HALFEN CAST-IN CHANNELS HZA DYNAGRIP

APPROVAL Z-21.4-1691

HALFEN CAST-IN CHANNELS

CONCRETE

Z_DYN_04/18-E

HALFEN

A CRH COMPANY

General note

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.

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Technical assessment institute for construction products and methods:

Deutsches Institut für Bautechnik (DIBt)
German Centre of Competence for Construction
(National and Federal State approved statutory public body)

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National Technical Approval

Date **Ref no.:**

20th July 2018 **| 23-1.21.4-25/18**

Approval number:

Z-21.4-1691

Applicant:

HALFEN GmbH
Liebigstraße 14
40764 Langenfeld

Period of validity:

Valid from: **2nd April 2018**

Expires on: **2nd April 2021**

Approved product: **HALFEN Cast-in anchor channels HZA 29/20, HZA 38/23, HZA 53/34 and HZA 64/44**

The aforementioned construction product is herewith granted a general building authority approval.
This general building authority approval comprises eight pages and twelve annexes.

I. GENERAL PROVISIONS

1. This national technical approval verifies the usability and applicability of the aforementioned construction product in accordance with the Regional Building Codes of the German Federal States (Landesbauordnungen).

2. The national technical approval does not replace any permits, approvals and certificates legally required for the execution of building projects.

3. 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.

4. 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.

5. Reproductions or copies of this national technical approval must always be in full. Reproduction in extracts requires the consent of the German Centre of Competence for Construction (Deutsches Institut für Bautechnik). Text and illustration used in advertising material must not contradict this 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).

6. 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.

7. This certificate applies to the information provided and the documents submitted by the applicant. Any change to these principles is not covered by this certificate, and the German Centre of Competence for Construction (Deutsches Institut für Bautechnik) is to be notified without delay.

8. This approval also includes a general building authority approval. The general type approval provided by this certificate may also be regarded as a general building authority design approval certificate.

II. SPECIFIC PROVISIONS

1.1 Object of approval and intended use

HALFEN HZA Cast-in anchor channels (type 29/20, type 38/23, type 53/34, type 64/44) consist of a C-shaped channel with serration and at least two weld-on anchors, or weld-on or riveted bolt anchors on the profile back; these are either mill-finished, hot-dip galvanized or stainless steel.

Hammer-head bolts or serrated T- bolts including corresponding nuts and washers are inserted into the channel, with which any secondary construction element can be fastened.

The cast-in anchor channel is embedded in concrete flush with the surface.

The HALFEN HZA Cast-in anchor channel is shown in an installed state in annex 1.

1.2 Area of application

HALFEN Cast-in anchor channels may be used under static or quasi-static loading in reinforced and non-reinforced normal weight concrete of strength class of at least C20/25 according to DIN EN 206-1: "Concrete - Part 1: Specification, performance, production and conformity".
If requirements for fire resistance duration are demanded for the concrete components in which the anchor channels are anchored, the restrictions in accordance with Section 3.2.7 must be observed.
For fire resistance requirements the cast-in anchor channel may only be exposed perpendicular to the longitudinal axis of the channel.
The cast-in anchor channels with t-bolts as shown in annex 10, table 15 may also be used in reinforced normal weight concrete of strength class C20/25 for fatigue-relevant centric tensile loading.
When anchored in concrete in the tensile zone generated by load stresses or when the minimum spacing between single anchor channels is used, additional reinforcement is required to account for bursting resulting from local transverse tensile stresses; unless constructive measures or other favourable methods (e.g. shear pressure) are used to prevent the concrete from cracking.

The areas of application for a cast-in anchor channel (channel profile, anchor, bolt, nut and washer) in respect to corrosion is dependent on the selected materials; see annex 7, table 11.

A galvanized cast-in anchor channel (channel and anchor) may only have contact with reinforcement steel when the temperature at the contact points between the reinforcement and the galvanized steel does not exceed 40 °C.

In pre-stressed concrete members, the distance between a galvanized cast-in anchor channel (channel and anchor) and the tendon ducts or a prestressing wire of pretensioned member must be at least 2 cm. If the hot-dip galvanized channel has bolt anchors made of stainless steel, the tendon ducts or tendons may have contact with the stainless steel anchor bolt but not touch the hot-dip galvanized channel.

2 Provisions for the construction product

2.1 Properties and materials

The individual parts of the cast-in anchor channel (channel, anchor, bolt, nut and washer) must correspond with the drawings and specifications in the annexes.

The characteristic material values not specified in this general building authority approval, dimensions and tolerances for the anchor channels and bolts must correspond with the information provided to the German Centre of Competence for Construction (Deutsches Institut für Bautechnik), to the certification body and the third party monitoring body.

2.2 Production and marking

2.2.1 Production (connection channel/anchor)

The connections of the anchors to the channel (welding, riveting) must be done in a controlled factory environment.

Depending on the requirements specified for the construction and in coordination with the structural engineer and the approval authority, the regulations according to DIN EN 1090-2:2011-10 apply for the execution of the weld seams.

2.2.2 Marking

All packaging and delivery documents for the cast-in anchor channels and bolts must be marked by the manufacturer with the conformity mark (Ü-mark) in accordance with the conformity mark regulations are specified by the Federal states of Germany.
In addition, the factory mark, the approval number and the complete designation of the cast-in anchor channel and bolts must be indicated on the delivery note.

The marking may only be used if the conditions in accordance with section 2.3 are met.

The cast-in anchor channels are marked according to the outer profile dimensions of the channel (width/height in mm), e.g. profile HZA 29/20; these specifications are rounded off.

The t-bolts are marked according to the type of bolt (serrated bolt type HZS, hammer-head bolt, type HS) and the thread size and allocated to the profile dimensions.

Each cast-in anchor channel must be marked as illustrated in annex 7.

The t-bolts must be stamped and marked as illustrated in annex 3 to 6.

2.3 Verification of conformity

2.3.1 General information

Confirmation of the conformity of the cast-in anchor channel and t-bolts with the specifications of the general building authority approval must be provided for each manufacturing location with a declaration of conformity based on factory production control and a certificate of conformity issued by a recognized body. Also required is regular third party monitoring by an approved inspection body in accordance with the following provisions:

To issue a certificate of conformity and for third party monitoring including any required product tests, the manufacturer of the cast-in anchor channel and t-bolts must contact an approved certification body as well as an approved inspection agency.

The manufacturer is required to mark the product(s) with a conformity mark (Ü-mark) including a declaration of the intended use.

A copy of the certificate of conformity issued by the certification body must be submitted to the German Centre of Competence for Construction (Deutsches Institut für Bautechnik).

2.3.2 Factory production controls

Each manufacturing plant must set up and implement an in-house, factory production control. Factory production control is understood as the continuous internal monitoring of the production process, implemented by the manufacturer, to ensure the products manufactured by them are in conformity with the provisions of this national technical approval.

The extent, type and frequency of factory production control is determined by the inspection plan deposited with the German Centre of Competence for Construction (Deutsches Institut für Bautechnik) and the third-party certification body.
The results of the factory production control must be documented and evaluated and must include at minimum the following:

- identification of the construction product, 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 evaluation against the requirements
- signature of the person responsible for factory quality control plan

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 records must be made available to the German Centre of Competence for Construction (Deutsches Institut für Bautechnik) and to the responsible building authority (oberste 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 manufacturing plant must be regularly inspected, at least twice a year, by a third party monitoring body.

Independent inspection must include an initial test of the cast-in anchor channel and bolts and samples taken for random inspections. The respective approved inspection body is responsible for taking samples and testing.

The extent, type and frequency of third-party control is as recorded in the document deposited with the Deutsches Institut für Bautechnik and the third-party monitoring authority.
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, dimensioning and execution

3.1 Planning

The anchorages must be designed according to standard engineering practices. Verifiable calculations and technical drawings must be compiled considering the planned anchor loads.

The technical drawings must contain precise information on the size, length and installation position of the cast-in anchor channel as well as the type of t-bolt included the size of the matching t-bolt.

3.2 Design and calculation

3.2.1 Introduction

The anchorages must be designed according to standard engineering practices. Verification of the immediate local loads application into the concrete has been provided.

Transfer of the loads to be anchored into the concrete component must be verified.

Weakening of the concrete cross-section caused by the installation of cast-in anchor channel has to be considered in the static analysis.

Bending loading on the t-bolt may be disregarded only if;

- the connected component is made of metal and can be braced against the channel without an intermediate layer and
- the through hole in the connected component does not exceed the values in tables 4, 6, 8 and 10, in annexes 3 to 6.

Additional loads that may occur in the cast-in anchor channel, in the connected component or in the concrete component in which the cast-in anchor channel is installed, can result from restraint deformation, must be taken into account. (for example; temperature fluctuations).

The individual load or the load pair can be applied at any point on the cast-in anchor channel. The axis spacings and end distances of the load application points (t-bolts) are indicated in annexes 9 and 10. The axis of the t-bolts must be at least 25 mm from the end of the cast-in anchor channel.

The minimum distances of the cast-in anchor channel (axial, edge and corner spacings) and component dimensions (component width and thickness) in accordance with annexes 7 or 8 must be observed.

3.2.2 Design resistances

The design resistances of the cast-in anchor channel are specified in table 14, annex 10 subject to the profile length, the load spacing and the corresponding t-bolts for concrete strength classes ≥ C20/25.

The allowable load directions (load areas) for the cast-in anchor channel are shown subject to t-bolt type in annex 9. When using a HS Hammer-head bolt, the cast-in anchor channel may only be stressed perpendicular (y shear load and z tension load) to the longitudinal axis of the channel. When using the serrated HZS t-bolt, the cast-in anchor channel may be loaded in all directions (x shear load, y shear load and z tension load).

The design value of the load resultant may not exceed the design resistances of the cast-in anchor channel and the t-bolts according to the verification in annex 9.

3.2.3 Bending loads on bolts

The bending design resistances are specified in annexes 3 to 6. The clamp point is calculated as the upper edge of the cast-in anchor channel.

The design value of the bolt bending moment may not exceed the design resistance against bending if, in accordance with Section 3.2.1, a bending stress must be considered.

In the case of bending with additional tensile load, the loads must be verified as follows:

$$F_{z,Ed} \leq F_{Rd} \left(1 - M_{Ed} / M_{Rd}\right)$$

F_{Rd} = Design resistance of the bolt according to annexes 3 to 6
M_{Rd} = Design resistance against bending of the bolt according to annexes 3 to 6
$F_{z,Ed}$ = Design value of the acting tensile load component
M_{Ed} = Design value of the acting bending moment.

For façade claddings with variable bending loads, the alternating stress amplitude $\sigma_A = \pm 50\,N / mm^2$ in respect to the mean value σ_m in relation to the calculated stress cross-section of the bolt must not be exceeded.

3.2.4 Fatigue-relevant centric tensile stress in reinforced normal weight concrete ≥ C20/25

The HZA 29/20, HZA 38/23, HZA 53/34 and HZA 64/44 Cast-in anchor channels with transverse I-anchors and with bolt anchors may be used for loading from fatigue-relevant centric tensile stress with load cycles $N \leq 2 \cdot 10^6$. The allowable range of amplitude with load cycles of $N \leq 2 \cdot 10^6$ is specified in table 15, annex 10. The cast-in anchor channels may only be anchored in reinforced normal weight concrete of at least C20/25. Only the matching bolts in accordance with table 15, annex 10 are permitted.
The design resistances according to section Abschnitt 3.2.2. apply for the highest loads.

3.2.5 Special cases; thin concrete elements

A cast-in anchor channel installed in the end face of an at least 10 cm thick minimal loaded reinforced concrete member may only be subjected to centric tension load in accordance with the design resistance as in table 14, annex 10, if additional reinforcement is provided in accordance with annex 11.

3.2.6 Displacement behaviour

Displacements ≤ 0.6 mm in direction of the load can be expected when subjected to full service load. With shear loads, the existing clearance between t-bolt and fixture must also be taken into account.

3.2.7 Fire resistance

If demands on the fire resistance duration of the concrete components are made, the cast-in anchor channels may only be subjected to static and quasi-static loading perpendicular (z tension load and y shear load) to the channels axis in reinforced and non-reinforced normal weight concrete of strength class C20/25 or higher. The design resistances for each cast-in anchor channel are specified in table 16, annex 12, for fire resistance duration of 90 minutes (F90) or 60 minutes (F60) subject to the t-bolt size; these values must not be exceeded.
The minimum spacings as specified in table 17, annex 12 must be observed.
The evaluation of fire resistance duration of the concrete component and the connected elements is not subject of this approval.

3.3 Application

3.3.1 Installation of the cast-in anchor channels

The cast-in anchor channels including the anchors are not to be modified or any anchors subsequently added or removed.

The installation of the cast-in anchor channels must be carried out according to the design drawings in accordance with section 3.1.

The cast-in anchor channels must be securely fixed to the formwork in a manner to ensure they do not move when the reinforcement is installed or when the concrete is poured and compacted. The concrete must be meticulously compacted around the cast-in anchor channels and under the anchor heads. The cast-in anchor channels must be protected to prevent concrete seeping into the channel.

3.3.2 Fixing the connecting elements (t-bolt installation)

The required t-bolt and size must be specified in the technical drawings. A serrated type HZS t-bolt must be used for loads in the longitudinal direction of the channel. The t-bolt is marked at the shaft end with two notches.

If the front edge of the cast-in anchor channel is not flush with the concrete surface due to inadequate installation, any gap must be fully shimmed when fixing the connecting secondary element(s).
The heads of the t-bolts are inserted into the cast-in anchor channel and after turning clockwise 90° must fully rest on both sides of the channel slot; The bolts are secured with the appropriate nut tightened with a torque wrench to the correct installation torque; these can be found in annex 3 to 6.

After final assembly, check that the t-bolt is correctly installed, the notches at the end of the t-bolt shaft must be at right angles to the longitudinal direction of the channel. The spacing for the t-bolts must not be less than specified in annex 9 and annex 10.

3.3.3 Checking the installation

The responsible contractor or a designated site manager or a designated competent representative must be present when installing the cast-in anchor channels, and also on site for final installation of the t-bolts (fixing of secondary elements). It is their responsibility to ensure the work is carried out properly and document the installation.
They are especially responsible for checking the installation and position of the cast-in anchor channels as well as any restraint reinforcement.
The documentation must remain available on site during the construction period and submitted to inspection personnel on request. The documentation, with the delivery notes, must be kept by the contractor for at least five years after completion of the project.

Beatrix Wittstock
Referatsleiter (Head of Division)

Installed channel
(Dimensions in mm)

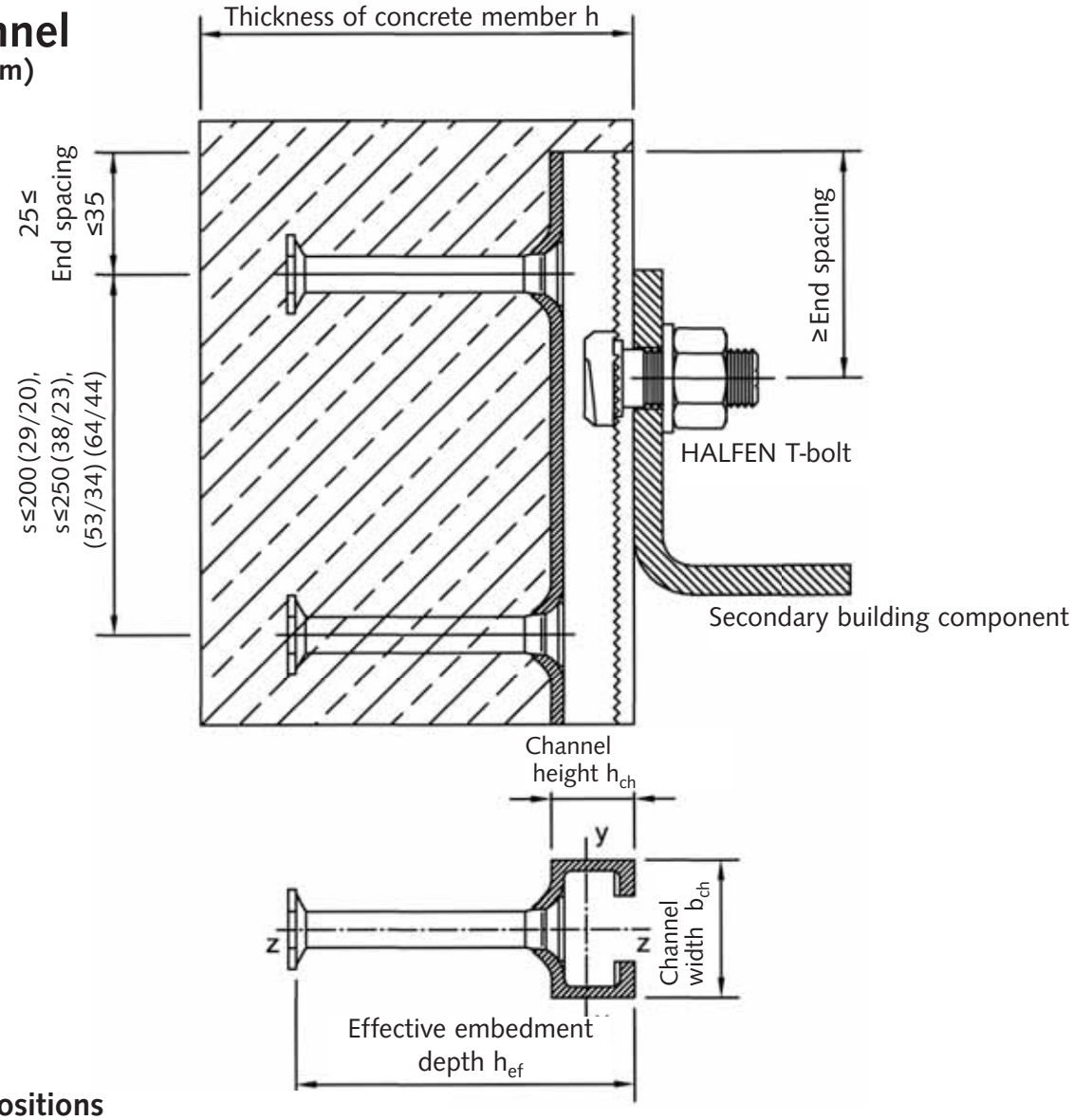
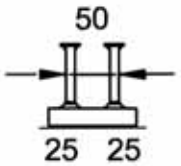
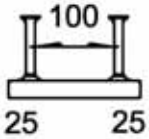
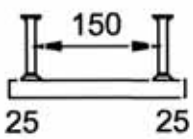
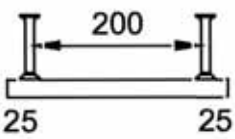
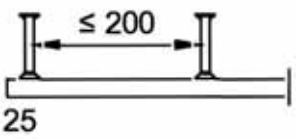
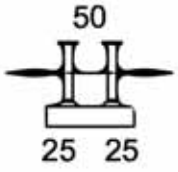
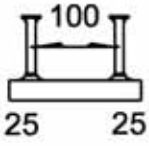
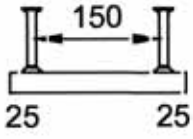
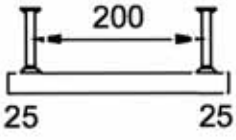
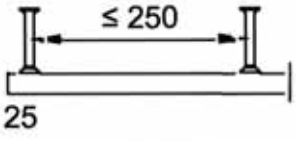


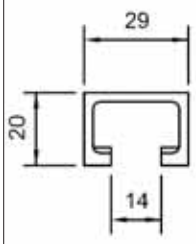
Table 1: Anchor positions

Channel length, end spacing① and spacing of the anchors (mm)					
Length	100	150	200	250	>250
Profile 29/20					
Profile 38/23 53/34 64/44					

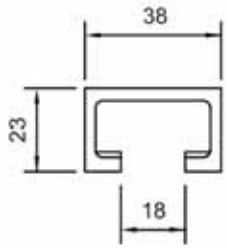
① **Minimal end spacing is 25 mm**

HALFEN A CRH COMPANY	**Annex 1** HALFEN HZA Cast-in anchor channels, type; 29/20, 38/23, 53/34, 64/44 Installed channel and anchor positions	HALFEN GmbH Liebigstr. 14 D - 40764 Langenfeld Phone: +49-2173-970-0 Fax: +49-2173-970-123

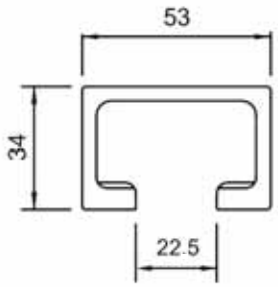
Profile HZA 29/20



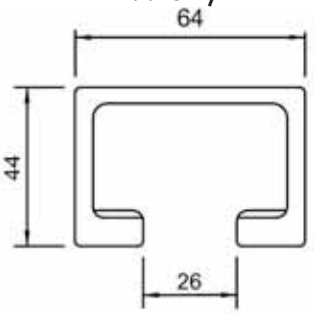
Profile HZA 38/23

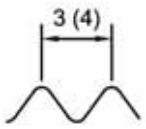


Profile HZA 53/34



Profile HZA 64/44



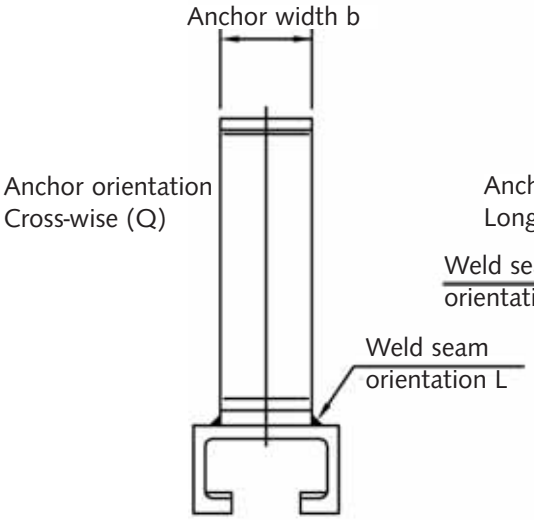


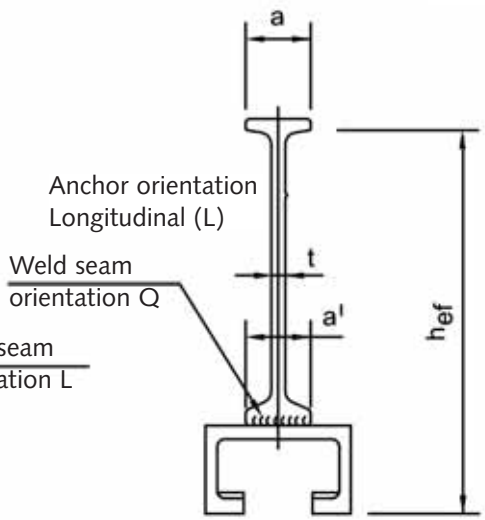
Steel S 275 JR (1.0044), in accordance with DIN EN100025:2005-04, stainless steel (1.4401/1.4404/1.4571) in accordance with DIN 10088:2009-08
Value in bracket for HZA 64/44

(Dimensions in mm)

Weld-on anchor, type I

Steel in accordance with DIN 10025:2005-04, stainless steel in accordance with DIN 10088:2009-08 (1.4401/1.4404/1.4571)





Bolt anchor, type B6

Steel in accordance with DIN 10263-2:2018-02, or DIN 10263-3:2018-02, stainless steel (cold hardened) in accordance with DIN 10088:2009-08 (1.4401/1.4404/1.4462/1.4571/1.4578)

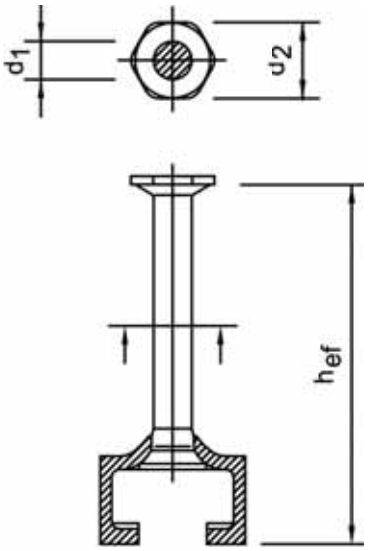


Table 2: Anchor dimensions

Weld-on anchors

Profile	Type	a	a'	min b	Anchor height	min h_{ef}	t	Anchor orientation	Weld orientation	Weld seam min. a × l
		[mm]								
29/20	I 62	18	18	12	62	79	5.0	L/Q	L/Q	3×12
	I 140	40	40	12	140	152	5.7	Q	L/Q	3×12
38/23	I 128	17	25	15	128	146	6.0	L/Q	L/Q	3×14
	I 140	40	40	16	140	155	5.7	Q	L/Q	3×18
53/34	I 128	17	25	28	128	157	6.0	L/Q	L/Q	3×19
	I 140	40	40	30	140	166	5.7	L/Q	L/Q	3×19
	I 140	20	38	24	140	168	7.1	L/Q	L/Q	3×19
64/44	I 140	40	40	40	140	176	5.7	L/Q	L/Q	3×34
	I 140	20	38	32	140	178	7.1	L/Q	L/Q	3×34

Bolt anchors

Profile	Type	d_1	d_2	min h_{ef}
		[mm]		
29/20	B6	Ø8	16	79
38/23	B6	Ø10	20	91
53/34	B6	Ø12	25	155
64/44	-	-	-	-

HALFEN
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Annex 2

HALFEN HZA Cast-in anchor channels, type; 29/20, 38/23, 53/34, 64/44
Channel dimensions and anchor types

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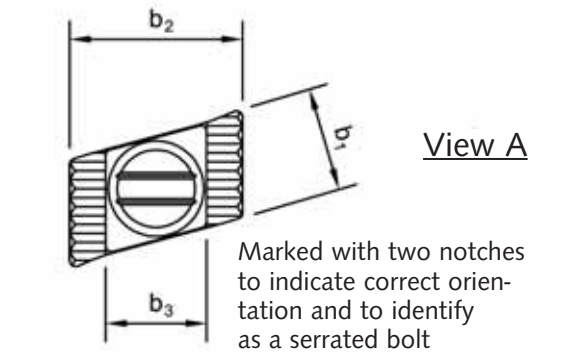
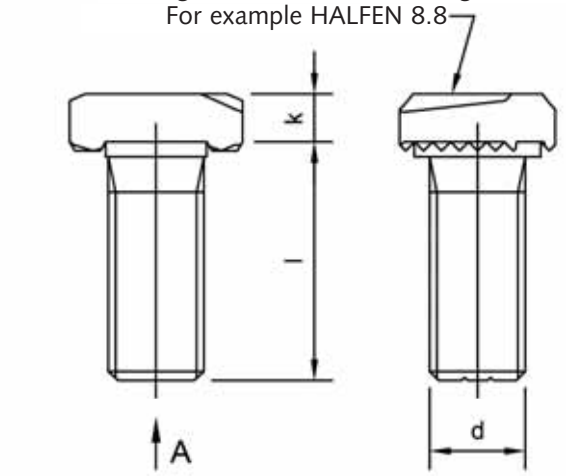


Marking: Production mark, strength class.
For example HALFEN 8.8



① See annex 9 for loading ranges
With simultaneous loading in all directions, the design value of the resultant load must not exceed the design resistances as in tables 4 and 14.

$$F_{Ed} = \sqrt{N_{Ed}^2 + V_{x,Ed}^2 + V_{y,Ed}^2} \leq F_{Rd}$$

② Applies to the channel or concrete surface.

Table 3: Dimensions and installation torques Steel HZS T-bolt; serrated

Profile	HZA 29/20		HZA 38/23		HZA 53/34		HZA 64/44	
d	M10	M12	M12	M16	M16	M20	M20	M24
b_1 (mm)	13.4	13.4	17.2	17.2	21.0	21.0	24.7	24.7
b_2 (mm)	20.9	20.9	28.8	28.8	41.6	41.6	51.0	51.0
b_3 (mm)	13.0	13.0	17.0	17.0	21.5	21.5	25.0	25.0
k (mm)	6.5	6.5	8.0	8.0	11.5	13.0	14.0	16.0
l (mm)	≥ 15	≥ 20	≥ 20	≥ 30	≥ 30	≥ 35	≥ 35	≥40
Installation torque (Nm)	40	80	80	120	200	350	350	450

Table 4: Design resistance Steel HZS T-bolt; serrated

T-bolt diameter d	M10	M12	M16	M20	M24
Throught-hole in connected component (mm)	12	14	18	22	26
Design resistance ① F_{Rd} (kN)	18.6	27.0	50.2	78.4	113.0
Design resistance ② against bending M_{Rd} (Nm)	47.8	83.8	213.1	415.4	718.4

Material/type

T-bolts:
- Shaft and thread design in accordance with DIN EN ISO 4018:2011-07
- Mat. steel; strength class 8.8 in accordance with DIN EN ISO 898-1:2013-05

Nuts:
- Design in accordance with DIN EN ISO 4032:2013-04
- Strength class 8 in accordance with DIN EN ISO 898-2:2012-08

Washers:
- In accordance with DIN EN ISO 7089:2000-11, DIN EN ISO 7093:2000-11 Product class A
- Mat. steel; in accordance with DIN EN 10025:2005-04

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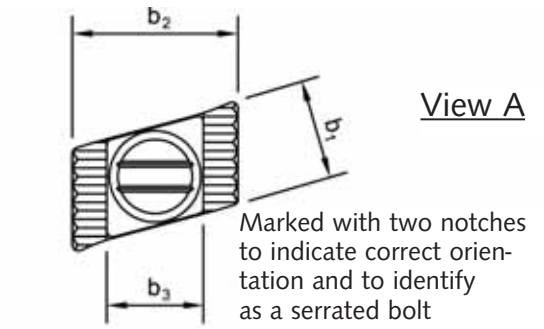
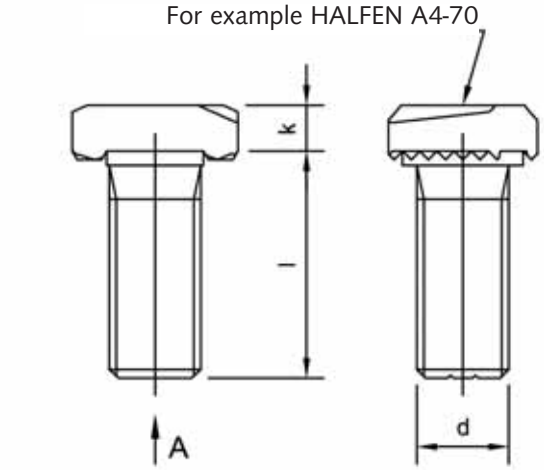


View A

Marked with two notches to indicate correct orientation and to identify as a serrated bolt

Marking: Production mark, strength class. For example HALFEN A4-70



① See annex 9 for loading ranges
With simultaneous loading in all directions, the design value of the resultant load must not exceed the design resistances as in tables 6 and 14.

$$F_{Ed} = \sqrt{N_{Ed}^2 + V_{x,Ed}^2 + V_{y,Ed}^2} \leq F_{Rd}$$

② Applies to the channel or concrete surface.

Table 5: Dimensions and installation torques Stainless steel HZS T-bolt; serrated

Profile	HZA 29/20		HZA 38/23		HZA 53/34		HZA 64/44	
d	M10	M12	M12	M16	M16	M20	M20	M24
b_1 (mm)	13.4	13.4	17.2	17.2	21.0	21.0	24.7	24.7
b_2 (mm)	20.9	20.9	28.8	28.8	41.6	41.6	51.0	51.0
b_3 (mm)	13.0	13.0	17.0	17.0	21.5	21.5	25.0	25.0
k (mm)	6.5	6.5	8.0	8.0	11.5	13.0	14.0	16.0
l (mm)	≥ 15	≥ 20	≥ 20	≥ 30	≥ 30	≥ 35	≥ 35	≥40
Installation torque (Nm)	40	80	80	120	200	350	350	450

Table 6: Design resistance Stainless steel HZS T-bolt; serrated

T-bolt diameter d	M10	M12	M16	M20	M24
Throught-hole in connected component (mm)	12	14	18	22	26
Design resistance ① F_{Rd} (kN)	15.6	22.7	42.2	66.0	95.1
Design resistance ② against bending M_{Rd} (Nm)	33.5	58.8	149.4	291.3	503.7

Material/type

T-bolts:
- Shaft and thread design in accordance with DIN EN ISO 4018:2011-07
- Mat. stainless steel; 1.4401/ 1.4404/1.4571/1.4578, A4-70 or 1.4462, FA-70 in accordance with DIN EN ISO 3506-1:2010-04

Nuts:
- Design in accordance with DIN EN ISO 4032:2013-04
- Mat. stainless steel, strength class A4-70 in accordance with DIN EN ISO 3506-2:2010-04

Washers:
- In accordance with DIN EN ISO 7089:2000-11, DIN EN ISO 7093:2000-11 Product class A
- Material; 1.4401/ 1.4404/1.4571/1.4578 DIN EN 10088:2005-09

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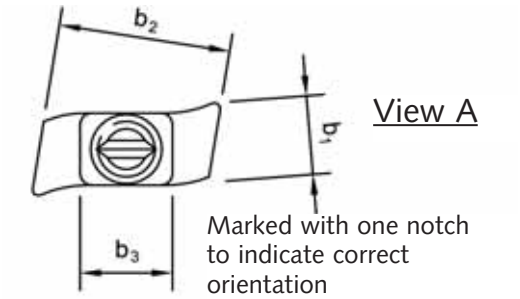
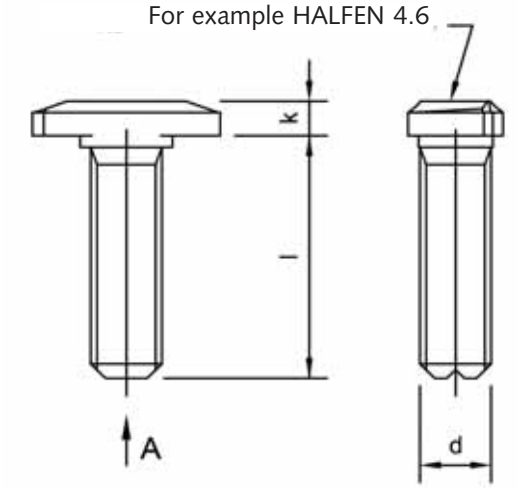


Marking: Production mark, strength class.
For example HALFEN 4.6



① See annex 9 for loading ranges
With simultaneous loading in y and z directions according to annex 9 the design value of the resultant load must not exceed the design resistances as in tables 8 and 14.

$$F_{Ed} = \sqrt{N_{Ed}^2 + V_{y,Ed}^2} \leq F_{Rd}$$

② Applies to the channel or concrete surface.

Table 7: Dimensions and installation torques Steel hammer-head HS T-bolt; serrated

Profile	HZA 29/20				HZA 38/23		
d	M6	M8	M10	M12	M10	M12	M16
b_1 (mm)	10.6	10.6	10.9	10.8	13.6	13.6	16.0
b_2 (mm)	21.1	21.1	20.2	20.1	29.0	29.0	29.0
b_3 (mm)	10.0	10.0	10.0	10.8	15.5	15.5	15.5
k (mm)	4.0	4.5	5.0	6.5	6.0	6.0	8.5
l (mm)	≥ 15	≥ 15	≥ 20	≥ 20	≥ 20	≥ 20	≥ 30
Installation torque (Nm)	3.0	8.0	15.0	25.0	15.0	25.0	60.0

Table 8: Design resistance Steel hammer-head HS T-bolt; serrated

T-bolt diameter d		M6	M8	M10	M12	M16
Throught-hole in connected component (mm)		7	9	12	14	18
Design resistance ① F_{Rd} (kN)	4.6	2.9	5.3	8.3	12.1	22.6
	8.8	6.4	11.7	18.6	27.0	50.2
Design resistance ② against bending M_{Rd} (Nm)	4.6	3.8	9.0	17.9	31.4	79.8
	8.8	9.8	24.0	47.9	83.8	213.1

Material/type

T-bolts:
- Shaft and thread design in accordance with DIN EN ISO 4018:2011-07
- Mat. steel; strength class 4.6 or 8.8 in accordance with DIN EN ISO 898-1:2013-05

Nuts:
- Design in accordance with DIN EN ISO 4032:2013-04
- Strength class 5 or 8.8 in accordance with DIN EN ISO 898-2:2012-08

Washers:
- In accordance with DIN EN ISO 7089:2000-11, DIN EN ISO 7093:2000-11 Product class A
- Mat. steel; in accordance with DIN EN 10025:2005-04

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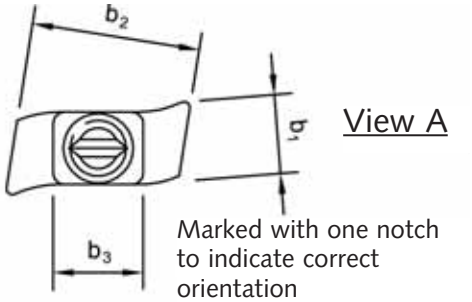
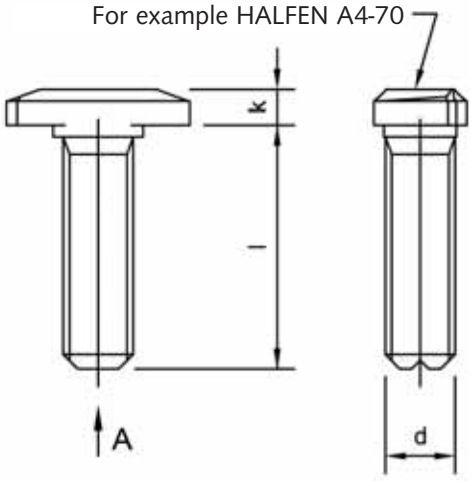


Marking: Production mark, strength class.
For example HALFEN A4-70



① See annex 9 for loading ranges
With simultaneous loading in y and z directions according to annex 9, the design value of the resultant load must not exceed the design resistances as in tables 10 and 14.

$$F_{Ed} = \sqrt{N_{Ed}^2 + V_{y,Ed}^2} \leq F_{Rd}$$

② Applies to the channel or concrete surface.

Table 9: Dimensions and installation torques Stainless steel hammer-head HS T-bolt

Profile	HZA 29/20				HZA 38/23		
d	M6	M8	M10	M12	M10	M12	M16
b_1 (mm)	10.6	10.8	10.9	10.8	13.6	13.6	16.0
b_2 (mm)	21.1	20.7	20.2	20.1	29.0	29.0	29.0
b_3 (mm)	10.0	10.0	10.0	10.8	15.5	15.5	15.5
k (mm)	4.0	4.5	5.0	6.5	6.0	6.0	8.5
l (mm)	≥ 15	≥ 15	≥ 20	≥ 20	≥ 20	≥ 20	≥ 30
Installation torque (Nm)	3	8	15	25	15	25	60

Table 10: Design resistance values Stainless steel hammer-head HS T-bolt

T-bolt diameter d		M6	M8	M10	M12	M16
Throught-hole in connected component (mm)		7	9	12	14	18
Design resistance ① F_{Rd} (kN)	A4-50	2.5	4.6	7.3	10.6	19.8
	A4-70	5.4	9.9	15.6	22.7	42.2
Design resistance ② against bending M_{Rd} (Nm)	A4-50	3.2	7.9	15.7	27.5	70.0
	A4-70	6.9	16.8	33.5	58.8	149.4

Material/type

T-bolts:
- Shaft and thread design in accordance with DIN EN ISO 4018:2011-07
- Mat. stainless steel; 1.4401/ 1.4404/1.4571/1.4578, A4-50, A4-70 or 1.4462, FA-70 in accordance with DIN EN ISO 3506-1:2010-04

Nuts:
- Design in accordance with DIN EN ISO 4032:2013-04
- Mat. stainless steel; strength class A4-50 and A4-70 in accordance with DIN EN ISO 3506-2:2012-04

Washers:
- In accordance with DIN EN ISO 7089:2000-11, DIN EN ISO 7093:2000-11 Product class A
- Mat. stainless steel; 1.4401/ 1.4404/1.4571/1.4578 in accordance with DIN EN 10088:2005-09

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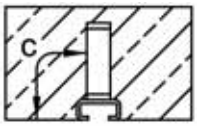
Table 11: Material and areas of application

	Component			Area of application
	Channel	Anchor	T-bolt, nut, washer	
1	Mill-finished	Mill-finished	No corrosion protection	Use only allowable if all fixing elements are protected by a minimum concrete cover according to DIN EN 1992-1-1:2011-01 with DIN EN 1992-1-1/ NA:2013-04, depending on the ambient conditions.
2	Hot dip galvanized (coating ≥ 50 µm)	Hot dip galvanized (coating ≥ 50 µm)	Electro-plated (coating ≥ 5 µm) zinc-plated (coating ≥ 10 µm)	Components used in indoors environments, e.g. flats, offices, schools, hospitals, shops - with the exception of rooms with an increased level of humidity.
3	Hot dip galvanized (coating ≥ 50 µm)	Hot dip galvanized (coating ≥ 50 µm) Bolt anchor in stainless steel 1.4401/1.4404/1.4571	① Hot dip galvanized (coating ≥ 40 µm)	Components used indoors in environments with normal humidity (incl. kitchens, bathrooms and laundry rooms in residential buildings)
4	Stainless steel 1.4401/1.4404/ or 1.4571	Weld-on anchor Mill finish ② Stainless steel 1.4401/1.4404/1.4462 /1.4571/1.4578	Stainless steel A4-50 A4-70 FA-70	Components according to corrosion resistance class III, Z-30.3-6

① Or zinc galvanized with special coating, thickness 12 µm.

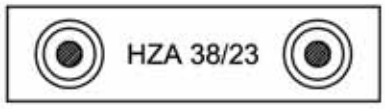
② Only allowable for profiles 38/23, 53/34 and 64/44. A concrete cover c of 30 mm (38/23), 40 mm (53/34) or 50 mm (64/44) may be used as a basis for the corrosion protection of the weld-on anchors.



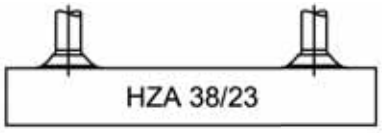
Identification marks on the HALFEN HZA Cast-in anchor channels

The channels must be permanently marked to ensure identification (inside or on the outside of the channel) on the channel web or on the anchor. The information may be printed, stamped or using other suitable measures. (Minimum requirements: Channel profile information, in addition with A4 if stainless steel)

Examples



a) Marking on back of channel



b) Marking on side of channel

Spacings

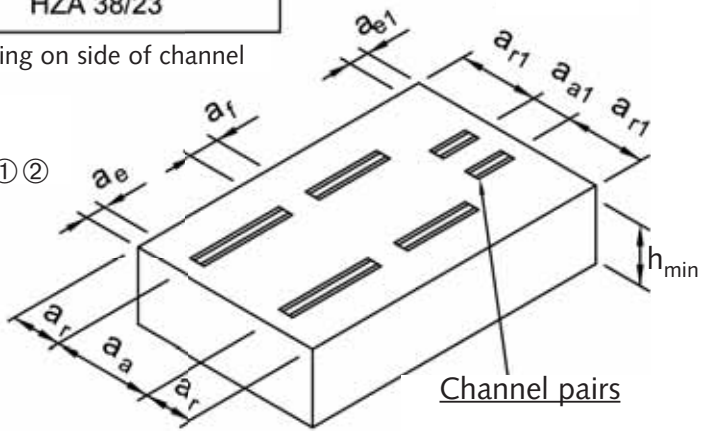


Table 12: Minimum spacings and component dimensions (mm) for non-reinforced concrete ①②

HZA profile	④			2 anchors		> 2 anchors		③ Channel pairs		
	h_{min}	a_r	a_a	a_r	a_e	a_r	a_e	a_{r1}	a_{a1}	a_{e1}
29/20	120	220	$2 \times a_r$	120	240	190	330	55	110	150
38/23	120	250		200	410	335	550	90	180	170
53/34	170	350		340	700	535	950	-		-
64/44	225	450		345	720	600	1000	-		-

① All values apply to non-cracked concrete of concrete strength classes ≥ C30/37.
When cracking needs to be accounted for, the spacings must be increased by a factor of 1.5.
Alternatively, the design resistances can be reduced by a factor of 1.4.

② For concrete strength classes C20/25 or C25/30, the spacings must be increased by a factor of 1.25 or 1.15.
Alternatively, the design resistance values can be reduced by the reciprocal value.

③ Only allowable for centric tension. When cracking needs to be account for, the spacings a_{r1} and a_{01} must be doubled or the design resistances reduced by a factor of 1.4.

④ Derived from the length of the anchors and the height of the channel profiles including the required concrete cover according to DIN EN 1992-1-1:2011-01 with DIN EN 1992-1-1/NA:2013-04.
May need to be increased; subject to the exposure class.

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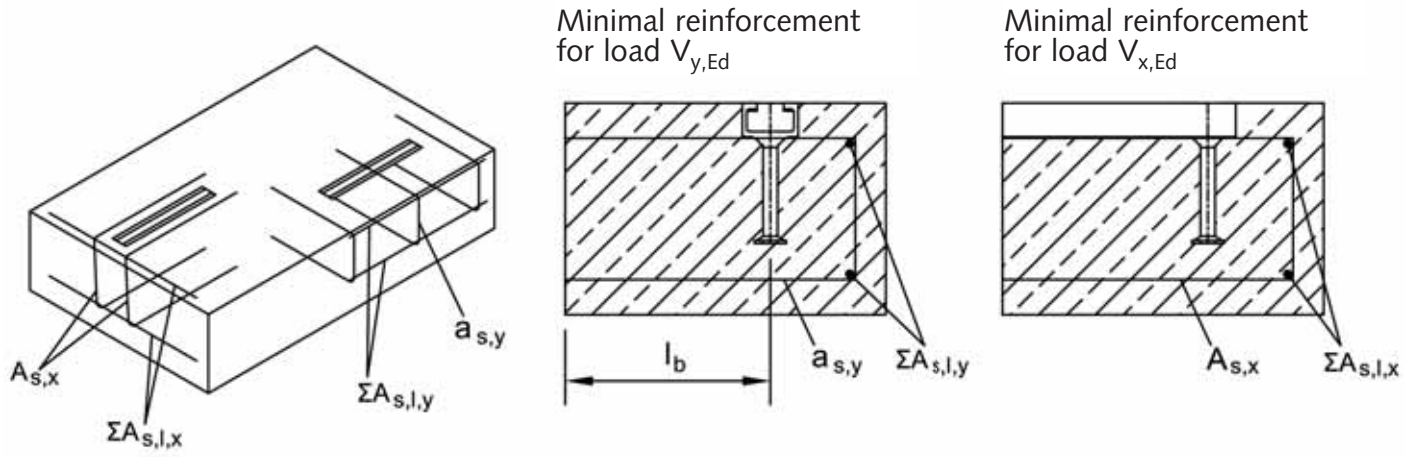
Table 13:
Min. spacings building components (mm) and min. reinforcement for reinforced concrete ⑥

HZA profile	① ② h_{min}	① a_r	① a_a	① a_r	① a_e	Minimal reinforcement For load $V_{x,Ed}$ $A_{s,x}$ ⑤	Minimal reinforcement For load $V_{y,Ed}$ $A_{s,y}$ ③	Minimal reinforcement ④ $\sum A_{s,l,x}$ or $\sum A_{s,l,y}$
29/20	120	220	$2 \times a_r$	110	90	2Ø6	Ø6/200	2Ø10
38/23	120	250		150	130	2Ø8	Ø8/200	
53/34	170	350		200	165	2Ø8	Ø8/200	
64/44	225	450		250	215	2Ø10	Ø10/200	



① See annex 7; drawing " Spacings ".

② Derived from the length of the anchors and the height of the channel profiles including the required concrete cover according to DIN EN 1992-1-1:2011-01 with DIN EN 1992-1-1/NA:2013-04:
Depending on the exposure class, may need to be increased.
May need to be increased; subject to the exposure class.

③ Symmetrical layout, distribution along the entire length of the channel and around a_r beyond the end of the channel; anchorage length l_b according to DIN EN 1992-1-1.

④ Include at least one reinforcement bar in the edges.

⑤ Close to the anchors.

⑥ All values apply for cracked concrete of concrete strength classes ≥ C30/37.
For concrete strength classes C20/25 or C25/30, the distances must be increased by a factor of 1.25 or 1.15.
Alternatively, the design resistances can be reduced by the reciprocal value.

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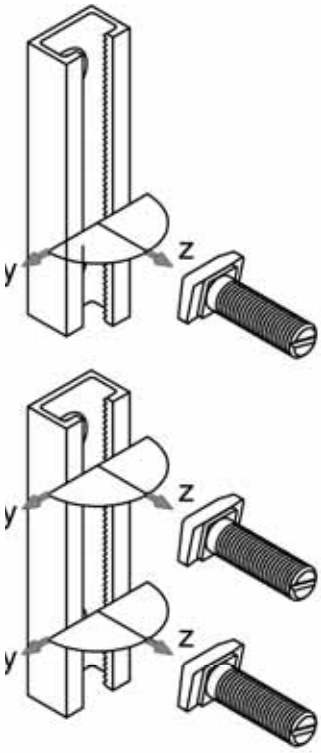
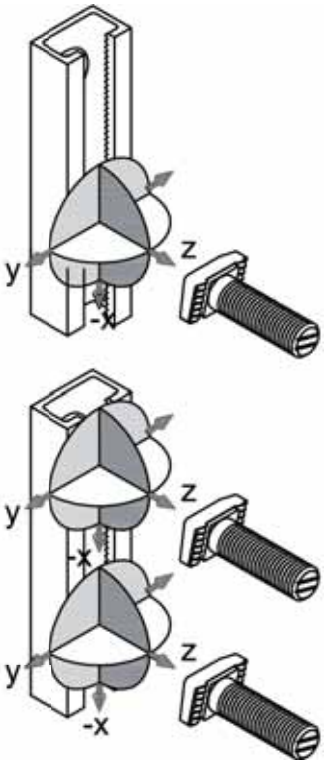
Allowable stress directions
depending on the bolt type

Hammer-head HS T- bolts loads perpendicular to the longitudinal axis of the channel (shear load y, tensile load z)	Serrated HZS T- bolts for loads in all directions (shear load y, shear load x, tensile load z)
See annex 12 for allowable fire resistance requirements	
	
$F_{Ed} = \sqrt{N_{Ed}^2 + V_{y,Ed}^2} \leq F_{Rd}$	$F_{Ed} = \sqrt{N_{Ed}^2 + V_{x,Ed}^2 + V_{y,Ed}^2} \leq F_{Rd}$

The design value of the resulting load must not exceed the design resistance as in table 14 in annex 10, and in accordance with annexes 3 to 6.

Load distribution for HZA 29/20, HZA 38/23, HZA 53/34 and HZA 64/44 (dimensions in mm)

Figure a) Single loads

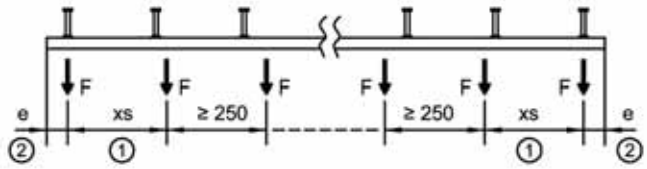
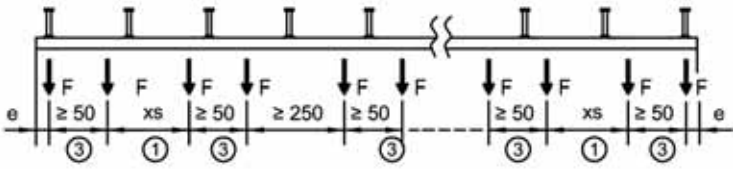


Figure a) Load pairs (see annex 10 for load spacings)



① with diagonal resultant loads the end spacing in xs must be ≥ 275 mm
(≥ 265 mm for HZA 38/23 ≥ 250 for HZA 29/20)
② 25 ≤ e ≤ 35
③ ≥ 100 for HZA 53/34 and HZA 64/44

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Table 14: Design resistances of the cast-in anchor channel for static and quasi-static load

Design resistances F_{Rd} (kN) ①②③ Loads in all load directions				Suitable bolts	
	Single load	Load pairs		Hammer-head bolts④	Nib- serrated bolts
HZA 29/20	11.2	6.3 ⑤	9.0 ⑤	HS 28/15 M12	HZS 29/20 M10 HZS 29/20 M12
HZA 38/23	16.8	9.4 ⑤	12.0 ⑤	HS 38/17 M16	HZS 38/23 M12 HZS 38/23 M16
HZA 53/34	30.8 (26.6) ⑥	-	19.3		HZS 53/34 M16 HZS 53/34 M20
HZA 64/44	37.8	-	22.4		HZS 64/44 M20 HZS 64/44 M24
Load spacing (mm)	≥ 250	≥ 50	≥ 150 ⑦		
Profile length (mm)	≥ 100	≥ 200			

① All values apply to concrete strength classes ≥ C30/37.
For concrete strength classes C20/25 or C25/30, the spacings must be increased by a factor of 1.25 or 1.15. Alternatively, the rated resistances (table 14) can be reduced by the reciprocal value.

② In cases of simultaneous loading in more than one direction, the load resultant must not exceed the design resistances specified in the above table (see annex 9).

③ See annex 9 for stress ranges

④ Hammer-head HS T- bolts are not approved for loads in the longitudinal channel direction (x-x). When using smaller HS T- bolts according to annex 5 and 6, the design resistance of the bolts must not be exceeded.

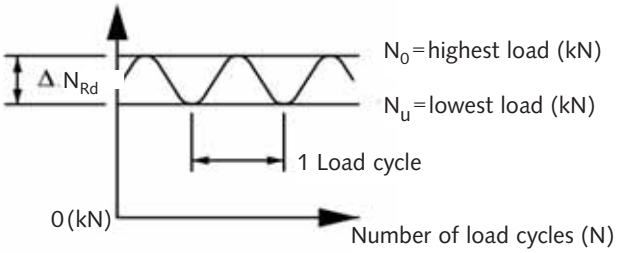
⑤ Intermediate values may be linearly interpolated.

⑥ The value in brackets applies to A4 profiles.

⑦ For HZA 53/34 and HZA 64/44: 100 mm

Table 15: Design resistance of fatigue load capacity for stress amplitude ΔN_{Rd} for Load cycles $N \leq 2 \times 10^6$

Stress amplitude $\Delta N_{Rd} = N_0 - N_u$ (kN) ③④ when subjected to tension				Approved bolts
Profile	Mat.	①	②	
HZA 29/20	St	2.0		HS 28/15 M12 HZS 29/20 M12
	A4	1.8		
HZA 38/23	St	3.0		HS 38/17 M16 HZS 38/23 M16
	A4	2.4		
HZA 53/34	St	6.0	12.0	HS 53/34 M16 HZS 53/34 M20
	A4	4.0	10.0	
HZA 64/44	St		15.0	HS 64/44 M20 HZS 64/44 M24
	A4		11.0	



① The specified stress amplitudes apply to profiles with bolt anchors or I-anchors with anchor/weld seam orientation Q/Q.

② The specified stress amplitudes apply to the profile with I-anchor 140/7.1 with anchor/welded seam orientation Q/L.
Application is only permitted in reinforced members. Further transfer of loads must be verified when installing in the tensile zone of reinforced concrete members which result from load stress.

③ The specified stress amplitudes apply only to individual loads.

④ The max. load must be verified separately using the design resistances in accordance with table 14.

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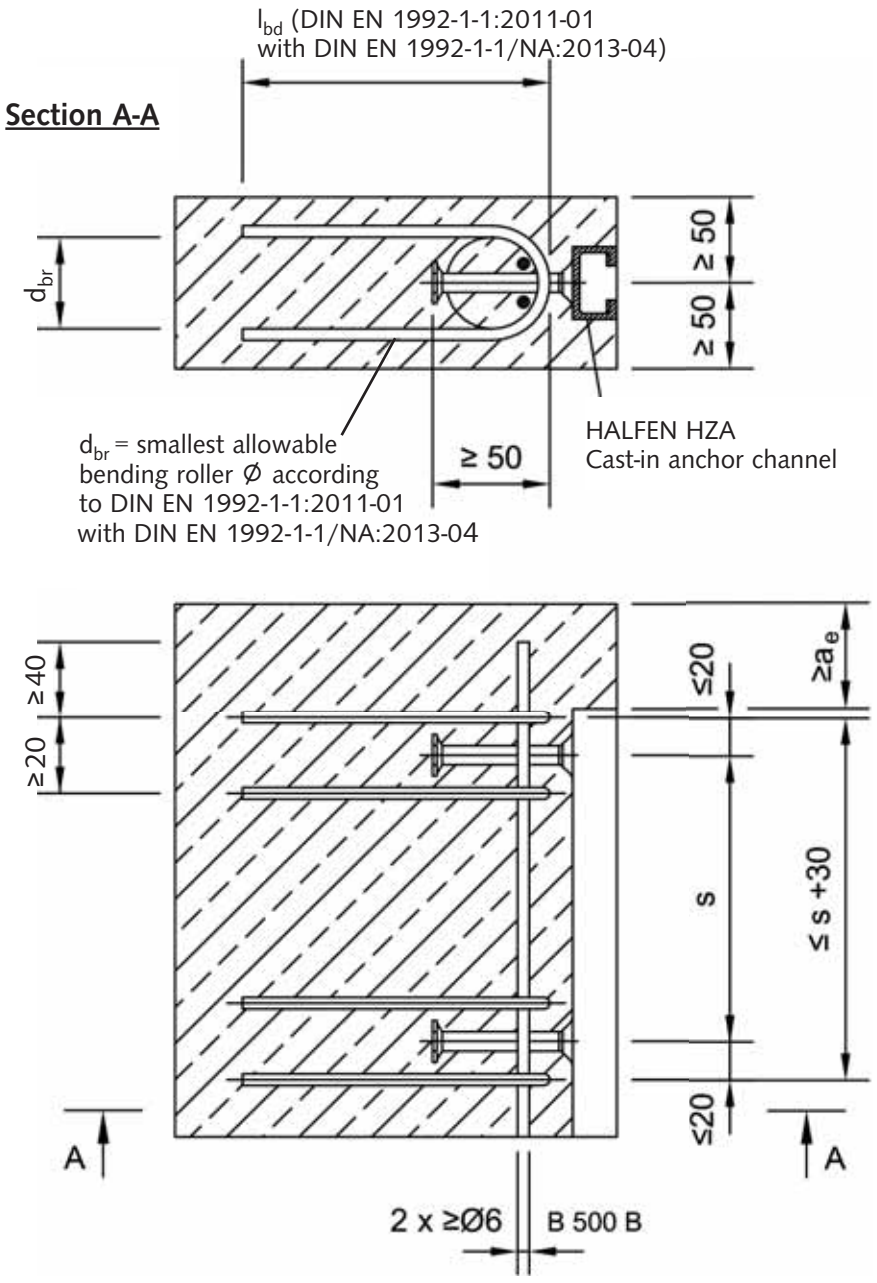
Reduced edge distance when subjected to tensile loading, and details for additional reinforcement for profiles HZA 29/20 and HZA 38/23. (Specified in section 3.2.5)



$$\text{erf. } A_s = \frac{F_{Ed}}{4 \times \sigma_{Rd}}$$

Quantifiable steel stress σ_{Rd} = 11 kN/cm²
erf. A_s = Cross section of a stirrup (cm²)
F_{Ed} = max. design value of the load (kN)

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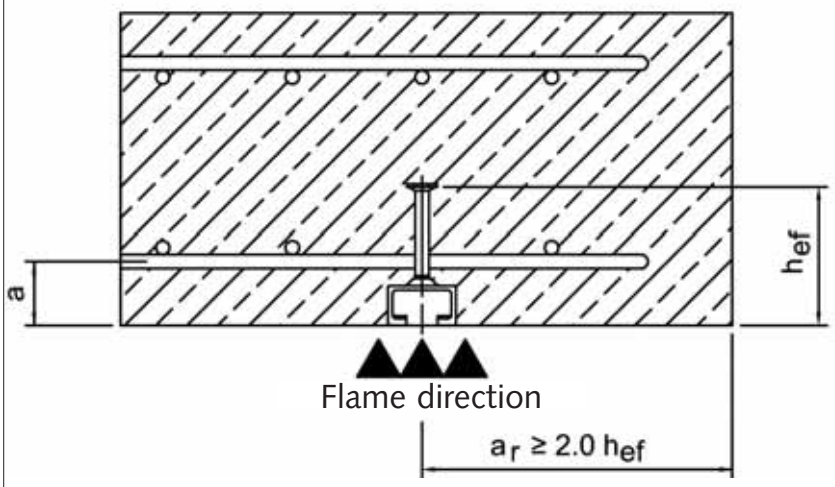
Table 16: Design resistances (kN) perpendicular to the longitudinal axis of the channel, central tension and shear tension under fire exposure according to fire resistance class F90 and F60 (value in brackets) for HALFEN Cast-in anchor channels, taking the corresponding HALFEN T-bolts into account.

HZA ① Profile	Design resistances (kN) ② HALFEN T-bolts strength class 4.6 / 8.8 / A4-50 / A4-70				
	M8	M10	M12	M16	M20
29/20	0.5 (0.7)	1.3	1.8	-	-
38/23	-	1.3	1.8	4.0	-
53/34	-	-	-	4.0	4.0
64/44	-	-	-	-	4.0

① Mill finish, galvanized or stainless steel profiles.
② Only allowable for load direction perpendicular to the longitudinal axis of the channel for centric and shear tension in accordance with annex 9.

Subjected to fire from one direction



Subjected to fire from mutiple directions

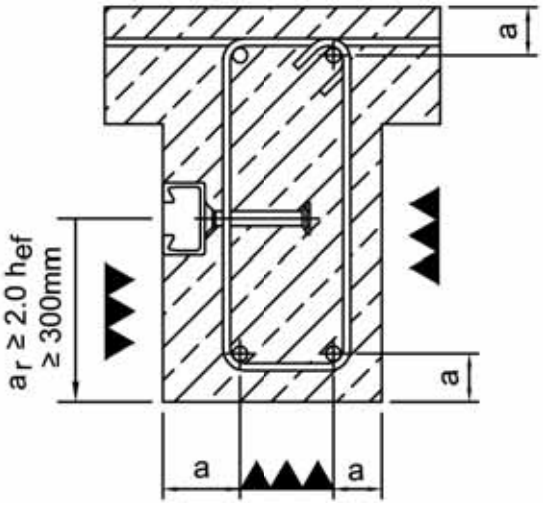


Table 17: Required centre spacing a (mm) for a fire resistance duration F60 and F90 in the vicinity of the HALFEN Cast-channels

HZA Profile	Required axial spacing a (mm) for fire resistance duration	
	60 minutes	90 minutes
29/20	35	45
38/23		
53/34	50	50
64/44		

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