



European Technical Approval ETA-13/0699

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung
Trade name

SFS VB Schrauben
SFS VB screws

Zulassungsinhaber
Holder of approval

SFS intec AG
FasteningSystems
Rosenbergsaustraße 10
9435 HEERBRUGG
SCHWEIZ

Zulassungsgegenstand
und Verwendungszweck
*Generic type and use
of construction product*

SFS VB Schrauben als Verbindungsmittel in Holz-Beton
Verbundkonstruktionen
SFS VB screws as fasteners in wood-concrete composite slab kits

Geltungsdauer:
Validity: vom
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to

13 June 2013
13 June 2018

Herstellwerke
Manufacturing plants

Werk 1
factory 1

Diese Zulassung umfasst
This Approval contains

14 Seiten einschließlich 3 Anhänge
14 pages including 3 annexes

I LEGAL BASES AND GENERAL CONDITIONS

- 1 This European technical approval is issued by Deutsches Institut für Bautechnik in accordance with:
 - Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products¹, modified by Council Directive 93/68/EEC² and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council³;
 - Gesetz über das In-Verkehr-Bringen von und den freien Warenverkehr mit Bauprodukten zur Umsetzung der Richtlinie 89/106/EWG des Rates vom 21. Dezember 1988 zur Angleichung der Rechts- und Verwaltungsvorschriften der Mitgliedstaaten über Bauprodukte und anderer Rechtsakte der Europäischen Gemeinschaften (Bauproduktengesetz - BauPG) vom 28. April 1998⁴, as amended by law of 8 November 2011⁵;
 - Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC⁶.
- 2 Deutsches Institut für Bautechnik is authorized to check whether the provisions of this European technical approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European technical approval and for their fitness for the intended use remains with the holder of the European technical approval.
- 3 This European technical approval is not to be transferred to manufacturers or agents of manufacturers other than those indicated on page 1, or manufacturing plants other than those indicated on page 1 of this European technical approval.
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¹ Official Journal of the European Communities L 40, 11 February 1989, p. 12
² Official Journal of the European Communities L 220, 30 August 1993, p. 1
³ Official Journal of the European Union L 284, 31 October 2003, p. 25
⁴ *Bundesgesetzblatt Teil I* 1998, p. 812
⁵ *Bundesgesetzblatt Teil I* 2011, p. 2178
⁶ Official Journal of the European Communities L 17, 20 January 1994, p. 34

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of product and intended use

1.1 Definition of product

This European technical approval is an assessment of the SFS VB screws for wood-concrete composite slab kits. The outer thread diameter of the SFS VB screws is 7.5 mm, the length ranges between 150 mm and 215 mm. Shape and tolerances of the screws are given in Annex 3.

The wood-concrete composite slab kits are individually designed in order to meet the requirements for the works.

This European technical approval includes assumptions for the intended use of the SFS VB screws.

The assessment and production of the wood-concrete composite slab kits is not subject of this European technical approval.

1.2 Intended use

SFS VB screws are intended to be used in structural composite members such as floor, roof, or wall constructions in service classes 1 and 2 as defined in EN 1995-1-1 subject to static or quasi static loading. The screws may be used for protected exterior constructions provided that they are classified in service class 2.

With regard to ER3, hygiene, health and the environment, the following use categories are relevant:

- **Category IA2: Products with no direct contact with indoor air but possible impact on indoor air:**
Although these products are covered (e.g. by other products) but could be released due to diffusion into the indoor air or have to be considered in the case of maintenance and repair work.
- **Category S/W3: Products with no contact to soil, ground- and surface water:**
Although these products are covered (e.g. by other products) but could never be released into the soil and/or water by diffusion.

SFS intec AG delivers the SFS VB screws which can be used for the composite as system components. The following components make a faultless functioning of the wood-concrete composite construction possible:

- Concrete slab, according to EN 1992-1-1. The minimum concrete strength class is C20/25,
- Formwork, e.g. timber boards or wood based panel. This is an optional intermediate layer between the concrete and the timber,
- Lateral moulding along the edges of the slab,
- Timber members, e.g. glulam according to EN 14080, sawn softwood and hardwood timber according to EN 14081-1, LVL according to EN 14374 or cross laminated timber according to European technical approval.

This European technical approval covers screws for composite members with a minimum concrete flange depth according to the provisions on the slab depth at the place use (national provisions), but not less than 50 mm and a minimum depth of the timber member of 100 mm. The maximum concrete flange depth is 70 % of the timber member depth. Typical spans for the construction are up to 8 m with sawn softwood timber members, 10 m with LVL members and 14 m with glulam members, but larger spans are also possible.

A typical composite construction is shown in Figure 1.1 of Annex 1. The area of concrete is subjected to compression. The timber members usually run parallel or nearly parallel to each other. The screws are shown in Annex 3.

The national provisions, particularly in relation to construction and design, corrosion protection and wood preservation shall be observed.

1.3 Assumed working life of the construction product

The provisions made in this European technical approval are based on an assumed working life of SFS VB screw for wood-concrete composite slab kits of 50 years, provided that the conditions laid down in this European technical approval for the installation, use and maintenance are met.

The indications given on the working life cannot be interpreted as a guarantee given by the producer or the approval body, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

2 Characteristics of the product and methods of verification

2.1 ER 1 Mechanical resistance and stability

Wood-concrete composite slab kits including SFS VB screws are manufactured and used according to an individual design made by a structural engineer responsible for the design of works on a case by case basis (floors) may function as directly load-bearing and structural bracing members.

The load-carrying capacity of the system shall be determined in accordance with the limit state design principles specified in the Eurocodes.

The performance of the composite slab is not part of this European technical approval.

The screws are made of case hardened steel as specified in the control plan and corrosion protected with a zinc coating or brown patina.

Geometry of the screws is defined in Annex 3.

The mechanical properties of SFS VB screws and the coefficients for creep and duration of load factors for composite members are given in Annex 2.

2.2 ER 2 Safety in case of fire

Reaction to fire

SFS VB screws including the zinc coating or brown patina are classified non-combustible in accordance with EC Decision 2000/147/EC and fulfil the requirements of class A1 according to EN 13501-1:2002.

Resistance to fire

For the assessment of the performance of the wood-concrete composite slab, the properties by SFS VB screw alone is not sufficient. No performance determined.

2.3 ER 3 Hygiene, health and the environment

Dangerous substances

The SFS VB screws do not contain cadmium and chromium (VI).

Materials and components of the wood-concrete composite slab kits added at the installation site shall be checked for the presence of dangerous substances as specified in the CE marking of those products.

In addition to the specific clauses relating to dangerous substances contained in this European technical approval, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive, these requirements need also to be complied with, when and where they apply.

Water vapour permeability and moisture resistance

For the assessment of the performance of the wood-concrete composite slab, the properties by SFS VB screw alone is not sufficient. No performance determined.

2.4 ER 4 Safety in use

For the assessment of the performance of the wood-concrete composite slab, the properties by SFS VB screw alone is not sufficient. No performance determined.

2.5 ER 5 Protection against noise

Airborne sound insulation

For the assessment of the performance of the wood-concrete composite slab, the properties by SFS VB screw alone is not sufficient. No performance determined.

Impact sound insulation

For the assessment of the performance of the wood-concrete composite slab, the properties by SFS VB screw alone is not sufficient. No performance determined.

Sound absorption

For the assessment of the performance of the wood-concrete composite slab, the properties by SFS VB screw alone is not sufficient. No performance determined.

2.6 ER 6 Energy economy and heat retention

Thermal resistance

For the assessment of the performance of the wood-concrete composite slab, the properties by SFS VB screw alone is not sufficient. No performance determined.

Air permeability

For the assessment of the performance of the wood-concrete composite slab, the properties by SFS VB screw alone is not sufficient. No performance determined.

Thermal inertia

For the assessment of the performance of the wood-concrete composite slab, the properties by SFS VB screw alone is not sufficient. No performance determined.

2.7 Aspects of durability, serviceability and identification

Durability

Durability of the finished wood-concrete composite slab kits is not covered by this European technical approval.

Durability of the SFS VB screws is provided for by the protective zinc coating with a mean coat thickness of 5µm or a brown patina with a mean coat thickness of 1µm. The assessment shall consider national corrosivity regulations.

Serviceability

Deformation characteristics for the SFS VB screws are given in Annex 2.

Identification

SFS VB screws are identified by bearing the mark of the manufacturer and the CE marking according to clause 3.3.

3 Evaluation of conformity and CE marking

3.1 System of attestation of conformity

According to the communication of the European Commission⁷, system 1 of the attestation of conformity laid down in the Decision 2000/447/EC of the European Commission⁸, for prefabricated wood-based load-bearing stressed skin panels shall also be applied to wood-concrete composite slab kits.

This system of attestation of conformity is defined as follows:

System 1: Certification of the conformity of the product by an approved certification body on the basis of:

- (a) Tasks for the manufacturer
 - (1) Factory production control;
 - (2) Further testing of samples taken at the factory by the manufacturer in accordance with a prescribed test plan (further called Control plan);
- (b) Tasks for the approved body
 - (3) Initial type-testing of the product;
 - (4) Initial inspection of factory and of factory production control;
 - (5) Continuous surveillance, assessment and approval of factory production control;

Notes: Approved bodies are also referred to as "notified bodies".

3.2 Responsibilities

3.2.1 Tasks for the manufacturer

3.2.1.1 Factory production control

The manufacturer shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of results performed. This production control system shall insure that the product is in conformity with this European technical approval.

The manufacturer may only use raw materials and components stated in the technical documentation of this European technical approval.

The factory production control shall be in accordance with the Control plan relating to the European technical approval ETA-13/0699 which is part of the technical documentation of this European technical approval. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited with Deutsches Institut für Bautechnik⁹.

The results of factory production control shall be recorded and evaluated in accordance with the provisions of the "control plan".

⁷ Letter of the European Commission of 7 March 2007 to EOTA
⁸ Official Journal of the European Communities L 180, 19 February 2000, p.

⁹ The control plan is a confidential part of the European technical approval and only handed over to the approved body/bodies involved in the procedure of attestation of conformity. See section 3.2.2.

3.2.1.2 Other tasks for the manufacturer

The manufacturer shall, on the basis of a contract, involve a body which is approved for the tasks referred to in section 3.1 in the field of screws for wood-concrete composite slab kits in order to undertake the actions laid down in section 3.2.2. For this purpose, the control plan referred to in sections 3.2.1.1 and 3.2.2 shall be handed over by the manufacturer to the approved body involved.

The manufacturer shall make a declaration of conformity, stating that the construction product is in conformity with the provisions of this European technical approval issued.

3.2.2 Tasks for the approved bodies

The approved body (bodies) shall perform the following task in conformity with the provisions of the control plan:

- Initial type-testing of the product,
- initial inspection of factory and of factory production control,
- continuous surveillance, assessment and approval of factory production control.

The approved body shall retain the essential points of its actions referred to above and state the results obtained and conclusions drawn in a written report.

The approved certification body involved by the manufacturer shall issue an EC certificate of conformity of the product stating the conformity with the provisions of this European technical approval.

In cases where the provisions of the European technical approval and its control plan are no longer fulfilled the certification body shall withdraw the certificate of conformity and inform Deutsches Institut für Bautechnik without delay.

The results of certification and continuous surveillance shall be made available on demand by the certification body to Deutsches Institut für Bautechnik.

3.2.2.1 Initial type-testing of the product

The results of the approval tests may be considered for the initial type testing of the product.

3.2.2.2 Initial inspection of factory and of factory production control

An approved body shall conduct initial inspection of each production line in order to ensure that the premises and technical equipment are suitable, personnel is qualified and the factory production control system which is in accordance with the provisions of this European technical approval is complied with.

3.2.2.3 Continuous surveillance, assessment and approval of the factory production control

The approved body shall visit the factory at least once a year for regular inspection. It shall be verified that the factory production control is performed according to this European technical approval, including tests of samples according to the prescribed test plan.

3.2.2.4 Certification

When all criteria of the attestation of conformity are satisfied the approved certification body shall issue an attestation of conformity with this European technical approval for each production line separately.

In cases where the provisions of the European technical approval and its control plan are no longer fulfilled the certification body shall withdraw the certificate of conformity and inform Deutsches Institut für Bautechnik without delay.

3.3 CE marking

The CE marking shall be affixed on each package of SFS VB screws for the use as component in wood-concrete composite slab kits. The letters "CE" shall be followed by the identification number of the approved certification body, and be accompanied by the following additional information:

- the name and address of the producer (legal entity responsible for the manufacture),
- the last two digits of the year in which the CE marking first was affixed,
- the number of the EC certificate of conformity for the product,
- the number of the European technical approval,
- designation of the screw.

4 Assumptions under which the fitness of the product for the intended use was favourably assessed

4.1 Manufacturing

SFS intec AG delivers the SFS VB screws for use as components in wood-concrete composite slab kits in accordance with the provisions of this European technical approval. The SFS VB screws are manufactured in the factory in accordance with the provisions of this European technical approval.

Changes to the product or production process, which could result in this deposited data/information being incorrect, shall be notified to Deutsches Institut für Bautechnik before the changes are introduced. Deutsches Institut für Bautechnik will decide whether or not such changes affect the European technical approval and consequently the validity of the CE marking on the basis of the European technical approval and if so whether further assessment or alterations to the European technical approval, shall be necessary.

At the building site, additional components of the kit shall be assembled according to the design of each individual kit as specified by the designer of the works.

4.2 Assembly and installation of the composite slab kit into the works

SFS VB screws shall be installed on the basis of a specific structural design for each wood-concrete composite slab kit installation. The values of the load-bearing capacities to be used for design are given in Annex 2. The design shall be prepared by a structural engineer responsible for the design of works according to the provisions of the Member State.

The design shall also take any aspects regarding installation of the wood-concrete composite slab kit components, as well as any temporary bracing and supporting into account. Wood-concrete composite slab kits shall be installed by appropriately qualified personnel, following the installation plan. Only screws without any defects are allowed to be used. Before concrete is poured, the person responsible for the design of the works shall check the set of the SFS VB screws to be in accordance with the design.

The manufacturer shall ensure that the parties involved will be informed of these provisions.

Andreas Kummerow
p. p. Head of Department

beglaubigt:
Stöhr

Annex 1

Wood-concrete composite slab kits composed with SFS VB screws

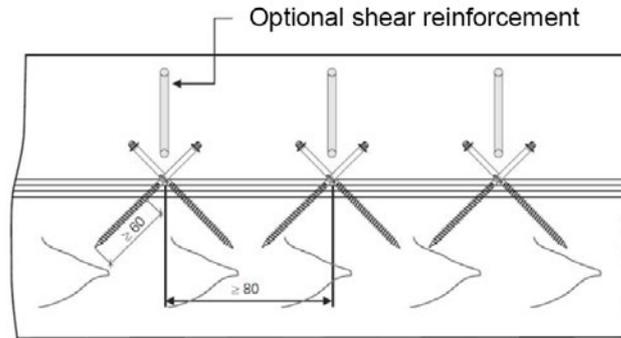


Figure 1.1 Elevation of a composite member with SFS VB screws

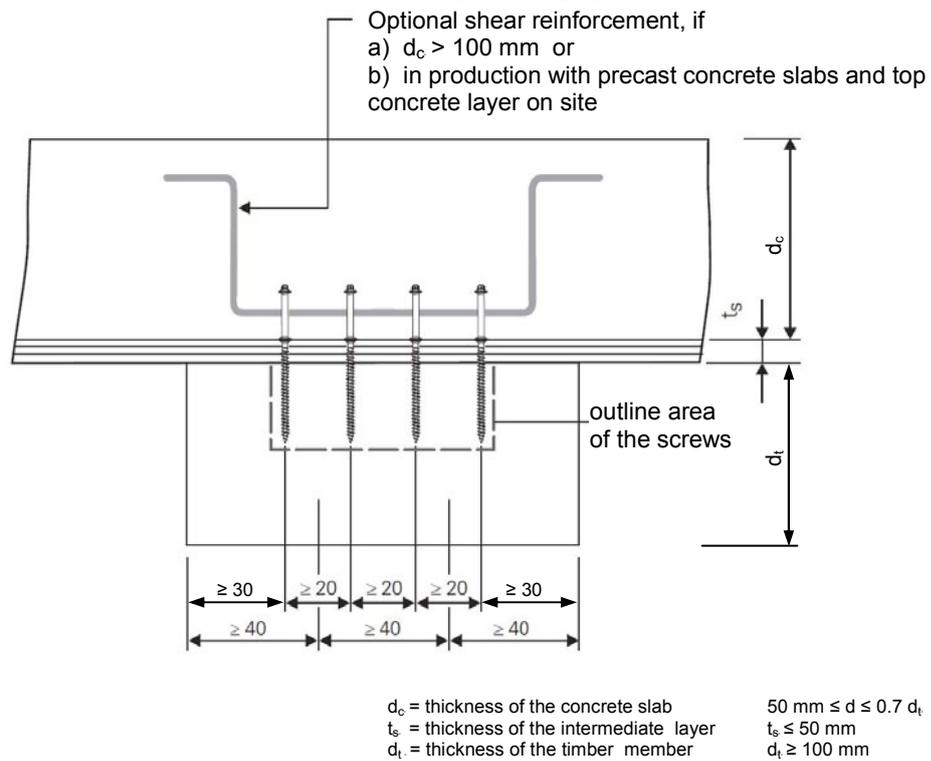


Figure 1.2 Cross-section through a composite member with SFS VB screws

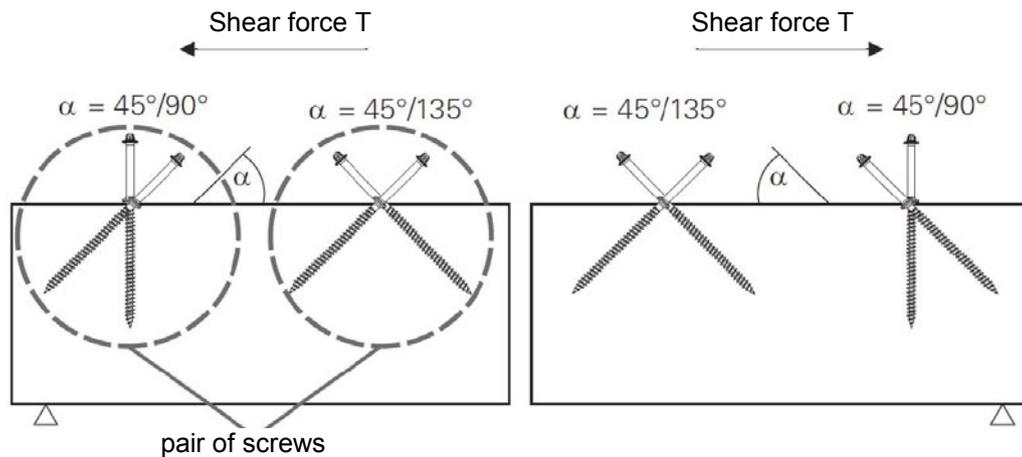


Figure 1.3 Arrangement of SFS VB screws in wood-concrete composite slabs kits

Table 1 Minimum spacing, end and edge distances for SFS VB screws in mm

SFS VB screw	$7.5 \times \ell$
Spacing parallel to grain a_1	80
Spacing perpendicular to grain a_2	20
End distance (end of end-grain) $a_{3,c}$	80
Edge distance $a_{4,c}$	30

Structural elements of hardwood have to be pre-drilled for screws. Oak timber has to be used installed dry.

The composition of the screw materials is deposited with Deutsches Institut für Bautechnik.

The length and diameter of the screws are given in Annex 3. A more exact description of the shape and tolerances of the screws can be found in the control plan.

Annex 2 Mechanical properties

Resistance and stiffness

Static model and general information

Composite constructions with SFS VB screws are to be designed taking into account the influence of the slip occurring in the joints. A method for the calculation of the load-bearing capacity and the deformation of mechanically jointed beams or columns is given in Annexes B and C of EN 1995-1-1¹. National requirements valid in the place of use may apply.

Calculations should be carried out assuming a linear relationship between force and slip. Alternative methods for the calculation based on numerical models are also applicable.

The mechanical model describing the shear force transfer is shown in figure 2.

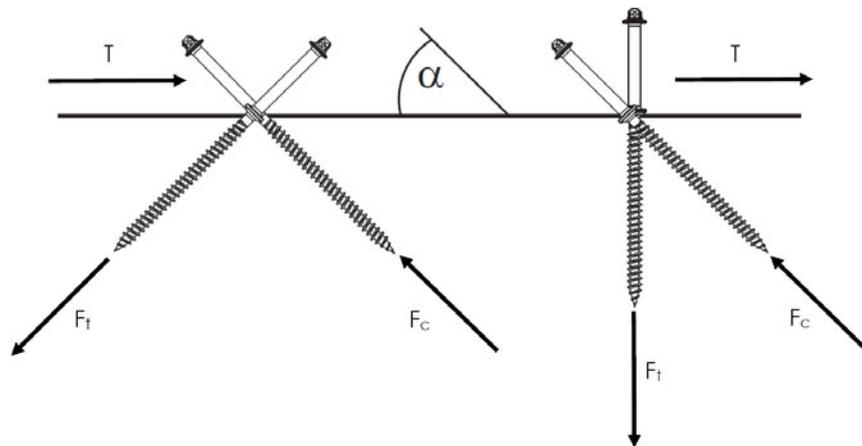


Figure 2: Mechanical model according to truss analogy

A truss analogy is used. The threaded part of the screw in the timber is considered elastically founded parallel to the screw axis. The foundation in the concrete is considered infinitely stiff. An interlayer with the thickness t may be arranged between timber and concrete.

The shear force T parallel to the joint between timber and concrete is divided into a component parallel to the tensile screw axis and a component parallel to the compressive screw axis. Friction forces between timber and concrete are not considered. The tensile force F_t and the compressive force F_c follow the shear force T and the angle α :

$$F_t = F_c = \frac{T}{\sqrt{2}} \quad \text{for screw arrangement } \pm 45^\circ$$

$$F_t = T \quad \text{for screw arrangement } 45^\circ/90^\circ$$

$$F_c = T \cdot \sqrt{2} \quad \text{for screw arrangement } 45^\circ/90^\circ$$

For calculation of internal forces the mean or nominal values of the elasticity and slip modulus shall be used. The concrete slab shall be arranged on top of the timber beams. The support of the wood concrete composite elements shall be carried out via the timber beams.

Design of the wood-concrete composite slab kit

SFS VB screws may be used in service class 1 and 2 according to Eurocode 5.

The design of the wood-concrete composite slab kit in the ultimate and the serviceability limit states shall take into account the influence of creep, concrete shrinkage and moisture changes. The verification of the limit states is to be performed both for the initial state ($t = 0$) and the final state ($t = \infty$).

¹ EN 1995-1-1:2010-12 Eurocode-5: Design of timber structures – Part 1-1: General – Common rules for buildings

The influence of creep and moisture changes may be taken into account by reducing the modulus of elasticity of the timber and concrete and the slip modulus to be used in calculations analogous with EN 1995-1-1. For the deformation factors k_{def} see Table 2.1.

Table 2.1 – Values of k_{def} for timber, concrete and SFS VB screws

Material	Service class	
	1	2
Solid timber, EN 14081-1	0.6	2.0
Glued Laminated timber, EN 14080	0.6	2.0
LVL, EN 14374	0.6	2.0
Cross laminated timber, ETA	0.8	2.0
Concrete, EN 206-1	2.5	2.5
SFS VB screw connection	0.6	4.0

For timber-concrete composite joints made with SFS VB screws the slip modulus K_{ser} per pair of screws under service load parallel to the shear plane should be taken from Table 2.2 with l_{ef} in mm.

Table 2.2 – Values of K_{ser} for timber-concrete joints with SFS VB screws

SFS VB screw orientation α in °	K_{ser} in N/mm
$\pm 45^\circ$	$240 \cdot l_{ef}$
$45^\circ/90^\circ$	$100 \cdot l_{ef}$

For timber-concrete composite joints made with SFS VB screws the characteristic load bearing capacity per pair of screws F_{Rk} parallel to the shear plane shall be taken from Table 2.3. with ρ_k in kg/m^3 and l_{ef} in mm.

Table 2.3 – Values of F_{Rk} for timber-concrete-joints with SFS VB screws

F_{Rk} in N	
$F_{Rk} = k_\alpha \cdot \min \begin{cases} F_{ax,\alpha,Rk} \\ 13000 \end{cases}$	
where:	
F_{Rk}	is the characteristic load-carrying capacity per pair of SFS VB screw in N;
k_α	is a factor taking into account the screw arrangement; $k_\alpha = 1,414$ for $\alpha = \pm 45^\circ$ $k_\alpha = 1,0$ for $\alpha = 45^\circ/90^\circ$
$F_{ax,\alpha,Rk}$	is the characteristic withdrawal capacity in N;
	$F_{ax,\alpha,Rk} = 90 \cdot l_{ef} \cdot \left(\frac{\rho_k}{350} \right)^{0,8}$ for SFS VB screws in softwood
	$F_{ax,\alpha,Rk} = 180 \cdot l_{ef} \cdot \left(\frac{\rho_k}{530} \right)^{0,8}$ for SFS VB screws in pre-drilled hardwood
l_{ef}	is the penetration depth of the SFS VB screw in the timber member in mm, for screw arrangement $45^\circ/90^\circ$ is l_{ef} the penetration depth of the 90° screw;
ρ_k	is the characteristic timber member density in kg/m^3 ;
α	is the angle between screw axis and grain direction.

Table 2.4 – Properties of SFS VB screws

SFS VB screw	VB-48-7,5x100	VB-48-7,5x110	VB-48-7,5x165
Tensile strength $f_{\text{tens,k}}$ [kN]	16	17	17
Torsional strength $R_{\text{tor,k}}$ [Nm]	16	18	18

Apart from the design of the composite member, the load-carrying-capacity of the concrete layer spanning between the timber beams and the shear capacity of the timber member in the perimeter area around the screws should be checked.

Resistance to fire

Simplified rules for calculation of resistance to fire in case of screws are enclosed in EN 1995-1-2 for constructions made with SFS VB screws.

Thus, in design of works, fire resistance of the timber members may be determined according to EN 1995-1-2 and the fire resistance of the concrete flange according to EN 1992-1-2, if the national rules allow for calculation.

Annex 3

Drawings showing the properties of the SFS VB screws

SFS VB screws made of carbon steel

