

Approval body for construction products
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and
Laender Governments



European Technical Assessment

ETA-22/0360
of 29 June 2022

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 HDB -Z punching shear reinforcement

Product family
to which the construction product belongs

S-shaped double headed reinforcement elements for the
increase of punching shear strength of footings and
ground slabs

Manufacturer

Leviat GmbH
Liebigstraße 14
40764 Langenfeld
DEUTSCHLAND

Manufacturing plant

Leviat Manufacturing Plants

This European Technical Assessment
contains

12 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 160208-00-0301 Edition 01/2022

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Specific Part

1 Technical description of the product

The HALFEN HDB-Z punching shear reinforcement system consists of S-shaped bar elements made of reinforcing steel B500 with diameters $d_A = 10, 12, 14, 16, 18, 20$ or 25 mm with heads upset on both sides. The anchor head diameter is three times the shaft diameter. In accordance with the mechanical properties according to EN 1992-1-1, Annex C, the reinforcing steels used are weldable and have a yield strength of 500N/mm^2 .

An HDB-Z element consists of two S-shaped bar elements which are spread at the lower bend to secure the position during concreting and are held in position by a connecting piece of reinforcing steel ($d_s = 6$ to 10 mm) at the rear end of the elements and by a clamping plate of structural steel at the upper bend.

The detailed 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 Product 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 Product 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
Increasing factor for punching shear resistance	$k_{pu,fo} = 2,35$ (for $d \leq 1,0$ m) $k_{pu,fo} = 1,50$ (for $d > 1,6$ m) Intermediate values may be interpolated linearly.
characteristic fatigue strength for $N = 2 \cdot 10^6$ load cycles	$\Delta\sigma_{Rsk,n=2 \cdot 10^6} = 70$ MPa

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	class A1

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

In accordance with EAD No. 160208-00-0301 the applicable European legal act is: [97/597/EC(EU)].

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.

The following standards and documents are referred to in this European Technical Assessment:

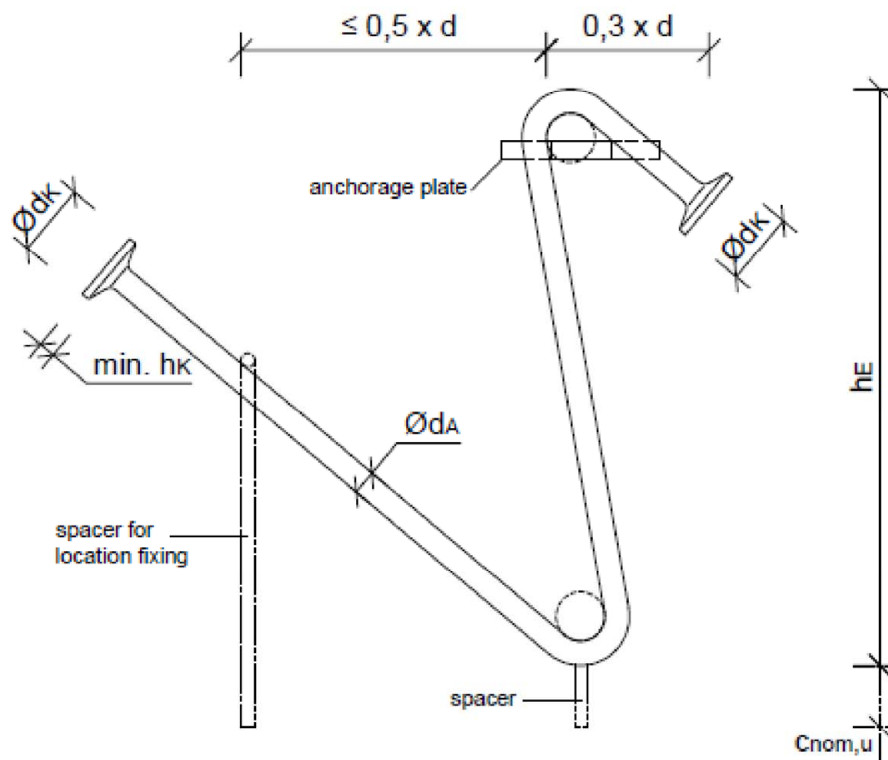
EN 206:2013	Concrete - Specification, performance, production and conformity
EN 1992-1-1:2011-01	Design of concrete - Part 1-1: General rules and rules for buildings
EN 1990:2021-10	Eurocode - Basis of structural design
EN ISO 17660-1:2006-12	Welding - Welding of reinforcing steel - Part 1: Load-bearing welded joints
EOTA TR 079:2022-01	Increase of punching resistance of footings and ground slabs - S-shaped double headed reinforcement elements - Calculation methods

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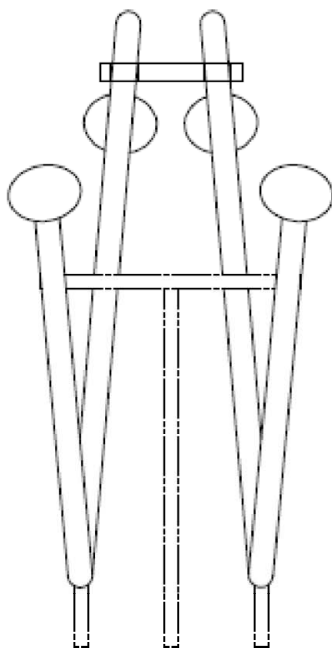
Dipl.-Ing Beatrix Wittstock
Head of Section

beglaubigt:
Schüler

HALFEN HDB-Z punching shear reinforcement



dimensions



Marking of the head ends on both sides e.g.



° = Symbol of manufacturing plant

Material: Reinforcing steel in acc. to EN 1992-1-1, Annex C with a characteristic yield strength $f_{yk} \geq 500$ MPa butt joints in accordance with EN ISO 17660-1 welding process 24 - flash welding

Anchor- \varnothing d_A [mm]	Head- \varnothing d_k [mm]	Head thickness min. h_k [mm]	Anchor- A_s A_s [mm ²]
10	30	5	79
12	36	6	113
14	42	7	154
16	48	8	201
20	60	10	314
25	75	12	491

spacer varies depending on concrete cover

HALFEN HDB-Z punching shear reinforcement

Product description
Product dimensions and marking

Annex A1

Specification of the intended use:

HDB-Z are used to increase the punching shear capacity of footing and ground slabs under static, quasi-static and fatigue loads.

They are placed next to columns or concentrated loads.

The punching shear capacity of footing and ground slabs is designed in accordance with EOTA TR 079.

The intended use includes the following specifications:

- Footing and ground slabs made of reinforced normal weight concrete of strength class C12/15 to C50/60 according to EN 206
- Footing and ground slabs with a minimum height of $h = 230$ mm
- The required concrete cover according to EN 1992-1-1 must be ensured
- The HDB-Z may be used up to a stress range of $\Delta\sigma_{Rs,k} = 70$ N/mm² and load cycles $n \leq 2 \times 10^6$ according to EN 1992-1-1, clause 6.8.6 (1) and (2).
- Table 6.3N from EN 1992-1-1 shall not be applied for HDB-Z. Provided that the stress range is within the scope of the simplified check according to EN 1992-1-1, clause 6.8.6, sufficient resistance to fatigue of the concrete may be considered to be given.

Installation:

- When arranging the elements, the specifications according to Annex B2 to B7 must be observed.
- When properly installed, the installed anchors have sufficient positional stability and resistance to normal stresses before concreting.

Packing, transport and storage:

- Packaging, transport and storage must be carried out in such a way that the reinforcement elements are not damaged. When storing and transporting the HDB-Z elements, care must be taken to avoid deformation of the reinforcement elements.

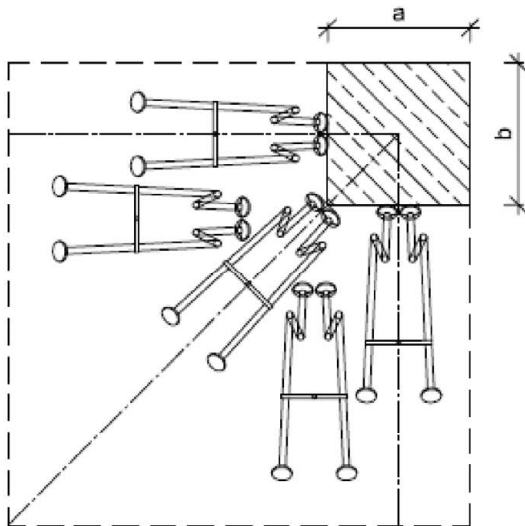
HALFEN HDB-Z punching shear reinforcement

Intended use
Specification

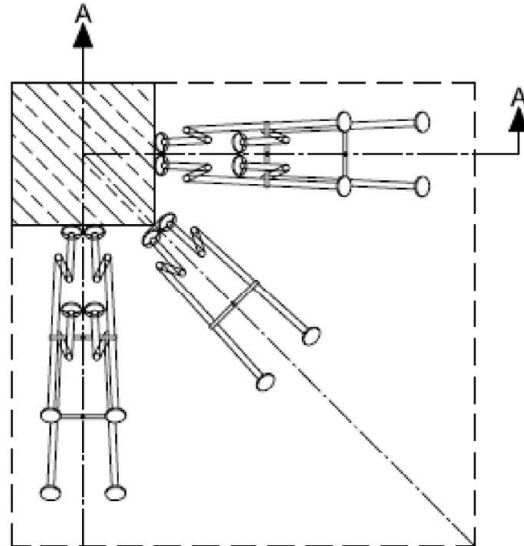
Annex B1

Arrangement of the HDB-Z elements (plan view)

Variant 1: Staggered arrangement of the second row

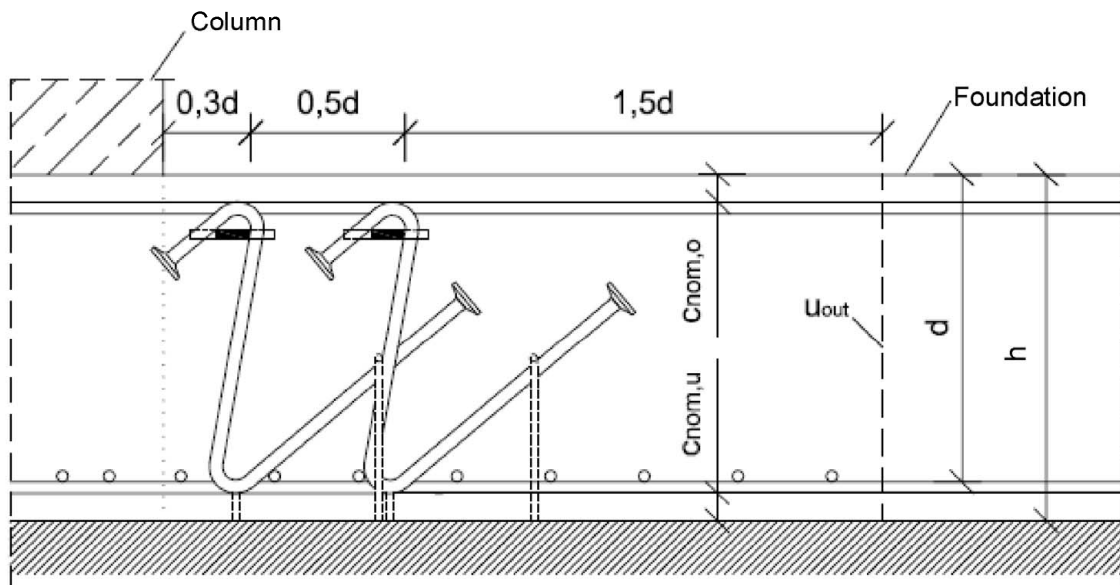


Variant 2: Crossed arrangement of the second row



a = column width side A
b = column width side B

Section A-A



Legend:

$c_{nom,u}$ = concrete cover bottom, $c_{nom,o}$ = concrete cover above, U_{out} = outer control perimeter,
 d = effective depth, h = height of footing or ground slab

HALFEN HDB-Z punching shear reinforcement

Intended use
Arrangement of HDB-Z elements

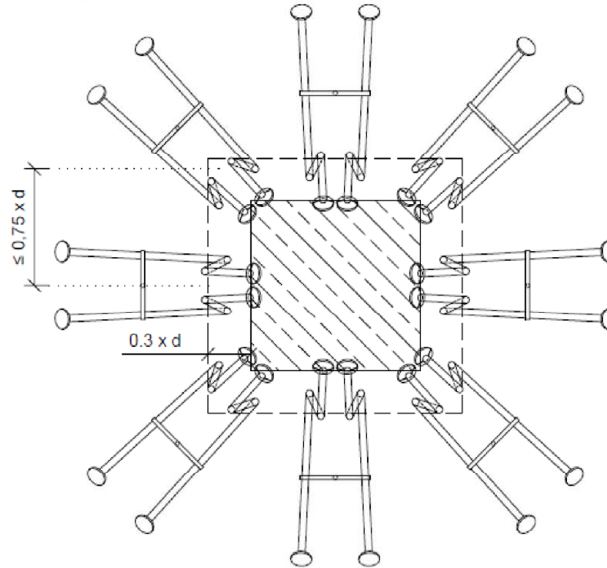
Annex B2

English translation prepared by DIBt

Spacing of the HDB-Z elements (plan view)

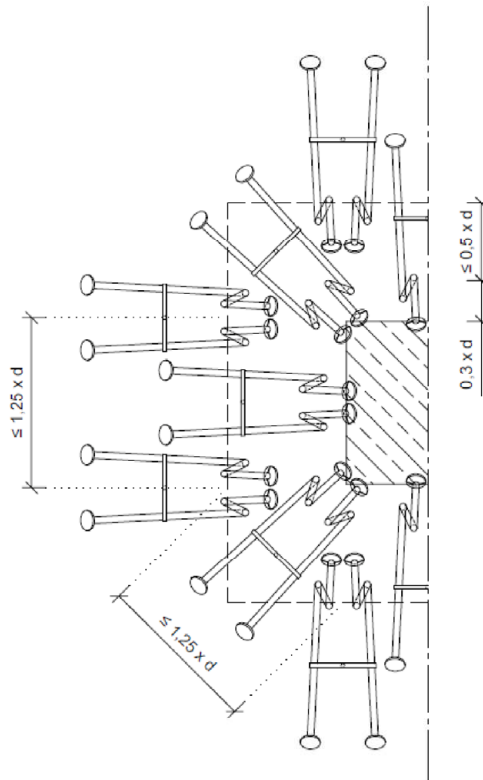
First row

arrangement shown applies accordingly to round column geometries

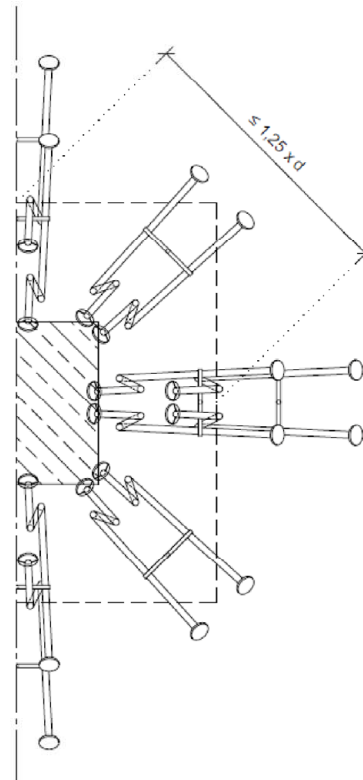


Second row

Variant 1
Staggered arrangement



Variant 2
Crossed arrangement



Legend: d = effective depth

HALFEN HDB-Z punching shear reinforcement

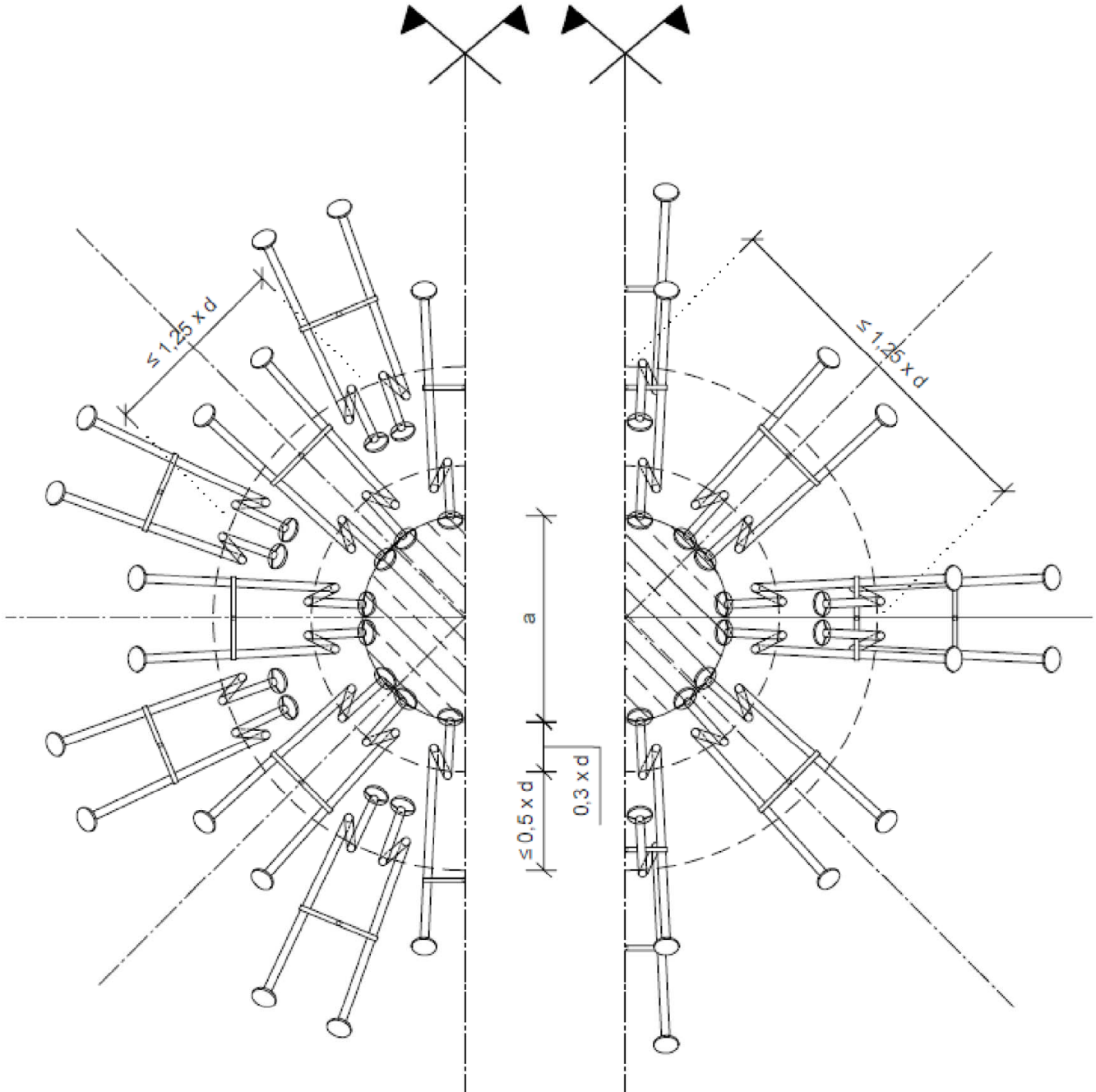
Intended use
Arrangement of elements in the first and second perimeter

Annex B3

Second row for round columns

Variant 1:
Staggered arrangement

Variant 2:
Crossed arrangement



Legend: d = effective depth

HALFEN HDB-Z punching shear reinforcement

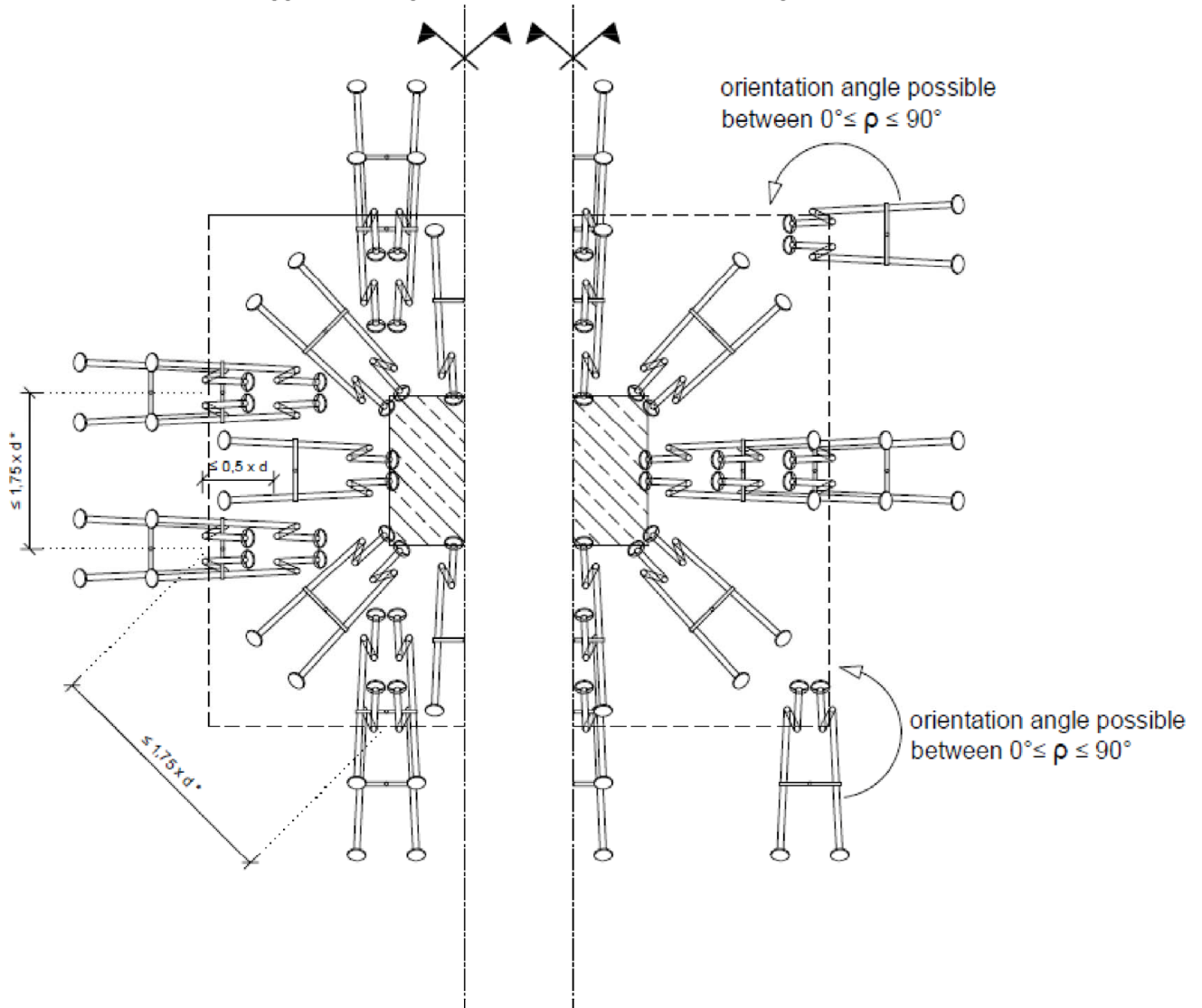
Intended use
Element arrangement for round columns

Annex B4

Third row

Variant 1:
Staggered arrangement

Variant 2:
Crossed arrangement



Exemplary element arrangement for the third row

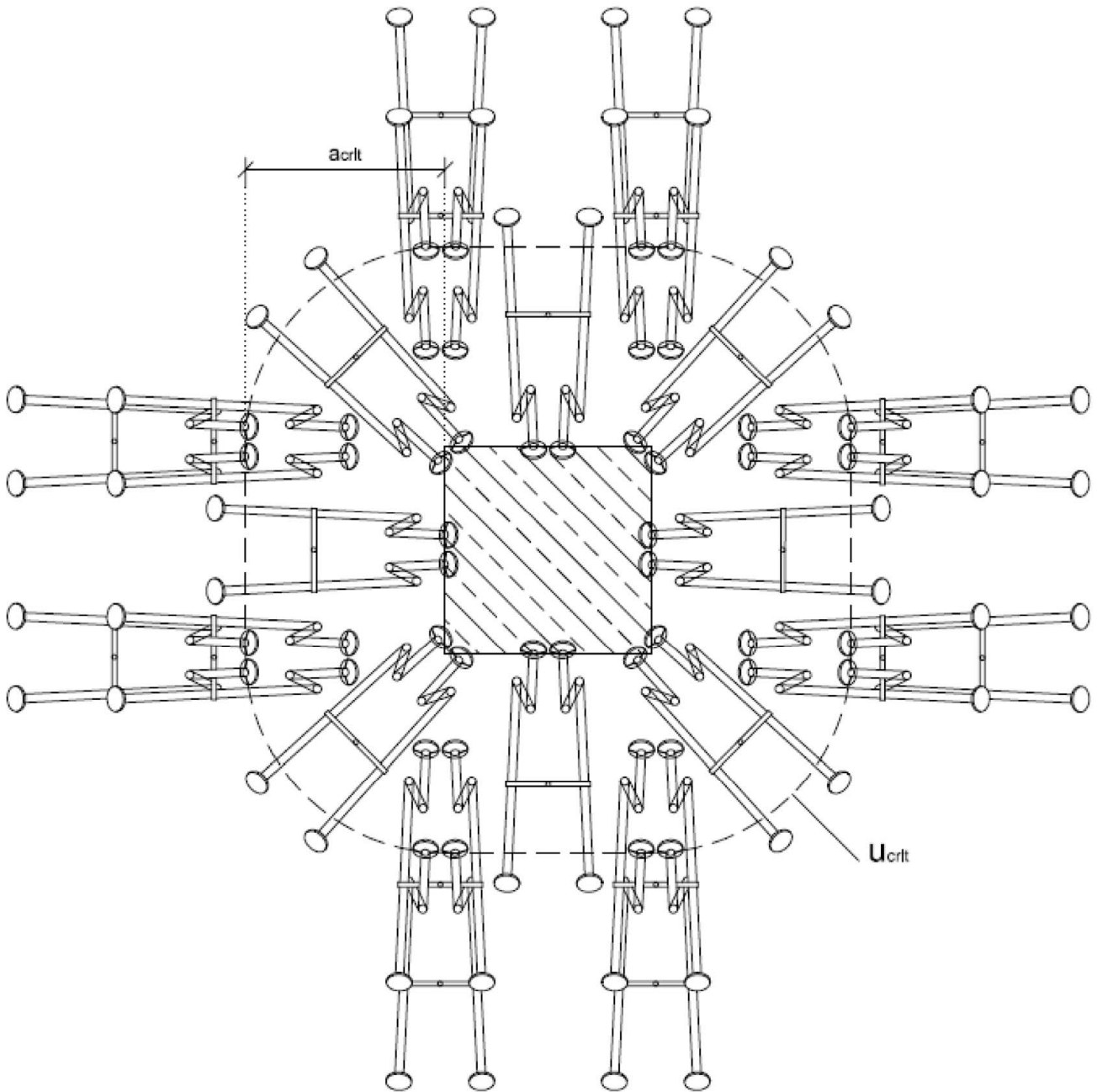
* From the fourth row onwards, the requirement $s_t \leq 2.0 \times d$ shall apply with regard to the tangential spacing of the elements.

Legend: d = effective depth

HALFEN HDB-Z punching shear reinforcement

Intended use
Element arrangement in the third row

Annex B5



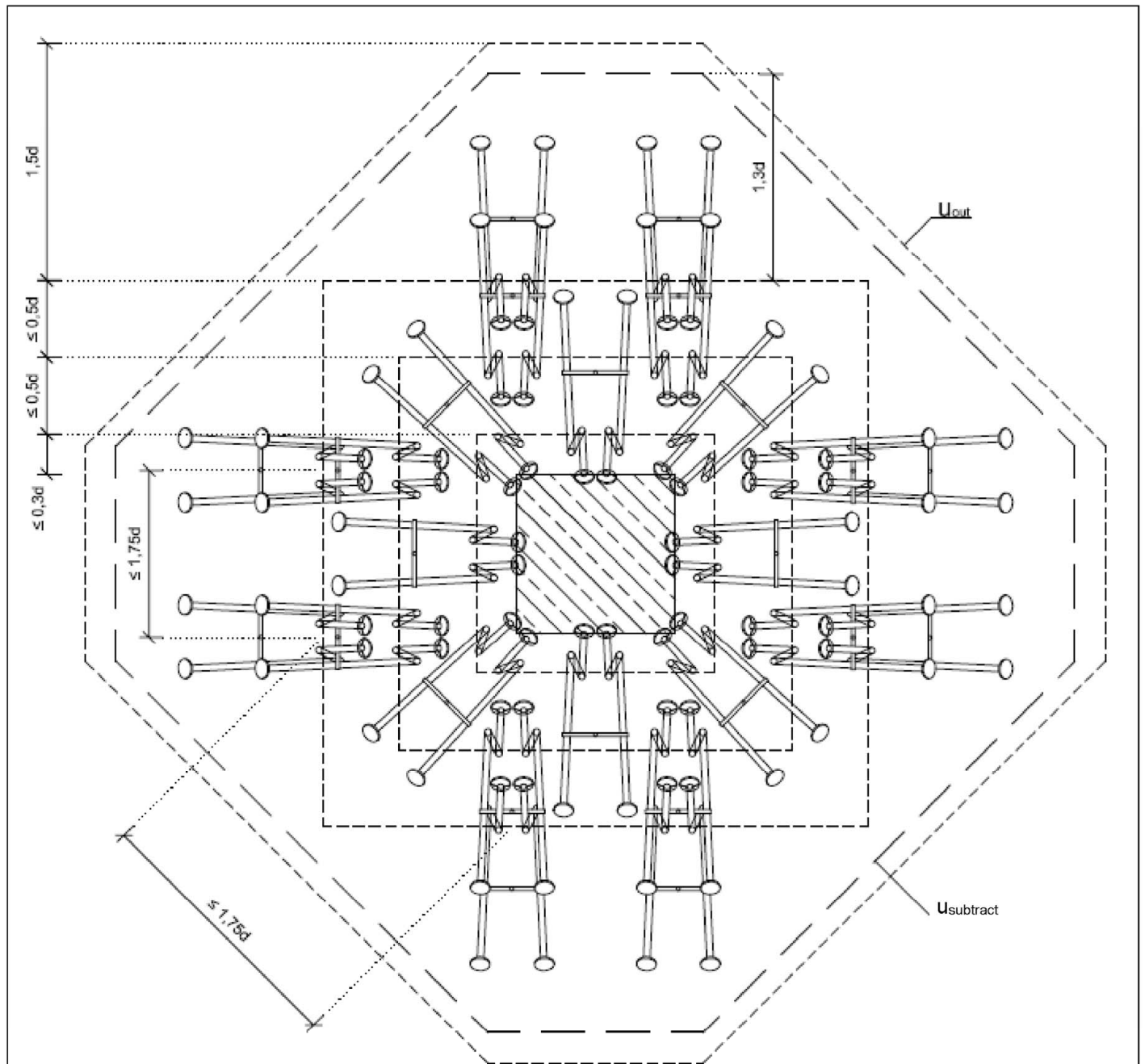
exemplary representation of the critical circular section u_{crit} according to EN 1992-1-1

Legend: a_{crit} = distance from column face to control perimeter

HALFEN HDB-Z punching shear reinforcement

Intended use
Outer control perimeter u_{crit}

Annex B6



Exemplary representation of the outer control perimeter u_{out} and the area to be subtracted due to soil pressure at the base $A_{subtract}$

Note:

Arrangement from the third row onwards
 First row at $\leq 0,3 d$
 from the second row onward at $\leq 0,5 d$
 u_{out} at $1,5 d$ behind the last upper bend of the element

Legend: d = effective depth, $U_{subtract}$ = perimeter of the area to be subtracted due to soil pressure

HALFEN HDB-Z punching shear reinforcement

Intended use
 Control perimeter u_{out} and $U_{subtract}$

Annex B7