Deutsches Institut für Bautechnik

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European Technical Assessment Body for construction products

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European Technical Assessment ETA-21/0169 of 26 February 2025

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	HALFEN HCC Column Shoe
Product family to which the construction product belongs	Column Shoe
Manufacturer	Leviat GmbH Liebigstraße 14 40764 Langenfeld GERMANY
Manufacturing plant	Leviat Manufacturing Plants
This European Technical Assessment contains	14 pages including 3 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	EAD 200102-00-0302, Edition 09/2021

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Specific Part

Technical description of the product

The HALFEN HCC Column Shoe consists of a base plate and a side plate of steel, which are welded together. Anchor bars made of reinforcing steel are welded to the side plate.

The product description is given in Annex A.

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

The column shoes serve as connectors of e.g. between a reinforced concrete column and a foundation or between two reinforced concrete columns or between two reinforced concrete beams.

The performances given in Section 3 are only valid if the column shoe 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 column shoe 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
Resistance to tension and shear loads	See Annex C1

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire – steel temperature time table under fire exposure	See Annex C1

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

In accordance with the European Assessment Document EAD 200102-00-0302 the applicable European legal act is Commission Decision 2000/606/EC.

The system to be applied is: 2+

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document

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 26 February 2025 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Müller

Deutsches Institut für Bautechnik DIBt

Fig. A1.1: Application example

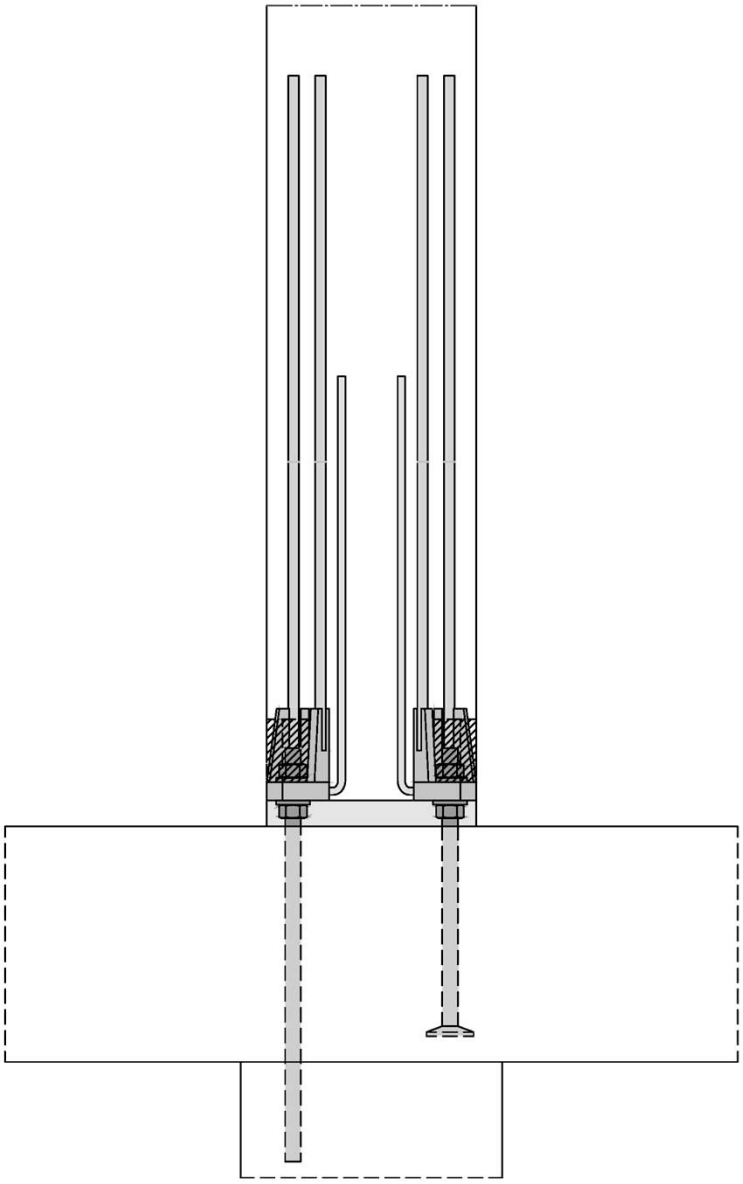


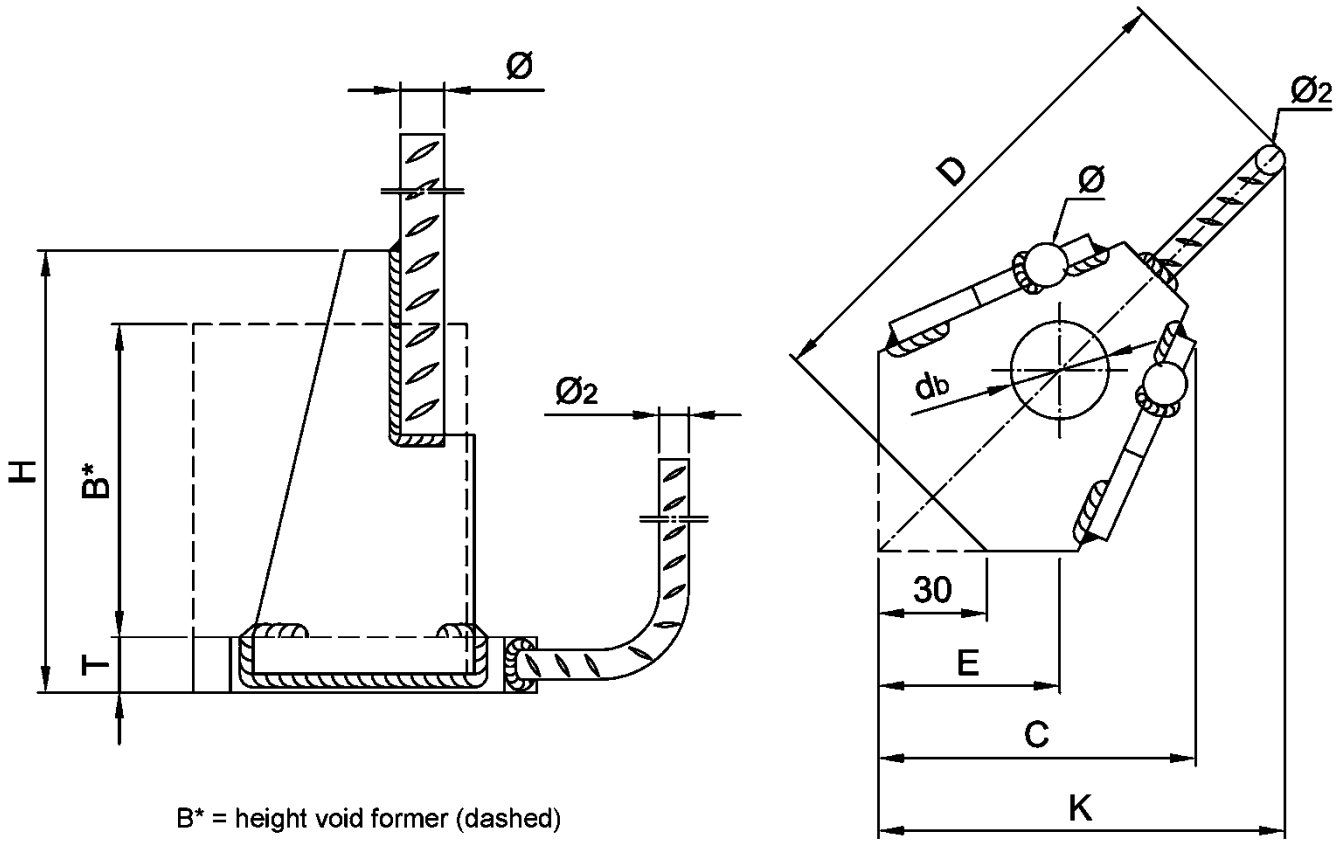
Fig. A1.2: HCC column shoe

HALFEN HCC Column Shoe

Product description
Installed condition

Annex A1

Fig. A2: Dimensions HCC Column Shoe



B* = height void former (dashed)

Table A2.1: Dimensions [mm]

HCC	d_b	Ø	$Ø_2$	H	T	B*	D	E	C	K
16	27	12	8	120	15	85	136	50	88	112
20	30	14	10	135	20	95	141	50	95	117
24	35	16	12	150	25	105	150	50	106	123
30	40	20	14	175	35	120	188	50	119	150
39	55	28	20	225	45	150	245	60	157	195

Table A2.2: Material

Component	Material
Reinforcing steel bars	B500A, B and C acc. to EN 1992-1-1:2004 + AC:2010, Annex C
Steel plates	S355 acc. to EN 10025-2:2019, EN 10025-3:2019, EN 10025-4:2023

HALFEN HCC Column Shoe

Product description
Dimensions and Materials

Annex A2

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Specifications of intended use

Loading

- Static or quasi- static tension, shear or combinations of tension and shear
- Fire exposure

Anchoring base material

- Reinforced normal weight concrete according to EN 206-1:2013 + A1:2016
- Strength class C30/37 to C70/85 according to EN 206-1:2013 + A1:2016
- Cracked or uncracked concrete

Conditions of use (Environmental conditions)

- Column shoe connections flush with the outer surface of the concrete members for use in dry internal conditions only.
- Column shoe connections designed with concrete cover must meet the requirements of EN 1992-1-1: 2004 + AC:2010.
- The lowest temperature for use is -20°C.

Design

- Column shoes are designed under the responsibility of an engineer experienced in the field of structural design and reinforced concrete constructions.
- Column shoe connections are designed according to EOTA TR 068, March 2020.
- Verifiable calculation notes and drawings are prepared taking into account the loads to be transferred.
- The position of the column shoes including the required reinforcement (for additional splicing reinforcement see Annex B2) and anchor bolts are given in the design drawings (e.g. position of the column shoes and anchor bolts relative to reinforcement or to the support).
- The column shoes serve as connectors between a concrete column and foundation or between two columns or beam to column connections.
- Lap length between HCC reinforcement bars and the concrete members reinforcement bars are designed acc. to EN 1992-1-1: 2004 + AC:2010.
- The connected concrete members are designed acc. to EN 1992-1-1: 2004 + AC:2010.
- Load bearing capacities for column shoe connections exposed to fire are verified acc. to EOTA TR 068, March 2020 considering the load reduction factors acc. to Annex C1.

HALFEN HCC Column Shoe	**Annex B1**
Intended use Specifications	

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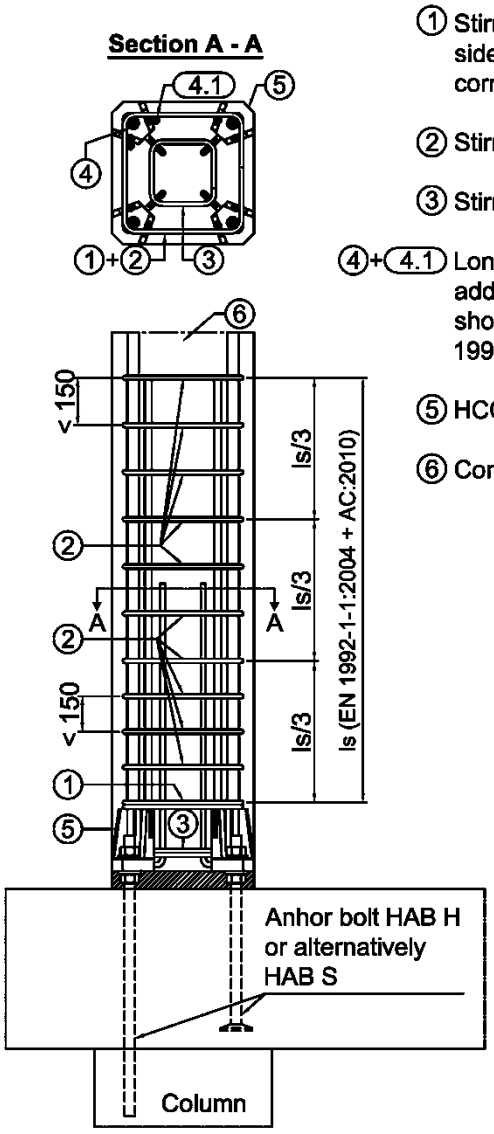
Fig. B2: Additional splicing reinforcements



① Stirrups for HCC Column shoe acc. to table B2, Stirrup flush with HCC side plate, concrete cover of 30 mm for HCC arrangement in column corner.

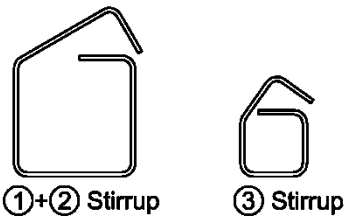
② Stirrups in splicing area acc. to EN 1992-1-1:2004 + AC:2010

③ Stirrups for HCC Column shoe acc. to table B2.

④+4.1 Longitudinal column reinforcements, acc. to calculation. If necessary, additional longitudinal reinforcements can be arranged outside the column shoe. Lab length in splicing area must be verified acc. to EN 1992-1-1:2004 + AC:2010 with column shoe reinforcement.

⑤ HCC Column shoe

⑥ Concrete: minimum concrete strength class C30/37



Alternative rebar arrangement for additional HCC column shoes at the edge.
Longitudinal HCC rebars have to be enclosed. Diameter and number of stirrups are equal to ① at minimum.

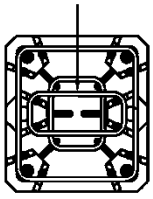


Table B2: Additional stirrups in the column shoe area

HCC	HAB	Additional Stirrup reinforcements		
		①	②	③
16	HAB H16 / HAB S16	1Ø8	Ø8	1Ø8
20	HAB H20 / HAB S20	1Ø10	Ø10	1Ø10
24	HAB H24 / HAB S24	1Ø10	Ø10	1Ø10
30	HAB H30 / HAB S30	1Ø12	Ø12	1Ø12
39	HAB H39 / HAB S39	2Ø12	Ø12	2Ø12

Stirrup design acc. to EN 1992-1-1:2004 + AC:2010

HALFEN HCC Column Shoe	**Annex B2**
Intended use Specifications for additional splicing reinforcements	

Installation

- The column shoe`s installation is carried out by appropriately qualified workers under the supervision of the person responsible for technical matters on site.
- Usage of the column shoes as supplied by the manufacturer without any manipulation and exchanging of the components.
- Installation of the column shoes in accordance with the manufacturer's specifications given in Annex B5.
- Column shoes must be fixed to the formwork, so that no movement occurs during the time of laying the reinforcement as well as pouring and compacting the concrete.
- The column shoe area must be compacted carefully.
- The column shoe`s inner pocket must be protected against contamination.
- The spacing between column shoes must be selected for proper concreting and compacting. Minimum distances and arrangements for rectangular and circular columns are given in Fig. B3 and Table B3.
- The column shoes may be used in any cross-section form, for example: square, rectangle, L-form, oval and circle.

Fig. B3: HCC arrangements and minimum distances in rectangular columns

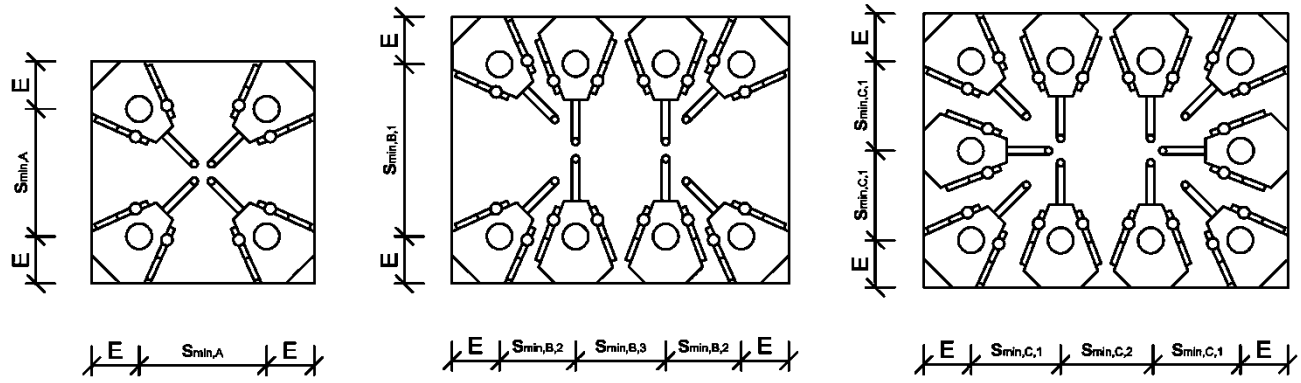


Table B3: Minimum distances for HCC in rectangular columns [mm]

HCC	E	A	B			C	
		$s_{min,A}$	$s_{min,B,1}$	$s_{min,B,2}$	$s_{min,B,3}$	$s_{min,C,1}$	$s_{min,C,2}$
16	50	135	185	80	95	95	100
20	50	145	205	105	105	105	105
24	50	160	220	110	125	115	125
30	50	210	300	135	140	150	140
39	60	280	400	170	170	200	170

HALFEN HCC Column Shoe

Annex B3

Intended use
Specifications and installation parameters

Fig. B4: HCC Arrangement and minimum distances in circular columns

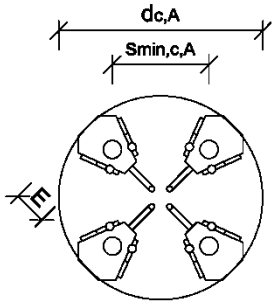


Table B4: Minimum distances for HCC in circular columns [mm]

HCC	E	A	
		$d_{c,A}$	$s_{min,c,A}$
16	50	300	142
20	50	310	149
24	50	330	163
30	50	400	213
39	60	515	281

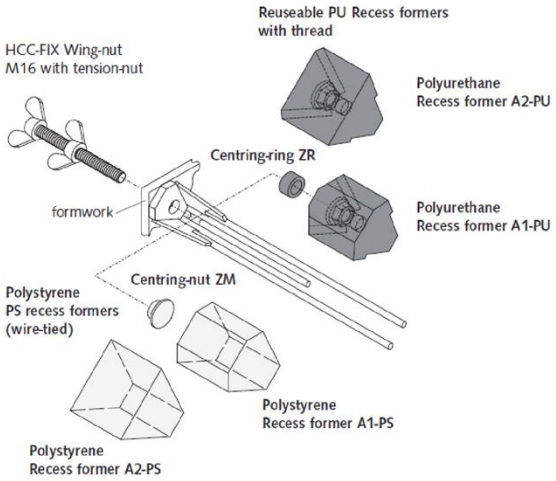
HALFEN HCC Column Shoe

Intended use
Specifications and installation parameters

Annex B4

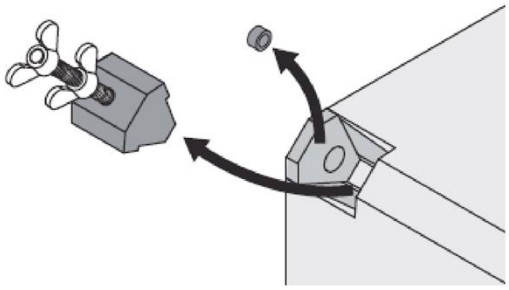
Installation Instructions for HCC Column Shoes in formwork

- Depending on the Column Shoes position (corner (A1) or edge types (A2)) different recess former can be chosen:

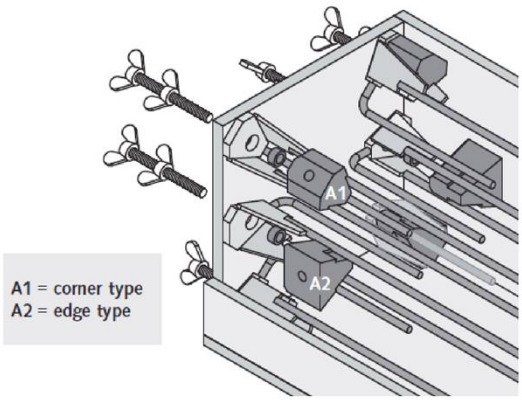


PU Recess former (reusable):

- 17 mm diameter holes are drilled in the bottom of the formwork for the M16 Fixing bolts.
- A ZR Centering-ring is placed in the base plate`s through hole (column shoe).
- To ensure simple and reliable removal the PU Recess formers must be lubricated before installation.
- The Fixing bolt is screwed through the formwork and column shoe into the PU recess former via the crimped Wing-nut.
- The second Wing-nut (not crimped) is then used to secure the column shoe firmly to the formwork.



- After the concrete has cured the polyurethane PU recess former and ZR centering-ring is easily removed using the Fixing Bolt (if screwed into the secondary threading positioned on the recess former`s front).



PS Recess former (single use):

- 17 mm diameter holes are drilled in the bottom of the formwork for the M16 Fixing bolts.
- The Column shoe is fixed to the formwork via the ZM Centering-nut which is placed in the column shoe`s base plate.
- The Fixing bolt is screwed through the formwork and column shoe into the ZM centering-nut via the crimped Wing-nut.
- The second Wing-nut (not crimped) is then used to secure the column shoe firmly to the formwork.
- The PS polystyrene recess formers are tied by wire or taped to the column shoe. No additional fixing is required.
- After stripping the striking formwork from the precast column, the PS recess formers can be removed by cutting, picking or similar means.

- Place column reinforcements according to design drawings including additional splicing reinforcement according to Annex B2.
- Cast in and compact the concrete in the column striking formwork.
- After concrete has hardened, remove the striking formwork and recess former.
- More details regarding anchor positioning, concreting, placing and adjusting the column see ETA-21/0371 from 29th November 2023.

HALFEN HCC Column Shoe	**Annex B5**
Intended use Installation instructions for HCC in formwork including column preparation	

Table C1.1: Resistance to tension, compression and shear loads

			HCC16	HCC20	HCC24	HCC30	HCC39
Design resistance under tension against steel failure	$N_{Rd,s}$	[kN]	62	97	139	221	384
Bending resistance factor	η_d	[-]	1,0				
Bending stiffness factor	k_L	[-]	1,0				
Shear resistance factor	k_s	[-]	1,0				

Note:
Laps with the welded reinforcing steel bars (Value Ø in Table A2.1) are designed acc. to EN 1992-1-1:2004 + AC:2010

Table C1.2: Steel temperature timetable for connections under fire exposure – $T_{cr}(t_i)$

HCC	Column dimension		Duration of exposure to fire t_i **[min]** acc. to uniform temperature curve (ETK)					
			30	**60**	**90**	**120**	**180**	**240**
16	234x234	$T_{cr}(t_i)$ [°C]	203	425	585	702	868	1038
		$\mu_{fi,Anchorage}$ [-]	1,00	0,95	0,52	0,23	0,08	0,03
		$T_{cr}(t_i)$ [°C]	182	424	581	696	866	984
		$\mu_{fi,Thread}$ [-]	0,94	0,72	0,28	0,11	0,05	0,01
20	245x245	$T_{cr}(t_i)$ [°C]	209	413	562	675	828	975
		$\mu_{fi,Anchorage}$ [-]	1,00	0,97	0,59	0,29	0,10	0,05
		$T_{cr}(t_i)$ [°C]	182	413	566	681	845	978
		$\mu_{fi,Thread}$ [-]	0,94	0,75	0,33	0,12	0,05	0,01
24	256x256	$T_{cr}(t_i)$ [°C]	214	401	539	647	788	913
		$\mu_{fi,Anchorage}$ [-]	1,00	1,00	0,66	0,36	0,12	0,06
		$T_{cr}(t_i)$ [°C]	179	395	551	667	824	973
		$\mu_{fi,Thread}$ [-]	0,94	0,78	0,38	0,14	0,06	0,01
30	310x310	$T_{cr}(t_i)$ [°C]	218	404	535	635	775	906
		$\mu_{fi,Anchorage}$ [-]	1,00	1,00	0,72	0,42	0,15	0,07
		$T_{cr}(t_i)$ [°C]	190	388	534	624	777	915
		$\mu_{fi,Thread}$ [-]	0,94	0,80	0,47	0,23	0,08	0,03
39	400x400	$T_{cr}(t_i)$ [°C]	194	369	500	599	747	863
		$\mu_{fi,Anchorage}$ [-]	1,00	1,00	0,78	0,47	0,17	0,08
		$T_{cr}(t_i)$ [°C]	189	366	496	569	713	840
		$\mu_{fi,Thread}$ [-]	0,94	0,82	0,56	0,32	0,10	0,05

HALFEN HCC Column Shoe

Annex C1

Performance
Resistance to tension, compression and shear loads and fire exposure