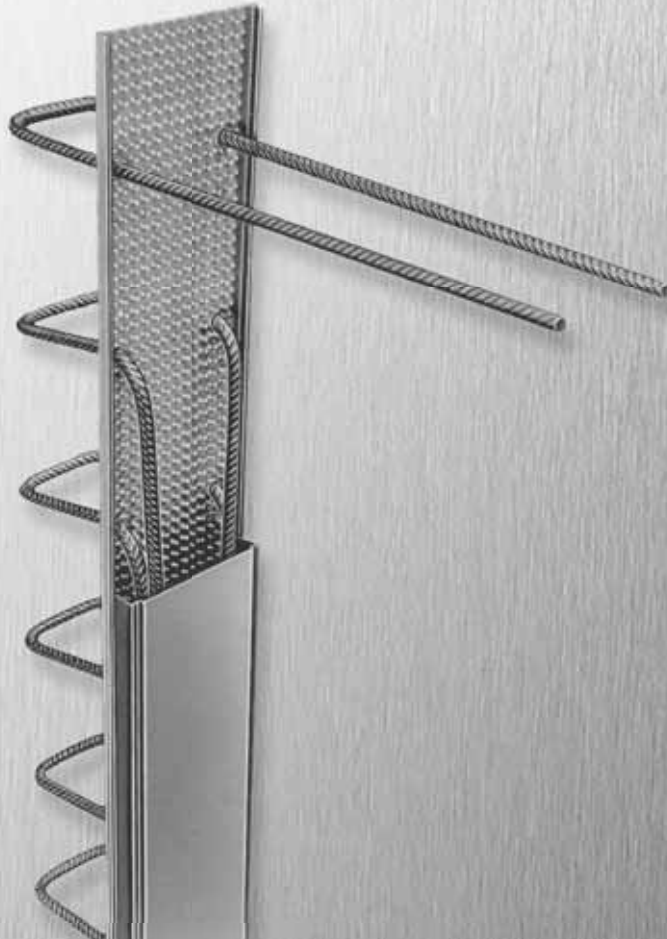


HALFEN HBT REBEND CONNECTION

Approval Z-21.8-2035



HALFEN REBEND CONNECTIONS

Z_HBT 12/14-E

CONCRETE



HALFEN

YOUR BEST CONNECTIONS

HALFEN HBT REBEND CONNECTION

General note

Use of third-party products

This approval only applies to original HALFEN products manufactured by HALFEN. The specifications in this approval are not transferable to other products. Users are fully liable for personal injuries and material damage caused by third-party products used instead of HALFEN products.

This translation of the original German version of the National Technical Approval no. Z-21.8-2035 is not authorized by the Deutsches Institut für Bautechnik.

National Technical Approval

Technical assessment institute for construction products and methods:

Deutsches Institut für Bautechnik (DIBt)
(National and Federal State approved statutory public body)

Member of the EOTA, UEAtc and WFTAO

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Date	Ref no.:
5 th December 2014	I 25-1.21.8-66/12

Approval number:

Z-21.8-2035

Applicant:

HALFEN GmbH
Liebigstraße 14
40764 Langenfeld

Period of validity:

Valid from: 5th December 2014

Expires on: 5th December 2019

Approved product: Halfen HBT Rebend connection

The aforementioned construction product is herewith granted a national technical approval. This national technical approval comprises six pages and five annexes.

Note: This translation of the original German version is not authorized by the Deutsches Institut für Bautechnik.

I. GENERAL PROVISIONS

1. This national technical approval verifies the usability and applicability of the aforementioned construction product in accordance with the Landesbauordnungen (Regional Building Codes of the German Federal States).
2. In so far that the national technical approval regulations require specialist knowledge and experience for persons entrusted with the manufacture of construction products and construction methods according to chapter 5, §17 of the model building code, it shall be noted that similar qualifications of other European Union member states which presume comparable knowledge and experience also suffice. This also applies, if necessary, to equivalent qualification in the context of the (EEA) European Economic Area treaty or other bilateral agreements.
3. The national technical approval does not replace any permits, approvals and certificates legally required for the execution of building projects.
4. The granting of this national technical approval does not affect the legal rights of any third party; in particular those pertaining to private protection laws.
5. The manufacturer and distributor of the aforementioned construction product must make copies of the national technical approval available to the purchaser i.e. the end-user irrespective of further regulations, as stated in the "Specific Provisions", and must give notice that the national technical approval for the product must be available at the point of application. Copies of the national technical approval must be made available to the respective authorities on request.
6. Reproduction of this national technical approval must be in full. Reproduction in extracts requires the consent of the Deutsches Institut für Bautechnik. Text and drawings used in advertising material must not contradict the national technical approval. Translations of the national technical approval must include a disclaimer as follows "This translation of the original German version is not authorized by the Deutsches Institut für Bautechnik" (Vom Deutschen Institut für Bautechnik nicht geprüfte Übersetzung der deutschen Originalfassung).
7. This national technical approval can be revoked at any time. The provisions of this national technical approval may be subsequently amended or modified, especially if technical progress makes this necessary.

II. SPECIAL PROVISIONS

1 Object of approval and intended use

1.1 Object of approval

The object of this national technical approval is the HALFEN HBT Rebind connection, which consists of the galvanized steel case and the reinforcement steel B500B with nominal diameters of $d_s = 8, 10$ or 12 mm or stainless reinforcing steel B500 NR, material classification no. 1.4571 or 1.4362 for connection of reinforced concrete elements in progressing concrete sections. The galvanized steel case which has a profiled back penetrated by reinforcement bars is cast into the concrete ensuring the cover is flush with the final surface. The Rebind connection enables connection with a subsequent reinforced concrete component in a successive concreting section. Annex 1 shows the rebind connection cast in concrete.

1.2 Area of application

The HBT Rebind connection may be used for connections of component under static or quasi-static as well as fatigue stress loads in reinforced or non-reinforced normal concrete of strength class C20/25 according to DIN EN 206-1:2001-07 "Concrete; section 1: Definition, characteristics, production and conformity".

2 Provision for the construction product

2.1 Product characteristics and composition

The manufactured parts of the rebind connection must correspond to the drawings and specifications as detailed in the annexes.

Characteristic material values, dimensions and tolerances not specified in this general construction approval must comply with the specifications in the documents deposited with the German institute for building technology (Deutsches Institut für Bautechnik).

2.2 Manufacturing and identification

2.2.1 Manufacturing

The rebind reinforcement and protective steel case are to be assembled at the production plant.

2.2.2 Product identification

All shipping documents must be marked by the manufacturer with the conformity mark (Ü-mark) according to the conformity symbol regulations of the country i.e. the federal state. In addition, the manufacturer's product code, the approval number and the full product description are to be included in the shipping documents. These markings may only be applied if the conditions specified in section 2.3 are met.

Each rebind connection must be marked according to annex 2.

2.3 Compliance certificate

2.3.1 General information

Confirmation of compliance of the rebind connection with the provisions of this general building approval must include a compliance certificate based on factory production control and regular third party monitoring including an initial inspection of the rebind connection for each production location, and must also be in accordance with the following provisions.

The manufacturer of the rebend connection must contract an approved certification body for independent inspection and to issue a certificate of conformity as well as a suitably approved inspection body for relevant product testing.

The manufacturer is required to mark the construction product with a conformity mark (Ü-mark) including a declaration of the intended use to which a certificate of conformity has been awarded. The certification body must submit a copy of the certificate of conformity to the Deutsches Institut für Bautechnik for their records.

2.3.2 Factory production controls

Each manufacturing plant must devise and implement a factory production control. Factory production control comprises the continuous internal control of the production process, exercised by the manufacturer, in order to ensure the construction products manufactured by them are in conformity with the provisions of this national technical approval.

The scope, type and frequency of factory production control must be as specified in the check list deposited with the German institute for building technology.

The results of the factory production control must be documented and evaluated. The documentation must contain at least the following information:

- specification of the construction product, the raw material or components
- method of test or inspection
- production date, test date of the construction product, raw material or components
- results of the inspection and tests, and as appropriate, evaluation against the requirements
- signature of the person responsible for factory production control

The documents must be kept for at least five years and be submitted to the inspection body responsible for third-party inspection. On request, these documents must be made available to the Deutsches Institut für Bautechnik and to the responsible building authority (obersten Bauaufsichtsbehörde).

In case of unsatisfactory test results the manufacturer must take immediate action to resolve the deficiency. Construction products which do not comply with the requirements must be handled in a manner to ensure they cannot be mistaken for products complying with the requirements. After a problem has been resolved, the respective test must be repeated immediately; as far as this is technically feasible and necessary to verify that the deficiency has been eliminated.

2.3.3 Third-party controls

The factory production control in each production facility must be regularly inspected by a third party approved inspection body. Independent inspection must include an initial test of the rebend connection; random test samples must be taken. The respective approved inspection body is responsible for taking samples and testing.

The scope, type and frequency of factory production control must be as specified in the check list deposited with the German institute for building technology.

The results of the certification and third-party control must be kept for at least five years. On request, they must be made available by the appointed certification or inspection body to the Deutsches Institut für Bautechnik and to the responsible building authority (Obersten Bauaufsichtsbehörde).

3 Provisions for design and dimensioning

3.1 Design

The connections must be designed to engineering standards according to DIN EN 1992-1-1:2011-01 with DIN EN 1992-1-1/NA:2011-01 and the guideline "Rebending of Reinforcing Steel and Requirements on Protective Boxes according to Eurocode 2" of the Deutschen Beton- und Bautechnik Verein e.V. (January 2011 edition). Verifiable calculation and drawings must be prepared with the required load actions.

For fatigue-related stress the mandrel diameter must be set to $\geq 15\phi$ during bending (ϕ = Nominal diameter of the rod). The steel tension, stress amplitude must not exceed 50 N/mm².

The construction drawings must include exact details of position, size, type and dimensions of the rebend connections (protective box and rebend reinforcement).

The following notes and details must be observed when detailing the joint between the connecting elements. The specifications in annex 5 also apply when the joint is loaded in longitudinal direction.

The tolerance allowance for the concrete cover ΔC_{dev} according to DIN EN 1992-1-1:2011-01 can be reduced for the box sheet by 5 mm. The anchorage and overlap length of the rebend reinforcement can be calculated as starting from the surface of the steel sheet of the case.

3.2 Dimensioning

The connections must be dimensioned according to DIN EN 1992-1-1:2011-01 with DIN EN 1992-1-1/NA:2011-01 as well as the following deviating provisions.

The reinforcement in the rebend connection must only be exploited to 80%, of its max load capacity; therefore a reduced yield strength for $f_{yd,red}$ must be selected for verification: $f_{yd,red} = 0,8 \times f_{yk} / \gamma_s$

When verifying the crosswise and longitudinal shear force resistance in the concrete joint the additional specifications in annex 4 and 5 must be observed.

Verification for each direction of stress must be done separately with combined stress from crosswise and longitudinal shear force in the joint.

The transfer of the loads from the rebend reinforcement into the concrete elements must be verified.

4 Provision for application

4.1 Dimensioning

When using HALFEN Rebend connections observe the information on cold bending of reinforcement steel and casings in the applicable guidelines "Rebending of Reinforcing Steel and Requirements on Protective Boxes according to Eurocode 2" of the Deutschen Beton- und Bautechnik-Verein e.V. (January 2011 edition) section 3 and 5.4.

4.2 Installing the rebend connections

The rebend connections must be installed in accordance with the plans which are required according to section 3.1 of this document. The rebend connection must be fixed securely to the formwork, ensuring that it remains in place when placing the main reinforcement and when pouring and compacting the concrete. The concrete must be properly compacted under the casing and the relevant reinforcement bar. The casing must be properly sealed to prevent concrete ingress.

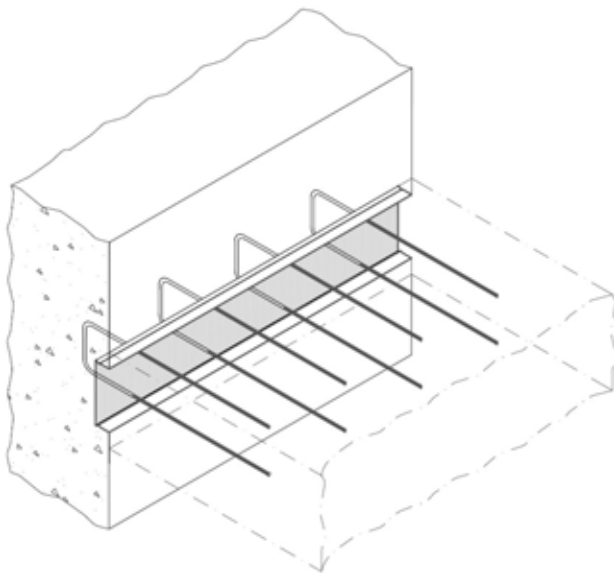
4.3 Rebending the reinforcement in the connection

The cover of the rebend connection is removed after striking the formwork. Rebending the reinforcement bars in the connection is only permitted when using an appropriate tool (for example, the HBT-RZ Rebending tool). The manufacturer's installation instructions must be observed. Rebending reinforcement steel (cold bending) is only permitted at ambient temperatures above -5°C.

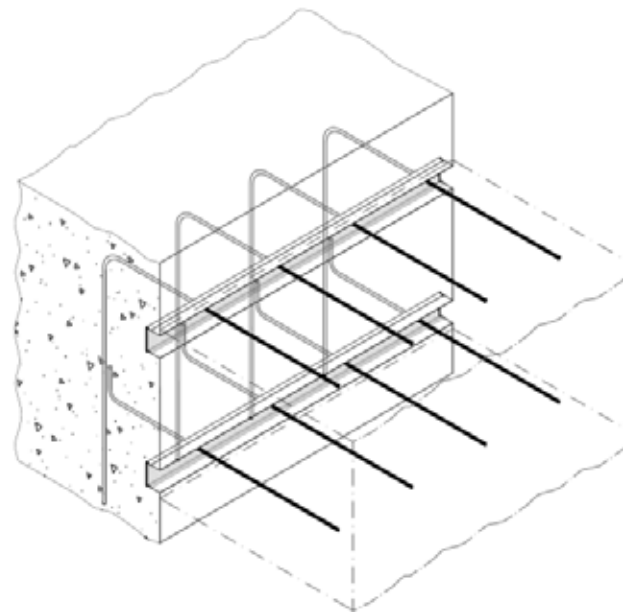
4.4 Inspection and installation

A contractor experienced in rebend connections, an appointed site manager or an experienced representative must be present when installing the rebend connection. The contractor or their representative must ensure the connection is correctly installed. In particular, the type and position of the element must be checked. The documentation must be readily available on site during the entire period of construction and must be submitted to the appropriate assigned person(s) on request. This documentation and the accompanying shipping documentation must be kept by the contractor for at least 5 years after final completion of construction.

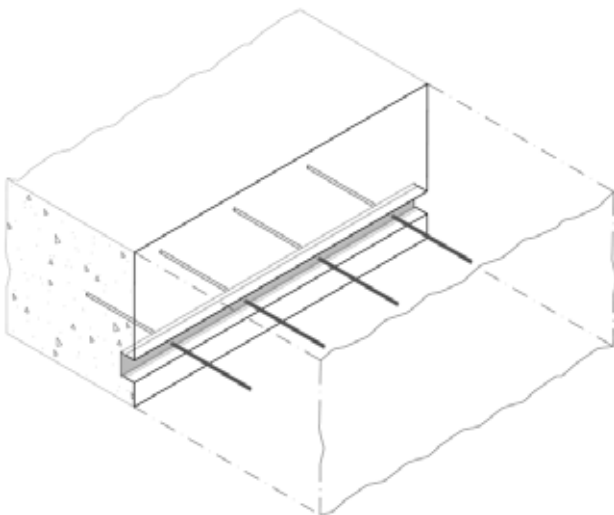
Andreas Kummerow
Referatsleiter



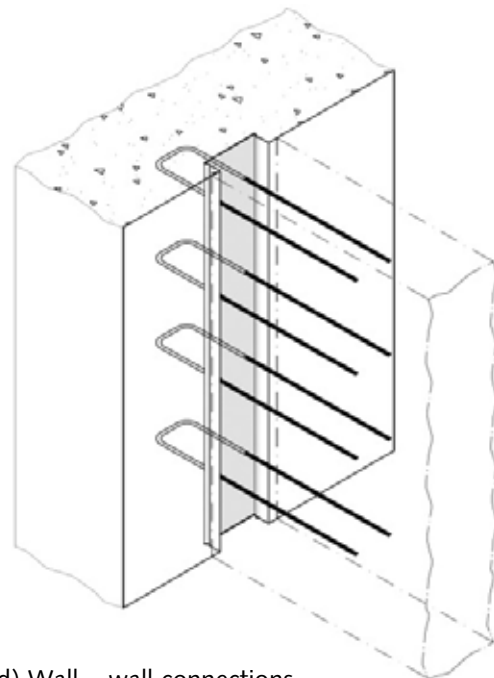
a) Slab - wall connections



b) Landing slab - wall connections



c) Slab - slab connections



d) Wall - wall connections

Figure 1: Application examples of cast-in HBT Rebend connections



Annex 1
HALFEN HBT Rebend connection
Cast-in examples

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Specifications for the label

Product identification, case identification,
Diameter/Spacing of the rebend reinforcement, rebar shape

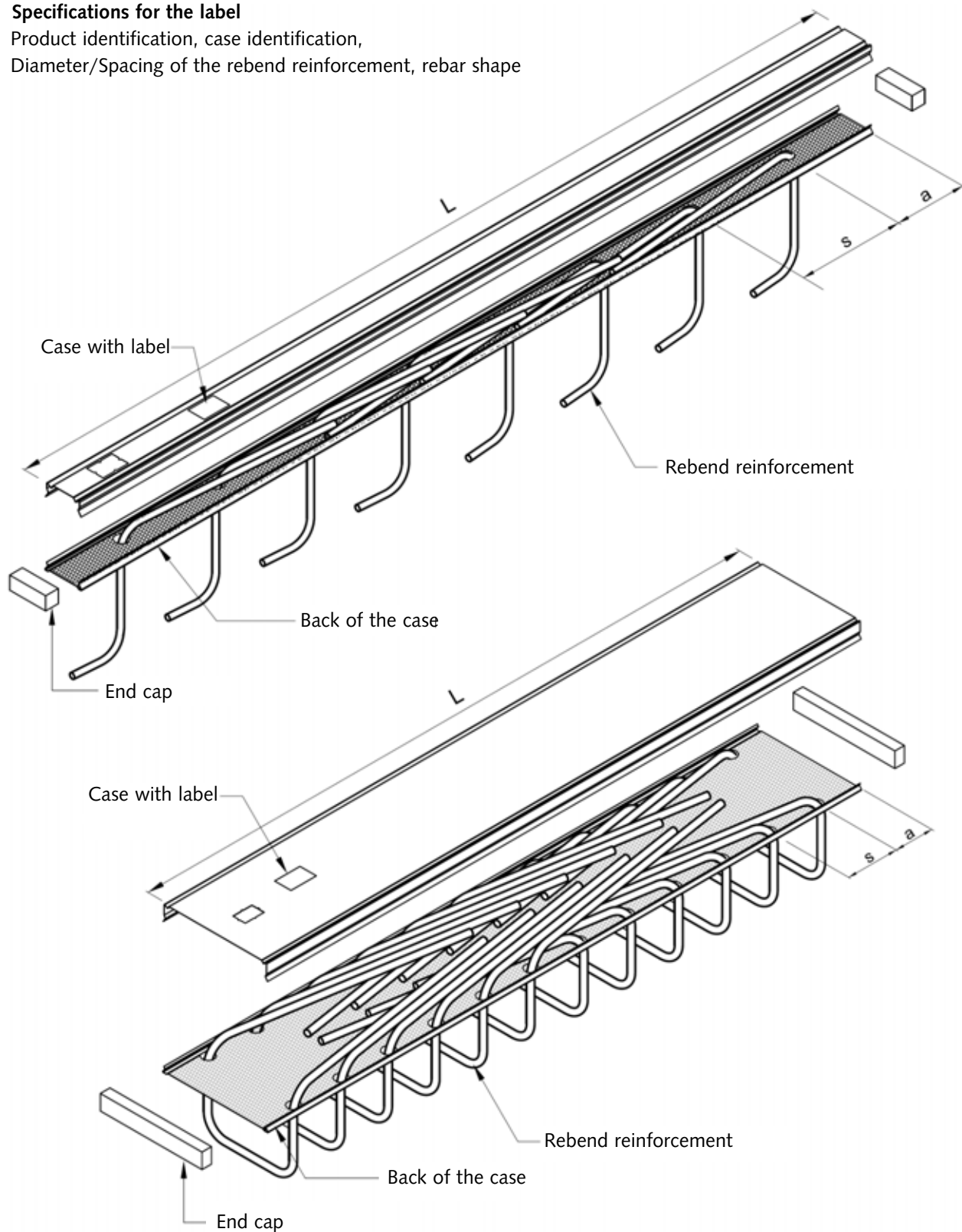


Figure 2: Details of the case single row/double row rebend reinforcement



Annex 2
HALFEN HBT Rebend connection
Product and labelling

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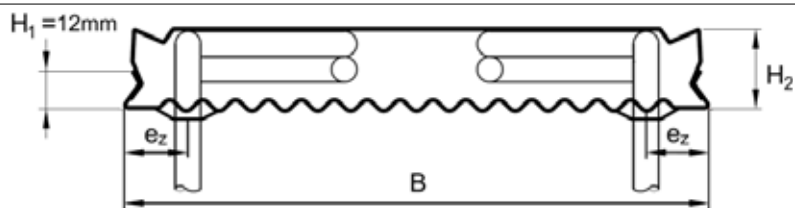


Figure 3: Cross-section of the steel case

Table 1: Rebend reinforcement

Material	B500B, B500NR
Rebar diameter ϕ [mm]	8, 10, 12
Nominal values rod spacing s [cm]	10, 15, 20, 25

Table 2: HBT Housings

HBT case type	55	80	85	120	150	190	220
Number of reinforcement rows	1	2	1	1; 2	2	2	2
Width case back B [mm]	58	86	86	122	150	186	222
Axial spacing reinforcement to case edge e_z [mm]	21	18	21	21	21	21	21
Standard case height H_2	$H_2 = 3 \cdot \phi$						

Type: Sheet steel, zinc galvanized, profiled case back

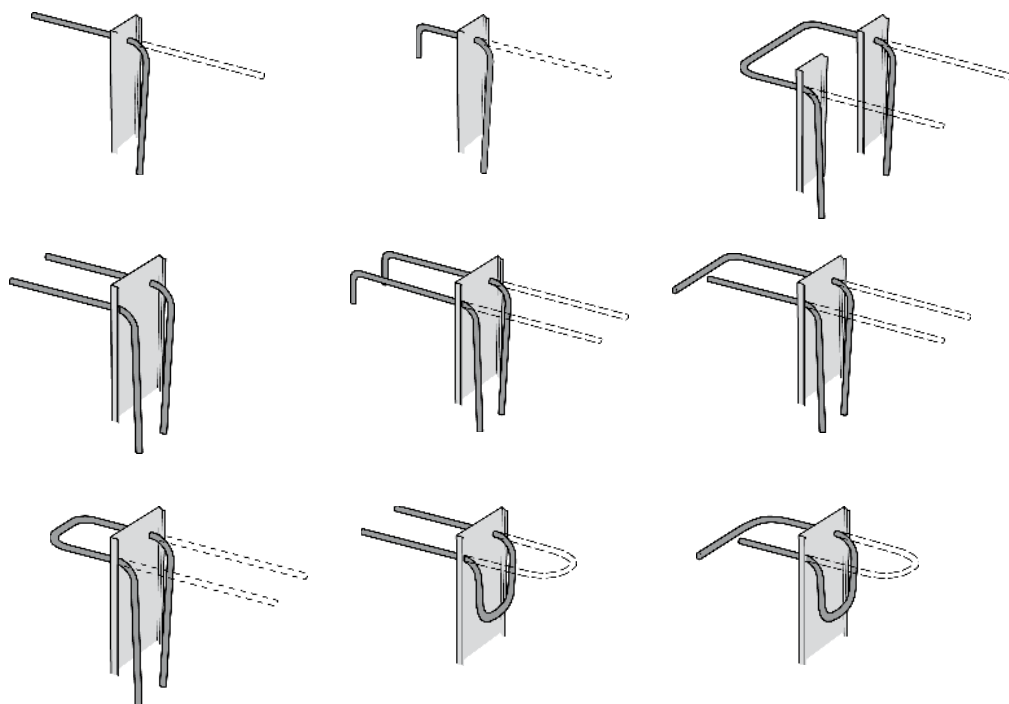
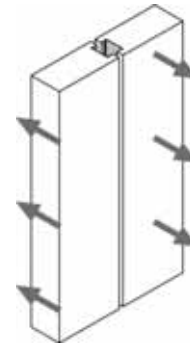


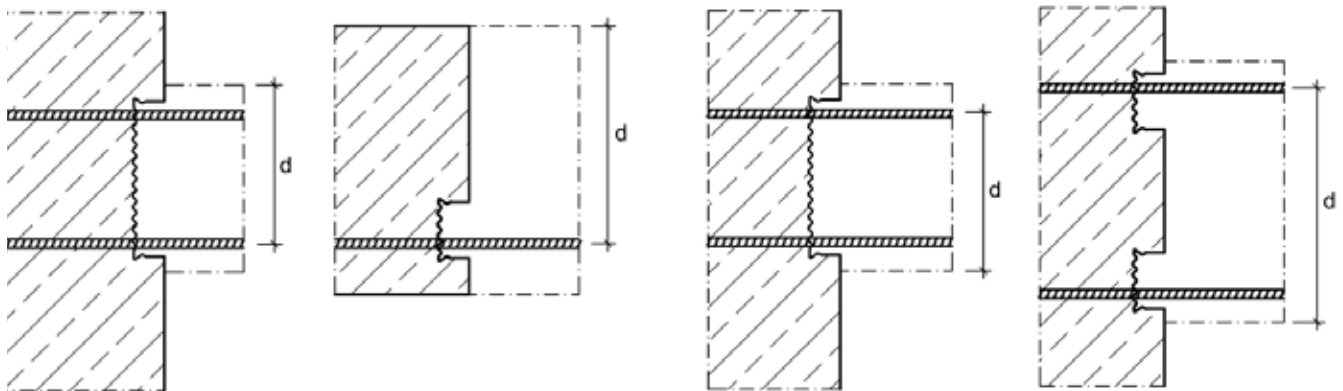
Figure 4: Bend shapes of the rebend reinforcement; examples

	<p>Annex 3 HALFEN HBT Rebend connection Product and types</p>	<p>HALFEN GmbH Liebigstr. 14 D - 40764 Langenfeld Phone: +49-2173-970-0 Fax: +49-2173-970-123</p>
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1 Calculation of shear load, transverse to the concrete joint



Verification is according to DIN EN 1992-1-1, section 6.2 and DIN EN 1992-1-1/NA, as for monolithic cast construction elements, however the following additional specifications must be observed.



a) Tension zone at the lower component edge b) Tension zone at the upper component edge

Figure 5: Location of the reinforcement under load and the respective effective static height d

Shear load resistance without shear load reinforcement:

The decisive resistance $V_{Rd,C}$ required for verification is obtained according to DIN EN 1992-1-1, section 6.2.2. A reduction in the ratio of reinforcement p_l is not necessary (because of the reduced strength of the rebend reinforcement).

Shear load resistance with shear load reinforcement:

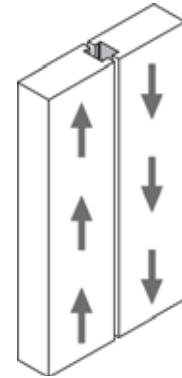
The decisive resistance $V_{Rd,max}$ required for verification is obtained from 30% of the shear load resistance $V_{Rd,max}$ according to DIN EN 1992-1-1, section 6.2.3:

$$V_{Ed} \leq 0,3 \cdot V_{Rd,max}$$

The additional shear load in the longitudinal reinforcement must be verified assuming a strut angle of 45° ($\cot \theta = 1,0$). The required shear reinforcement must be determined with $\cot \theta = 1,0$.



2 Calculation of shear load, longitudinal to the concrete joint



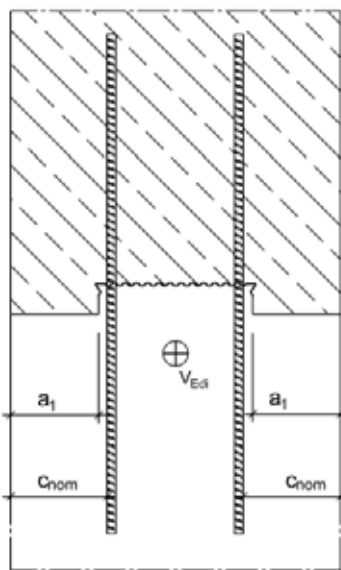
Verification is according to DIN EN 1992-1-1, section 6.2.5 and DIN EN 1992-1-1/NA, however the following additional specifications must be observed.

The standard coefficient to verify the shear load resistance is

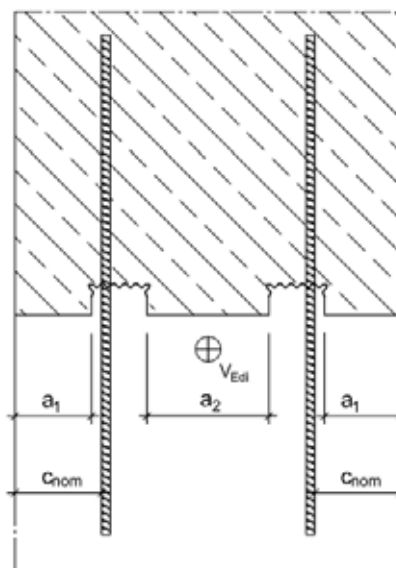
$c = 0.4$ and $c = 0$ for fatigue related loads.

$\mu = 0.7$

$\nu = 0.5$



a) Single-part connection



b) Multi-part connection

Figure 6: Type variants, identification

If the joint area between two rebend cases is also to be considered for shear load transfer, these must be designed as rough or indented according to DIN EN 1992-1-1. Similarly, the edge zones can be assumed for load if $a_1 \geq 50$ mm is applicable.

Concrete cover C_{nom} must be designed according to DIN EN 1992-1-1.

For the rebend reinforcement the following must also be observed.

$$C_{nom} \geq \text{Max}\{3\phi, 30 \text{ mm, maximum aggregate diameter } d_g\}$$



Annex 5
HALFEN HBT Rebend connection
Dimensioning

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