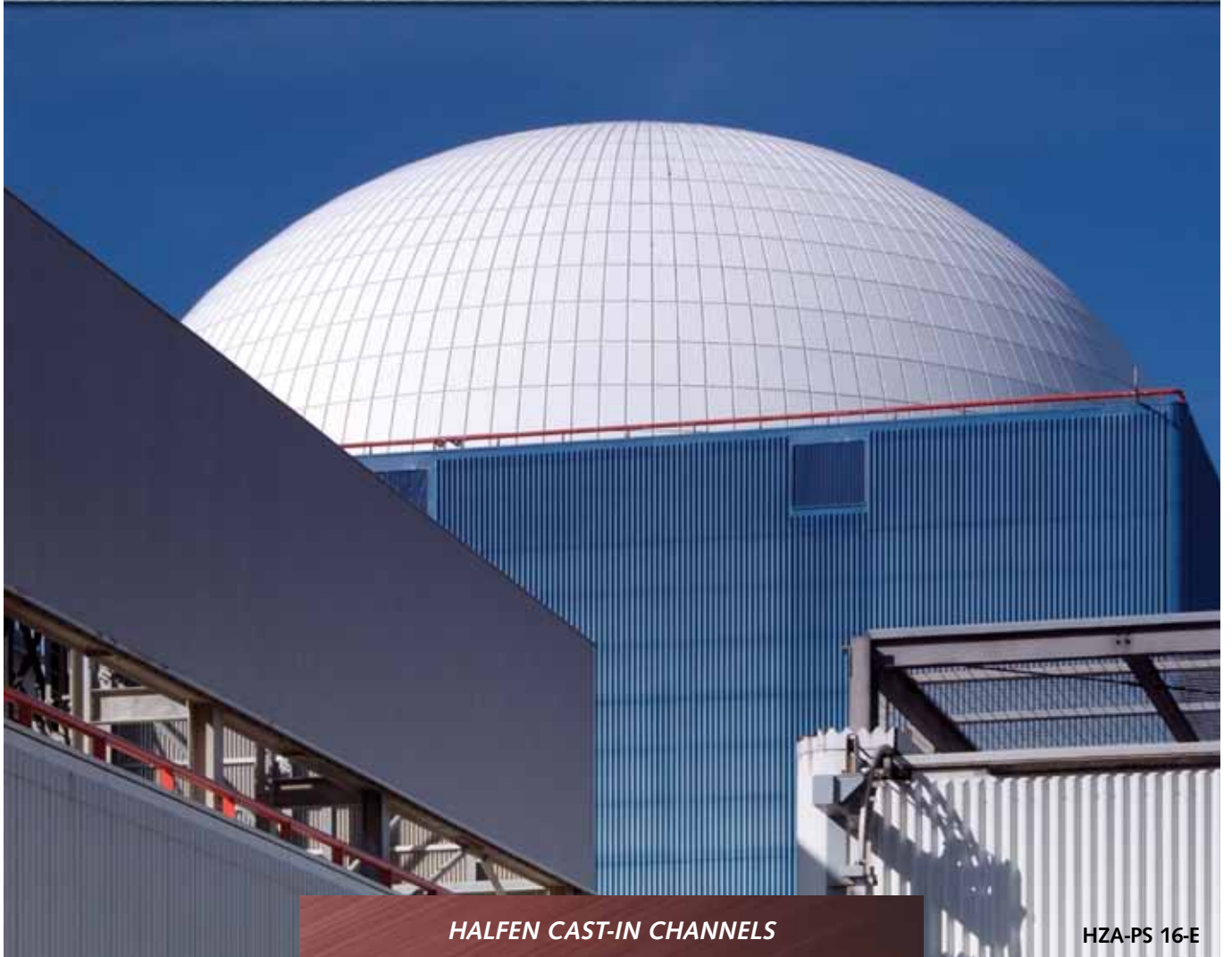


HALFEN HZA-PS CAST-IN CHANNELS

TECHNICAL PRODUCT INFORMATION



HALFEN CAST-IN CHANNELS

HZA-PS 16-E

CONCRETE



HALFEN
YOUR BEST CONNECTIONS

HALFEN Cast-in channels

The Benefits at a glance

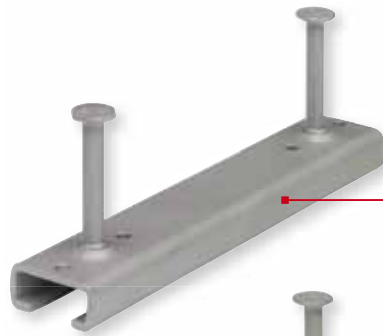
Offers easy, reliable and excellent adjustment of all types of fixings, HALFEN Cast-in channels save considerable installation time for connections to concrete. The result: Faster completion of the construction project and reduced overall costs.

Safe and reliable

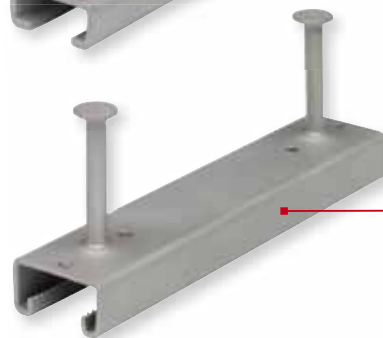
- no damage to supporting reinforcement
- approved for fire-resistant structural elements
- can be installed in concrete pressure and tensile-stress zones
- suitable for dynamic loading
- building authority approval
- easy checking
- minimizes the risk of installation errors
- no health hazards caused by power-tools, noise, dust, sparks or fumes

Quick and economical

- adjustable component anchoring
- no welding or drilling required
- extremely economical
- installation with simple tools, reduces costs
- pre-engineered to reduce construction time
- large range of channels for most requirements



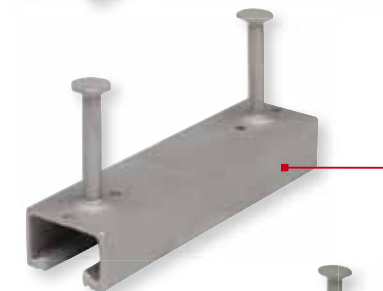
HALFEN HTA-CE Cast-in channels
cold-formed



HALFEN HZA Cast-in channels
cold-formed, serrated



serrated



HALFEN HTA-CE Cast-in channels
hot-rolled



suitable for dynamic loading



HALFEN HZA Cast-in channels
**DYNAGRIP
hot-rolled, serrated**



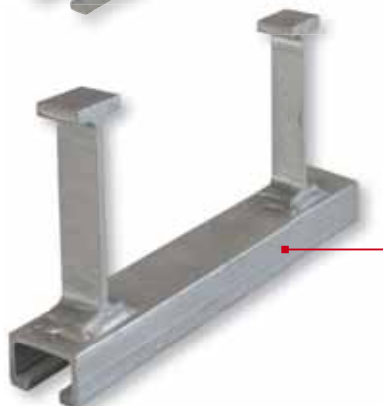
serrated



3D - loading



suitable for dynamic loading



HALFEN HZA-PS Cast-in channels
hot-rolled, serrated



serrated



3D - loading



suitable for dynamic loading



suitable for seismic loading



suitable for safety relevant areas

HALFEN HZA-PS CAST-IN CHANNELS

General

Approvals

HALFEN Cast-in channels are available hot-dip galvanized or stainless steel and are building authority approved by the German Institute for building technology (*Deutsches Institut für Bautechnik, DIBt*).

Cast-in channels are cast in flush with the final concrete surface. Suitable HALFEN T-bolts or nibbed bolts, nuts and washers are used to reliably secure structural elements to the channels.

HTA: App. no. Z-21.4-34
HTA-CE: App. no. ETA-09/0339
HZA 41/22: App. no. Z-21.4-145
HZA Dynagrip: App. no. Z-21.4-1691



Evaluation Report

HALFEN HZA-PS Cast-in channels are suitable for applications in safety relevant areas of nuclear power plants and other nuclear facilities.

HALFEN HZA-PS Cast-in channels meet the high requirements for extraordinary impacts from external (EVA) and internal (EVI) loads e.g. earthquakes, plane crash or explosions.

HZA-PS:
Evaluation Report
Technical University of Dortmund
09.05.18-E

evaluated by the:



Faculty for Architecture and Building Engineering
Concrete structures – Connection technology



Approvals on the internet: The approvals can be found at www.halfen.com/downloads/brochures, or simply scan the code, select the required document and click to download as a PDF file.

Fire Protection

HALFEN Cast-in channels HTA and HZA, in combination with HALFEN Bolts, have been certified for use in fire-exposed structural elements.

The anchoring channels achieve a fire rating of 60 or 90 minutes respectively for concrete structures if installed according to the approvals as above.



Quality

Quality is the outstanding feature of our products. HALFEN materials and products are subjected to most stringent quality control procedures.

A quality inspection by the **DNV GL** has certified that our quality management system meets the requirements of the DIN EN ISO 9001:2015 standard.



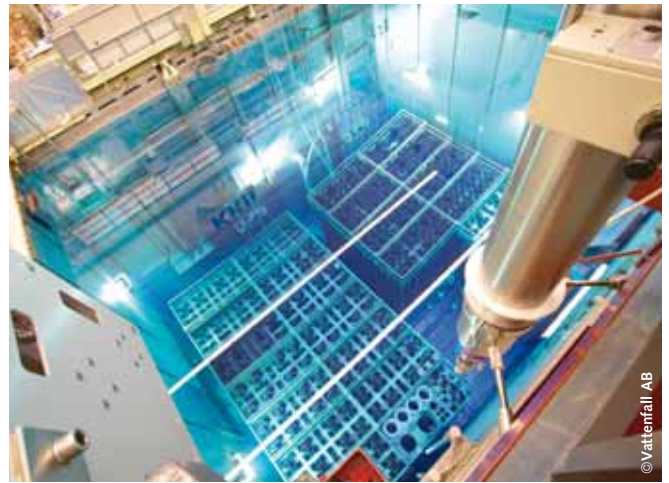
Cert.-no. QS-281 HH

HALFEN HZA-PS CAST-IN CHANNELS

Application Examples



Nuclear power plant, operated by Vattenfall AB



Fuel element cooling



Stacked cable trays; by bolting to vertical serrated channels



Pipe support bolted to ceiling



Nuclear power plant under construction

HALFEN HZA-PS CAST-IN CHANNELS

Application Examples



Turbine in a nuclear power plant



Turbine block in a nuclear power plant



Cantilever for support of pipes mounted to vertical serrated channel



Pipe support using vertical cast-in channels

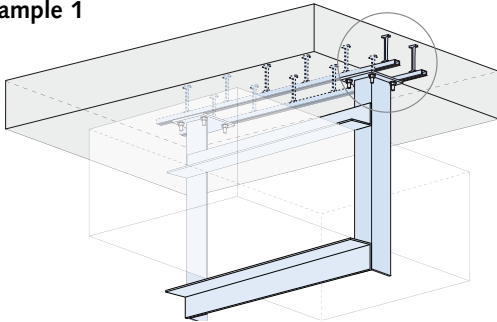


Adjustable pipe support using a cantilever with vertical serrated channel

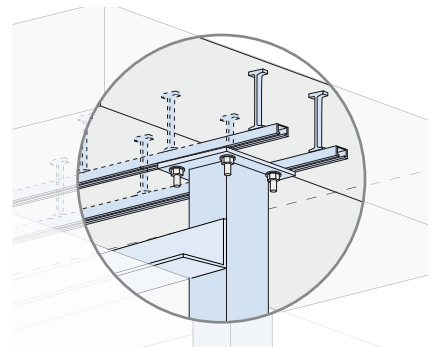
HALFEN HZA-PS CAST-IN CHANNELS

Application Examples

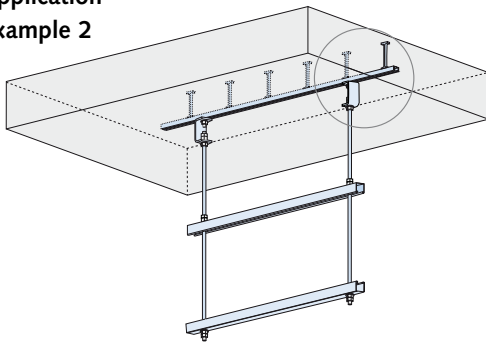
Application example 1



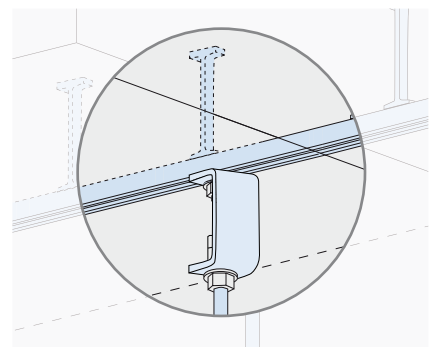
Air ventilation duct supported by welded steel frame anchored to concrete floor slab with a pair of serrated channels



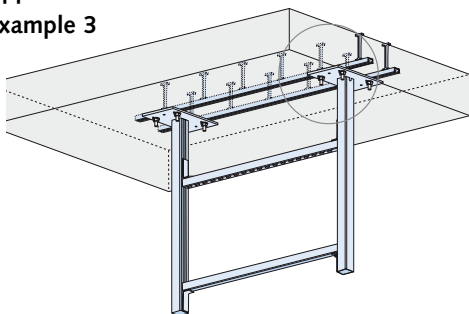
Application example 2



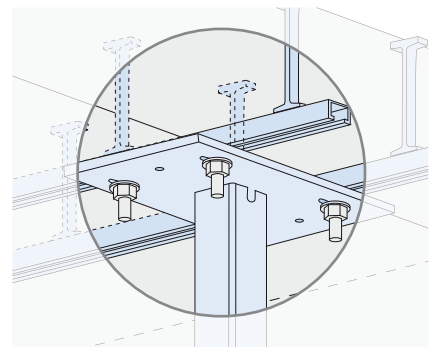
Air ventilation duct suspended with a light weight construction bolted to a concrete slab using a serrated channel



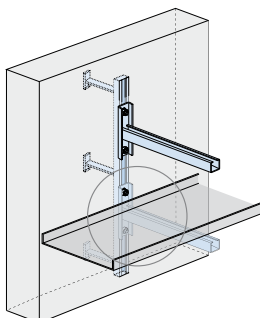
Application example 3



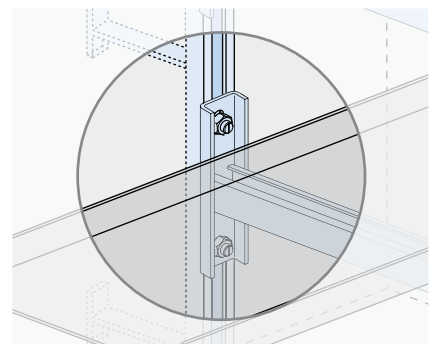
Air ventilation duct supported by a HALFEN Framing system attached to a concrete slab with a pair of serrated channels



Application example 4



Cable tray supported by cantilever brackets mounted to a vertical serrated channel

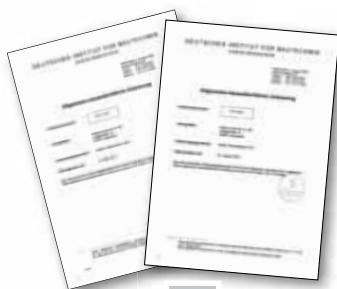
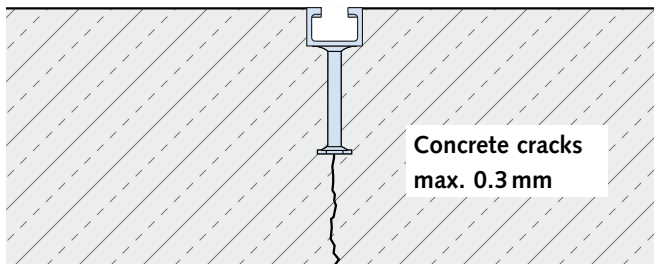
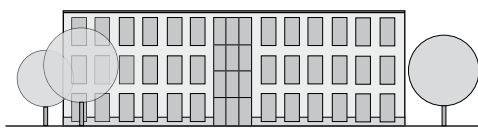


HALFEN HZA-PS CAST-IN CHANNELS

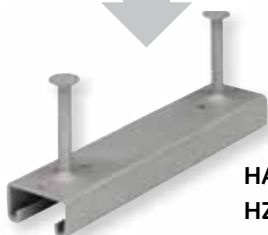
Safety Relevant Aspects

Standard application

HALFEN HTA-CE & HZA Channels are officially approved, and recommended for applications in normal concrete constructions such as office buildings, schools, industrial buildings or in non-critical areas of nuclear power plants. In these applications the maximum crack width in the concrete is 0.3 mm.



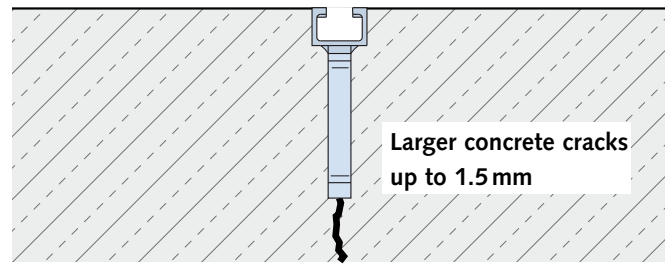
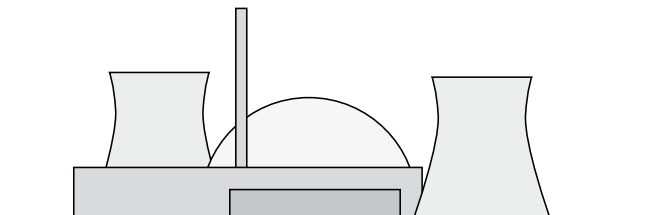
Approvals



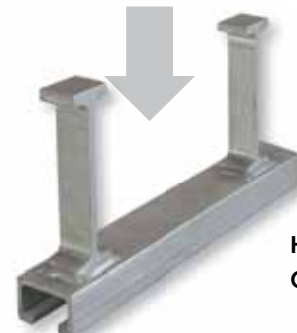
HALFEN HTA-CE and HZA Cast-in channels

Safety relevant applications

Higher safety requirements for exterior (EVA) or interior (EVI) impact loads must be observed in safety relevant areas in nuclear power plants or other nuclear facilities. The suitability of the HZA-PS Channels for this type of extra-ordinary impact loads has been verified in simulated application tests. All the tests were carried out in concrete with opening and closing cracks varying from 1.0 mm up to 1.5 mm. The results are summarized in evaluation report 09.05.18-E (see also pages 8 and 9).



Expert Report



HALFEN HZA-PS Cast-in channel

HALFEN HZA-PS CAST-IN CHANNELS

Test Procedures

Various specifications in different categories must be observed in nuclear power plants and nuclear facilities (see DIN 25449):

Category A3: Load cases which occur only once during the lifetime of the facility:

- earthquake
- plane crash
- exterior explosion
- interior explosion
- differential pressure
- supporting forces etc.

Category A2: Load cases which occur less than ten times during the lifetime of the facility.

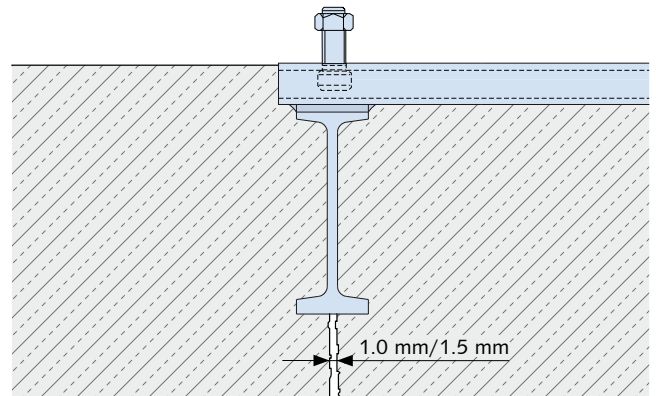
Category A1: Load cases which occur more than ten times during the lifetime of the facility.

As a result of the higher demands of category 3 and 2 wider concrete cracks have to be considered. Therefore the behaviour of the anchoring systems is examined in additional suitability tests with crack widths larger than 0.4 mm. The existing guidelines set by the German Institute for Building technology (DIBt) for the use of post installed anchors in nuclear power plants was the basis of specification for the additional tests.

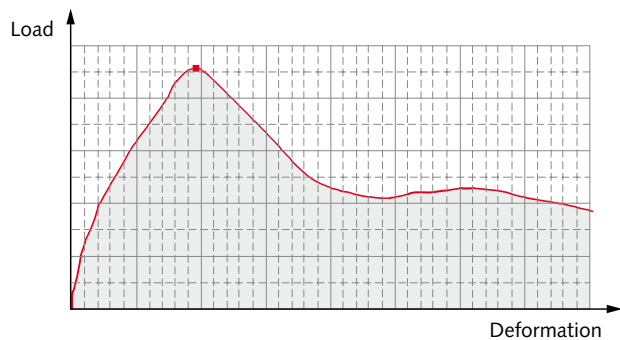
Examples of tests include:

1. Pull-out test; the anchor was tested in a 1.0 mm wide concrete crack

2. Pull-out test; the anchor was tested in a 1.5 mm wide concrete crack



1.0 and 1.5 mm concrete cracks in the location of the anchor



Load-deformation diagram of a pull-out test showing the steady load increase with a low deformation until maximum load is achieved.



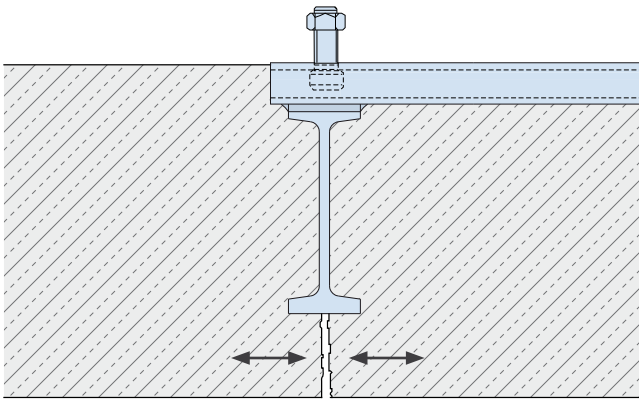
Test setup; pull-out test

HALFEN HZA-PS CAST-IN CHANNELS

Test Procedures

3. Performance test in an opening and closing concrete crack

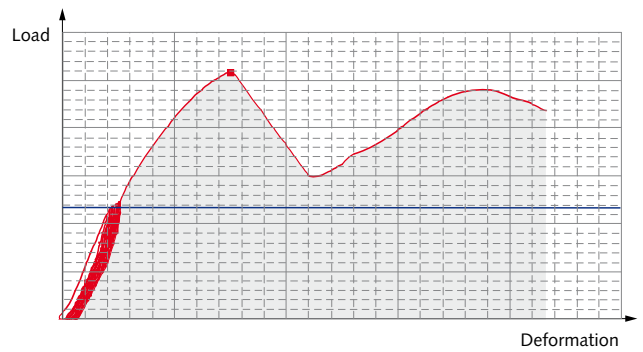
For this purpose 10 alterations of the concrete crack width between 1.0 and 1.5 mm were performed in a frequency of 0.2 Hz while the anchor channel was loaded with a constant tension load. A pull-out test was subsequently carried out in the widest concrete crack of 1.5 mm.



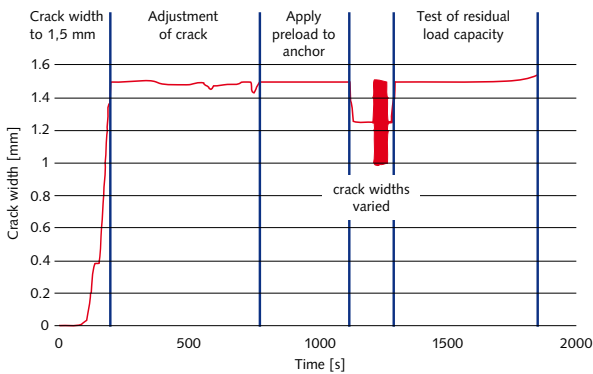
Anchor position directly in an opening and closing concrete crack.

4. Cyclic load change in a wide concrete crack

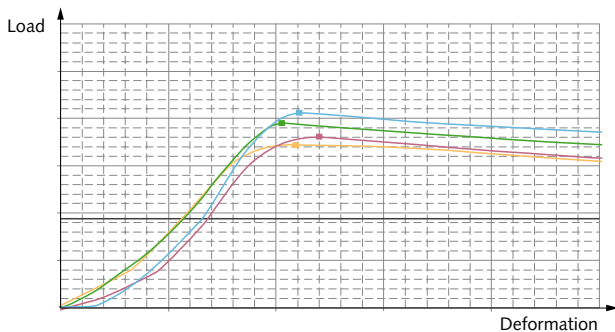
In this test the concrete crack is opened up to 1.5 mm and a tension load applied to the cast-in channel. Then the cast-in channel is completely unloaded. In this test 15 load cycles with a frequency $F < 1$ Hz are carried out. A pull-out test was subsequently carried out in the widest concrete crack of 1.5 mm.



Load-deformation diagram - even after the cyclic load test the final pull-out test shows a steady rise with only low deformation.



Chronological test procedure



Load-deformation diagram: shows ductile behaviour during the final pull-out test.



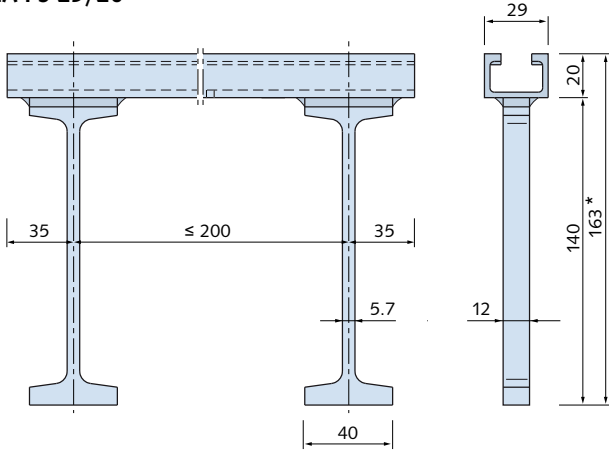
Test setup for cyclic load test

HALFEN HZA-PS CAST-IN CHANNELS

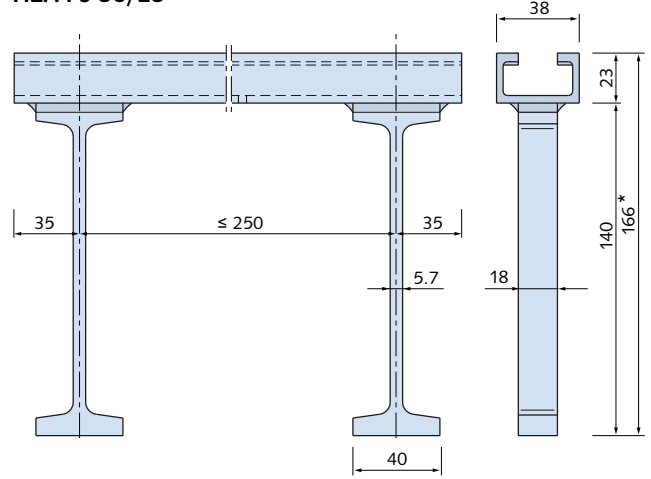
Product Overview

HZA-PS Cast-in channels

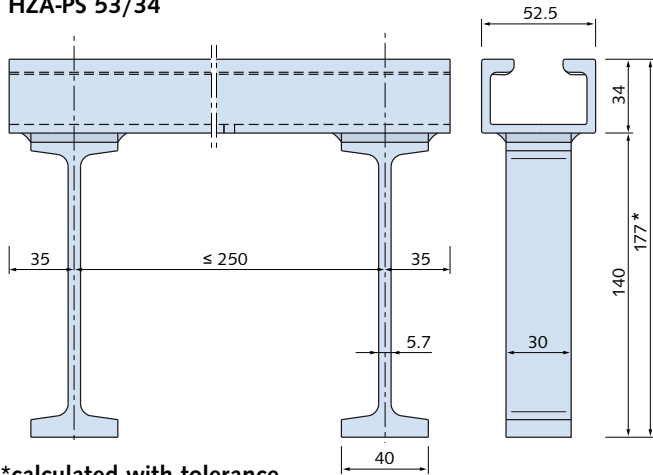
HZA-PS 29/20



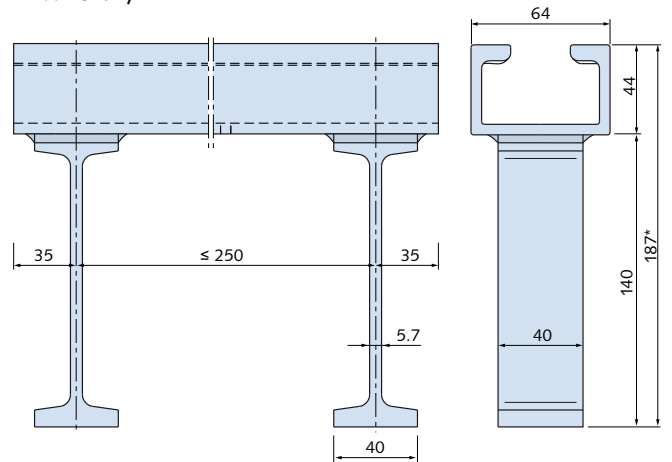
HZA-PS 38/23



HZA-PS 53/34



HZA-PS 64/44



*calculated with tolerance

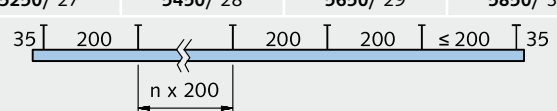
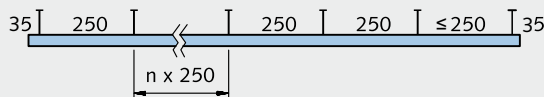
Available lengths (produced to order) and anchor placement

HZA-PS 38/23, 53/34, 64/44 - Standard lengths			
Length [mm] / Number of anchors			
200 / 2	350 / 3	550 / 3	800 / 4
1050 / 5	3030 / 13	6070 / 25	

HZA-PS 29/20 - Standard lengths			
Length [mm] / Number of anchors			
200 / 2	350 / 3	550 / 4	800 / 5
1050 / 6	3030 / 16	6070 / 31	

HZA-PS 38/23, 53/34, 64/44 - Fixed standard lengths			
Length [mm] / Number of anchors			
-	1300 / 6	1550 / 7	1800 / 8
2050 / 9	2300 / 10	2550 / 11	2800 / 12
-	3300 / 14	3550 / 15	3800 / 16
4050 / 17	4300 / 18	4550 / 19	4800 / 20
5050 / 21	5300 / 22	5550 / 23	5800 / 24

HZA-PS 29/20 - Fixed standard lengths			
Length [mm] / Number of anchors			
1250 / 7	1450 / 8	1650 / 9	1850 / 10
2050 / 11	2250 / 12	2450 / 13	2650 / 14
2850 / 15	-	3250 / 17	3450 / 18
3650 / 19	3850 / 20	4050 / 21	4250 / 22
4450 / 23	4650 / 24	4850 / 25	5050 / 26
5250 / 27	5450 / 28	5650 / 29	5850 / 30

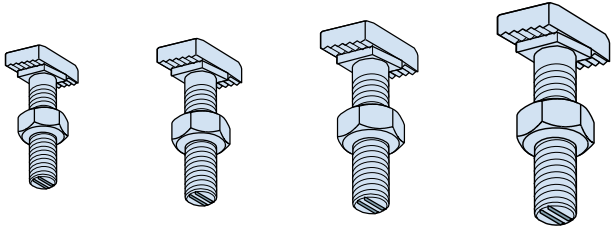


HALFEN HZA-PS CAST-IN CHANNELS

Product Overview

HZS bolts – available lengths

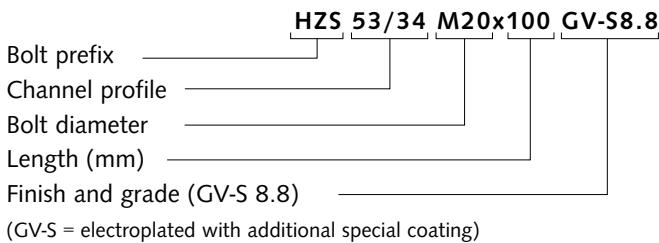
HZS 29/20 M12 **HZS 38/23 M16** **HZS 53/34 M20** **HZS 64/44 M24**



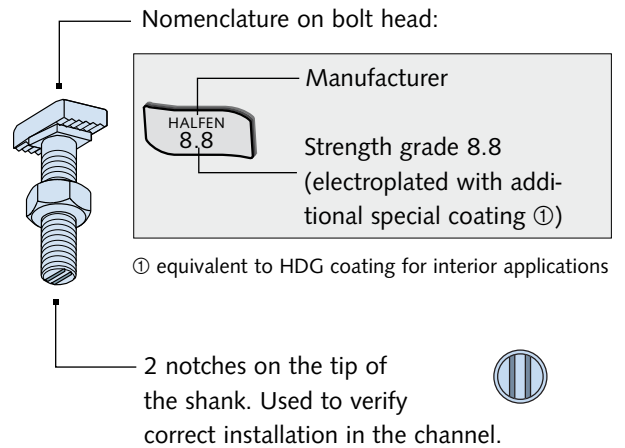
HZS T-Bolt lengths		
Bolt type/ channel profile	Bolt diameter (mm)	Grade 8.8 Bolt length (mm)
HZS 64/44	M24	80, 150
HZS 53/34	M20	65, 100
HZS 38/23	M16	40, 60, 80
HZS 29/20	M12	60, 80

For bolts in other lengths and diameters please contact HALFEN (→ see page 19).

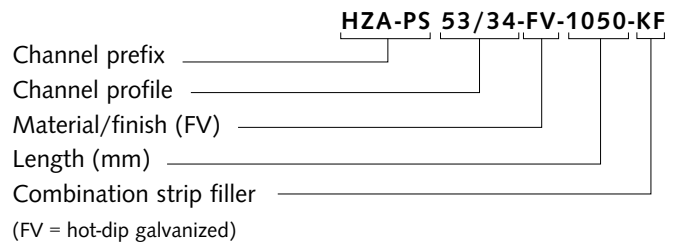
Example order code for bolts:



Product identification



Example order code for channels:

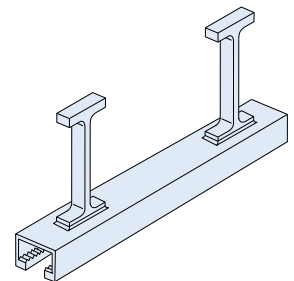


Tender specifications

1. HALFEN Cast-in channels

1.1 HALFEN Channel type HZA-PS – Power Solution

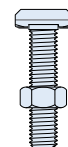
HALFEN Cast-in channel HZA-PS _____, hot-dip galvanized (FV) with strip filler (KF), suitable for adjustable connections to concrete in safety relevant areas of nuclear plants or other nuclear installations, channel length _____ mm, design resistance $F_{Rd} =$ _____ kN in all directions, up to _____ kN dynamic loading, delivery and installation according to the HALFEN installation instructions.



2. HALFEN Bolts

2.1 HALFEN Bolts type HZS

HALFEN serrated bolt HZS _____ belonging to correspondent HALFEN Cast-in channel HZA-PS, electroplated with special coating, including nut, delivery and installation according to the HALFEN installation instructions.



HALFEN HZA-PS CAST-IN CHANNELS

Technical Data

Load capacities

Loads

All the values shown are design resistance capacities and should therefore be compared against fully factored loads.

e.g. $F_{Ed} = \gamma_G G_k + \gamma_Q Q_k$

where:

- γ_G = partial factor for permanent loads
- G_k = characteristic value of permanent loads (dead load)
- γ_Q = partial factor for variable loads
- Q_k = characteristic value of variable loads (imposed or live load)

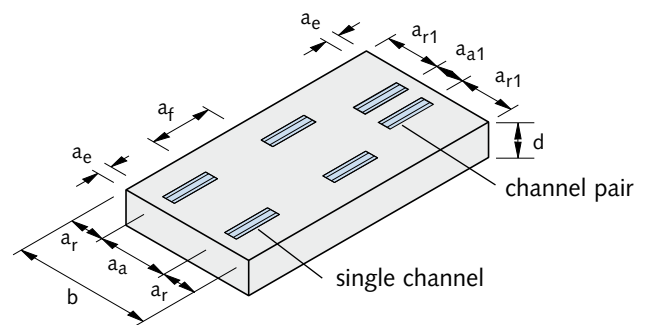
Design resistance F_{Rd} ; valid for h.d.g material		s = anchor spacing see page 10						
F_{Rd} with simultaneous loading in <u>all</u> directions		Single loads		Load pairs				
Concrete \geq C20/25								
To check: ① Ⓐ $F_{Ed} = \sqrt{N_{Ed}^2 + V_{xEd}^2 + V_{yEd}^2} \leq F_{Rd}$ Ⓑ $V_{x,Ed} \leq 0.8 \times F_{Rd}$ (single load)		F_{Rd} [kN]		F_{Rd} [kN] ②				
HZA-PS profile ①		$b_1 \geq 250$		$p_i = 50$	$p_i = 100$	$p_i = 150$	$p_i = 200$	$p_i = 250$
64/44		37.8	-	23.6	27.0	31.5	37.8	
53/34		30.8	-	19.25	22.0	25.7	30.8	
38/23		16.8	9.4	10.5	12.0	14.0	16.8	
29/20		11.2	6.3	7.5	9.0	11.2	11.2	

① Check B is only necessary if there are 2 or more bolts connecting **one** component.

② Intermediate values may be linearly interpolated.

Minimum edge distances and spacings							
	a_r	a_a	a_e	a_f	a_{r1}	a_{a1}	d
HZA-PS 64/44	250	500	225	450	-	-	190 + c
HZA-PS 53/34	200	400	175	350	-	-	180 + c
HZA-PS 38/23	150	300	130	250	225	150	170 + c
HZA-PS 29/20	100	200	80	200	140	125	165 + c

c = min concrete cover (specified by others)



HZA T-Bolt capacities						
Bolt diameter (mm)	Grade 8.8				Moment capacity M_{Rd} (Nm)	Tensile capacity F_{Rd} (kN)
	Torque (Nm)					
	HZA 29/20	HZA 38/23	HZA 53/34	HZA 64/44		
M24	-	-	-	450	523.9	113.7
M20	-	-	350	-	303.0	79.0
M16	-	120	-	-	155.4	50.5
M12	80	-	-	-	61.2	27.2

Load amplitude for load cycles of $N = 2 \times 10^6$		
	Design load amplitude ΔF in tension S275	Allowable bolts
HZA-PS 64/44	15.0	M24
HZA-PS 53/34	12.0	M20
HZA-PS 38/23	3.0	M16
HZA-PS 29/20	2.0	M12

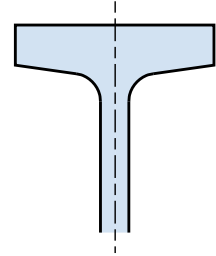
HALFEN HZA-PS CAST-IN CHANNELS

Product Advantages

The anchor head

The wide, almost parallel anchor head is a positively interlock connection and results in very effective load transmission due to the low bearing pressure under the head. Furthermore there is an additional enormous advantage

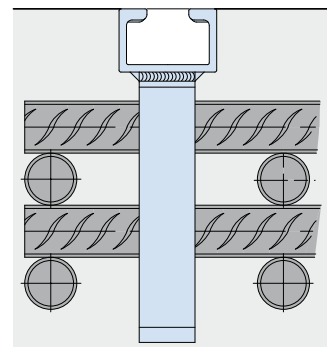
when used in concrete designed for possible wide cracks. With the minor movement of the anchorage system during opening and closing of cracks, a safe fixing with low deformation can be guaranteed.



The anchoring depth

Deep anchoring guarantees high loading capacity and compensates for concrete attenuation due to wide cracks. Concrete elements in security relevant areas are frequently heavily reinforced. The increase in anchoring depth guarantees an ideal load impact regard-

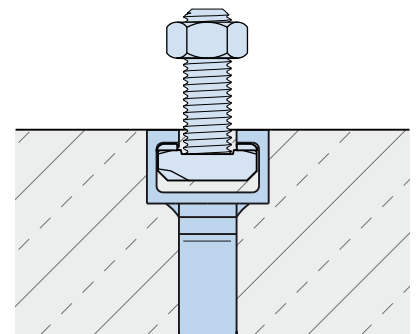
ing the reinforcing layers. Simultaneously the channel body (maximum height 44 mm) can be easily installed with standard concrete cover of approx. 45–60 mm.



The channel profile

The manufacturing process of the hot-rolled channels enables efficient design of the channel cross section. This means that the channel lips are thicker and stronger than the flanges or channel backs. This feature avoids lip deformation while enabling safe and efficient transfer of impact loads through the channel profile for

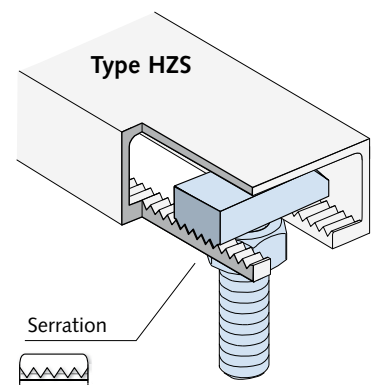
dispersal into the concrete structure. The hot-rolling process also prevents manufacturing distortion over the channel length and provides good bearing for attached components. Dynamic loads can also be safely transmitted as the hot-rolled material has low internal stresses.



The serrated channel lips

During the rolling process robust internal serrations are pressed into the channel lip material. With a pitch of only 3.0 mm the channel serration positively interlocks with nibbed HALFEN Bolts and therefore provides safe load capacity in the longitudinal direction of the channel.

The serrated channels are very advantageous for application in seismic zones or other anticipated load cases such as explosion or collision loads. To activate load capacities in the longitudinal direction of the channels a defined torque has to be observed (see page 12).



HALFEN HZA-PS CAST-IN CHANNELS

Product Advantages

The anchor foot

All four sides of the anchor foot are welded solidly to the back of the channel. This provides an efficient and even transmission of static loads and critical dynamic loads from the channel into the anchor.

The extensive weld length is an additional safety feature. This is enhanced by regular selective ultimate load checks of welded anchors as part of our quality assurance programme.



T- bolts

Without exception all HZS Bolts for the HZA-PS Systems are only available in high strength class 8.8. This guarantees that the bolt, even if an additional moment acts on the bolt, can safely transmit forces into the channel.

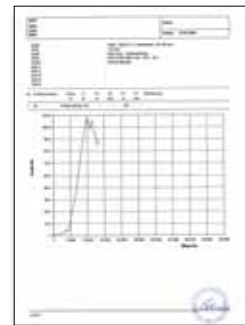
The application of an specified torque guarantees a positive interlock between the bolt and the channel serration. This is important for the loading capacity in the longitudinal direction of the channels. This is why the provided torques values have to be observed.



Quality

Our production facility in Langenfeld/ Germany is DIN EN ISO 9001 certified. The certification requires regular maintenance of all machines and continual inspections of all processes at the facility. All inspections are according to the HALFEN QS quality system which is based on DIN EN ISO 9001. The HALFEN production facility is certified for welding processes according to international DIN EN ISO 3834-2 and DIN EN 1090 standards. To ensure the quality of all purchased materials HALFEN has incoming material- inspections in place:

Certificates according to EN 10204 must be provided by the suppliers with each delivery of material. The certificates are checked by the QM-department before materials are accepted. Chemical, mechanical and geometric properties are also checked. During the production process all products are subject to random quality testing including ultimate tensile testing. The thickness of the protective zinc layer is regularly checked to ensure the corrosion resistance can be guaranteed.



Certification

According to DIN EN 10204 the following documents can be issued: Acceptance certificates based on non specific test (production certificate 2.1 and production certificate 2.2 [a more detailed description]) and acceptance certificates based on specific tests on the delivered product (inspection certificate 3.1).

Customer CAN request an acceptance certificate 3.1 at order placement. The certificate 3.1 issued by the manufacturer confirms that the delivered products fulfil the requirements specified in the test results.



HALFEN HZA-PS CAST-IN CHANNELS

Summary

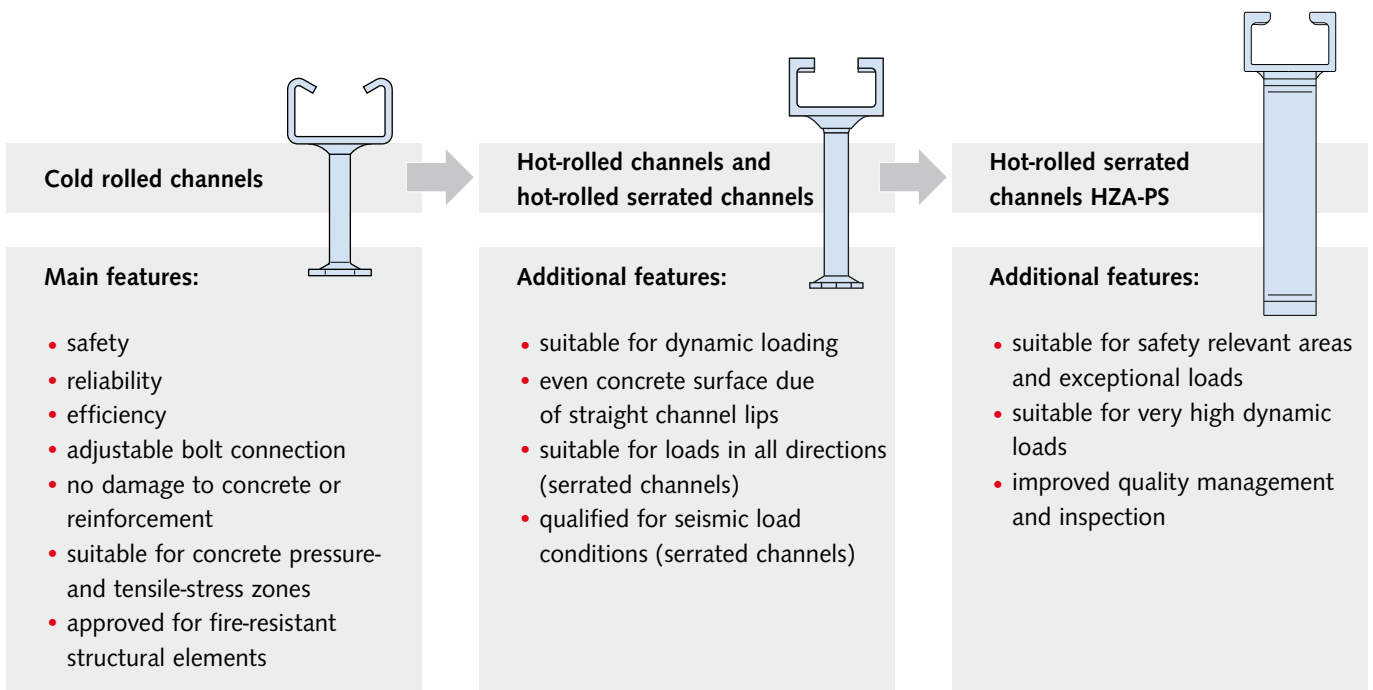
In its more than 80 years history HALFEN has become a world leader in providing adjustable anchoring systems.

HALFEN Cold-rolled cast-in channels fulfil all basic requirements for an adjustable, user-friendly and safe anchoring system. The product family is complemented with hot-rolled channels that provide further advantages for safe support of dynamic loads. The HALFEN serrated hot-rolled range of channels is suitable for loads in longitudinal direction.

The HZA-PS product range is the logical addition to the serrated hot rolled channel range allowing their use in safety relevant areas of nuclear power stations and facilities.

The dedicated test-programme carried out at the Technical University of Dortmund/Germany confirms that the HALFEN Channels HZA-PS 53/34, HZA-PS 38/23 and HZA-PS 29/20 are all suitable for exceptional loading.

This additional research and the tests assume extreme interior and exterior load-effects caused by earthquakes, explosions and plane impacts.



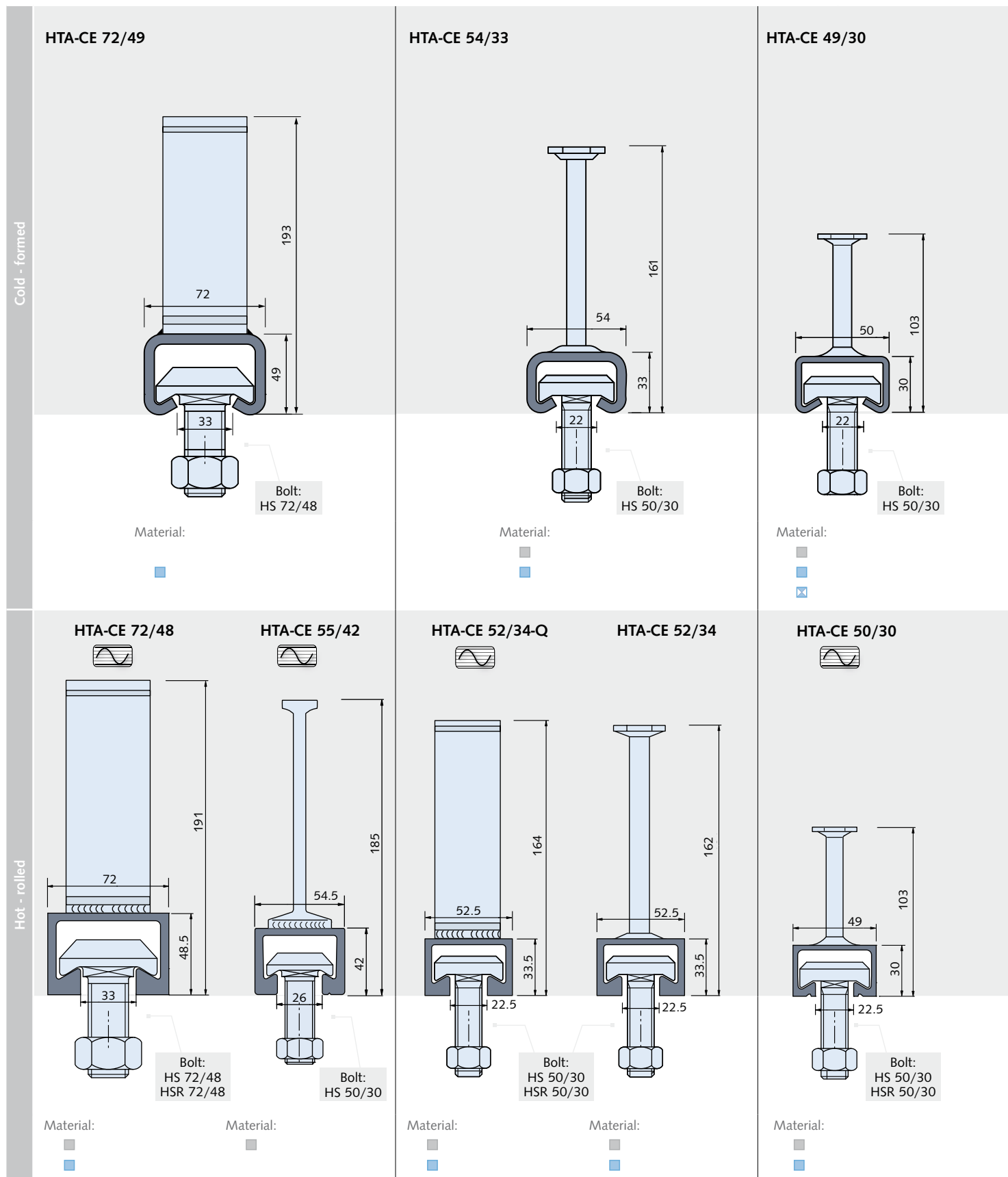
For more details please contact:
HALFEN Engineering
 Phone: +49 (0) 2173 - 970 9020
 E-Mail: es.ans@halfen.com

For more information on HALFEN HTA-CE and HZA Cast-in channels please refer to our **Technical Product Information "HALFEN Cast-in channels"**.



HALFEN HZA-PS CAST-IN CHANNELS

Product Overview HALFEN HTA-CE/HZA Cast-in Channels

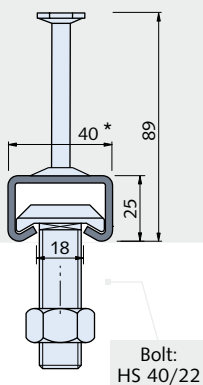


HALFEN HZA-PS CAST-IN CHANNELS

Product Overview HALFEN HTA-CE/HZA Cast-in Channels

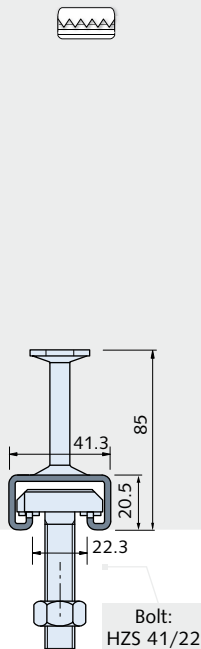
- **FV** = steel S235JR, hot-dip galvanized
- **A4** = stainless steel 1.4571/1.4404/1.4401
- **HCR** = stainless steel 1.4547/1.4529

HTA-CE 40/25



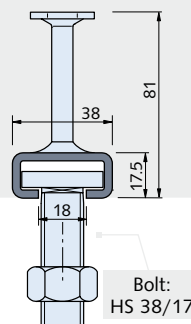
Material:
 ■ *40
 ■ *39.5

HZA 41/22



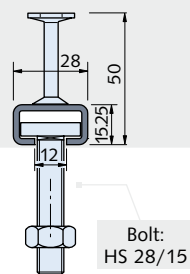
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HTA-CE 38/17



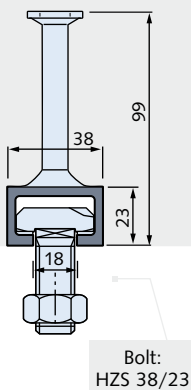
Material:
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HTA-CE 28/15



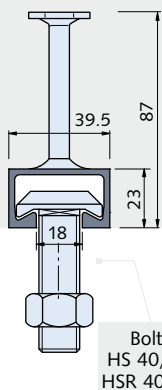
Material:
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HZA 38/23



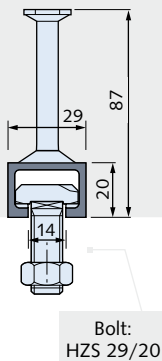
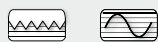
Material:
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HTA-CE 40/22



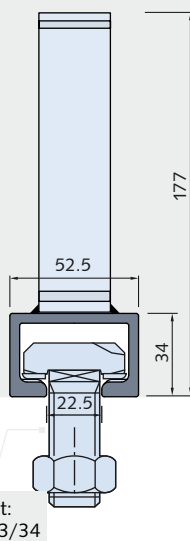
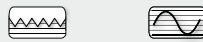
Material:
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HZA 29/20



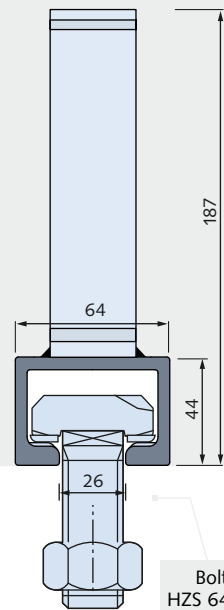
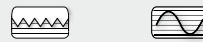
Material:
 ■

HZA 53/34



Material:
 ■
 ■

HZA 64/44



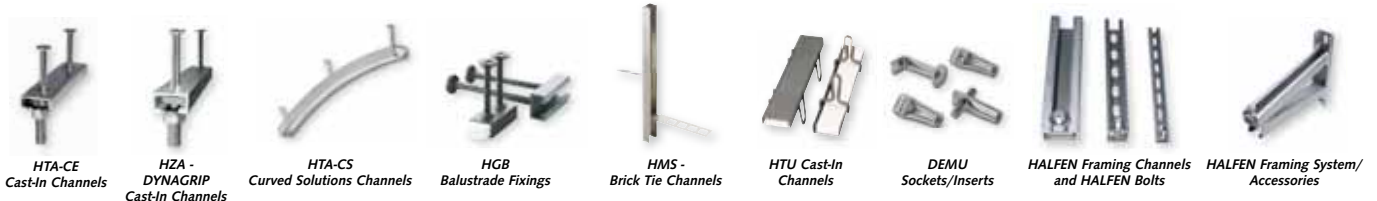
Bolt:
 HZS 64/44

Connection Solutions.

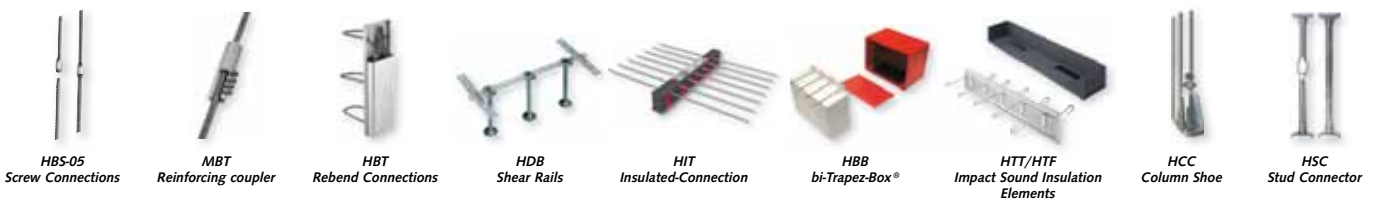
The HALFEN Product range.

Footbridge Simone de Beauvoir, Paris

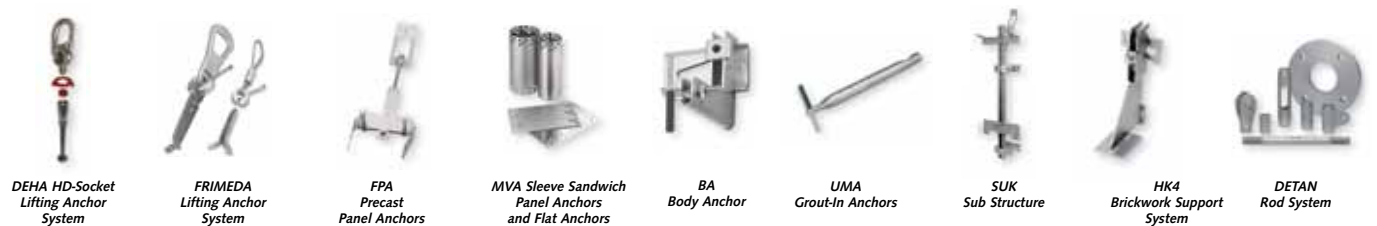
FIXING SYSTEMS, FRAMING SYSTEMS AND ACCESSORIES



REINFORCEMENT SYSTEMS



LIFTING SYSTEMS, CONCRETE PRE-CAST SYSTEMS, NATURAL STONE SYSTEMS, BRICKWORK SUPPORT SYSTEMS, ROD SYSTEMS



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