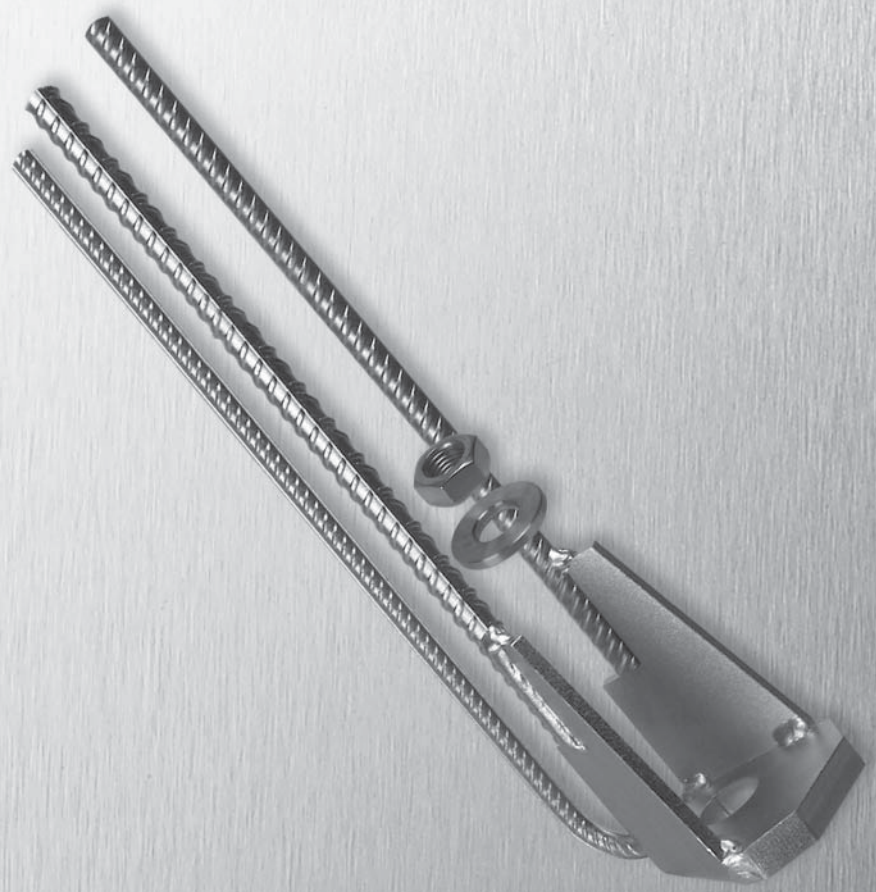
# HALFEN HCC COLUMN SHOE
## TYPE TEST REPORT



*HALFEN COLUMN SHOE*

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CONCRETE

HALFEN

YOUR BEST CONNECTIONS

# Baden-Württemberg
# Municipality steering commitee
# Tübingen
# Federal Office of Construction Engineering


Date 8th June 2009
Editor Willi Weidner
Telephone 0711 126 - 1996
Reference No: 27-19/2621.4-6-08.21


## Type test report no. 03/30

| | |
|---|---|
| **Applicant:** | Halfen GmbH |
| **Subject of the type test:** | Halfen column shoe type HCC |
| **Applicant for the confirmation tests:** | Fa. Halfen GmbH & Co. KG Werk Wiernsheim Wurmberger Str. 30-34; 75446 Wiernsheim |
| **Structural documents:** | The documents specified in Section 3.1 and this test report |
| **Period of validity:** | until 15th June 2014 |

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1. Due to § 68 par. 1 of the federal state building regulations for Baden-Württemberg 08.08.95 (GBL p. 617) in connection with the regulations of the Ministry of Economic Affairs on the structural testing of structural systems (building test regulation BauPrüfVO) of 21.05.96 (GBL. p. 410), the Federal Office for Trade – Federal Office of Construction Engineering – examined the documents for the Halfen column shoe as a type test. The design complies with the public legal regulations. This test report has 4 pages.


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## 2. Design, bases of and enclosures for the type test

Halfen column shoes are made from several welded steel plates and concrete reinforcement steel parts. They are connection elements (special fittings) for attachment to the joints and foot restraints of columns in the steel-reinforced concrete prefabricated construction.

## 3. Bases of the type test

3.1 Type test report sheets to be submitted to the federal building authority

Appendix 1 according to the structural analysis column shoe 23rd April 2004. construction materials/general references/technical data, page 1 to 3 including the corresponding type test report sheets:

Assembling references Halfen column shoe type HCC
Dimensions Halfen column shoe type HCC 16 - HCC 24
Dimensions Halfen column shoe type HCC 30 - HCC M52

3.2 Further tested records

Structural analysis calculation of 23rd February 2004 with Pages 1 to 21 and the evaluation using Excel tables plus Page 22 and the following plans from Halfen GmbH & Co. KG:

Plan 4b Column shoe load increment HCC 16
Plan 1b Column shoe load increment HCC 20
Plan 6a Column shoe load increment HCC 24
Plan 2b Column shoe load increment HCC 30
Plan 3b Column shoe load increment HCC 39
Plan 8a Column shoe load increment HCC M 30
Plan 7a Column shoe load increment HCC M 36
Plan 9a Column shoe load increment HCC M 39
Plan 10a Column shoe load increment HCC M 45
Plan 5b Column shoe load increment HCC M 52

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3.3 Structural bases

3.3.1 The structural regulations which currently apply, in particular, German Industrial Standard DIN 1045-1:2001 - 07, DIN 18800: 1990-11, DIN 18800-7:2002-9 DIN 1055, DIN 4099

3.3.2 Licence notification of the German Institute for Civil Engineering Berlin for Halfen anchor bolts HAB MH, Approval no: Z-21.5-1758 of 28th October 2008 (11 pages, 20 appendices)

3.3.3 Licence notification of the German Institute for Civil Engineering Berlin for Halfen anchor bolts HAB H, Approval no: Z-21.5-1761 of 26th November 2008 (11 pages, 19 appendices)

## 4. Design loads

As a result of the type structural analysis the force limits $N_{R,d}$ acc to DIN 1045-1 are indicated for the structural components.

## 5. Construction materials

| | |
|---|---|
| Sheet steel: | S355 J2 |
| Ribbed concrete reinforcement steel | BSt 5OO S |
| U washers | S355 JO |
| Column concrete | minimum concrete strength class C30/37 |

## 6. References

6.1 The range of application for Halfen column shoes includes structural elements with predominantly static loading.

6.2 The fitting instructions (see Section 3.1 of this test report) must be followed.

6.3 The column shoes were tested in the uncast state (installation state) in the type structural analysis. The design loads or permitted forces given in the documents are transferable both in the uncast state and in the cast state (final state).

6.4 The column shoes were tested for the transfer of normal forces. The transfer of transverse forces is not covered by this type test. Any transverse forces must be tested separately (cf. enclosure 1 on static analysis, section 2.5).

6.5 The introduction or transfer of forces into the column shoes, and particularly the anchors and lapped splices connected to the column shoes, must be tested both in the installation state and in the end state.
When using Halfen Type HAB anchor bolts with swaged end anchor heads, the relevant general construction approvals Z-21.5-1761 (Type HAB H) and Z-21.5-1758 (Type HAB MH) must be followed.

6.6 The long certificate of suitability according to DIN 18800 Part 7 and the certificate of suitability according to DIN 4099 are required to manufacture the column shoe.

6.7 The recesses in the area of the column shoe must be grouted with suitable non-shrinking mortar to ensure protection from corrosion.
The suitability of the mortar, the supervision of manufacture and the conditions for use must comply with the current version in each case of the German Concrete and Concrete Technology Association code of practice “Grouting mortar code of practice for the use of factory-mixed grouting mortar”.

6.8 The level of fire protection for the column shoes must be confirmed in each case and the fire resistance class must be verified in accordance with the current regulations.

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## 7. General provisions

7.1 The documents specified under Section 3.1 together with this test report replace the separate static test for Halfen column shoes.
The structural test centre needs only to make sure that the design corresponds to the type sheet and complies it‘s requirements. Deviations of this type test repport require a separate static proof in each single case.

7.2 This type test report does not replace required authorizations for building projects.

7.3 The type sheets may only be used in their entirety, without alteration and together with the test report, for construction proposals.

7.4 In case of doubt, a second preparation of the documents deposited with the Federal Office of Construction Engineering is definitive.

7.5 Validity of this type test report ends at 15th June 2014

7.6 If basic documents of this type test report (eg. industry standards or approvals) change or become void, this has to be indicated to the federal office. The federal office then decides about the further proceeding.

7.7 Regardless the federal office can declare the type test report void, if a new state of art or changes of regulations are against further use of the type test report.
The existing type test report can then be tendered again in it‘s changed or complemented form for a renewed type test.

**Federal Office of Construction**
representative superintendent:

BD Dipl.- Ing. Peter Mutsch

consultant:

Dipl.-Ing. W. Weidner

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# Construction materials / General information / technical specifications

for
Type HCC column shoe

**Type tested for construction application**

Test number; 03/30

**Landesstelle für Bautechnik Baden-Württemberg**

Tübingen, dated. 8th June 2009

Processor (signature)

## 1. Construction materials

Floor plate S355J2

Side plates S355J2G3

Concrete reinforcing steel BSt500S

Special washers S355JO

Column concrete minimum strength C30/37

## 2. General information

2.1 Halfen Type HCC column shoes are used together with Halfen Type HAB anchor bolts to anchor steel-reinforced precast concrete columns using bolt connections.
In this case, the column shoes are installed at the corners or on the long sides of rectangular columns, or even inside round precast concrete columns while the anchor bolts are anchored in foundations or column heads which have been prepared beforehand.
The connection, which consists of the column shoe and the anchor bolt, makes it possible to form both articulated and rigid connections.

With columns which are designed for articulated connection, tensile and compressive forces can be supported at each column shoe in the erection state. Therefore assembly struts during the construction period are not necessary.

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Next endorsement by the federal office of construction required by 15th June 2014

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2.2 In the erection state (without assembly joints grouted) the column shoes are connected force locked to the anchor bolts with using nuts/lock nuts and special washers. In this state, the column shoes can be loaded with the full subsequent tensile and compressive force as listed.

2.3 For the final state, the assembly joint under the column and the recesses for the nut assembly must be grouted with non-shrinking mortar – the strength class of the grouting mortar must correspond at least to that of the column concrete. After the grouting has cured, the concrete cross section can be determined according to the general calculation rules for steel-reinforced concrete construction.

2.4 The load-bearing capacity of the column shoes is predominantly determined for static loading by positive or negative normal forces.

2.5 Determination of transverse forces is not covered by this type of structural analysis. A transverse force which may be present must be determined case by case. That determination can be carried out structurally via a concrete crown, a shearing cleat or by friction in accordance with DIN 1045-1.

2.6 The lapped splice between the reinforcement arranged at the column shoe, the reinforcement selected by the client and sufficient load-carrying capacity of the available Type HAB anchor bolts must be decided upon case by case for the installation situation in question.

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## 3. Technical specifications

### 3.1 Load bearing capacity

The load-bearing capacity of the column shoes for tension and compression is found at the same height according to the following table.

| Column shoe Type | Suitable anchor bolt Type | Max. non-centricity assembly tolerance e [mm] | Force limit [according to: DIN 1045-1 or EC2 and DIN 18800 or EC3] NR,d [kN] |
|---|---|---|---|
| HCC16 | HABH16/HABS16 | ± 5 | ± 61.7 |
| HCC20 | HAB H20 / HAB S20 | ± 5 | ± 96.3 |
| HCC24 | HAB H24 / HAB S24 | ± 5 | ±138.7 |
| HCC30 | HAB H30 / HAB S30 | ± 5 | ± 220.4 |
| HCC39 | HAB H39 / HAB S39 | ± 8 | ± 383.4 |
| HCC M30 | HAB MH36 / HAB MS36 *) | ± 4.5 | ± 299.2 |
| HCC M36 | HAB MH36 / HAB MS36 | ± 9.5 | ± 436.0 |
| HCC M39 | HAB MH39 / HAB MS39 | ± 8 | ± 520.6 |
| HCC M45 | HAB MH45 / HAB MS45 | ± 10 | ± 696.6 |
| HCC M52 | HAB MH52 / HAB MS52 | ± 9 | ± 937.3 |

*) Type HAB MH30 and HAB MS30 are in preparation.

### 3.2 Dimensions

The functional dimensions of the column shoe are listed in the two pages of the appendix labelled “Dimensions”.

### 3.3 Fitting instructions

The rules on the page in the appendix labelled “Fitting instructions” must be followed for assembling and fitting the column shoes.

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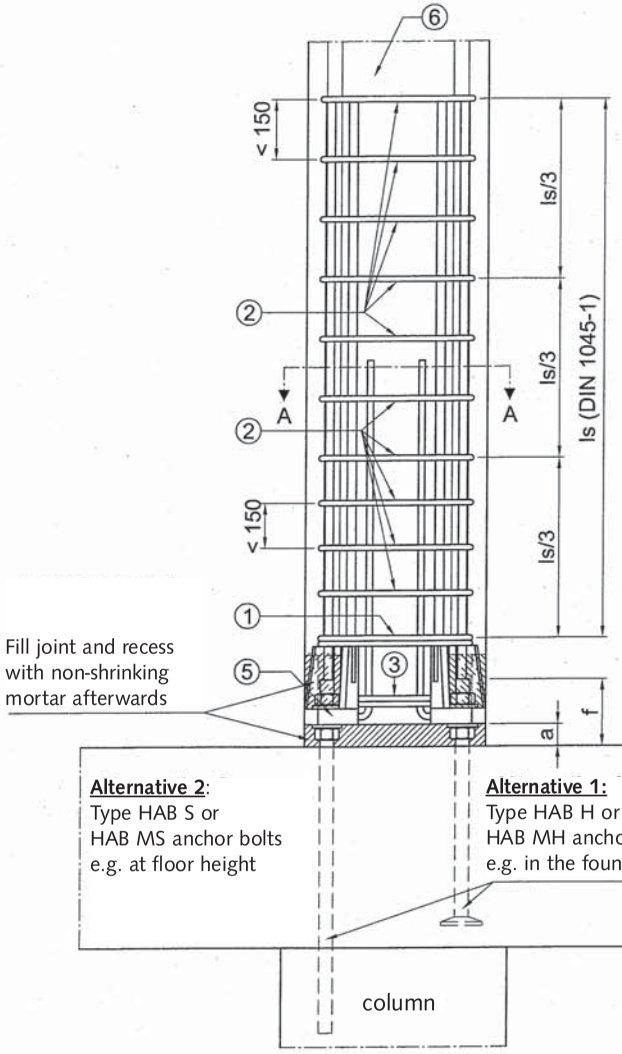
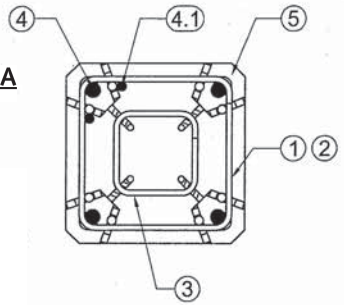
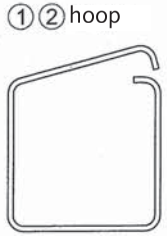
1...Fertigung




## Section A – A





① Hoop for column shoe according to the table flush with upper edge. Cover of 30 mm present for the hoop when fitting the column shoe in the corner.

② Arrange hoop in the corner in accordance with DIN 1045-1:2001-07

③ Arrange hoop for column shoe in accordance with the table, in the bending radius of the bent column-shoe concrete reinforcing steel.

④ Columns – longitudinal reinforce ment in the corner

(4.1) Where necessary, additional longitudinal reinforcement can also be arranged outside the cross section of the shoe. The client must determine the lapped splice with the column-shoe reinforcement.

⑤ Type HCC column shoe

⑥ Column concrete
Minimum strength class C30/37

| Column shoe | Anchor bolt | Joint height a [mm] | Bolt protrusion. f [mm] | ① | ② | ③ |
|---|---|---|---|---|---|---|
| HCC 16 | HAB H16/ HAB S16 | 50 | 105 | 1 Ø 8 | Ø 8 | 1 Ø 8 |
| HCC 20 | HAB H20/ HAB S20 | 50 | 115 | 1 Ø 10 | Ø 10 | 1 Ø 10 |
| HCC 24 | HAB H24/ HAB S24 | 50 | 130 | 1 Ø 10 | Ø 10 | 1 Ø 10 |
| HCC 30 | HAB H30/ HAB S30 | 50 | 150 | 1 Ø 12 | Ø 12 | 1 Ø 12 |
| HCC 39 | HAB H39/ HAB S39 | 50 | 165 | 2 Ø 12 | Ø 12 | 2 Ø 12 |
| HCC M30 | HAB MH36/ HAB MS36 *) | 50 | 165 | 2 Ø 10 | Ø 10 | 2 Ø 10 |
| HCC M36 | HAB MH36/ HAB MS36 | 55 | 165 | 2 Ø 12 | Ø 12 | 2 Ø 12 |
| HCC M39 | HAB MH39/ HAB MS39 | 55 | 185 | 2 Ø 12 | Ø 12 | 2 Ø 12 |
| HCC M45 | HAB MH45/ HAB MS45 | 65 | 195 | 3 Ø 12 | Ø 12 | 3 Ø 12 |
| HCC M52 | HAB MH52/ HAB MS52 | 70 | 240 | 3 Ø 12 | Ø 12 | 3 Ø 12 |

*) Bolzen Typ HAB MH30/ HAB MS30 sind in Vorbereitung

**Type tested for construction application**

Test number; 03/30

**Landesstelle für Bautechnik Baden-Württemberg**

Tübingen, dated. 8th June 2009

Processor (signature)

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Next endorsement by the federal office of construction required by 15th June 2014

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Municipality steering commitee Tübingen

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# Fitting instructions
# Halfen column shoe type HCC

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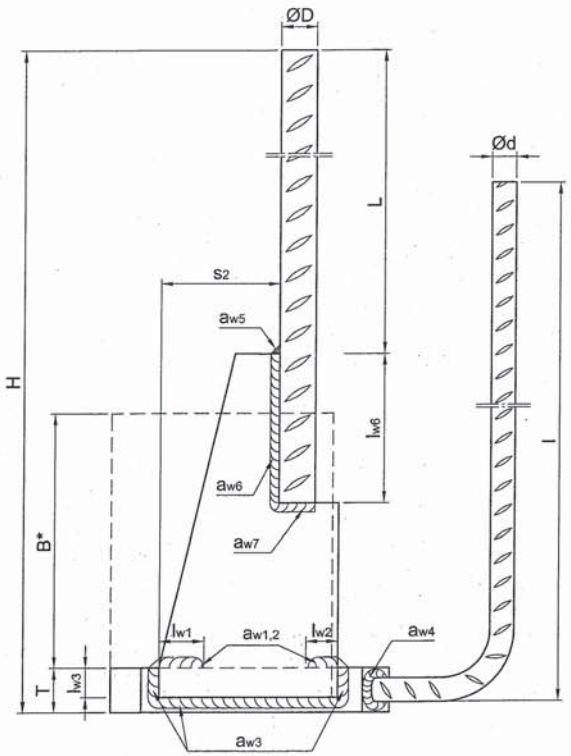
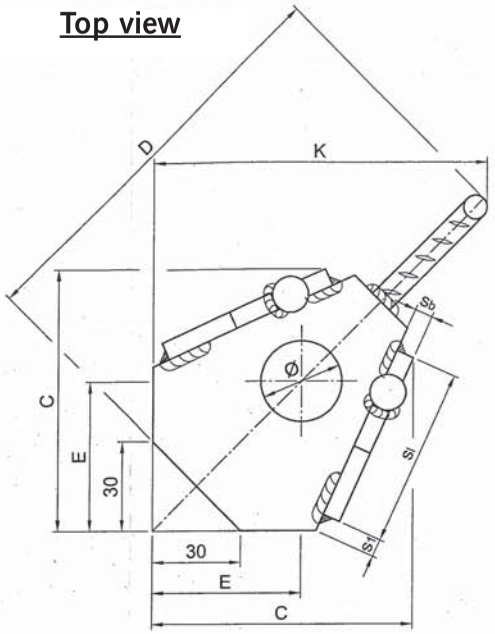
1...Fertigung

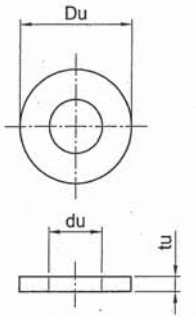
## Lateral view




## Top view




## U washers (special)




| Column shoe | Du [mm] | du [mm] | tu [mm] |
|---|---|---|---|
| HCC 16 | 38 | 18 | 5 |
| HCC 20 | 46 | 22 | 6 |
| HCC 24 | 55 | 25 | 6 |

**Materials:**

| | |
|---|---|
| Floor plate: | S355J2 |
| Side plates: | S355J2 |
| Concrete reinforcement steel: | BSt 500S |
| U-washer: | S355J0 |

**Type tested for construction application**

Test number; 03/30

**Landesstelle für Bautechnik Baden-Württemberg**

Tübingen, dated. 8th June 2009

Processor (signature)

B* = Maximum height of recess former

1) Lengths for good (moderate) anchoring conditions ...gen, or bond zones VB I (VB II)

| Column shoe | B* [mm] | C [mm] | D [mm] | E [mm] | H 1) [mm] | K [mm] | Ø [mm] | T [mm] | ØD [mm] | L 1) [mm] | Ød [mm] | l [mm] | aw1,2 ≥ [mm] | lw1 [mm] | lw2 [mm] | aw3 ≥ [mm] | lw3 [mm] | aw4 ≥ [mm] | aw5 ≥ [mm] | aw6 ≥ [mm] | lw6 [mm] | aw7 ≥ [mm] | Sl [mm] | Sb [mm] | S1 [mm] | S2 [mm] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HCC 16 | 85 | 88 | 136 | 50 | 760 (1015) | 112 | 27 | 15 | 12 | 640 (895) | 8 | 300 | 3 | 15 | 10 | 3 | 10 | 3 | 4 | 3 | 50 | 3 | 60 | 6 | 6 | 40 |
| HCC 20 | 95 | 95 | 141 | 50 | 965 (1290) | 117 | 30 | 20 | 14 | 830 (1155) | 10 | 450 | 3 | 15 | 10 | 5 | 12 | 4 | 4 | 4 | 60 | 4 | 60 | 8 | 5 | 45 |
| HCC 24 | 105 | 106 | 150 | 50 | 1055 (1410) | 123 | 35 | 25 | 16 | 905 (1260) | 12 | 550 | 4 | 15 | 15 | 8 | 12,5 | 5 | 4 | 4 | 80 | 0 | 70 | 12 | 5 | 41 |

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# Dimensions
# Halfen column shoe type HCC 16 – HCC 24

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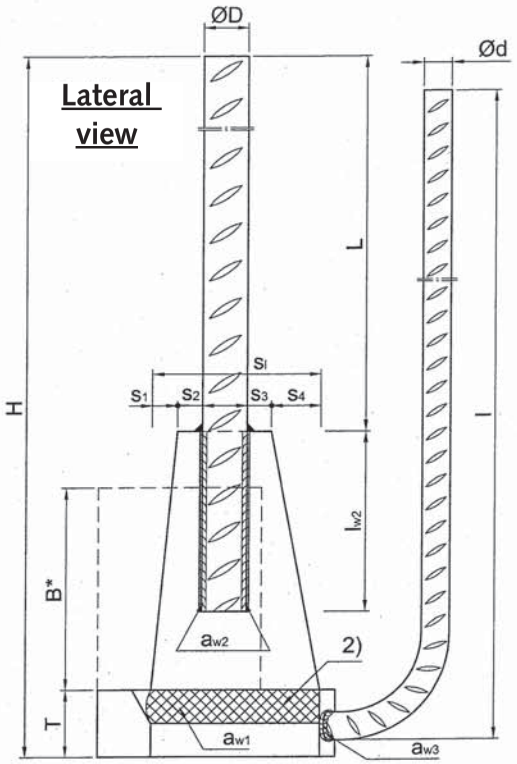
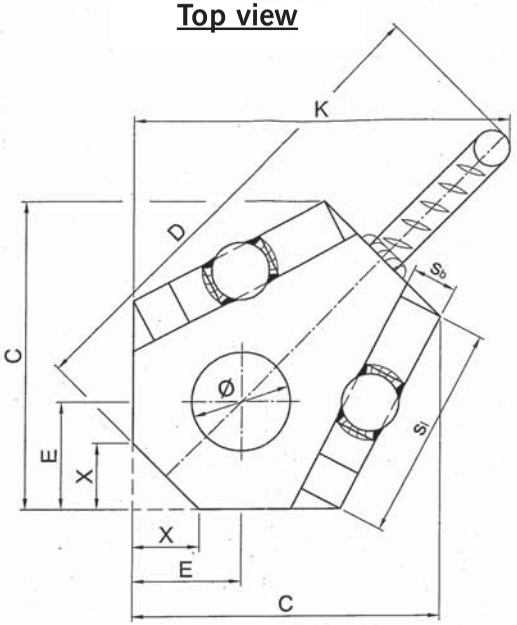
1....Fertigung

## Lateral view

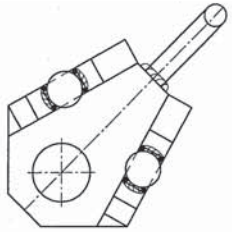



## Top view

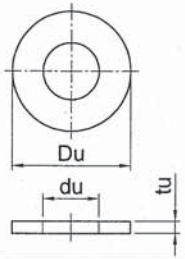



## Version type HCC M 45

Contoured floor plate rear edge



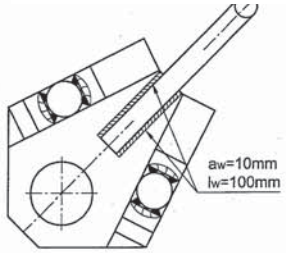
## U washers (special)




| Column shoe | Du [mm] | du [mm] | tu [mm] |
|---|---|---|---|
| HCC 30 | 65 | 31 | 8 |
| HCC 39 | 90 | 41 | 10 |
| HCC M30 | 65 | 38 | 8 |
| HCC M36 | 80 | 38 | 8 |
| HCC M39 | 90 | 41 | 10 |
| HCC M45 | 105 | 48 | 12 |
| HCC M52 | 110 | 55 | 12 |

## Version type HCC M 52

Centring rod on the floor plate




**Materials:**

| | |
|---|---|
| Floor plate: | S355J2 |
| Side plates: | S355J2 |
| Rebar steel: | BSt 500S |
| U-washer: | S355J0 |

1) Design for good (moderate) anchoring conditions or bond zones VB I (VB II)

2) Welding seam preparation by bevelling between 45° and 55°, either in the floor slab alone or both the floor plate and the side panel

B* = Maximum height of recess former **) see sketch HCC M52

| Column shoe | B* [mm] | C [mm] | D [mm] | E [mm] | H 1) [mm] | K [mm] | Ø [mm] | T [mm] | ØD [mm] | L 1) [mm] | Ød [mm] | l [mm] | aw1 ≥ [mm] | aw2 ≥ [mm] | lw2 [mm] | aw3 ≥ [mm] | Sl [mm] | Sb [mm] | S1 [mm] | S2 [mm] | S3 [mm] | S4 [mm] | X [mm] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HCC 30 | 120 | 119 | 188 | 50 | 1275 (1645) | 150 | 40 | 35 | 20 | 1100 (1470) | 14 | 800 | 15 | 3 | 80 | 6 | 80 | 15 | 20 | 22 | 18 | 0 | 30 |
| HCC 39 | 150 | 157 | 245 | 60 | 1675 (2395) | 195 | 55 | 45 | 28 | 1450 (2170) | 20 | 900 | 20 | 4 | 115 | 8 | 110 | 20 | 22 | 22 | 38 | 0 | 37 |
| HCC M30 | 130 | 134 | 220 | 50 | 1395 (1985) | 173 | 45 | 45 | 25 | 1200 (1790) | 16 | 1050 | 20 | 5 | 80 | 7 | 90 | 20 | 18 | 22 | 25 | 0 | 30 |
| HCC M36 | 160 | 157 | 245 | 60 | 1880 (2430) | 195 | 55 | 50 | 28 | 1650 (2200) | 20 | 1000 | 20 | 4 | 115 | 8 | 110 | 20 | 22 | 22 | 38 | 0 | 37 |
| HCC M39 | 180 | 172 | 267 | 60 | 1955 (2765) | 209 | 55 | 55 | 32 | 1650 (2460) | 20 | 1000 | 25 | 5 | 130 | 8 | 120 | 25 | 22 | 22 | 44 | 0 | 37 |
| HCC M45 | 180 | 207 | 317 | 60 | 2360 (3390) | 246 | 65 | 60 | 40 | 2070 (3100) | 25 | 1460 | 30 | 6 | 160 | 10 | 150 | 30 | 22 | 22 | 22 | 44 | 37 |
| HCC M52 | 180 | 232 | 366 | 60 | 2735 (3745) | 280 | 70 | 70 | 40 | 2290 (3300) | 25 | 1450 | 40 | 8 | 160 | **) | 170 | 40 | 18 | 22 | 22 | 68 | 35 |

**Type tested for construction application**

Test number; 03/30

**Landesstelle für Bautechnik Baden-Württemberg**

Tübingen, dated. 8th June 2009

Processor (signature)

Stamp
Municipality steering commitee Tübingen

Stamp
Next endorsement by the federal office of construction required by 15th June 2014

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# Dimensions
# Halfen column shoe type HCC 30 – HCC M52

**HALFEN GmbH**
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## CONTACT HALFEN WORLDWIDE

**HALFEN is represented in more than 45 countries worldwide. Please contact us: www.halfen.com**

The Quality Management System of Halfen GmbH is certified for the locations in Germany, Switzerland and Poland according to **DIN EN ISO 9001:2000**, Certificate No. QS-281 HH.



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