



ARGUMENTS FOR MODERN TIMBER CONSTRUCTION MATERIALS

KVH®, DUOBALKEN®, TRIOBALKEN®



KVH® structural timber – a precision building material

KVH® structural timber is a building material with precisely defined product characteristics which was developed specially to meet the high requirements of modern timber construction. KVH® is a kiln-dried and in most cases finger-jointed timber product made of solid softwood and strength graded. Thanks to the method of cutting used and the low moisture content of the material it has little propensity for cracking, is dimensionally stable and, subject to due observance of the rules relating to the structural protection of wood against biological attack, can also be used without the need for wood preservatives. KVH® is available for quick delivery in a wide range of preferred dimensions and wood species (spruce, fir, pine, larch or Douglas fir) with precisely defined surface finishes.

Better than state-of-the-art

The requirements imposed on KVH® structural timber exceed the usual requirements set out in national grading regulations and are aimed at achieving not only reliable strength values but also a defined visual appearance. The maximum permitted moisture content of 18%, for example, is lower than the limits set out in most national product standards, while the definition of surface quality is both more stringent – if defined at all in the national regulations – and covers more criteria. Reference can be made to a European standard to find out how KVH® structural timber graded by strength in accordance with German grading regulations equates with the relevant European strength classes. Individual points are addressed in more detail below.

Kiln-dried and systematically cut

For modern timber buildings (residential buildings), a wood moisture content any higher than 18% is far from ideal and in some European countries it is no longer even permitted. KVH® structural timber is kiln-dried to a maximum moisture content of $15 \pm 3\%$. When the finger-joints are made, the moisture content of every single piece of wood is checked.

Another special feature of KVH® structural timber is the method of cutting used. The square-sawn timber is cut on either a free-of-heart or split-heart basis, depending on the surface quality class. In split-heart cutting the log is sawn lengthwise along the ideal course of the pith, thereby minimizing the propensity for cracking. In free-of-heart cutting the heart plank, which is particularly susceptible to cracking, is also removed from the cross-section. This special method of cutting ensures that KVH® exhibits outstanding dimensional stability and has little propensity for twisting.

Strength graded in accordance with European regulations

KVH® structural timber is strength graded according to grading standard DIN 4074. This German grading standard complies with the requirements of the European standard EN 14081 for strength grading. In this regard the normal German grading class for KVH® structural timber, which is S10 TS, corresponds to European strength class C24 as defined in the European standard EN 1912.

Graded according to appearance

Depending on whether KVH® structural timber is to be used purely for its dimensional stability and low moisture content or whether a high-quality appearance is also desired, two different surface quality classes - KVH®-Si (exposed applications) and KVH®-NSi (non-exposed applications) - are available to choose from. For exposed applications there are certain limits set for such features as knot size, knot condition, ingrown bark and crack widths. The grading criteria are set out in Table 1.

Both types are finger-jointed as a rule. The use of color-neutral adhesives means that the finger joints are barely visible. The look of the natural surface is preserved.

Figure 1:

Split-heart (a) and heart-free (b) cutting

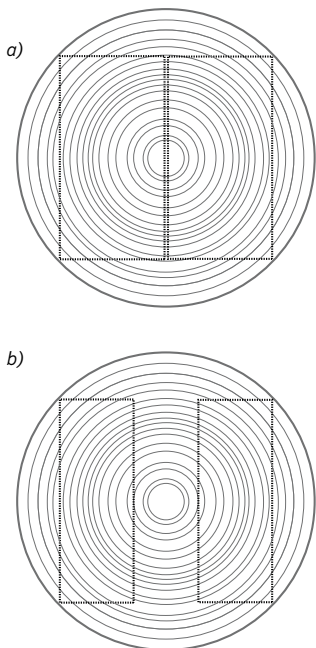


Table 1: Requirements of KVH® structural timber

Grading criterion	Requirements to be met by KVH® structural timber		Remarks
	Exposed areas (KVH®-Si)	Non-exposed areas (KVH®-NSi)	
Grading class compliant with DIN 4074-1	Min. S10TS; C24 in accordance with DIN 1052		The main strength and rigidity characteristics of relevance for load-bearing capacity are set out in DIN 1052
Wood moisture content	15% ± 3%		The specified wood moisture content is a precondition for dispensing for the most part with chemical wood preservatives and can also be the precondition for the making of finger-joints.
Type of cutting	Split-heart; free-of-heart on request.	Split-heart	Split-heart: Given that the pith does not always automatically run through the middle of the log, split-heart is defined as follows: For a log with an ideal growth form the pith would be cut through in two-strand conversion. Free-of-heart: Heart plank has $d \geq 40$ mm
Wane	Not permitted	Measured at an angle $\leq 10\%$ of the smaller cross-section side	
Dimensional stability of the cross-section	DIN EN 336 Dimensional stability class 2: $b \leq 100$ mm: ± 1 mm $b > 100$ mm: ± 1.5 mm		The dimensional stability for the longitudinal dimensions must be agreed between the customer and supplier.
Knot condition	Loose knots and dead knots not permitted. Occasional faulty knots or parts of knots up to max. 20 mm in diameter are permitted	DIN EN 4074 sorting class S10	Replacement with natural wood dowels is permitted. Maximum of 2 adjacent to each other permitted for Si.
Knot diameter ratio	S 10: $A \leq 2/5$ S 13: $A \leq 1/5$ not exceeding 70 mm	S 10: $A \leq 2/5$ S 13: $A \leq 1/5$ not exceeding 70 mm	Knot diameter ratio A is determined in accordance with DIN 4074-1. The following applies for mechanical sorting: <ul style="list-style-type: none"> • Knot sizes are not taken into consideration for KVH®-NSi • $A \leq 2/5$ applies for KVH® -Si
Ingrown bark	Not permitted	DIN 4074-1	
Cracks, radial cracks caused by shrinking (shrinkage shakes)	Width of the crack b must be $\leq 3\%$ of the respective cross-section width	DIN 4074-1	For Si the requirements are higher than those applicable to sorting class S10 in accordance with DIN 4074-1
Pitch pockets	Width $b \leq 5$ mm		Additional criterion
Discoloration	Not permitted	DIN 4074-1	For Si the requirements are higher than those applicable to sorting class S10 in accordance with DIN 4074-1
Insect attack	Not permitted	DIN 4074-1	For Si the requirements are higher than those applicable to sorting class S10 in accordance with DIN 4074-1
Twisting			The permissible extent of twisting is not specified in further detail because no unacceptable twisting is to be expected if all the other criteria are complied with.
Longitudinal warping	≤ 8 mm/2 m for split-heart cutting ≤ 4 mm/2m for heart-free cutting	≤ 8 mm/2 m for split-heart cutting	In comparison: In accordance with DIN 4074-1 S10 and S13: ≤ 8 mm/2m
Finishing of the ends	Trimmed perpendicular		
Surface quality	Planed and chamfered	Leveled and chamfered	
Finger-jointing	DIN EN 385		



KVH® structural timber is mainly used:

- for load-bearing and stiffening timber construction elements, e.g. posts and beams, purlins and rafters, and the columns and heads in wall, ceiling and roof panels
- for exposed construction features with high requirements in terms of aesthetics (KVH®-Si)
- for building components which are not supposed to have chemical preservatives
- for building components which have to meet high requirements in terms of dimensional stability

No need for preservative treatment

Kiln-drying of the timber is a key precondition for doing without preservative treatment. The process of kiln-drying reduces cracking and the insect attractants which would otherwise be contained in the wood. Given a constant low moisture content of 15% ± 3% and due consideration of suitable structural measures to protect the wood, the likelihood of KVH® suffering from fungal attack can be ruled out.

KVH® has now been in use for over 15 years and there has not been a single case of it having been infested by xylophaga. It can be safely assumed that KVH® is resistant to xylophaga infestation.

KVH® product ranges and preferred cross-sections

KVH® structural timber is produced in preferred cross-sections as shown in Table 2. It is supplied planed & chamfered or leveled & chamfered depending on the surface quality class. It is available in standard lengths of up to 13 m, with longer lengths (special lengths) also available on request.

Sustainable, ecological and healthy

KVH® structural timber is produced exclusively from softwood supplied from sustainably managed forests in Europe. A large proportion of the energy used for drying the wood comes from renewable sources. Being easy to process, the amount of energy required for machining is actually small, so it should come as no surprise that KVH® structural timber has an outstanding ecological balance sheet.

Table 2: KVH® preferred cross-sections

Height (mm)	100	120	140	160	180	200	220	240
60	■	■	■	■	■	■	■	■
80	■	■ ●	■ ●	■ ●	■ ●	■ ●	■ ●	■ ●
100	■	■ ●	■ ●	■ ●	■ ●	■ ●	■ ●	■ ●
120		■ ●	■	■ ●	■ ●	■ ●	■ ●	■ ●
140			■ ●	■	■	■	■	■

■ = NSi
● = Si



Natural construction materials which have no harmful effects on health are a key precondition for contemporary construction projects. KVH® structural timber is kiln-dried to a low level of wood moisture, enabling it to absorb humidity from the ambient air in the room. It therefore contributes to a healthy atmospheric environment whatever the room.

Energy efficient

Compared to other construction materials such as steel or concrete, wood has a very low level of thermal conductivity. Load-bearing KVH® structural timber elements in exterior wall or roof structures have low thermal conductivity, which reduces thermal bridges and makes energy efficient buildings possible.

Given the particularly high level of heat insulation in modern timber buildings, the shell of the building must be windproof and airtight. To achieve airtightness on the inside, the building components must be dimensionally stable when installed and, once fixed in position, they must not deform through shrinkage to any great extent as this would reduce the level of airtightness. Thanks to the method of cutting used, finishing to an exact fit and a maximum wood moisture content of 18%, KVH® structural timber is predestined for use in passive energy houses and energy-efficient houses.

Inspected quality

KVH® structural timber is, first and foremost, subject to the statutory requirements applicable to finger-jointed solid timber: The manufacturer must possess a general qualification certificate (glulam certification), must use adhesives which conform with European standards or national authorizations, and must also have installed a system of continuous internal and external controls and inspections (with the latter including the taking of samples). Compliance with these requirements is documented by the German "Ü" mark (see Fig. 2).

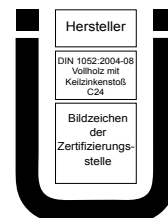


Figure 2:
"Ü" mark (inspection mark)

It should be noted, however, that the KVH® inspection mark (Fig. 3) is only permitted to be used on structural timber which is monitored by internal and external controls and inspections for compliance with the supplementary requirements set out Table 2.



Figure 3:
KVH® inspection mark

The "Ü" mark and the KVH® inspection mark are proof to owner-builders, developers, architects and designers that they are getting the reliable, inspected and high level of quality needed to realize their building projects.



Duobalken®/Triobalken® beams - a further development for large cross-sections

The kiln-drying of KVH® structural timber is subject to limits in terms of commercial viability. For larger cross-sections, a logical further development is available in the form of Duobalken® and Triobalken® beams (also referred to as laminated beams).

Duobalken® and Triobalken® beams are made of kiln-dried, finger-jointed lamellas which are graded according to strength. The lamellas have cross-sections which make them suitable for reliable and economical kiln drying. Either two (Duobalken® beams) or three (Triobalken® beams) lamellas are glued together by their face sides and the overall cross-section is then planed. In combination with the very low wood moisture content, this face gluing results in a product which is even less susceptible to cracking and twisting than KVH® structural timber.

Duobalken® and Triobalken® beams are manufactured in accordance with the general technical approval of the building control authorities in Germany (Z-9.1-440) by members of the Überwachungsgemeinschaft Konstruktionsvollholz e.V. This approval also regulates the type and scope of inspection, which is equivalent to the inspection of KVH® structural timber.

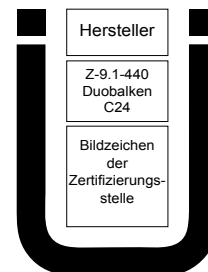


Figure 4:
"Ü" mark (inspection mark) for
Duobalken® and Triobalken® beams

KVH**Duobalken® beams****Triobalken® beams****Properties**

The wood moisture content of Duobalken® and Triobalken® beams amounts to 15%, which is actually less than that of KVH® structural timber. Like KVH®, the choice of wood species covers spruce, fir, pine, larch and Douglas fir.

The strength and rigidity properties of Duobalken® and Triobalken® beams are defined by the properties of the lamellas in accordance with the aforementioned national authorization. Since the lamellas normally used for the production of Duobalken® and Triobalken® beams fall within German sorting class S10, they equate to European strength class C24.

The dimensional stability of Duobalken® and Triobalken® beams complies with the more stringent dimensional stability class 2 in accordance with EN 336.

Duobalken® and Triobalken® beams also come in two surface qualities: - Si (planed and chamfered) and - Nsi (leveled and chamfered).

Cross-sections and supply lengths

Duobalken® and Triobalken® beams can be supplied as standard or system lengths of up to 13 meters. The preferred cross-sections are set out in Table 3, with longer lengths (special lengths) also being available on request.

Applications

Duobalken® and Triobalken® beams are used for the same applications as KVH® structural timber and they also combine well with it too. Duobalken® and Triobalken® beams are used especially where large cross-sections are required or where particularly high requirements in terms of dimensional stability or resistance to cracking have to be met.

Table 3: Duobalken® and Triobalken® beams preferred cross-sections

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

■ = NSi
● = Si

For further information,

please see www.kvh.de or www.kvh.eu.

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