

Approval body for construction products  
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and  
Laender Governments



## European Technical Assessment

ETA-11/0120  
of 19 May 2016

English translation prepared by DIBt - Original version in German language

### General Part

Technical Assessment Body issuing the  
European Technical Assessment:

Deutsches Institut für Bautechnik

Trade name of the construction product

SB headed studs made of steel

Product family  
to which the construction product belongs

Headed studs cast-in and welded on steel plates made of  
steel

Manufacturer

AS Schöler + Bolte GmbH  
Gewerkenstraße 1  
58456 Witten  
DEUTSCHLAND

Manufacturing plant

Werk 1

This European Technical Assessment  
contains

15 pages including 11 annexes which form an integral  
part of this assessment

This European Technical Assessment is  
issued in accordance with Regulation (EU)  
No 305/2011, on the basis of

European Assessment Document (EAD)  
330084-00-0601

**European Technical Assessment**

**ETA-11/0120**

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## Specific Part

### 1 Technical description of the product

The SB headed studs welded on steel plates consist of steel.

The headed studs have a diameter of the shaft of 10, 13, 16, 19, 22 and 25 mm. At one end a head is formed by upsetting. The other end is prepared for drawn arc stud welding with ceramic ferrule or shielding gas (method 783 according to EN ISO 4063:2002-02).

The steel plates with welded on headed studs are embedded surface-flush in the concrete.

The product description is given in Annex A.

### 2 Specification of the intended use in accordance with the applicable European Assessment Document

The performances given in Section 3 are only valid if the anchor is used in compliance with the specifications and conditions given in Annex B.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the anchor of at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, 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.

### 3 Performance of the product and references to the methods used for its assessment

#### 3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistances under static and quasi-static loads and displacements	See Annex C1 to C2

#### 3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Anchorage satisfy requirements for Class A1

### 4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

In accordance with EAD No. 330084-00-0601, the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

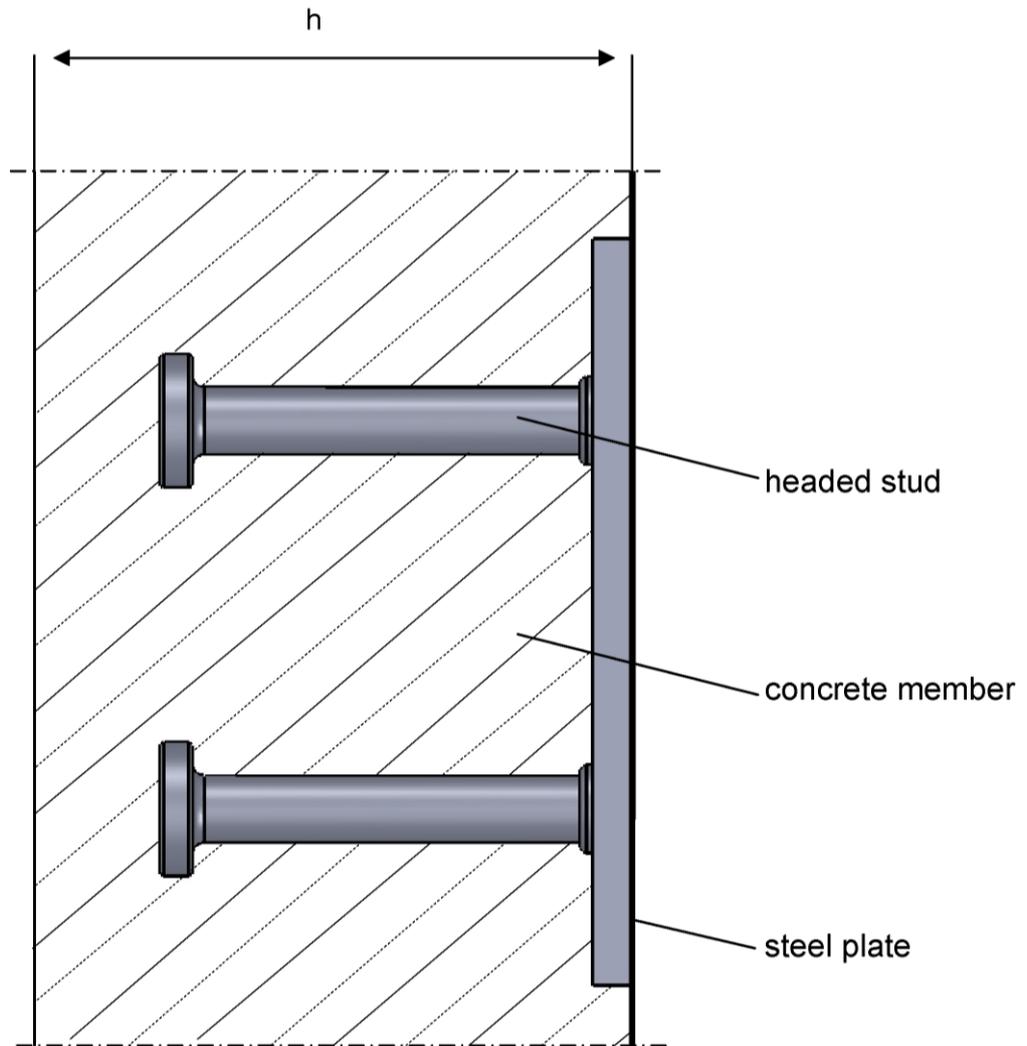
**5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD**

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 19 May 2016 by Deutsches Institut für Bautechnik

Uwe Bender  
Head of Department

*beglaubigt:*  
Müller



$h$  = thickness of concrete member

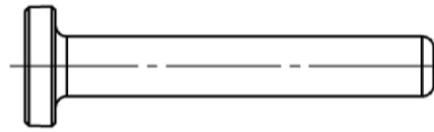
SB headed studs made of steel

Product description  
Installed condition

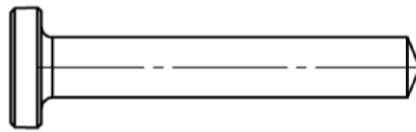
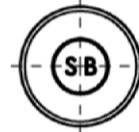
Annex A1

Marking

Steel



Form A



Form B



Marking:  
Manufacturer = SB

Table 1: **Dimensions**

Headed stud typ	Shaft $\varnothing d_1$ [mm]	Head $\varnothing d_2$ [mm]	Nominal length		Thickness of the head k [mm]
			min $h_n$ [mm]	max $h_n$ [mm]	
10	10	19	50	200	7.1
13	13	25	50	400	8
16	16	32	50	525	8
19	19	32	75	525	10
22	22	35	75	525	10
25	25	41	75	525	12

SB headed studs made of steel

Product description  
Headed studs dimensions and marking

Annex A2

**Table 2: Material steel**

Part	Denomination	Material	Mechanical properties	Intended use
1	Headed stud according to EN ISO 13918:2008 Type SD1	Killed steel acc. material group 1 ISO/TR 15608 within limits according to EN ISO 13918:2008-10, Table 2 (for example S235J2+C450 according to EN10025:2005)	$f_{uk} \geq 450 \text{ N/mm}^2$ $f_{yk} \geq 350 \text{ N/mm}^2$	Steel plates with welded on headed studs may only be used in structures subject to dry internal conditions
2	Steel plate	Steel S235JR; S235JO; S235J2 according to EN 10025:2005	$f_{uk} = 340-470 \text{ N/mm}^2$ $f_{yk} = 255 \text{ N/mm}^2$	
		Steel S355JO; S355J2 according to EN 10025:2005	$f_{uk} = 510-680 \text{ N/mm}^2$ $f_{yk} = 345 \text{ N/mm}^2$	

SB headed studs made of steel

Product description  
Material

Annex A3

## Specifications of intended use

### Loading of steel plate with cast-in anchors subject to:

- Static and quasi-static loads in tension and shear.

### Base materials:

- Reinforced normal weight concrete according to EN 206.
- Strength classes C20/25 to C90/105 according to EN 206.
- Cracked or uncracked concrete.

### Use conditions (Environmental conditions):

- Structures subject to dry internal conditions

### Design:

- Steel plate with cast-in anchors are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored. The position of the anchors are indicated on the design drawings (e.g. position of the anchor relative to the reinforcement or to supports).
- For static and quasi-static loading the steel plate with cast-in anchors are designed in accordance with CEN/TS 1992-4-2:2009.
- It is generally assumed that the concrete is cracked and that the occurring splitting forces are resisted by the reinforcement. The required cross section of the minimum reinforcement is determined according CEN/TS 1992-4-2:2009 section 6.2.6.2 b).

### Installation:

#### Welding of the headed studs to the steel plate

- Steel plates, on which headed studs will be welded, consist of the materials S235JR, S235JO, S235J2, S355JO or S355J2 according to Annex A3, Table 2
- Headed studs shall be welded to the steel plate by means of drawn arc stud welding with ceramic ferrule or shielding gas in accordance with EN ISO 14555.
- Level of quality requirements corresponds to EN ISO 3834-3.
- Possibly not homogeneous structure of the steel plate (e.g. lamellar tearing/ lamellar imperfections) in the direction of the thickness are taken into account.
- Welding of the headed studs via arc stud welding may be performed in the manufacturing plant or on the construction site.
- For the welding of headed studs on the steel plate the executing company has a valid qualification for arc stud welding according EN ISO 14555.

SB headed studs made of steel

Intended use  
Specifications

Annex B1

Placing steel plates into concrete

- The installation of headed studs is carried out by appropriately qualified personnel under the supervision of the person responsible for the technical matters on site.
- Use of the product only as supplied by the manufacturer.
- Installation in accordance with the manufacturer's specifications given in Annexes B4, B5 and B6.
- The anchorages are fixed on the formwork, reinforcement or auxiliary construction such that no movement of the product will occur during the time of laying the reinforcement and of placing and compacting the concrete.
- The concrete under the head of the headed studs are properly compacted.
- For large fixtures (steel plate > 400 mm x 400 mm) vent openings are provided, specified in the design drawings.

SB headed studs made of steel

Intended use  
Specifications

Annex B2

**Table 3: Installation parameter for headed studs made of steel**

Nominal size (mm)		10	13	16	19	22	25
anchorage depth	min $h_{ef}$ [mm]	50	50	50	75	75	75
minimum spacing	$s_{min}$ [mm]	50	70	80	100	100	100
minimum edge distance	$c_{min}$ [mm]	50	50	50	70	70	100
minimum thickness of concrete member	$h_{min}$ [mm]	$h_{ef} + k + c_{nom}^{1)}$					

<sup>1)</sup>  $c_{nom}$  = required concrete cover according to national regulations

### Arrangement of headed studs

Regulations for the arrangement of headed studs on the plate are given in CEN/TS 1992-4-1:2009, section 1.2.3.

SB headed studs made of steel

Intended use  
Installation parameters

Annex B3

Fig 1: Simple headed stud

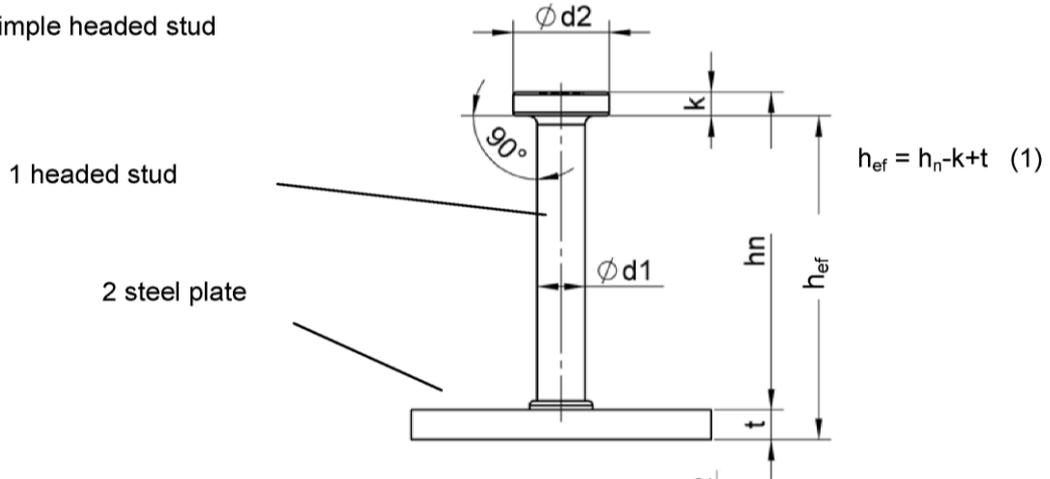


Fig 2: Doubled headed stud

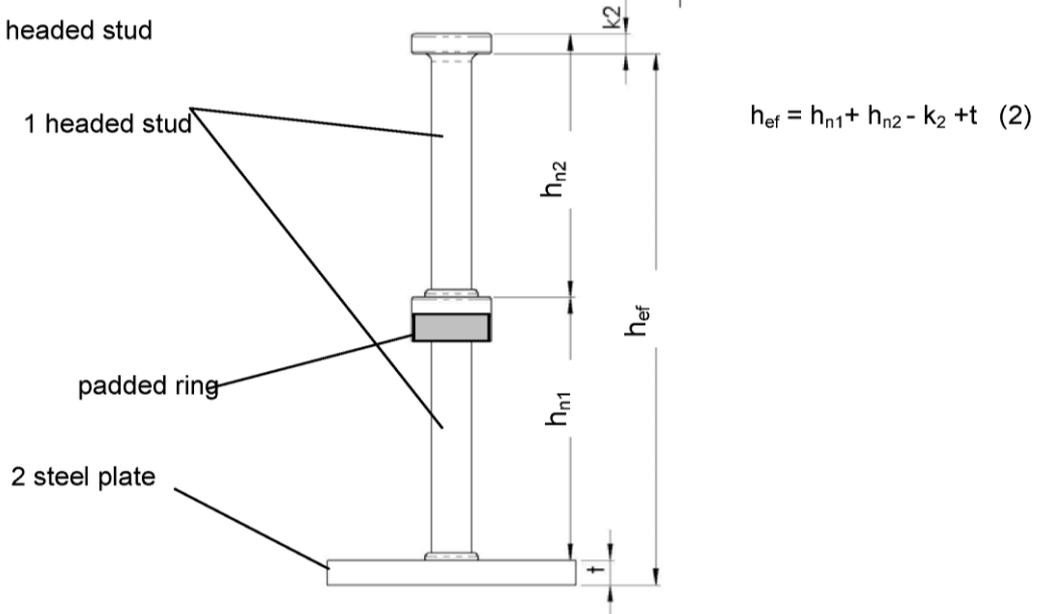
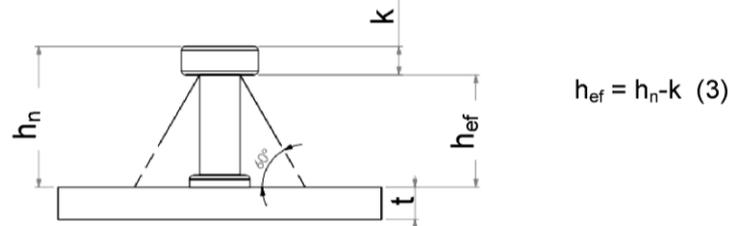


Fig 3: Short headed stud,  
If the theoretic cone meets  
the steel plate at an  
angle of  $\sim 60^\circ$

or  $t \geq 0,2 h_n$



$d_1$  = diameter of shaft  
 $d_2$  = diameter of head  
 $h_{ef}$  = effective embedment depth  
 $h_n$  = nominal length of the headed stud (after welding)  
 $k$  = thickness of the head  
 $t$  = thickness of the steel plate  
 $\alpha = 90^\circ$

SB headed studs made of steel

Intended use  
Effective embedment depth

Annex B4

## Installation instruction

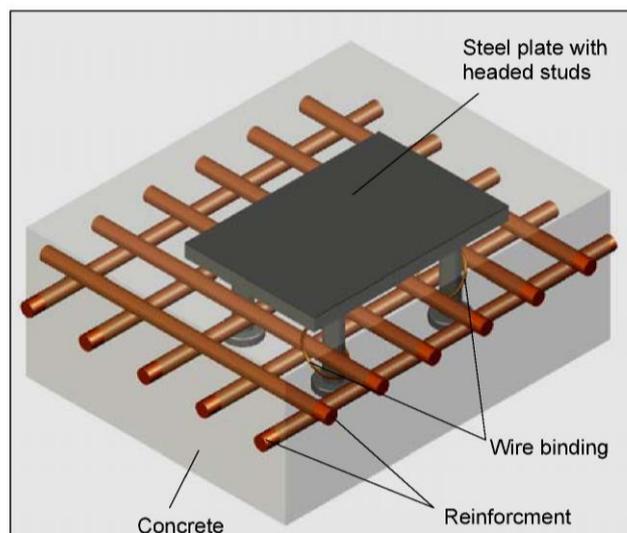
### 1 Welding headed studs to steel plate

- Conflect steel plate (material S235JR, S235JO, S235J2, S355JO or S355J2) acc. design drawings,
- Weld headed studs to steel plate acc. method 783 of EN ISO 4063 and at position acc. design drawings.



### 2 a Fixing steel plate to reinforcement

- Fix steel plate with headed studs directly to reinforcement or to mounting bar by wire binding,
- Fix in a way that steel plate does not move while pouring and compacting concrete,
- Orient steel plate surface-flush with the assumed concrete member.



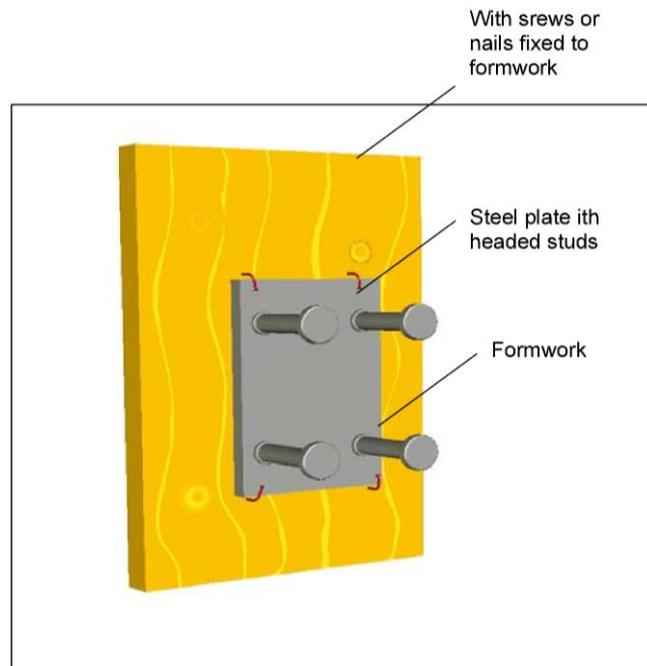
SB headed studs made of steel

Intended use  
Installation instructions

Annex B5

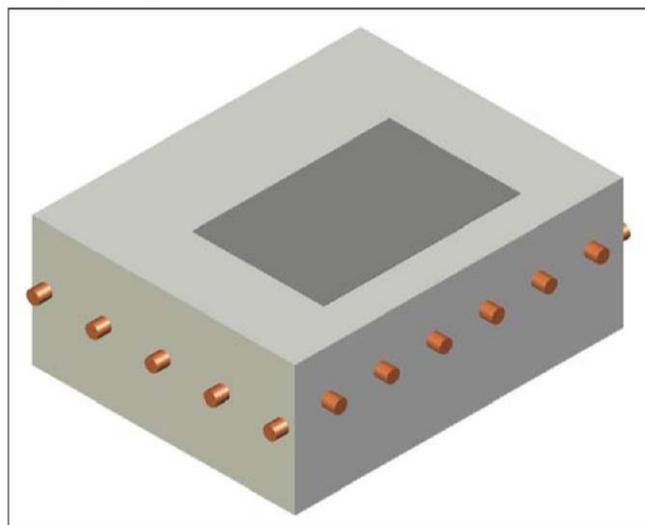
2 b Fixing steel plate to formwork

- Fix steel plate with headed studs directly to formwork by nails, screws or wire binding,
- Control close contact between steel plate and formwork;
- Fix in a way that steel plate does not move while pouring and compacting concrete.



3 Pouring concrete and compacting concrete

- Compact concrete properly around steel plate and headed studs.



SB headed studs made of steel

Intended use  
Installation instructions

Annex B6

**Table 4: Characteristic resistances under tension load**

Headed stud - nominal size		10	13	16	19	22	25
<b>Steel failure for headed studs made of steel</b>							
Characteristic resistance	$N_{Rk,s}$ [kN]	35	60	91	128	171	221
Partial safety factor	$\gamma_{Ms}$ <sup>1)</sup>	1,54					
<b>Pull-out failure for cracked concrete</b>							
Characteristic resistance	$N_{Rk,p}$ [kN]	30	50	90	75	85	120
Increasing factors $\psi$ for the characteristic resistance	C25/30	1.20					
	C30/37	1.48					
	C35/45	1.80					
	C40/50	2,00					
	C45/55	2,20					
	C50/60	2,40					
Partial safety factor	$\gamma_{Mp}$ <sup>1)</sup>	1.5					
<b>Concrete cone failure and splitting</b>							
Effective anchorage depth	$h_{ef}$ [mm]	$h_n - k + t$ <sup>2)</sup>					
factor to take into account the influence of load transfer mechanisms for cracked concrete	$k_{cr}$ [-]	8.5					
Characteristic spacing	$s_{cr,N} = s_{cr,sp}$ <sup>3)</sup> [mm]	3 $h_{ef}$					
Characteristic edge distance	$c_{cr,N} = c_{cr,sp}$ <sup>3)</sup> [mm]	1.5 $h_{ef}$					
Partial safety factor	$\gamma_{Mc}$ <sup>1)</sup>	1.5					
<b>Blow-out failure</b>							
Partial safety factor	$\gamma_{Mcb}$ <sup>1)</sup>	1.5					

<sup>1)</sup> In absence of other national regulations

<sup>2)</sup> For simple headed studs (for doubled headed studs resp. short headed studs see Fig.2 resp. 3, Annex 2)

<sup>3)</sup> Reinforcement resists the splitting forces and limits the crack width to  $w_w \leq 0.3$  mm

**Table 5: Displacement under tension load**

Headed stud - nominal size	10	13	16	19	22	25
Displacements <sup>1)</sup> to 0.7 mm under following loads in [kN]	15	22	31	31	35	48

<sup>1)</sup> The indicated displacements are valid for short term loading, the displacements can be increased under long term loading to 1,8 mm.

SB headed studs made of steel

Performance data  
Characteristic resistances and displacements under tension load

Annex C1

**Table 6: Characteristic resistances under shear load**

Headed studs - nominal size		10	13	16	19	22	25
<b>Steel failure for headed studs made of steel</b>							
Characteristic resistance	$V_{Rk,s}$ [kN]	21	36	54	77	103	132
Partial safety factor	$\gamma_{Ms}$ <sup>1)</sup>	1,29					
<b>Concrete pry-out failure</b>							
Factor in equation (32) according CEN/TS 1992-4.2:2009, section 6.3.4 without tensile reinforcement	$k_3$ <sup>2)</sup>	2.0					
Partial safety factor	$\gamma_{Mcp}$ <sup>1)</sup>	1.5					
<b>Concrete edge failure</b>							
Effective length of the headed stud	$l_f = h_{ef}$ [mm]	$h_n - k + t$ <sup>3)</sup>					
Effective outside diameter	$d_{nom} = d_1$ [mm]	10	13	16	19	22	25
Partial safety factor	$\gamma_{Mc}$ <sup>1)</sup>	1.5					

1) In absence of other national regulations

2) In case of supplementary reinforcement the factor  $k_3$  shall be multiplied by 0.75

3) For simple headed studs (for doubled headed studs resp. short headed studs see Fig. 2 resp. 3, Annex 2)

**Table 7: Displacements under shear load**

Headed studs - nominal size	10	13	16	19	22	25
Displacements <sup>1)</sup> to 1.5 mm under following loads in [kN]	15	20	30	45	60	75

1) The indicated displacements are valid for short term loading, the displacements can be increased under long term loading to 2.0 mm

**Combined tension and shear load**

The factor  $k_7$  according CEN/TS 1992-4.2:2009, section 6.4.1.3 is for combined tension and shear load

$$k_7 = 2/3$$

SB headed studs made of steel

Performance data

Characteristic resistances and displacements under shear load, combined tension and shear load

Annex C2