_m \leq 20$ %, which is required by German building regulations.
3) The identifier "K" marks a board or plank graded like a scantling.
4) The identifier "M" marks machine strength grading.
5) In practice, the mean moisture content um is decisive for assessing the wood moisture, with u_m being the arithmetical mean value of the measuring results obtained from each piece of wood with the electrodes having an insertion depth of 5 mm each (surface moisture), of half of the wood thickness (core moisture) and of a third of the wood thickness (mean wood moisture).

3 _ Requirements and fields of application

3.1 _ Application of KVH® for structures dimensioned pursuant to EN 1995-1-1 (Eurocode 5)

Solid structural timber – KVH®

Sub-section 3.2 „Solid timber" of EN 1995-1-1:2010 [14] demands, on the one hand, strength grading pursuant to EN 14081-1 and finger joints pursuant to EN 385 [15], on the other. Structural finger-jointed timber, such as KVH®, can basically be used in those fields of application, where the use of solid timber is also permitted. There is an additional restriction for structural finger-jointed timber in as much, as it must only be used in service classes 1 and 2.

The above-mentioned EN 385 was withdrawn in September 2013 and has been replaced by EN 15497: 2014.

EN 15497 regulates the performance and production requirements of finger-jointed structural timber with rectangular cross sections made from certain coniferous species. Solid structural timber KVH® is structural finger-jointed timber which is subject to additional requirements concerning the dimensional tolerances and the surface quality.

When using EN 15497, the regulations effective in the countries of the EU regarding the use of the products, which are found in the national annexes to Eurocode 5, are to be considered in application standards or building regulations.

The European product standard EN 14081-1 is applicable to KVH® that is not finger-jointed.

In addition to the above-mentioned requirements imposed by the construction supervision authorities, solid structural timber KVH® must satisfy the additional requirements of the agreement on solid structural timber; see also Table 3.1 and Table 3.2.

Fields of application for KVH®

Finger-jointed KVH® must only be used in service classes 1 and 2 pursuant to EN 1995-1-1 (see Table 3.5) in structures that are not prone to fatigue.

It is produced with adhesives of type I pursuant to EN 301 [16] or EN 15425 [17] and clearly remains below the limit for formaldehyde emissions class E1 (formaldehyde emission ≤ 0.124 mg/m³ of air). The usability of KVH® with a different natural durability or with preservative treatment is regulated at national level.

KVH® not finger-jointed with the relevant natural durability can also be used in service class 3.

Table 3.1

Requirements to be met by solid structural timber KVH® according to the surveillance regulations and the agreement between Holzbau Deutschland – Bund Deutscher Zimmermeister (BDZ) [Association of German Carpenters] and the Überwachungsgemeinschaft Konstruktionsvollholz [Organization for the Quality Control of Solid Structural Timber] when using DIN 4074-1[10] or ÖNORM 4074 -1 [22]

Grading criterion	Requirements to be met by KVH®		Remarks
	Visible application (KVH®-Si)	**Non-visible application (KVH®-NSi)**	
Technical rule	Finger-jointed KVH®: EN 15497:2014 [3] Non-finger-jointed KVH®: EN 14081-1:2011 [4]	Finger-jointed KVH®: EN 15497:2014 [3] Non-finger-jointed KVH®: EN 14081-1:2011 [4]	
Strength class pursuant to EN 338 [9]	At least C24M	At least C24M	Strength classes other than C24 are to be agreed on separately. For the design according to EC 5, the strength, stiffness, and bulk density properties determining the structural capacity can be found in EN 338 [9], Table 1.
Sorting standard for visual sorting [1)]	DIN 4074-1 [10] or ÖNORM 4074-1 [22] (same content)	DIN 4074-1 [10] or ÖNORM 4074-1 [22] (same content)	The elastomechanical properties according to EN 338 can be found in Table 5.4 of this document.
Moisture content	15% ± 3% Kiln-dried: wood dried for at least 48 h to a moisture content of u ≤ 20% in a process-controlled technical plant that is suitable for this purpose at a temperature of T ≥ 55°C.	15% ± 3% Kiln-dried: wood dried for at least 48 h to a moisture content of u ≤ 20% in a process-controlled technical plant that is suitable for this purpose at a temperature of T ≥ 55°C.	The specified moisture content is a prerequisite for dispensing with a preventive preservative treatment to a large extent and may also be a precondition for finger joint assembly.
Type of cutting	Cutting in such a way that the pith of an ideally grown log is cut through in two strands On request: a heart plank with $d \geq 40$ mm is removed	Cutting in such a way that the pith of an ideally grown log is cut through in two strands	
Wane	Not admissible	≤ 10% of the smaller cross-section side	Wood wane measured obliquely according to DIN 4074-1
Dimensional tolerances of the cross section	EN 336 [19] Tolerance class 2: b ≤ 100 mm: ±1 mm b >100 mm: ± 1.5 mm	EN 336 [19] Tolerance class 2: b ≤ 100 mm: ±1 mm b >100 mm: ± 1.5 mm	The dimensional tolerance for longitudinal dimensions will have to be agreed between customer and supplier

1) The German national sorting standard DIN 4074-1 meets the requirements of EN 14081-1, which is referred to as the decisive sorting standard for solid timber by EN 1995-1-1. EN 1912 can be used to assign the national grading classes for scantling and board or plank used as scantling to the European strength classes defined in EN 338.

Continuation of Table 3.1

Grading criterion	Requirements to be met by KVH®		Remarks
	Visible application (KVH®-Si)	**Non-visible application (KVH®-NSi)**	
Knot conditions	Loose knots and dead knots are not admissible; occasional faulty knots or parts of knots up to a maximum diameter d of 20 mm are permitted	Pursuant to DIN 4074-1 grading class S10	Replacement with wooden dowels is permitted
Knots	S10: A ≤ 2/5 must not exceed 70 mm	S10: A ≤ 2/5 must not exceed 70 mm	The knottiness A measured pursuant to DIN 4074-1. Applicable in the case of machine grading: • knot size can be disregarded for KVH®-NSi • A ≤ 2/5 is applicable for KVH®-Si
Ingrown bark	Not admissible	DIN 4074-1	
Cracks, radial shrinkage cracks (dry cracks)	Crack width b ≤ 3% of the relevant cross-section width; must not exceed 6 mm	Crack width b ≤ 5% of the relevant cross-section width	Crack width b related to the relevant side of the cross section without restrictions as to the length or the number of cracks
Crack depth (shrinkage cracks)	Up to 1/2 of the width	Up to 1/2 of the width	Measured pursuant to DIN 4074-1
Crack depth (cracks caused by lightning; ring shakes)	Not admissible	Not admissible	
Pitch pockets	Width b ≤ 5 mm		Additional criterion
Discoloration	Not admissible	Blue stains: admissible	Measured pursuant to DIN 4074-1
		Nailable brown and red stripes: up to 2/5	
		Blight, white rot: not admissible	
Insect attack	Not admissible	Grooves up to a diameter of 2 mm admissible	According to DIN 4074-1
Longitudinal warping	For split-heart cut: ≤ 8 mm / 2 m When the heart plank is cut out: ≤ 4 mm / 2 m	For split-heart cut: ≤ 8 mm / 2 m	For comparison: Pursuant to DIN 4074-1 S10: ≤ 8 mm / 2 m
Finishing of the ends	Trimmed perpendicularly (according to arrangement)	Trimmed perpendicularly (according to arrangement)	
Surface quality	Planed and chamfered	Levelled and chamfered	

Table 3.2

Requirements to be met by solid structural timber KVH®

when using a national sorting standard other than DIN 4074-1 [10] or ÖNORM 4074-1 [22]

Grading criterion	Requirements to be met by KVH®		Remarks
	Visible application (KVH®-Si)	**Non-visible application (KVH®-NSi)**	
Technical rule	Finger-jointed KVH®: EN 15497:2014 [3] Non-finger-jointed KVH®: EN 14081-1:2011 [4]	Finger-jointed KVH®: EN 15497:2014 [3] Non-finger-jointed KVH®: EN 14081-1:2011 [4]	
Strength class pursuant to EN 338 [9]	C24, C24M	C24, C24M	Other strength classes need to be agreed separately
Moisture content	15% ± 3% Kiln-dried: wood dried for at least 48 h to a moisture content of u ≤ 20% in a process-controlled technical plant that is suitable for this purpose at a temperature of T ≥ 55°C	15% ± 3% Kiln-dried: wood dried for at least 48 h to a moisture content of u ≤ 20% in a process-controlled technical plant that is suitable for this purpose at a temperature of T ≥ 55°C	The specified moisture content is a prerequisite for dispensing with a preventive preservative treatment to a large extent and may also be a precondition for finger joint assembly.
Type of cutting	Cutting in such a way that the pith of an ideally grown log is cut through in two strands. On request: a heart plank with $d \geq 40$ mm is removed	Cutting in such a way that the pith of an ideally grown log is cut through in two strands	
Wane	Not admissible	≤ 10% of the smaller cross-section side	
Dimensional tolerances of the cross section	EN 336 [19] Tolerance class 2: ≤ 10 cm: ±1 mm >10cm and ≤ 30 cm: ± 1.5 mm	EN 336 [19] Tolerance class 2: ≤ 10 cm: ±1 mm > 10cm and ≤ 30 cm: ± 1.5 mm	The dimensional tolerance for longitudinal dimensions will have to be agreed between customer and supplier
Knot conditions	Loose knots and dead knots are not admissible; occasional faulty knots or parts of knots up to a maximum diameter d of 20 mm are permitted		

Continuation of Table 3.2

Grading criterion	Requirements to be met by KVH®		Remarks
	Visible application (KVH®-Si)	**Non-visible application (KVH®-NSi)**	
Knots	Must not exceed 70 mm	Must not exceed 70 mm	Applicable in the case of machine grading: • knot size can be disregarded for KVH®-NSi • $A \leq 2/5$ is applicable for KVH®-Si (knottiness A measured pursuant to DIN 4074-1)
Ingrown bark	Not admissible		Bark will be added to the knot
Cracks	Crack width $b \leq 3\%$ Must not exceed 6 mm	Crack width $b \leq 5\%$	Crack width b related to the relevant side of the cross section without restrictions as to the length or the number of cracks
Pitch pockets	Width $b \leq 5$ mm	Width $b \leq 5$ mm	Without restriction to the length or number of pitch pockets
Discoloration	Not admissible	Blue stains: admissible	Measured pursuant to DIN 4074-1
		Nailable brown and red stripes: up to 2/5	
		Blight, white rot: not admissible	
Insect attack	Not admissible	Grooves up to a diameter of 2 mm admissible	Measured pursuant to DIN 4074-1
Twisting	1 mm per 25 mm height	1 mm per 25 mm height	Measured pursuant to DIN 4074-1
Longitudinal warping	≤ 8 mm / 2 m When the heart plank is cut out: ≤ 4 mm / 2 m	≤ 8 mm / 2 m	Pursuant to DIN 4074-1
Finishing of the ends	Trimmed perpendicular	Trimmed perpendicular	
Surface quality	Planed and chamfered	Levelled and chamfered	

3.2 _ Duobalken® / Triobalken® – Glued solid timber for structures dimensioned pursuant to EN 1995-1-1 (Eurocode 5)

Glued solid timber is not mentioned in EN 1995-1-1, since it has not yet been subject of a European regulation at the time of printing this standard. Glued solid timber is usually used, when KVH® proves to be uneconomical due to large cross sections.

The following glued solid timbers exist:
– glued solid timber pursuant to the general technical approval Z-9.1-440
or
– glued solid timber pursuant to EN 14080:2013

Glued solid timbers are distinguished depending on the dimensions of their lamellas and cross sections and the arrangement of the lamellas of different strength classes in the cross section.

The permissible overall cross-sectional dimensions *B/H* of the glued solid timber and the cross-sectional dimensions *b/d* of the lamellas can be found in the following list. *B* stands for the width, *H* for the height perpendicular to the adhesive joint. The thickness *d* of the individual lamellas is also specified.

1) Produced from lamellas with a strength class C24 or higher.
2) Universal finger jointing is only permitted in glued solid timber produced from two lamellas glued together.
3) The individual pieces of wood must be separated at the core.
4) External lamellas with a strength class of C24, internal lamellas with a strength class of C18.
5) Dimensions post-sawing.

1) Glued solid timber produced from two to five lamellas glued together pursuant to EN 14080:2013
$B \leq 280$ mm
$90 < H \leq 280$ mm
$45 < d \leq 85$ mm

2) Glued solid timber produced from two lamellas glued together and universally finger-jointed pursuant to Z-9.1-440 [1) 2)]
$B \leq 260$ mm
$H \leq 160$ mm
$20 \leq d \leq 80$ mm

3) Glued solid timber produced from three lamellas glued together along their narrow sides pursuant to Z-9.1-440 [1) 3)]
$60 \leq B \leq 100$ mm
$60 < H \leq 360$ mm
$20 < d \leq 120$ mm
$b \leq 100$ mm

4) Homogeneous glued solid timber without a separating cut [1)] and glued solid timber containing lamellas of different strength classes [4)] with larger height pursuant to Z-9.1-440 produced from up to nine lamellas glued together
$60 \leq B \leq 240$ mm
$280 < H \leq 420$ mm
$45 < d \leq 80$ mm

5) Homogeneous resawn glued solid timber pursuant to Z-9.1-440 [3) 5)]
produced from up to nine lamellas glued together
$60 \leq B \leq 120$ mm
$90 < H \leq 420$ mm
$45 < d \leq 85$ mm

The individual pieces of wood can be connected in the longitudinal direction by finger jointing pursuant to EN 15497.

Glued solid timber pursuant to EN 14080:2013 may only be made from softwood or poplar.

Table 3.3

Requirements to be met by the overall cross section according to the agreement on Duobalken®/Triobalken®

Grading criterion	Requirements to be met by Duobalken®/Triobalken®		Remarks
	Visible application (Si)	**Non-visible application (NSi)**	
Technical rule	EN 14080:2013 [5] or general technical approval Z-9.1-440 [6]	EN 14080:2013 [5] or general technical approval Z-9.1-440 [6]	
Strength class pursuant to EN 338 [9]	At least C24 or C24M	At least C24 or C24M	Other strength classes need to be agreed separately. The strength, stiffness, and bulk density properties determining the structural capacity can be found in EN 14080:2013 or the general technical approval Z-9.1-440.
Moisture content	Maximum 15%	Maximum 15%	Precondition for gluing
Dimensional tolerances of the cross section	EN 336 [19] Tolerance class 2: $b \leq 10$ cm = ± 1,0 mm, $b > 10$ cm and ≤ 30 cm = ±1,5 mm	EN 336 [19] Tolerance class 2: $b \leq 10$ cm = ± 1,0 mm, $b > 10$ cm and ≤ 30 cm = ±1,5 mm	The dimensional tolerances for longitudinal dimensions are to be agreed between customer and supplier
Twisting	≤ 4 mm / 2 m	≤ 4 mm / 2 m	For comparison: DIN 4074-1; S10: ≤ 8 mm / 2 m
Longitudinal warping	≤ 4 mm / 2 m	≤ 4 mm / 2 m	For comparison: DIN 4074-1; S10: ≤ 8 mm / 2 m
Surface quality	Planed and chamfered	Levelled and chamfered	The right-hand sides (sides adjacent to the heart) must face outwards
Finishing of the ends	Trimmed perpendicular	Trimmed perpendicular	
Gluing of the wood including finger jointing	Pursuant to EN 14080:2013 or the general technical approval Z-9.1-440	Pursuant to EN 14080:2013 or the general technical approval Z-9.1-440	

Table 3.4
Requirements to be met according to the agreement on Duobalken®/ Triobalken® that refer to the visible surfaces of the individual pieces of wood

Grading criterion	Requirements to be met by Duobalken®/ Triobalken®		Remarks
	Visible application (KVH®-Si)	**Non-visible application (KVH®-NSi)**	
Type of cutting	Cutting in such a way that the pith of an ideally grown log is cut through in two strands On request: a heart plank with $d \geq 40$ mm is removed	Cutting in such a way that the pith of an ideally grown log is cut through in two strands	
Wane	Not admissible	Not admissible	
Knot conditions (on the visible sides of the lamellas)	Loose knots and dead knots are not admissible; occasional faulty knots or parts of knots up to a maximum diameter d of 20 mm are permitted	Pursuant to DIN 4074-1	Replacement with wooden dowels is permitted. In Si max. 2 pieces side by side
Knots, knottiness	S10: $A \leq 2/5$ S13: $A \leq 1/5$ Must not exceed 70 mm	S10: $A \leq 2/5$ S13: $A \leq 1/5$ Must not exceed 70 mm	Knotiness pursuant to DIN 4074-1 Applicable in the case of machine grading: • knot size can be disregarded for NSi • $A \leq 2/5$ is applicable for Si
Ingrown bark	Not admissible		Bark will be added to the knot
Cracks – radial shrinkage cracks (dry cracks)	Crack width $b \leq 2\%$ of the relevant side of the cross section of the individual lamellas; must not exceed 4 mm	DIN 4074-1	For Si higher requirements than for grading class S10 pursuant to DIN 4074-1
Pitch pockets	Width $b \leq 5$ mm	Width $b \leq 5$ mm	
Discoloration	Not admissible	Blue stains: admissible	DIN 4074-1
		Nailable brown and red stripes: up to 2/5	
		Blight, white rot: not admissible	
Insect attack	Not admissible	Grooves up to a diameter of 2 mm admissible	DIN 4074-1

Table 3.5
Service classes

Service classes (SC) pursuant to EN 1995-1-1[1)]	**Mean wood moisture content u_m**	**Description**
SC 1	≤ 12 %	Service class 1 is characterized by a moisture content in the building materials that corresponds to a temperature of 20° C and a relative humidity in the ambient air that exceeds a value of 65 % for a few weeks in the year only.
SC 2	≤ 20 %	Service class 2 is characterized by a moisture content in the building materials that corresponds to a temperature of 20° C and a relative humidity in the ambient air that exceeds a value of 85 % for a few weeks in the year only.
SC 3	> 20 %	Service class 3 covers climatic conditions resulting in a moisture content higher than that in service class 2.

When needed, the requirements of EN 14080:2013 or the technical approval Z-9.1-440 can be overridden and glued solid timber that meet the additional requirements of the agreement on Duobalken®/Triobalken® can be ordered; see Tables 3.3 and 3.4.

Fields of application for Duobalken® and Triobalken®

Duobalken® and Triobalken® beams may be used in service classes 1 and 2 as defined in EN 1995-1-1 (see Table 3.5). Extreme alternating thermal stresses are to be avoided.

4 _ Product range and preferred cross sections

KVH®, Duobalken® and Triobalken® beams made of the species spruce are available in a wide range of cross-sections for immediate delivery from stock. The species pine and fir as well as the more moisture-resistant species larch and Douglas fir are available on request.

In the following sections, reference is only made to homogeneous glued solid timber (Duobalken®/Triobalken®) of strength class C24 or higher.

Cost savings with preferred cross sections
Preferred cross sections in the construction dimensions typically used in timber construction facilitate considerable cost savings. The stocks of timber held by timber wholesalers save businesses specializing in timber construction from maintaining extensive stocks themselves and give them planning freedom without tying down operating capital. Industrial production systems enable manufacturers to produce at low costs.

Timber also supplied cut to special dimensions as listed
The organization of production is so flexible that it is also possible to supply lengths cut to specific building-related dimensions "as listed". This means that dried and dimensionally stable timber can also be supplied to places, where job-order planning is the preferred option.

Dimensions
The maximum available cross-sectional dimensions of KVH® are limited by the kiln-drying and the minimum split-heart cutting requirements. With maximum dimensions of approx. 14/24 cm, KVH® is capable of meeting most requirements, such as those concerning the cross sections for ceiling beams. For larger cross sections and higher requirements in terms of appearance, Duobalken® and Triobalken® beams are available, the cross-sectional dimensions of which are subject to the limits set by the general technical approval.

KVH®	b/h ≤ 14/24 cm
Duobalken®	b/h ≤ 16/28 cm (pursuant to EN 14080 or the technical approval)
Triobalken®	b/h ≤ 24/28 cm (pursuant to EN 14080 or the technical approval) b/h ≤ 10/36 cm (only according to the technical approval)
Glued solid timber (not resawn)	up to 28/28 cm (pursuant to EN 14080) up to 24/42 cm (pursuant to the technical approval)

Table 4.1

Preferred cross sections for solid structural timber KVH® NSi made from spruce/fir of strength class C24/C24M

Height (mm)	100	120	140	160	180	200	220	240
Width (mm)								
60	•	•	•	•	•	•	•	•
80		•		•	•	•	•	•
100	•			•		•		•
120		•		•		•		•
140			•					

- No cross sections with a width of more than 140 mm because of the technical drying process. The use of glued solid timber or glued laminated timber is recommended for widths larger than 140 mm.
- Cross sections for other species (e.g. pine, Douglas fir, larch) on request.
- Cross sections in visual quality (Si) on request.
- Other strength classes than C24/C24M on request

Table 4.2

Preferred cross sections for Duobalken®/ Triobalken® for spruce/fir (Si and NSi) and pine (NSi)

Height (mm)	100	120	140	160	180	200	220	240
Width (mm)								
60	•	•	•	•	•	•	•	•
80	•	•	•	• ○	• ○	• ○	•	•
100	•	•	• ○	• ○	• ○	• ○	• ○	• ○
120		• ○		• ○	• ○	• ○	• ○	• ○
140			• ○	• ○	• ○	• ○	• ○	• ○
160				• ○		• ○	• ○	• ○
180					• ○	• ○	• ○	• ○
200						• ○	• ○	• ○
240								•

● = NSi non-visible application ○ = Si visible application

- As regards the load-bearing capacity of homogeneous glued solid timber, it is irrelevant whether the glue joint runs horizontally or vertically. If a specific orientation is required, it must be stated when placing the order.
- Preferred cross sections for other wood species, for beams consisting of lamellas of different strengths or for resawn glued solid timber on request

5 _ Design pursuant to EN 1995-1-1 (Eurocode 5-1-1)

5.1 _ General

General matters concerning Eurocode 5: Design of timber structures – Part 1-1: General – Common rules and rules for building – The current status as regards the development of the Eurocodes

The European Design standards, the so-called Eurocodes, have been developed since the mid-1970s and have become effective all over Europe in the meantime. In Germany, the Eurocodes have been published as European standards EN 1990 – EN 1999.

The following parts of Eurocode 5 have been developed for timber construction:

- EN 1995-1-1: 2010 in conjunction with EN 1995-1-1/A2:2014 – Eurocode 5: Design of timber structures – Part 1-1: General – Common rules and rules for buildings
- EN 1995-1-2 [20] 2010 – Eurocode 5: Design of timber structures – Part 1-2: General – Structural fire design
- EN 1995-2 [21]: 2010 – Eurocode 5: Design of timber structures – Part 2: Bridges

The Eurocodes contain so-called nationally determined parameters (NDPs). The EU countries are permitted to draw up national annexes for the implementation and application of the Eurocodes. These appendices stipulate national parameters, e.g. partial safety factors for load and material parameters, so as to enable the national construction supervision authorities to ensure the required national safety level.

The NDPs are determined in a National Annex (NA) to each part of the relevant Eurocode. Apart from the NDPs, the National Annexes may also contain complementary regulations and explanations that do not contradict the Eurocode (non-contradictory complementary information = NCI). The National Annexes are marked in the set of German standards by the suffix "/NA" that complement the number of the relevant standard. For example, DIN EN 1995-1-1/NA is the German Annex to DIN EN 1995-1-1 (Eurocode 5).

The safety concept of the partial safety factors

When verifying the load-bearing capacity it must be checked that the design values[1)] of the strain (E_d) do not exceed in any design situation the design values of the stress resistance (building component resistance R_d). The design values are determined by multiplying the characteristic[2)] impacts from permanent and variable loads (G_k and Q_k, respectively) with the partial safety factors γ_G or γ_Q. Similarly, the characteristic building component resistance R_k is reduced by a partial safety factor γ_M of the material.

[1)] Design values are marked with index d (design)

[2)] Characteristic values are marked with index k

Verification:	$E_d \leq R_d$
Design values for loads:	$E_d = \gamma_G \cdot G_k + \gamma_Q \cdot Q_k$
Design values for strenghts and resistances:	$R_d = \frac{k_{mod} \cdot R_k}{\gamma_M}$

For the verification of the ultimate limit states, the factor k_{mod}, a so-called modification factor, is used to consider the specific properties of wood as a function of the prevailing climatic conditions and the load duration. The climatic conditions are defined within the framework of the service classes; see Table 3.5.

For the verification of the serviceability limit states, the relevant deformation factors k_{def} are used, allowing for the consideration of the different creep behaviours of wood and other timber-derived products.

The material's partial safety factors γ_M, the modification factors k_{mod} as well as the deformation factors k_{def} can initially be taken from EN 1995-1-1. Values from EN 1995-1-1 shall only be applicable, if the relevant national annex of the country in which the structure is built does not specify any other values.

Table 5.1
Factors γ_M, k_{mod} and k_{def}, an example for Germany

Factors	DIN EN 1995-1-1	DIN EN 1995-1-1/NA [18] (National Annex of Germany) [1]				
Partial safety factor γ_M	DIN EN 1995:2010, Table 2.3 does not apply!	Applicable are: DIN EN 1995-1-1/NA:2013, Table NA.2 and Table NA.3 [2] $\gamma_U = 1{,}3$				
Modification factor k_{mod}	DIN EN 1995:2010, Table 3.1	Additionally applicable: DIN EN 1995-1-1/NA:2013, Table NA.4 [2]				
		DOL class	**permanent**	**long-term**	**medium-term**	**short-term**	**instantaneous**
		SC 1	0,6	0,7	0,8	0,9	1,1
		SC 2	0,6	0,7	0,8	0,9	1,1
		SC 3 [3]	0,5	0,55	0,65	0,7	0,9
Deformation factor k_{def}	DIN EN 1995:2010, Table 3.2	Additionally applicable: DIN EN 1995-1-1/NA:2013, Table NA.5 [2]				
		SC 1			0,6		
		SC 2			0,8		
		SC 3 [3]			2		

1) The national annexes of the other EU countries may contain other regulations which are to be considered
2) Additional values for glued solid timber, cross-laminated timber, solid wood panels, gypsum boards, gypsum fibreboards, cement-bonded wood chipboards
3) Only for non-finger-jointed KVH

Characteristic strength and stiffness properties and their marking

As regards the design of structural solid timber that is not finger-jointed, the Eurocode 5-1-1 makes reference to the harmonized European product standard EN 14081-1. It is additionally demanded for structural finger-jointed timber that the finger joints must conform to EN 385. EN 385 has since been withdrawn.

Finger-jointed solid wood is now regulated according to the European product standard EN 15497, which has replaced EN 385 regarding finger jointing. The European product regulations are listed in Table 5.2.

The product "glued solid timber" (generic term for Duobalken® and Triobalken®) which is regulated according to EN 14080 is not defined in EN 1995-1-1; it is usually dimensioned like solid timber.

Table 5.2
Europäische Produktregelungen

Product	Product regulations
Non-finger-jointed structural timber	EN 14081-1
Structural finger-jointed timber	EN 15497
Duobalken®, Triobalken® (glued solid timber)	EN 14080

Construction timber for load-bearing applications has had to be marked with the CE sign in accordance with EN 14081-1. The CE marking shall indicate the strength class pursuant to EN 338 (see also Section 7).

Structural timber can be strength graded visually or by machine. When visually strength graded, DIN 4074-1:2012 "Strength grading of wood – Part 1: Coniferous sawn timber" is usually applied in Germany for softwood.

The machine strength grading is based on EN 14081-4: 2009 "Timber structures – Strength graded structural timber with rectangular cross section – Part 4: Machine grading – Grading machine settings for machine controlled systems".

Due to the long history of woodworking in Europe, a large amount of different visual grading standards, often based on geographical peculiarities (wood species, growing areas and growth characteristics, traditions), must be taken into account, making it currently impossible to have one grading standard for visual grading that is valid throughout Europe. An overview of the various national grading standards can be found in the current version of EN 1912.

Table 5.3
Allocation of German visual grading classes to European strenght classes

Species (softwood)	Grading class pursuant to DIN 4074-1 [10]	Strength class
Spruce, fir, pine, larch, Douglas fir	S10[1)] TS or S10K[2)] TS	C 24

1) Admissible bending strength in N/mm² pursuant to DIN 1052:1988/1996 which is no laonger applicable.
2) The identifier K marks a board or a plank that is graded like a scantling.

Table 5.4
Strength and stiffness parameters in N/mm² and density parameters in kg/m³ pursuant to EN 338:2016 (for KVH®) and for Duobalken®/Triobalken® for strength class C24

Parameter	Explanation	Symbol	C24
Bending strength	—	$f_{m,k}$	24
Tensile strength	parallel to grain	$f_{t,0,k}$	14.5
	perpendicular to grain	$f_{t,90,k}$	0.4
Compressive strength	parallel to grain	$f_{c,0,k}$	21
	perpendicular to grain	$f_{c,90,k}$	2.5
Shear strength (shear and torsion)	—	$f_{v,k}$	4 [1)]
Rolling shear strength	—	$f_{R,k}$	1
Modulus of elasticity	mean value parallel to grain	$E_{0,mean}$	11 000
	5% quantile parallel to grain	$E_{0,05}$	7 400
	mean value perpendicular to grain	$E_{90,mean}$	370
Shear modules		G_{mean}	690
Rolling shear modules		$G_{R,mean}$	69
Raw density	5% quantile	ρ_k	350
	mean value	ρ_{mean}	420

1) In order to prove the shear streess as a result of a shear force $f_{v,k}$ shall be reduced by the factor k_{cr} as specified in the relevant National Annex.

6 _ Tender and technical rules

A performance requirement shall be clearly and comprehensively described, so that all bidders understand and interpret the description/specification in the same way and that they can calculate their prices safely and without substantial preparatory work. You can only safely expect to get the right product, if the wording of your tender documents is clear, technically correct and complete.

The high quality demands to be met by KVH®, Duobalken® and Triobalken® require a careful internal quality control. You should therefore make sure in your own interest that the timber and its production are subjected to a strict quality inspection. You can find an up-to-date list of supervised companies in the Internet under www.kvh.eu.

Tender specification for the supply of KVH® solid structural timber

Item ... ... m³ **Supply of solid structural timber KVH® Si, C24**
solid structural timber KVH® Si (for the visible application)
pursuant to EN 15497 or EN 14081-1,
strength class C24,
moisture content $u_m = 15 \pm 3$ %,
type of cutting: split-heart
surface planed and chamfered,
tolerance class 2 pursuant to EN 336,
from monitored production.

Item ... ... m³ **Supply of solid structural timber KVH® NSi**
solid structural timber KVH® NSi (for non-visible application)
pursuant to EN 15497 or EN 14081-1,
strength class C24,
moisture content $u_m = 15 \pm 3$%,
type of cutting: split-heart,
surface levelled and chamfered,
tolerance class 2 pursuant to EN 336,
from monitored production.

Special requests

Species

KVH® as well as Duobalken® and Triobalken® beams are supplied as standard in spruce/fir. They are also available in pine, larch and Douglas fir on request.

Tender specification for the supply of glued solid timber pursuant to EN 14080:2013

Item ... ... m³ **Supply of glued solid timber Duobalken® beams Si**
glued solid timber Duobalken® Si beams (for visible application),
made from two individual lamellas bonded together,
pursuant to EN 14080:2013,
strength class C24,
moisture content u_m = max. 15 %,
surface planed and chamfered,
tolerance class 2 pursuant to EN 336,
from monitored production.

Item ... ... m³ **Supply of glued solid timber Triobalken® beams Si**
glued solid timber Triobalken® beams Si (for visible application),
made from three to six individual lamellas bonded together,
pursuant to EN 14080:2013,
strength class C24,
moisture content u_m = max. 15 %,
surface planed and chamfered,
tolerance class 2 pursuant to EN 336,
from monitored production.

Item ... ... m³ **Supply of glued solid timber NSi**
glued solid timber for non-visible application,
made from up to six individual lamellas bonded together,
pursuant to EN 14080:2013,
strength class C24,
moisture content u_m = max. 15 %,
surface planed and chamfered,
tolerance class 2 pursuant to EN 336,
from monitored production.

Tender specification for the supply of glued solid timber pursuant to the technical approval

Item ... ... m³ **Supply of glued solid timber Duobalken® beams Si**
glued solid timber Duobalken® Si beams (for visible application)
made from two individual lamellas bonded together,
pursuant to the general technical approval Z-9.1-440,
strength class C24,
moisture content u_m = max. 15 %,
surface planed and chamfered,
tolerance class 2 pursuant to EN 336,
from monitored production.

Item ... ... m³ **Supply of glued solid timber Triobalken® beams Si**
made from three individual lamellas bonded together,
pursuant to the general technical approval Z-9.1-440,
strength class C24,
moisture content u_m = max. 15 %,
surface planed and chamfered,
tolerance class 2 pursuant to EN 336,
from monitored production.

Item ... ... m³ **Supply of glued solid timber Si**
glued solid timber for visible application
made from up to nine individual lamellas bonded together,
pursuant to the general technical approval Z-9.1-440,
strength class C24,
moisture content u_m = max. 15 %,
surface planed and chamfered,
tolerance class 2 pursuant to EN 336,
from monitored production.

7 _ Labelling

Declaration of performance, CE marking and additional monitoring in accordance with the agreement about KVH®

A declaration of performance (DoP) must be drawn up for all construction materials produced in accordance with European harmonized product standards. By means of the DoP, manufacturers confirm that their products have the declared properties. The CE mark, which is based on the declaration of performance, is placed on the product, the packaging or the delivery note.

Finger-jointed solid structural timber KVH® is to be labelled according to the harmonized product standard EN 15497, non-finger-jointed KVH according to EN 14081-1. Glued solid timber is regulated according to EN 14080 and must therefore be labelled in accordance with the requirements of this standard. It should be noted that the regulations for the CE mark, which are contained in the aforementioned standards, are partly overridden by the newer construction products regulation and the associated delegated act for the DoP. The following examples of DoPs and CE marks therefore differ in some ways from the annexes of the aforementioned product standards.

For glued solid timber pursuant to the general building approval Z-9.1-440 the labelling regulations according to this approval apply.

Figure 7.1
Example of a CE mark for KVH® without finger jointing pursuant to EN 14801-1

CE marking pursuant of Directive 93/68/EEC:
- Number of the notified body
- Name or sign of the manufacturer (please note: the address of the manufacturer can be added)
- Last two figures: year of the initial inspection
- Number of the Declaration of Performance
- Standard number with year of publication
- Product description and field of application

- Mandated characteristics

CE **1234**	
Company Name, address 14 No. xyz	
EN 14081-1:2005 + A1:2011 Structural timber S10, DIN 4074-1, TS: C24, spruce For application in buildings and bridges	
Modulus of elasticity, Bending strength, Compressive strength, Tensile strength, Shear strength	C24
Reaction to fire class	D-s2,d0
Natural durability against wood-destroying fungi	Durability class against fungi: 5

7.1 _ KVH® without finger joints

The manufacturer is required to issue a Declaration of Performance, of which an example of such Declaration of Performance for KVH® without finger jointing can be found below. The green text needs to be adapted to the manufacturer's specific conditions.

Declaration of Performance
No. xyz

1.	**Unambiguous ID code of the product type:**	Structural timber S10, DIN 4074-1, TS: C24, spruce Structural timber C24M, TS: C24, larch
2.	**Intended use:**	Buildings and bridges
3.	**Manufacturer:**	Company Muster Street Postal code, City Country
4.	**Authorized representative:**	No external authorized representative
5.	**System for assessing and verifying the constancy of performance:**	System 2+
6.a)	**Harmonized standard:**	EN 14081-1:2005 + A1:2011
	Notified body:	NB 1234
7.	**Performance declared:**	

Essential characteristics	*Performance*
Modulus of elasticity, bending strength, compressive strength, tensile strength, shear strength	For all product types 1 and 2: C24
Reaction to fire	For all product types: pursuant to delegated regulation (EU) 2016/364
Durability	For all product types: durability class against fungi: 5

The characteristics of the above product conform to the performance declared. The above named manufacturer is exclusively responsible for preparing the Declaration of Performance in accordance with Regulation EU/305/2011.

Signed on behalf of the manufacturer and in his name by:

.....
(Name and function)

.....
(Place & date of issue) (Signature)

7.2 _ KVH® with finger joints

The manufacturer is required to issue a Declaration of Performance, of which an example of such Declaration of Performance for KVH® without finger jointing can be found below. The green text need to be adapted to the manufacturer's specific conditions.

Declaration of Performance
No. xyz

1.	**Unambiguous ID code of the product type:**	Finger-jointed structural timber, C24, spruce Finger-jointed structural timber, C24, larch
2.	**Intended use:**	Buildings and bridges
3.	**Manufacturer:**	Company Muster Street Postal code, City Country
4.	**Authorized representative:**	No external authorized representative
5.	**System for assessing and verifying the constancy of performance:**	System 1
6.a)	**Harmonized standard:**	EN 15497:2014
	Notified body:	No. 1234
7.	**Performance declared:**	

Essential characteristics	*Performance*
Mechanical characteristics Modulus of elasticity, bending strength, compressive strength, tensile strength, shear strength	For all product types: C24
Bonding strength as bending strength of the finger joints	For all product types: 24 N/mm²
Durability of the bonding strength as wood species	For all product types: spruce
adhesive	Product types 1 and 2: Adhesive for finger joints: PUR, adhesive type I
Durability against biological attack as natural durability class against wood destroying fungi EN 350-2	For all product types: 5
Fire resistance as geometric data	For all product types: widths ranging between 60 and 140 mm heights ranging between 100 and 240 mm
Charring rate as – characteristic density – species	C24 finger-jointed structural timber, C24, spruce: spruce finger-jointed structural timber, C24, larch: larch
Reaction to fire as reaction to fire class	For all product types: D-s2,d0 pursuant to delegated regulation (EU) 2016/364
Emission of formaldehyde as formaldehyde emission class	For all product types: E1
Release of other dangerous substances	For all product types: not relevant

The characteristics of the above product conform to the performance declared. The above named manufacturer is exclusively responsible for preparing the Declaration of Performance in accordance with Regulation EU/305/2011.

Signed on behalf of the manufacturer and in his name by:

.....
(Name and function)

.....
(Place & date of issue) (Signature)

The CE mark is based on the Declaration of Pperformance (DoP) and must be attached to the product, the shipping slip or the packaging.

CE 1234	
Company Name, address 14 No. xyz	
EN 15497:2014 Structural finger-jointed timber C24, spruce for applications in buildings and bridges	
Mechanical characteristics and fire resistance	
geometric data (mm)	60 x 120 x 12000
strength class and characteristic raw densitiy	C 24
species	Spruce (Picea abies)
Bondings strength as	
bending strength of finger joints	24 N/mm²
Durability of the bonding strength as	
species	Spruce (Picea abies)
adhesive for finger joints	PUR, I
Durability of other characteristics as	
natural durabilty against wood destroying fungi	5
reaction on fire	D-s2,d0
emission of formaldehyde	E1

Figure 7.2
Example of a CE mark for KVH® with finger joints

CE marking pursuant of Directive 93/68/EEC:
- Number of the notified body
- Name or sign of the manufacturer (please note: the address of the manufacturer can be added)
- Last two figures: year of the initial inspection
- Number of the Declaration of Performance
- Standard number with year of publication
- Product description and field of application

- Mandated characteristics

7.3 _ Glued solid timber (Duobalken®/ Triobalken®) pursuant to EN 14080:2013

The manufacturer is required to issue a Declaration of Performance, of which an example of such Declaration of Performance for Duobalken® without finger jointing can be found below. The green text need to be adapted to the manufacturer's specific conditions.

Declaration of Performance
No. xyz

1.	**Unambiguous ID code of the product type:**	Glued solid timber, C24, spruce Glued solid timber, C24, Douglas fir
2.	**Intended use:**	Buildings and bridges
3.	**Manufacturer:**	Company XY Street Postal code, City Country
4.	**Authorized representative:**	No external authorized representative
5.	**System for assessing and verifying the constancy of performance:**	System 1
6.a)	**Harmonized standard:**	EN 14080:2013
	Notified body:	No. 1234
7.	**Performance declared:**	

Essential characteristics	*Performance*
Mechanical characteristics	
Modulus of elasticity, bending strength, compressive strength, tensile strength, shear strength	For all product types: C24 k_{sys} according to EN 1995-1-1:2004, 6.6(4) must not be used
Geometric data	For all product types: Width ranging between 60 and 160 mm Heights ranging between 80 and 240 mm
Bonding strength as	
bending strength of the finger joints	For all product types: 24N/mm²
glue line integrity of the surface bonding	Delamination test pursuant to EN 14080, Annex C, method B
Durability of the bonding strength as	
wood species	Glued solid timber, C24, spruce: spruce Glued solid timber, C24, Douglas fir: Douglas fir
adhesive	For all product types: adhesive for finger joints: PUR, adhesive type I adhesive for surface bonding: MUF, IGP70S
Durability against biological attack as	
natural durability class against wood destroying fungi EN 350-2	For all product types: 5
Fire resistance as	
geometric data	see "Geometric data"
Charring rate as	
– characteristic density	Characteristic raw density of the relevant strength class
– species	Glued solid timber, C24, spruce: spruce Glued solid timber, C24, Douglas fir: Douglas fir
Reaction to fire as	
reaction to fire class	For all product types: D-s2,d0
Emission of formaldehyde as	
formaldehyde emission class	For all product types: E1
Release of other dangerous substances	For all product types: not relevant

The characteristics of the above product conform to the performance declared. The above named manufacturer is exclusively responsible for preparing the Declaration of Performance in accordance with Regulation EU/305/2011.

Signed on behalf of the manufacturer and in his name by:

.....
(Name and function)

.....
(Place & date of issue) (Signature)

The CE mark is based on the Declaration of Pperformance (DoP) and must be attached to the product, the shipping slip or the packaging.

CE 1234	
Company Name, address 14 No. xyz	
EN 14080:2013 Glued solid timber, C24, spruce for applications in buildings and bridges	
Mechanical characteristics and fire resistance	
geometric data (mm)	160 x 240 x 12000
strength class and characteristic raw densitiy	C 24
species	Spruce (Picea abies)
Bondings strength as	
bending strength of finger joints	24 N/mm²
Klebfugenintegritätsprüfung	B
reaction on fire	D-s2,d0
emission of formaldehyde	E1
Durability of the bonding strength as	
species	Spruce (Picea abies)
adhesive for the surface bonding between lamellas	MUF, IGP70S
adhesive for finger joints	PUR, I
Durability of other characteristics as	
natural durabilty against wood destroying fungi	Durability class against fungi: 5

Figure 7.3

Example of a CE mark for glued solid timber (Duobalken®)

CE marking pursuant of Directive 93/68/EEC:
- Number of the notified body
- Name or sign of the manufacturer (please note: the address of the manufacturer can be added)
- Last two figures: year of the initial inspection
- Number of the Declaration of Performance
- Standard number with year of publication
- Product description and field of application

- Mandated characteristics

7.4 _ Glued solid timber pursuant to the general technical approval Z-9.1-440

The German technical approval leads to the conformity mark according to Figure 7.4, not the CE mark. According to the construction products regulations, it is not allowed to issue a declaration of performance for nationally regulated products such as glued solid timber.

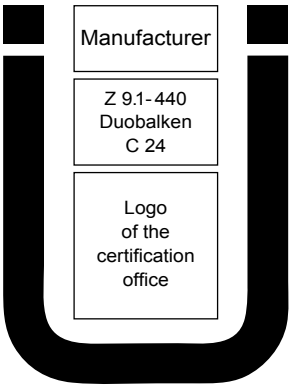

Figure 7.4:
Conformity mark (Ü-Zeichen) and text coding for Duobalken® and Triobalken®

7.5 _ KVH® inspection mark

The members of the Überwachungsgemeinschaft Konstruktionsvollholz e.V. monitor the quality of their products by internal inspections (self-control) and by additional inspections carried out by independent institutions. This does not only apply to the conditions imposed by the construction supervision authorities but also to additional requirements arising from the agreement about solid structural timber.

Only solid structural timber produced and controlled by the member companies of the Überwachungsgemeinschaft Konstruktionsvollholz e.V. must be marked with the internationally protected KVH® trademark sign.

Figure 7.5:
KVH® inspection mark

8 _ Literature and list of standards

[1] Bund Deutscher Zimmermeister and Überwachungsgemeinschaft Konstruktionsvollholz e.V. (2015): Agreement about KVH® (solid structural timber) made of spruce, fir, pine, larch and Douglas fir

[2] Bund Deutscher Zimmermeister and Überwachungsgemeinschaft Konstruktionsvollholz e.V. (2015): Agreement about Duo/Trio beams made of spruce, fir, pine, larch and Douglas fir

[3] EN 15497:2014: Structural finger-jointed timber – Performance requirements and minimum production requirements

[4] EN 14081-1:2005+ A1:2011 : Timber structures – Strength graded structural timber with rectangular cross section – Part 1: General requirements (The current version of the standard is not yet cited in the Official Journal of the EU and is therefore not binding according to the building authorities)

[5] EN 14080:2013: Structural timber – glued laminated timber and glued solid timber – Requirements

[6] Deutsches Institut für Bautechnik: Allgemeine baufaufsichtliche Zulassung Z-9.1-440 über Balkenschichtholz in Abweichung zu DIN EN 14080:2013; valid until 17.12.2023

[7] Institut Bauen und Umwelt e.V. (2018): Environmental Product Declaration pursuant to ISO 14025 and EN 15804 for solid structural timber KVH®

[8] Institut Bauen und Umwelt e.V. (2018): Environmental Product Declaration pursuant to ISO 14025 and EN 15804 for Duobalken® & Triobalken® members (glued solid timber)

[9] EN 338:2016: Structural timber – strength classes

[10] DIN 4074-1:2012: Strength grading of wood – Part 1: Coniferous sawn timber

[11] EN 13501-1:2010: Fire classification of construction products and building elements – Part 1: Classification using data from reaction to fire tests

[12] DIN 4108:2017: Thermal insulation and energy economy in buildings – Part 4: Characteristic values relating to thermal insulation and protection against moisture

[13] EN 1912:2013: Structural timber – Strength classes – Assignment of visual grades and species

[14] EN 1995-1-1:2010, Eurocode 5: Design of timber structures – Part 1-1: General – Common rules and rules for buildings

[15] EN 385:2001: Structural finger joints – Performance requirements and minimum production requirements (withdrawn)

[16] EN 301:2018: Adhesives, phenolic and aminoplastic, for load-bearing timber structures – Classification and performance requirements

[17] EN 15425:2017: Adhesives – one component polyurethane (PUR) for load-bearing timber structures – Classification and performance requirements

[18] DIN EN 1995-1-1/NA:2013: National Annex – Nationally specified parameters – Eurocode 5: Design of timber structures – Part 1: General – Common rules and rules for buildings

[19] EN 336:2013: Structural timber – Sizes, permitted deviations

[20] EN 1995-1-2:2010, Eurocode 5: Design of timber structures – Part 1-2: General – Structural fire design

[21] EN 1995-2:2010, Eurocode 5: Design of timber structures – Part 2: Bridges

[22] ÖNORM 4074-1:2012, Strength grading of wood – Part 1: Coniferous sawn timber

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