HALFEN CAST-IN CHANNELS
Technical Product Information
Under the Leviat brand, we are uniting the expertise, skills and resources of HALFEN and its sister companies to create a world leader in fixing, connecting and anchoring technology.

The products you know and trust, including the HALFEN Cast-in channels, will remain an integral part of Leviat’s comprehensive brand and product portfolio. As Leviat, we can offer you an extended range of specialist products and services, greater technical expertise, a larger and more agile supply chain and better, faster innovation.

By bringing together CRH’s construction accessories family as one global organisation, we are better equipped to meet the needs of our customers, and the demands of construction projects, of any scale, anywhere in the world.

This is an exciting change. Join us on our journey.

Read more about Leviat at Leviat.com
Our product brands include:

- Ancon
- HALFEN
- PLAKA

60 locations

sales in

30+ countries

3000 people worldwide

Leviat.com
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BETTER SAFE THAN SORRY.
The right channel for every application.

Besides excellent adjustability HALFEN Cast-in channels save considerable installation time. The result, faster construction and therefore cost saving. HALFEN Cast-in channels are the ideal basis for easy to install, adjustable connections. A foam strip filler stops the ingress of concrete into the channel.

HALFEN Channels are suitable for various types of construction connections, for example; façades, precast concrete elements, stadium seating, in civil engineering (fixing of tunnel signals) lift guide-rails, crane runway, pipe fixings under bridges.

HALFEN Fixing systems – The intelligent alternative to drilling and welding.

### Features
- adjustable
- hot-rolled profile; suitable for dynamic loads
- can be installed in concrete pressure and tensile-stress zones
- with European Technical Assessment

### Application
- fixing of all types of building components

### HTA-CE Cast-in channels

### HZA Cast-in channels, serrated

### Features
- adjustable
- load transmission in longitudinal channel direction
- can be installed in concrete pressure and tensile-stress zones
- suitable for dynamic loads (applies for all hot-rolled and serrated DYNAGRIP® channels)

### Application
- fixing of all types of building components

### HZA-PS Cast-in channels, Power Solution, serrated

### HGB Handrail connections

### Features
- as HZA Channels
- suitable for exceptional load cases caused by earthquake, plane crashes or explosions – for concrete crack widths up to 1.5 mm

### Application
- fixing of all types of building components in safety critical areas of nuclear power stations and similar nuclear facilities

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### Application
- fixing of all types of building components in safety critical areas of nuclear power stations and similar nuclear facilities
APPLICATION EXAMPLES HALFEN CAST-IN CHANNELS
Areas of Application

CURTAIN WALL

Edificio Gas Natural, Barcelona/Spain

POWER STATIONS

Power station

BRIDGES

Passerelle Simone de Beauvoir, Paris/France

SPORTS

Rheinenergiestadion, Cologne/Germany

LIFTS AND ELEVATORS

Lift fixings, guide-rails

HTU TRAPEZOIDAL SHEET PANELS

UPS Air Hub, Cologne Bonn Airport, Germany

TUNNELS

Lötschberg-Base tunnel, Switzerland

ROOFS AND WALLS

Timber pitched-roof construction
HTA-CE CAST-IN CHANNELS
The advantages at a glance

Apart from excellent adjustability, HALFEN Cast-in channels save considerable installation time. The result; faster construction and therefore reduced overall cost.

Safe and reliable
- no damage to the reinforcement
- approved for fire-resistant structural elements
- suitable for use in concrete pressure and tensile stress zones
- high corrosion resistance steels available
- hot-rolled profiles suitable for dynamic loads
- European Technical Assessment (ETA)
- precise calculation with HALFEN Software

Quick and economical
- adjustable anchoring
- bolts instead of welding
- maximum efficiency when installing matrices and rows
- cost effective installation using standard tools
- optimised pre-planning reduces construction time
- large range of types available for various requirements
- no noise, no vibration during installation

HALFEN HTA-CE Cast-in channels, cold-rolled

HALFEN HTA-CE Cast-in channels, hot-rolled
HALFEN CAST-IN CHANNELS HTA-C

General


<table>
<thead>
<tr>
<th>Tension</th>
<th>VERIFICATION</th>
<th>Shear</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Steel</strong></td>
<td><strong>Concrete</strong></td>
<td><strong>Steel</strong></td>
</tr>
<tr>
<td>Steel failure of the anchor</td>
<td>Pull-out</td>
<td>Steel failure of the bolt</td>
</tr>
<tr>
<td>Failure of channel-anchor connection</td>
<td>Concrete cone failure</td>
<td>Failure of channel-anchor connection</td>
</tr>
<tr>
<td>Local flexure of the channel lip</td>
<td>Splitting</td>
<td>Steel failure of the anchor</td>
</tr>
<tr>
<td>Steel failure special bolt</td>
<td>Blow-out</td>
<td>Steel failure special bolt</td>
</tr>
<tr>
<td>Failure due to flexure of the channel</td>
<td></td>
<td>Failure due to flexure of the channel</td>
</tr>
</tbody>
</table>

**Additional verifications / tension**
- Steel failure in the supplementary reinforcement
- Failure of the supplementary reinforcement in the breakout cone

**Additional verifications / shear**
- Special bolt for shear loads with cantilever
- Steel failure in the supplementary reinforcement
- Bond failure of reinforcement

Decisive verifications for tension and shear

Superposition of tension and shear loadings

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HALFEN HTA-CE CAST-IN CHANNELS

General

BIM

We already have considerable experience as a BIM partner and we successfully completed various projects using the BIM methodology. All Leviat engineers are trained to properly supervise this process. With a combination of wide experience and highly-trained engineers the increasing demand for BIM projects can be efficiently met. Examples of previous projects developed using BIM can be found at www.halfen.com ➤ Service ➤ BIM ➤ BIM references.

Sustainability

An EPD® (Environmental Product Declaration) provides transparent and comparable ecological data which helps to evaluate the sustainability of a building. Already during the planning phase the data provided here is of great significance for architects and planners. The data provided also helps to ensure the high demands on the environmental performance of the building are met. Health Product Declarations (abbrev. = HPD) complement our information on sustainability. The HPDs include a list of all components and information on the health effects of these components. The new HPD for hot-dip galvanized HALFEN Cast-in channels helps to achieve additional points in the Leed-v4-system. www.halfen.com ➤ Brochures ➤ Product declarations.

Fire-resistance / Material fatigue

ETA-09/0339 contains characteristic values under fire stress according to TR 020 "Evaluation of anchorages in concrete with regard to fire resistance" as well as characteristic values for fatigue stress.

Quality

Quality is the outstanding feature of our products. All materials and products are subjected to the most stringent quality control procedures. A quality inspection by the DNV GL* has verified that our quality management system meets the requirements of the ISO 9001:2015 standard.

*merger of DNV (Det Norske Veritas) and GL (Germanischer Lloyd) in 2013

Approvals on the internet

Currently valid approvals can be found at:
www.halfen.com ➤ Brochures ➤ Approvals ➤ Fixing systems.
Or simply scan the code and select the required document.
HALFEN HTA-CE CAST-IN CHANNELS
Materials/Corrosion Protection

Hot-dip galvanized FV:
Dipped in a galvanizing bath, with a temperature of approx. 460 °C; this is a method used primarily for open-profile channels.

Zinc galvanized GVs:
HALFEN T-bolts are electrogalvanized and coated with a Cr(VI)-free thick layer passivation.

HALFEN Cast-in channels, steel, hot-dip galvanized

<table>
<thead>
<tr>
<th>Material</th>
<th>Standard</th>
<th>Zinc coat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel profile</td>
<td>1.0038</td>
<td>EN 10 025-2</td>
</tr>
<tr>
<td></td>
<td>1.0044</td>
<td>EN 10 025-2</td>
</tr>
<tr>
<td>Bolt anchor B6</td>
<td>Steel</td>
<td>EN 10263 or EN 10269</td>
</tr>
<tr>
<td>Weld-on anchor</td>
<td>Steel</td>
<td>EN 10 025-2</td>
</tr>
</tbody>
</table>

Stainless steel (NR):
Chromium is the most important alloy element in stainless steel. A specific chromium concentration ensures the generation of a passive layer on the surface of the steel that protects the base material against corrosion. This explains the high corrosion resistance of stainless steel.

HALFEN Cast-in channels, stainless steel

<table>
<thead>
<tr>
<th>Material</th>
<th>Standard</th>
<th>Corrosion resistance class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel profile</td>
<td>1.4404 or 1.4571</td>
<td>EN 10 088</td>
</tr>
<tr>
<td></td>
<td>1.4529 or 1.4547</td>
<td>EN 10 088</td>
</tr>
<tr>
<td>Bolt anchor B6</td>
<td>1.4404, 1.4571 or 1.4578</td>
<td>EN 10 088</td>
</tr>
<tr>
<td></td>
<td>1.4529 or 1.4547</td>
<td>EN 10 088</td>
</tr>
<tr>
<td>Weld-on anchor</td>
<td>1.4404 or 1.4571</td>
<td>EN 10 025-2</td>
</tr>
</tbody>
</table>

HALFEN Bolts, stainless steel

<table>
<thead>
<tr>
<th>Material</th>
<th>Standard</th>
<th>Corrosion resistance class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolt</td>
<td>1.4404, 1.4571, 1.4578 (A4-50 or A4-70)</td>
<td>EN 3506-1 and EN 10 088</td>
</tr>
<tr>
<td></td>
<td>1.4529, HCR-50</td>
<td>EN 3506-1</td>
</tr>
<tr>
<td>Hexagonal nut</td>
<td>1.4404, 1.4571, 1.4578 (A4-50, A4-70)</td>
<td>EN 3506-2 and EN 10 088</td>
</tr>
<tr>
<td></td>
<td>1.4529, HCR-50</td>
<td>EN 3506-2 and EN 10 088</td>
</tr>
<tr>
<td>Washer</td>
<td>1.4404, 1.4571</td>
<td>EN 10 088</td>
</tr>
<tr>
<td></td>
<td>1.4529 or 1.4547</td>
<td>EN 10 088</td>
</tr>
</tbody>
</table>

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## HALFEN HTA-CE CAST-IN CHANNELS

### Materials/Corrosion Protection

### Corrosion protection requirements

<table>
<thead>
<tr>
<th>Material and applications</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Dry interior rooms</td>
<td>Damp interior rooms</td>
<td>Medium corrosion level</td>
<td>High level of corrosion</td>
</tr>
<tr>
<td>Definition of application areas</td>
<td>Anchor channels may only be used in components in indoor environments. For example: living and office spaces, schools, hospitals, commercial shops with the exception of wet rooms as in column 2.</td>
<td>Anchor channels may also be used in components in areas with normal humidity. For example: kitchens, bathrooms and laund- dry rooms in residential buildings. Exceptions: where permanent steam is present, and under water.</td>
<td>Anchor channels may also be used in outdoor environments (including industrial environments and coastal regions) or in wet rooms, if conditions are not especially aggressive (for example: continual immersion in sea water etc. as in column 4).</td>
<td>Anchor channels may also be used in exceptionally aggressive environments (for example: continual immersion in sea water) or in seawater spray zones, chloride environments in swimming pools or in environments with an extremely aggressive chemical atmosphere (for example: flue gas desulphurization plants or road tunnels where deicer systems are in use).</td>
</tr>
<tr>
<td>Channel profile</td>
<td>Steel 1.0038, 1.0044; EN 10025 Hot-dip galvanized ≥ 55 μm</td>
<td>Steel 1.0038, 1.0044; EN 10025 Hot-dip galvanized ≥ 55 μm Stainless steel 1.4307, 1.4567, 1.4541; EN 10088</td>
<td>Stainless steel 1.4404, 1.4571, 1.4062, 1.4162, 1.4362 EN 10088</td>
<td>Stainless steel 1.4404, 1.4571, 1.4062, 1.4162, 1.4362, 1.4578 EN 10088 Mill finish, 1.0038</td>
</tr>
<tr>
<td>Anchor</td>
<td>Steel 1.0038, 1.0214, 1.0401, 1.1132, 1.5525; EN 10263, EN 10269 Hot-dip galvanized 55 μm</td>
<td>Steel 1.0038, 1.0214, 1.0401, 1.1132, 1.5525; EN 10263, EN 10269 Hot-dip galvanized ≥ 55 μm Stainless steel 1.4307, 1.4567, 1.4541; EN 10088</td>
<td>Stainless steel 1.4404, 1.4571, 1.4062, 1.4162, 1.4362, 1.4578 EN 10088</td>
<td>Stainless steel Strength class 50, 70 1.4404, 1.4571, 1.4062, 1.4162, 1.4362, 1.4578 EN ISO 3506-1</td>
</tr>
<tr>
<td>Special HALFEN Bolts with shaft and bolts in accordance with EN ISO 4018</td>
<td>Steel strength class 4.6 / 8.8 EN ISO 898-1 Zinc galvanized ≥ 5 μm</td>
<td>Steel strength class 4.6 / 8.8; EN ISO 898-1 Hot-dip galvanized ≥ 50 μm Stainless steel, strength class 50, 70 1.4307, 1.4567, 1.4541 EN ISO 3506-1</td>
<td>Stainless steel Strength class 50, 70 1.4404, 1.4571, 1.4062, 1.4162, 1.4362, 1.4578 EN ISO 3506-1</td>
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<tr>
<td>Washers</td>
<td>Steel EN 10025 Zinc galvanized ≥ 5 μm</td>
<td>Steel EN 10025 Hot-dip galvanized ≥ 50 μm Stainless steel, strength class 50, 70 1.4307, 1.4567, 1.4541 EN ISO 3506-1</td>
<td>Stainless steel Steel grade A4, A5 EN ISO 3506-1</td>
<td>Stainless steel Steel grade A4, A5 EN ISO 3506-1</td>
</tr>
<tr>
<td>Hexagonal nut</td>
<td>Steel strength class 5/8 EN ISO 898-2 Zinc galvanized ≥ 5 μm</td>
<td>Steel strength class 5/8 EN ISO 898-2 Hot-dip galvanized ≥ 50 μm Stainless steel, strength class 70, 80 Steel grade A2, A3 EN ISO 3506-2</td>
<td>Stainless steel Steel strength class 70, 80 Steel grade A4, A5 EN ISO 3506-2</td>
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</tr>
</tbody>
</table>

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### HALFEN Channels (NR)

#### mill finish welded-on anchors

Corrosion protection of the mill finished weld-on anchor is based on the following concrete cover:

<table>
<thead>
<tr>
<th>Profile HTA-CE</th>
<th>Concrete cover c [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>40/22P 40/25 52/34 54/33 50/30P 49/30</td>
<td>35 40 50 60</td>
</tr>
</tbody>
</table>

The minimum concrete cover depends on local environmental conditions and bid specifications.

HALFEN Channels (NR) made completely in stainless steel

The HALFEN Cast-in channels “entirely of stainless steel” are not restricted to any minimum concrete cover as no relevant corrosion occurs.

#### Areas of application

- bridge and tunnel construction  
- construction of sewage treatment plants (fixing of spillovers)  
- chemical industry (installations exposed to aggressive substances)  
- ventilated façades, e.g. masonry renders  
- also for all structural reinforced concrete elements with higher demands on the concrete cover

HALFEN Channels made in stainless steel – HCR

The high corrosion resistance (HCR) HALFEN Cast-in channels are mandatory when high concentrations of chlorides, sulphur and nitrogen oxides are present.

#### Areas of application

- road tunnels  
- structures in salt water  
- indoor swimming pools  
- areas not routinely cleaned  
- poorly ventilated parking garages  
- in narrow, major city streets

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HALFEN HTA-CE CAST-IN CHANNELS
Installation/Assembly

1.1 Delivery and identification
We can supply ready to install short channels and standard lengths.

Product identification
① inside the channel
② also on the channel side

1.2 Installing to formwork
If required, HALFEN Cast-in channels can also be cut to size on site.

≥ 2 anchors
≤ 200 (250)
25–35

2.1 Fixing to the formwork

2.1.1 with nails

2.1.2 with staples

2.1.3 aluminium rivets

2.1.4 HALFEN Bolt and nut

2.1.5 HALFEN HFK Fixing cone

2.2 Top face installation

2.2.1 directly to reinforcement:
with tying wire

2.2.2 with HALFEN HCP ChanClip

2.2.3 Installation using an auxiliary aid
### 3.1 Removing the filler

**Strip filler, available in two versions:**

- KF – PE strip filler with reinforcement layer
- KF – PE strip filler

Removing the strip filler
Grip the strip filler at one end and pull out in one piece by hand; use a tool, e.g. a screwdriver.

### 4.1 Installing HALFEN Bolts

**Safe assembly with HALFEN Cast-in channels**
HALFEN Bolts can be inserted anywhere in the channel slot, turned 90° and then locked in place by tightening the nut. Do not position bolts at channel ends past the last anchor. On channels with bolt anchors, the anchor locations are visible through the channel slot.

**Check**
Bolts: After installation check that the bolts are properly aligned; the notch or notches in the tip of the shank must be at right angles to the longitudinal axis of the channel.

**Fixings**
The bolt heads must sit flush on both lips of the anchor channel and be secured by tightening the nut with a torque wrench with the required value. Observe the torque values in the tables on page 20.

**Direct attachment**

1. If the front surface of the channel is set back from the concrete surface, the attached structure must be shimmied with a washer (VUS). In case of shear stress, add bolt flexure to the tensile force.

**Stand-off installation**

2. Always install a square washer for stand-off installations.

**Example:**
- HALFEN Channel: HTA-CE 49/30
- HALFEN Bolt: HS 50/30 - M16
- Washer: VUS 49/30 - M16

---

**Assembly instructions on the internet**
Multi-language assembly instructions can be found at [www.halfen.com](http://www.halfen.com) ➤ Brochures ➤ Installation Instructions.
Or scan the code and select the required document.
HALFEN HTA-CE CAST-IN CHANNELS
Identification/Geometry

<table>
<thead>
<tr>
<th>Channel material</th>
<th>Type identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0038 / 1.0044</td>
<td>HTA-CE 38/17</td>
</tr>
<tr>
<td>A4: 1.4404 / 1.4571</td>
<td>HTA-CE 38/17 - A4</td>
</tr>
<tr>
<td>HCR: 1.4529 / 1.4547</td>
<td>HTA-CE 38/17 - HCR</td>
</tr>
</tbody>
</table>

**Type identification**
1. Inside on the bottom of the channel.
2. Additionally on the channel side

**Minimum edge distances and minimum bolt spacing**

Anchors must be installed at a minimum distance from the component edges. The distance depends on the selected channel profile. According to the ETA, the spacing between bolts $s_{cbo}$ must not be less than $5 \times d_s$. Reduction of the load-bearing capacity is required if $s_{cbo} < s_{ssl,N}$ (see table on page 16).

The concrete load-bearing capacity must be verified for each individual case using the HALFEN Software!

---

*$s_{ssl,N} = centre distance of the bolts N_Rd,s,l$*
HALFEN HTA-CE CAST-IN CHANNELS

Product range – Overview: channel and bolts

### Identification values HTA-CE

<table>
<thead>
<tr>
<th>Profile</th>
<th>HTA-CE 72/48</th>
<th>HTA-CE 55/42</th>
<th>HTA-CE 52/34</th>
<th>HTA-CE 50/30P</th>
<th>HTA-CE 40/22P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>hot-rolled</td>
<td>hot-rolled</td>
<td>hot-rolled</td>
<td>hot-rolled</td>
<td>hot-rolled</td>
</tr>
</tbody>
</table>

### Geometry

HALFEN HTA-CE Channels

<table>
<thead>
<tr>
<th>Material</th>
<th>Steel</th>
<th>A4</th>
<th>HCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolts</td>
<td>HS 72/48</td>
<td>HS 50/30</td>
<td>HS 50/30</td>
</tr>
</tbody>
</table>

**Profile load capacity**

- **N_{N,0} [kN]**
  - 66.7
  - 61.1
  - 40.0
  - 23.9
  - 21.1

- **V_{N,0} [kN]**
  - 81.1
  - 61.1
  - 43.5
  - 32.8
  - 19.4

- **M_{N,0,flex} [Nm]**
  - 7472
  - 5606
  - 2933
  - 2437
  - 1208

### Geometry

<table>
<thead>
<tr>
<th>h_{nom} [mm]</th>
<th>191 (185)</th>
<th>182 (185)</th>
<th>162 (164)</th>
<th>112 (161)</th>
<th>97 (154)</th>
</tr>
</thead>
<tbody>
<tr>
<td>b_{ch} [mm]</td>
<td>72</td>
<td>54.5</td>
<td>52.5</td>
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<td>39.5</td>
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<tr>
<td>h_{ch} [mm]</td>
<td>48.5</td>
<td>42</td>
<td>33.5</td>
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<td>23</td>
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<tr>
<td>I_{y} [mm^4]</td>
<td>Steel</td>
<td>349721</td>
<td>187464</td>
<td>93262</td>
<td>52896</td>
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<tr>
<td>h_{ef} [mm]</td>
<td>179</td>
<td>175</td>
<td>155</td>
<td>106</td>
<td>91</td>
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<tr>
<td>c_{min} [mm]</td>
<td>150</td>
<td>100</td>
<td>100</td>
<td>75</td>
<td>50</td>
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</tbody>
</table>

* Concrete load capacity has to be verified for each individual case (taking the geometric boundary conditions into account).

- c_{min} = minimal spacing channel/concrete edge
- N_{N,0} = channel lip load capacity (tension)
- V_{N,0} = channel lip load capacity (shear)
- N_{N,0,flex} = channel lip load capacity (flexural)
- h_{nom} = Nominal size and tolerance
- Weld-on I- or T- anchors
# HALFEN HTA-CE CAST-IN CHANNELS

## Product range – Overview: channel and bolts

### Identification values HTA-CE

<table>
<thead>
<tr>
<th>Profile</th>
<th>HTA-CE 54/33</th>
<th>HTA-CE 49/30</th>
<th>HTA-CE 40/25</th>
<th>HTA-CE 38/17</th>
<th>HTA-CE 28/15</th>
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</thead>
<tbody>
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<td>Type</td>
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<td>cold-rolled</td>
<td>cold-rolled</td>
<td>cold-rolled</td>
<td>cold-rolled</td>
</tr>
</tbody>
</table>

#### Geometry

**HALFEN Channels HTA-CE**

*Note: observe the installation height \( h_{nom} \)*

- **Material**
  - Steel
  - A4
  - HCR

- **Bolts**
  - HS 50/30
  - HS 50/30
  - HS 40/22
  - HS 38/17
  - HS 28/15

- **Threads**
  - M 10-M 20
  - M 10-M 20
  - M 10-M 16
  - M 10-M 16
  - M 6-M 12

#### Profile load capacity*  

<table>
<thead>
<tr>
<th>(N_{0Rd,s,l}^k) [kN]</th>
<th>30.6</th>
<th>17.2</th>
<th>11.1</th>
<th>10.0</th>
<th>5.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>(V_{0Rd,s,l}^k) [kN]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(M_{Rd,s,flex}^k) [Nm]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
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<th>Steel</th>
<th>A4</th>
<th>HCR</th>
<th>A4</th>
<th>HCR</th>
<th>A4</th>
<th>HCR</th>
<th>A4</th>
<th>HCR</th>
<th>A4</th>
<th>HCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolts</td>
<td>HS 50/30</td>
<td>HS 50/30</td>
<td>HS 40/22</td>
<td>HS 38/17</td>
<td>HS 28/15</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Threads</td>
<td>M 10-M 20</td>
<td>M 10-M 20</td>
<td>M 10-M 16</td>
<td>M 10-M 16</td>
<td>M 6-M 12</td>
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</tr>
</tbody>
</table>

#### Profile load capacity*  

- **Steel**
  - \(N_{0Rd,s,l}^k\) [kN]
  - \(V_{0Rd,s,l}^k\) [kN]
  - \(M_{Rd,s,flex}^k\) [Nm]

<table>
<thead>
<tr>
<th>Material</th>
<th>(h_{nom}^k) [mm]</th>
<th>162 (164)</th>
<th>103 (101)</th>
<th>89 (89)</th>
<th>81 (82)</th>
<th>50 (79)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(b_{ch}) [mm]</td>
<td>54</td>
<td>50</td>
<td>40</td>
<td>38</td>
<td>28.0</td>
<td></td>
</tr>
<tr>
<td>(p_{ch}) [mm]</td>
<td>33</td>
<td>30</td>
<td>25</td>
<td>17.5</td>
<td>15.25</td>
<td></td>
</tr>
<tr>
<td>(l_y) [mm*]</td>
<td>Steel</td>
<td>72079</td>
<td>41827</td>
<td>20570</td>
<td>19097</td>
<td>8547</td>
</tr>
<tr>
<td>(h_{ref}) [mm]</td>
<td>155</td>
<td>94</td>
<td>79</td>
<td>76</td>
<td>45</td>
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</tr>
<tr>
<td>(c_{min}) [mm]</td>
<td>100</td>
<td>75</td>
<td>50</td>
<td>50</td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>

* *Concrete load capacity has to be verified for each individual case (taking the geometric boundary conditions into account).*

- \(c_{min}\) = minimal spacing channel/concrete edge
- \(N_{0Rd,s,l}^k\) = channel lip load capacity (tension)
- \(V_{0Rd,s,l}^k\) = channel lip load capacity (shear)
- \(M_{Rd,s,flex}^k\) = channel lip load capacity (flex)
- \(h_{nom}^k\) = Nominal size and tolerance
- \((\ )\) value in brackets is for weld-on I- or T-anchors
### HALFEN HTA-CE CAST-IN CHANNELS

#### Product range

**Standard product range**

The standard HALFEN Cast-in channel product range with European Technical Approval is listed in the following table. Other lengths are available on request. See also current HALFEN Price list.

<table>
<thead>
<tr>
<th></th>
<th>Length [mm] / Number of anchors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Supplied lengths and number of anchors</strong></td>
<td>HTA-CE 72/48</td>
</tr>
<tr>
<td></td>
<td>150/2</td>
</tr>
<tr>
<td></td>
<td>200/2</td>
</tr>
<tr>
<td></td>
<td>250/2</td>
</tr>
<tr>
<td></td>
<td>300/2</td>
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<tr>
<td></td>
<td>350/3</td>
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<tr>
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<td>400/3</td>
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<td>550/3</td>
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<tr>
<td></td>
<td>1050/5</td>
</tr>
<tr>
<td></td>
<td>6070/25</td>
</tr>
<tr>
<td></td>
<td>3030/13</td>
</tr>
<tr>
<td></td>
<td>6070/25</td>
</tr>
<tr>
<td></td>
<td>1800/8</td>
</tr>
<tr>
<td></td>
<td>2300/10</td>
</tr>
<tr>
<td></td>
<td>3030/13</td>
</tr>
<tr>
<td></td>
<td>6070/25</td>
</tr>
</tbody>
</table>

**Anchor spacing**

- ≤ 250 mm
- ≤ 200 mm

1. Does not apply to HTA-CE 52/34, HTA-CE 54/33
2. Does not apply to HTA-CE 40/22P - A4

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**HALFEN HTA CAST-IN CHANNELS**

**HALFEN HS Bolts**

HALFEN Bolts — Type HS

- two direction load capacity
- identified on bolt tip with 1 notch

**Dimensions vmin**

<table>
<thead>
<tr>
<th>Bolt diameter</th>
<th>vmin [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>M6</td>
<td>11.0</td>
</tr>
<tr>
<td>M8</td>
<td>12.5</td>
</tr>
<tr>
<td>M10</td>
<td>14.5</td>
</tr>
<tr>
<td>M12</td>
<td>17.0</td>
</tr>
<tr>
<td>M16</td>
<td>20.5</td>
</tr>
<tr>
<td>M20</td>
<td>26.0</td>
</tr>
<tr>
<td>M24</td>
<td>29.0</td>
</tr>
<tr>
<td>M27</td>
<td>31.5</td>
</tr>
<tr>
<td>M30</td>
<td>33.5</td>
</tr>
</tbody>
</table>

**Lip dimensions f**

<table>
<thead>
<tr>
<th>Channel profile</th>
<th>f [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>28/15</td>
<td>2.3</td>
</tr>
<tr>
<td>38/17</td>
<td>3.0</td>
</tr>
<tr>
<td>40/22P</td>
<td>6.0</td>
</tr>
<tr>
<td>40/25</td>
<td>5.6</td>
</tr>
<tr>
<td>49/30</td>
<td>7.4</td>
</tr>
<tr>
<td>50/30P</td>
<td>7.9</td>
</tr>
<tr>
<td>52/34</td>
<td>10.5</td>
</tr>
<tr>
<td>54/33</td>
<td>7.9</td>
</tr>
<tr>
<td>55/42</td>
<td>12.9</td>
</tr>
<tr>
<td>72/48</td>
<td>15.5</td>
</tr>
</tbody>
</table>

The table on the right lists the design resistance of HALFEN Bolts with different thread diameters, materials and strength classes.

- **NRd.s,s** is the resistance against tension loads,
- **VRd.s,s** is the resistance against shear loads and
- **Mr0Rd.s,s** is the flexural resistance when subjected to transverse load induced with a cantilever.

The required bolt length can be calculated as:

\[ l_{req} = t_{fix} + f + h + v_{min} \]

**Calculating the bolt length \( l_{req} \) for HALFEN Bolts**

<table>
<thead>
<tr>
<th>Dimensions vmin</th>
<th>Lip dimensions f</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolt diameter</td>
<td>Channel profile</td>
</tr>
<tr>
<td>M6</td>
<td>28/15</td>
</tr>
<tr>
<td>M8</td>
<td>38/17</td>
</tr>
<tr>
<td>M10</td>
<td>40/22P</td>
</tr>
<tr>
<td>M12</td>
<td>40/25</td>
</tr>
<tr>
<td>M16</td>
<td>49/30</td>
</tr>
<tr>
<td>M20</td>
<td>50/30P</td>
</tr>
<tr>
<td>M24</td>
<td>52/34</td>
</tr>
<tr>
<td>M27</td>
<td>54/33</td>
</tr>
<tr>
<td>M30</td>
<td>55/42</td>
</tr>
</tbody>
</table>

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HALFEN HTA-CE CAST-IN CHANNELS
HALFEN HS Bolts

<table>
<thead>
<tr>
<th>Bolt dimensions</th>
<th>30</th>
<th>40</th>
<th>45</th>
<th>50</th>
<th>55</th>
<th>60</th>
<th>70</th>
<th>75</th>
<th>80</th>
<th>100</th>
<th>125</th>
<th>150</th>
<th>200</th>
<th>300</th>
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</thead>
<tbody>
<tr>
<td><strong>L [mm]</strong></td>
<td>M20</td>
<td>M24</td>
<td>M27</td>
<td>M30</td>
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<td>Gv4.6*</td>
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</tbody>
</table>

Material types: see page 10 *on request ☞ Other bolt lengths and materials on request!
### HALFEN HTA-CE CAST-IN CHANNELS
### HALFEN HS Bolts

<table>
<thead>
<tr>
<th>Suitable for profile</th>
<th>HTA-CE 40/22P, 40/25</th>
<th>HTA-CE 38/17</th>
<th>HTA-CE 28/15</th>
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</thead>
<tbody>
<tr>
<td>Bolt</td>
<td>HS 40/22</td>
<td>HS 38/17</td>
<td>HS 28/15</td>
</tr>
</tbody>
</table>

#### Bolt dimensions

<table>
<thead>
<tr>
<th>l [mm]</th>
<th>M10</th>
<th>M12</th>
<th>M16</th>
<th>M10</th>
<th>M12</th>
<th>M16</th>
<th>M6</th>
<th>M8</th>
<th>M10</th>
<th>M12</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>GVs4.6</td>
<td>FV4.6</td>
<td>GVs4.6</td>
<td>FV4.6</td>
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Material types: see page 10  *on request Other bolt lengths and materials on request!
HALFEN HTA-CE CAST-IN CHANNELS
HALFEN HS Bolts

Torque values HS

Standard
Components are braced against the concrete and anchor channel.
Torque is applied as in the following table and must not be exceeded.

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<tr>
<th>HTA-CE Profile</th>
<th>HALFEN Bolt HS...M [mm]</th>
<th>Torque value T_{inst} [Nm]</th>
<th>Steel 4.6; 8.8 Stainless steel Strength class 50</th>
<th>Stainless steel Strength class 70</th>
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Steel-Steel
Components are braced against the anchor channels using suitable washers.
Torque is applied as in the following table and must not be exceeded.

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<th>Torque value T_{inst} [Nm]</th>
<th>Steel 4.6</th>
<th>Steel 8.8</th>
<th>Stainless steel Strength class 50</th>
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Torque values apply only to bolts in delivery condition (unlubricated).
HALFEN HTA-CE CAST-IN CHANNELS
HALFEN HSR Bolts with nib

HALFEN Bolts – Type HSR (not ETA approved)

- only for hot-rolled profiles: 40/22P, 50/30P, 52/34, 72/48
- only for normal steel: WB and FV
- load capacity in all directions
- load capacity in channel longitudinal direction according to expert report
- identification on bolt tip with 2 notches

Bolt design values HSR

<table>
<thead>
<tr>
<th>Available HSR</th>
<th>Suitable for profile</th>
<th>72/48</th>
<th>52/34, 50/30P</th>
<th>40/22P</th>
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<td>HSR 50/30</td>
<td>HSR 40/22</td>
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<td>Bolt dimensions</td>
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<td>l [mm]</td>
<td>M20</td>
<td>M16</td>
<td>M20</td>
<td>M16</td>
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<td>FV8.8</td>
<td>-</td>
<td>GV8.8</td>
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<td>GV8.8</td>
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<td>GV8.8</td>
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GVs = Zinc galvanized with special coating
FV = Hot-dip galvanized
* on request

Torque values HSR

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<th>HSR 8.8</th>
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Load capacity HSR

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<td>Bolt HSR</td>
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<td>F_{Rd} [kN]</td>
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<tr>
<td>40/22 - M16</td>
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<td>50/30 - M20</td>
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<tr>
<td>72/48 - M20</td>
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HALFEN Bolts HS: Design value; load bearing capacity F_{Rd} [kN]

Design value F_{Rd} [kN] in channel longitudinal direction (for each HALFEN HS Bolt)

<table>
<thead>
<tr>
<th>Design value F_{Rd} [kN] in channel longitudinal direction (for each HALFEN HS Bolt)</th>
<th>for steel profiles</th>
<th>for profiles in stainless steel</th>
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\(\text{Values only applicable with torque moments } T_{\text{inst steel-steel}} \text{ (see table on the left, on page 20)}

Not included in the ETA!

Following combination can be used in supporting structures subjected to loads in channel longitudinal direction:
- hot-rolled, smooth, hot-dip galvanized HALFEN Cast-in channels with HALFEN HSR Bolts with nib

If loads in the channel's longitudinal direction have been verified, we recommend using serrated HALFEN HZA Channels with serrated HALFEN HZS Bolts. See pages 30-31.
HALFEN HTA-CE CAST-IN CHANNELS
Application Examples

CURTAIN WALL
Fixings for curtain wall façades

SPORTS
Seat fixing in stadiums

NOISE BARRIERS
Fixings of noise barriers to concrete posts

UTILITY TUNNELS
Utility fixings in TBM tunnels with curved anchor channels

CURTAIN WALL
Fixings for curtain wall façades

LIFTS/ELEVATOR FIXINGS
Fixing guide-rails with HALFEN Channels

BRIDGES
Fixings for drainage systems

TUNNELS
Fixing of overhead cables in railway tunnels
HALFEN HTA-CE CAST-IN CHANNELS
Custom Anchors – Anchor Variations (Not ETA Approved)

ANK-E end anchor; for on-site custom cut-length of HALFEN Cast-in channels

Notes for assembling end anchor, type ANK-E

• Cut the HALFEN Cast-in channel at the selected point. The cut face must be at a right angle to the longitudinal axis of the channel. The end projection “e” should not be less than 35 mm and not more than 175 (225) mm*.

• Select the correct ANK-E End anchor for the HALFEN Cast-in channel profile; see table on the right. Slide the clamping element on to the back of the channel. If necessary, push in the foam filler at the end of the channel.

• Tighten the bolt by applying the required torque. See table (right) for correct torque value.

<table>
<thead>
<tr>
<th>End anchor selection</th>
<th>for profile</th>
<th>End anchor</th>
<th>Thread</th>
<th>Torque $T_{\text{inst}}$ [Nm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>28/15 - FV</td>
<td>ANK-E1 - FV</td>
<td>M8</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>28/15 - A4</td>
<td>ANK-E1 - A4</td>
<td>M8</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>38/17 - FV</td>
<td>ANK-E2 - FV</td>
<td>M10</td>
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<tr>
<td>40/25 - FV</td>
<td>ANK-E2 - A4</td>
<td>M10</td>
<td>20</td>
<td></td>
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<tr>
<td>41/22 - A4 ⚠️</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

⚠️ Short HZA 41/22 sections may be used with one end anchor only. Not included in the approval.

Custom lengths

On-site HALFEN End anchor

ANK-E

35 $\leq e \leq 175 (225)$* [mm]

Custom length, ready to install

HALFEN Anchor channels, hot-dip galvanized with stainless steel anchors

Requirements

According to EN 1992-1-1/NA
(EC 2 with German National Annex, 2nd edition, 2016, chapter 8.10.1.1)

“Ensure at least 20 mm concrete between pre-stressed tension strands and galvanized components.” Otherwise there is a risk of hydrogen induced cracking.

Solution

If hot-dip galvanized channels are used together with stainless steel bolt-anchors then the pre-stressed tension-strands are allowed to have contact with the stainless steel bolt anchor.

Types:

Lengths available: up to 6.07 m

Available profiles:

• 50/30P
• 49/30
• 40/25
• 38/17

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HALFEN HTA-CE CAST-IN CHANNELS
Available Types – HTA-CS/Channel Pairs/Corners Elements

HALFEN HTA-CS Channels – Curved Solution

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Inner channel slot:</td>
<td>on request</td>
<td>0.80 m</td>
<td>0.75 m</td>
<td>on request</td>
<td>0.80 m</td>
<td>on request</td>
<td>1.10 m</td>
<td>0.70 m</td>
<td>0.75 m</td>
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</tr>
<tr>
<td>min. Ri</td>
<td>on request</td>
<td>0.80 m</td>
<td>0.80 m</td>
<td>on request</td>
<td>0.80 m</td>
<td>on request</td>
<td>0.90 m</td>
<td>0.70 m</td>
<td>0.75 m</td>
<td></td>
</tr>
<tr>
<td>Outer channel slot:</td>
<td>on request</td>
<td>4.00 m</td>
<td>3.60 m</td>
<td>on request</td>
<td>3.00 m</td>
<td>on request</td>
<td>2.20 m</td>
<td>3.20 m</td>
<td>2.00 m</td>
<td></td>
</tr>
<tr>
<td>min. Ra</td>
<td>on request</td>
<td>4.00 m</td>
<td>3.60 m</td>
<td>on request</td>
<td>5.70 m</td>
<td>on request</td>
<td>1.70 m</td>
<td>5.40 m</td>
<td>7.80 m</td>
<td></td>
</tr>
</tbody>
</table>

*please contact our technical support team for more detailed information

Material/type:
Channel (Type straight or curved):
FV = Hot-dip galvanized
A4 = Stainless steel

Spacer:
Reinforced concrete B500B or B500B/A NR, Ø 10-16 mm
Recommended for stainless steel type spacers in: B500B/A NR.

Ordering example:
Type: HALFEN Channel pair HTA-CE 38/17
Dimensions: L = 350 mm, a = 200 mm
Material: hot-dip galvanized, with filler
Radius: Ri =... (for curved type)

Areas of application:
• tunnel construction
• reinforced concrete tunnels for service utilities
• curved walls
• sewage plants

Ordering example:
HALFEN Cast-in channel, curved
HTA-CS 52/34-Q - A4, Ri = 4000 mm, L = 1050 mm

Curved HALFEN Cast-in channels in tunnel segments

HALFEN Channel pairs
Material/type:
Channel and anchor:
FV = Hot-dip galvanized
A4 = Stainless steel

Spacer:
Reinforced concrete B500B or B500B/A NR, Ø 10-16 mm
Recommended for stainless steel type spacers in: B500B/A NR.

Ordering example:
Type: HALFEN Channel pair HTA-CE 38/17
Dimensions: L = 350 mm, a = 200 mm
Material: hot-dip galvanized, with filler
Radius: Ri =... (for curved type)

Area of application:
• fixing for HALFEN Console anchors for supporting brickwork cladding
• other near edge fixings

HALFEN Corner channel
Material/type:
Channel and anchor:
FV = Hot-dip galvanized
A4 = Stainless steel

Standard type:
a/b = 125/250 mm
Other lengths for a and b and other profiles are available on request

Figure: HTA-38/17 – Corner piece
HALFEN HTA-CE CAST-IN CHANNELS
Calculation Basics

**General**

The following information is necessary to verify an anchor channel:

- type of HALFEN Cast-in channel and material
- length of the HALFEN Cast-in channel with number of anchors and spacing
- position of the HALFEN Cast-in channel in the concrete, defined by its distance from the lower, upper, left and right edges of the component
- thickness of the concrete elements
- concrete strength class
- condition of the concrete; cracked or verified as non-cracked
- dense reinforcement in the vicinity of the anchor channel
- HALFEN T-head bolt thread size
- bolt positions
- tensile load and shear load of each bolt

**Verification method**

1. Select channel.
2. Verify local load application (channel lips) for tension, shear and combined loading.
3. Calculate the anchor loads resulting from tensile loads and shear loads according to the load influence model (unfavourable anchor and load position).
4. Verify the connection between anchor and channel (tension loading).
5. Verify anchor pull-out failure (tension loading).
7. Verify pry-out failure (loading in shear).
8. Verify concrete edge failure (loading in shear) considering a possible structural edge reinforcement.
9. Verify concrete failure for combined loading, (combination of 6. and 7. as well as combination of 6. and 8.).

**Technical support**

Engineering services and technical support for your individual projects. Our contact information can be found on page 89 of this catalogue.

**Tip:**
A free, simple to use calculation software to simplify planning can be downloaded at www.halfen.com.

If verification is negative, determine required additional reinforcement.

If last verification is negative, determine required additional reinforcement.

The following information is necessary to verify an anchor channel:

- type of HALFEN Cast-in channel and material
- length of the HALFEN Cast-in channel with number of anchors and spacing
- position of the HALFEN Cast-in channel in the concrete, defined by its distance from the lower, upper, left and right edges of the component
- thickness of the concrete elements
- concrete strength class
- condition of the concrete; cracked or verified as non-cracked
- dense reinforcement in the vicinity of the anchor channel
- HALFEN T-head bolt thread size
- bolt positions
- tensile load and shear load of each bolt
HALFEN HTA-CE CAST-IN CHANNELS
Software

HALFEN HTA-CE Software

The HALFEN Calculation program for HALFEN Cast-in channels according to the ETA provides the user with a convenient and very powerful calculation tool.

Verifications
CEN/TS 1992-4 and EOTA TR047 require a wide range of verifications for cast-in channels and the concrete used. These verifications are processed by the user-friendly dimensioning Software. In just a few seconds the user is provided with a list of suitable HALFEN Cast-in channels for the relevant load situation.

Boundary conditions
The calculation takes into account all necessary boundary conditions, typical examples being:

➢ cracked or non-cracked concrete
➢ the geometry of the concrete components, in particular the distances from the channel to the component edge
➢ various reinforcement patterns
➢ consideration of several dimensioning or characteristic loads
➢ positioning of the loads with a definable adjustment range, and the option of shifting the defined bolt pattern along the complete channel length
➢ verification of the required HALFEN T-head bolts and if required also for stand-off installations

Input
The geometry and loads are entered interactively. Entries are displayed promptly in a 3D graphic. Entries can also be changed directly in the graphic. Click on the load, the measurement or the component line you want to change to make the required modification.

Input loads
In addition to direct input of bolt loads, it is also possible to calculate the resulting loads by entering the actions/loads caused by secondary components (for example, curtain wall applications).

Results
After calculation, the software output provides either the results for a preselected profile, or in the case of automatic selection a list of all suitable profiles. Profiles and T-bolts with in-complete verifications are high-lighted in red.

All software can be found under: www.halfen.com ➤ Downloads ➤ Software/CAD
HALFEN HTA-CE CAST-IN CHANNELS

Software

HALFEN HTA-CE Software

Visual control
All verifications for the current channel profile are listed in a tree structure. Green check-marks indicate successful verifications. Red check-marks indicate unsatisfactory verifications.

For further visual control a progress bar on the right indicates the status of the verification process. Here too, red bars mean that a load has been exceeded, while green bars symbolize verifications that meet the criteria.

Detailed calculation information (with load positions, section sizes and utilization factors) can also be selected in a tree menu.

Print-outs
Print-outs are possible in a brief and in a verifiable long version. The long version includes all decisive verifications, a diagram of necessary reinforcement and a 2D graphic of the geometry and load.

The latest version of the dimensioning program is available for download on the Internet at www.halfen.com.

System requirements:
• Windows 10, Windows 8, Windows 7,
• Microsoft .NET Framework 4.6

Print-outs are possible in a brief and
in a verifiable long version. The long
version includes all decisive verifi-
cations, a diagram of necessary rein-
forcement and a 2D graphic of
the geometry and load.

Tender text

HALFEN HTA-CE type Channel 49/30 - A4 - 350 - KF - ANK.A4

HALFEN HTA-CE Channel 49/30 with smooth channel lips for adjustable fixing of components,

according to European Technical Assessment ETA-09/0339, suitable for anchoring in reinforced or non-reinforced standard concrete in a strength class of at least C12/15 and a maximum C90/105 in accordance with EN 206 under quasi-static loading as well as fire exposure.

Type HTA-CE 49/30 - A4 - 350 - KF - ANK.A4

with
\[ \text{NR}_{k,s,c} = 31 \text{kN} \] = char. resistance, steel failure (tension), connection channel anchor A4 = Carbon steel or stainless steel 1.4404 / 1.4571, 350 = Channel length [mm] with 3 anchors, KF = Foam strip filler, ANK.A4 = Anchor in stainless steel 1.4404 / 1.4571 / 1.4578,

or equivalent; deliver and install according to the manufacturer’s instructions.
HZA CAST-IN CHANNELS, serrated

The advantages at a glance

Apart from providing excellent adjustability, HALFEN Cast-in channels save considerable time during installation. The result; faster construction and therefore reduced overall costs.

**Safe and reliable**
- no damage to the main reinforcement
- approved for fire-resistant structural elements
- suitable for installation in concrete pressure and concrete tensile zones
- hot-rolled channels, suitable for dynamic loads
- building authority approved

**Quick and economical**
- adjustable anchorage
- bolts instead of welding
- maximum efficiency when installing in rows
- cost-effective installation using standard tools
- optimized pre-planning reduces construction time
- large range of channels types for various applications
- user-friendly installation; no noise, dust and vibration

HZA HALFEN Channels, cold-rolled, serrated

HZA-PS HALFEN Channels, hot-rolled, serrated

HZA DYNAGRIP Halfenschienen, gezahnt

More Information on the HZA-PS is available at:
www.halfen.com ➤ Products ➤ Fixing systems ➤ HZA - DYNAGRIP Cast-In Channels
Or scan the QR-Code and select the current “HZA-PS” catalogue.
HALFEN HZA CAST-IN CHANNELS
Application Examples: Installations with HALFEN HZA Cast-In Channels

CURTAIN WALL

Fixings of a Curtain wall façade, HZA near edge installation

INDUSTRIAL PLANT INSTALLATIONS

Pipe supports on vertical HZA Channels

LIFTS / ELEVATORS

Fixing for guide-rails

FAÇADES

Fixings for emergency access balconies
(Vertical installation of HALFEN Channels)

Ski Lift

Fixing of the drive unit for a ski lift

INDUSTRIAL BUILDING

Vertical channels in columns to attach further components
HALFEN HZA CAST-IN CHANNELS

Areas of Application

<table>
<thead>
<tr>
<th>Area of application</th>
<th>Material and area of application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use only possible if all fixture components are protected by a minimum concrete cover, depending on environmental conditions, as specified in DIN EN 1992-1-1:2011-01.</td>
<td>For interior use only, for example; in residential, office and school buildings, hospital and retail facilities, not suitable for wet rooms. For use in building components in rooms with normal humidity (including kitchens, bathrooms, laundry rooms in residential buildings). Building components, corrosion class III, according to EN 1993-1-4, table A.3.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Channel profile</th>
<th>Mill finish</th>
<th>Hot-dip galvanized (thickness ≥ 50μm)</th>
<th>Hot-dip galvanized (thickness ≥ 50μm)</th>
<th>Stainless steel 1.4404/1.4571</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anchor</td>
<td>Mill finish</td>
<td>Hot-dip galvanized (thickness ≥ 50μm)</td>
<td>Bolt anchor in stainless steel 1.4404/1.4571</td>
<td>Stainless steel 1.4404/1.4462</td>
</tr>
<tr>
<td>Bolts, nuts, washers</td>
<td>No corrosion protection</td>
<td>Zinc galvanized (thickness ≥ 5μm)</td>
<td>Hot-dip galvanized (thickness ≥ 10μm)</td>
<td>Stainless steel A4-50 FA-70 A4-70</td>
</tr>
</tbody>
</table>

1. Or zinc galvanized with special coating, thickness > 12 μm.
2. Only allowed for profiles 38/23, 53/34, 64/44 and 41/22. For corrosion protection of the welded anchors a minimum concrete cover c is given: for profile (38/23) 30 mm; (41/22) 30 mm; (53/34) 40 mm; (64/44) 50 mm.

Available HZA

<table>
<thead>
<tr>
<th>Profile</th>
<th>HZA 64/44 DYNAGRIP</th>
<th>HZA 53/34 DYNAGRIP</th>
<th>HZA 38/23 DYNAGRIP</th>
<th>HZA 29/20 DYNAGRIP</th>
<th>HZA 41/22</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geometry</td>
<td>HALFEN HZA Channels</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Observe the installation height h_{inst}.

Nominal size and tolerance

<table>
<thead>
<tr>
<th>F_{nd}</th>
<th>37.8 kN all load directions</th>
<th>26.6 kN all load directions</th>
<th>30.8 kN all load directions</th>
<th>16.8 kN all load directions</th>
<th>11.2 kN all load directions</th>
<th>7.0 kN all load directions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Bolt</td>
<td>HZS 64/44</td>
<td>HZS 53/34</td>
<td>HZS 38/23</td>
<td>HZS 29/20</td>
<td>HZS 41/22</td>
<td></td>
</tr>
</tbody>
</table>

FV = Steel hot-dip galvanized 1.0038/1.0044
A4 = Stainless steel 1.4571/1.4404
Suitable for dynamic loads
HALFEN HZA CAST-IN CHANNELS
HALFEN HZS Bolts

Available HALFEN HZS Bolts

- The serration also ensures a positive load transmission in the longitudinal channel direction. The danger of bolt slippage is minimized.
- The bolt is marked on the shaft end with 2 notches.

<table>
<thead>
<tr>
<th>HALFEN HZS Bolts</th>
<th>Suitable for profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolt</td>
<td>HZA 29/20</td>
</tr>
<tr>
<td></td>
<td>HZA 38/23</td>
</tr>
<tr>
<td></td>
<td>HZA 53/34</td>
</tr>
<tr>
<td></td>
<td>HZA 64/44</td>
</tr>
<tr>
<td></td>
<td>HZA 41/22</td>
</tr>
</tbody>
</table>

Bolts dimensions

<table>
<thead>
<tr>
<th>l [mm]</th>
<th>M12</th>
<th>M12</th>
<th>M16</th>
<th>M16</th>
<th>M20</th>
<th>M20</th>
<th>M24</th>
<th>M12</th>
<th>M16</th>
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<td>GV8.8</td>
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<td>GV8.8</td>
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<td>FV8.8*</td>
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<tr>
<td>150</td>
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</tbody>
</table>

*on request

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HALFEN HZA CAST-IN CHANNELS
HALFEN HZA Channels: Standard Lengths/HALFEN HZA Channels Curved Solution

HALFEN HZA Channels — Standard lengths and Anchor positions

| Standard lengths — Project related orders | HZA 38/23, 41/22, 53/34, 64/44 |
| Length [mm] / Number of anchors | |
| 1050 / 5 | 1300 / 6 |
| 2050 / 9 | 2300 / 10 |
| 3050 / 13 | 3300 / 14 |
| 4050 / 17 | 4300 / 18 |
| 5050 / 21 | 5300 / 22 |

| Standard lengths — Project related orders | HZA 29/20 |
| Length [mm] / Number of anchors | |
| 1250 / 7 | 1450 / 8 |
| 2050 / 11 | 2250 / 12 |
| 2850 / 15 | 3050 / 16 |
| 3650 / 19 | 3850 / 20 |
| 4450 / 23 | 4650 / 24 |
| 5250 / 27 | 5450 / 28 |

---

**Areas of application:**
- tunnel construction
- reinforced concrete tunnels for utilities
- curved walls
- sewage plants

**Ordering example:**
HALFEN Cast-in channel, curved
HZA-CS 38/23-Q - A4, Rᵢ = 4000 mm, L = 1050 mm

---

**Curved HALFEN Cast-in channels in tunnel segments**

---

| Smallest radius [m]* |
| | Profile | HZA-CS 64/44 | HZA-CS 53/34 | HZA-CS 38/23 | HZA-CS 29/20 | HZA-CS 41/22 |
| | Material | | | | | |
| Inner channel slot: | on request | on request | 2.60 m | 0.85 m | 0.70 m |
| min. Rᵢ | on request | on request | 1.20 m | - | 0.70 m |
| Outer channel slot: | on request | on request | 1.40 m | 1.10 m | 2.20 m |
| min. Rᵢ | on request | on request | 3.50 m | - | 4.80 m |

* hot-dip galvanized | A4 stainless steel

* please contact our technical support for more detailed information

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### HZA DYNAGRIP Design resistance calculation value $F_{Rd}$

#### Design resistance $F_{Rd}$

**Concrete $\geq$ C30/37**

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

<table>
<thead>
<tr>
<th>Profile HZA DYNAGRIP</th>
<th>$F_{Rd}$ [kN]</th>
<th>$F_{Rd}$ [kN]</th>
</tr>
</thead>
<tbody>
<tr>
<td>64/44</td>
<td>37.8</td>
<td>-</td>
</tr>
<tr>
<td>53/34</td>
<td>30.8</td>
<td>-</td>
</tr>
<tr>
<td>38/23</td>
<td>16.8</td>
<td>9.4</td>
</tr>
<tr>
<td>29/20</td>
<td>11.2</td>
<td>6.3</td>
</tr>
</tbody>
</table>

$s =$ Anchor spacing, see page 32

① The load spacings must be increased by a factor of 1.25 for concrete strength class C20/25, or 1.15 for concrete strength class C25/30. Alternatively the design resistances may be reduced by using the reciprocal values.

② Interim values may be linearly interpolated.

③ With loading at the end of the channel, the load distance to the next single load must be increased to $x_i$ ($b_1$).

For HZA 53/34 and HZA 64/44 $\rightarrow b_1 \geq 275$ mm, for HZA 38/23 $\rightarrow b_1 \geq 265$ mm, for HZA 29/20 $\rightarrow b_1 \geq 250$ mm.

④ With loading at the end of the channel, the load distance to the next load pair must be increased to $x_i$ ($b_1$).

For HZA 53/34 and HZA 64/44 $\rightarrow b_1 \geq 100$ mm.

### HZA Profile 41/22: Design resistance calculation value $F_{Rd}$

#### Design resistance $F_{Rd}$

**Concrete $\geq$ C30/37**

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

<table>
<thead>
<tr>
<th>Profile HZA 41/22</th>
<th>$F_{Rd}$ [kN]</th>
<th>$F_{Rd}$ [kN]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7.0</td>
<td>4.9</td>
</tr>
</tbody>
</table>

$s =$ Anchor spacing, see page 32

### Calculation criteria

**Paired loads**

$$\beta = \arccos \left( \frac{V_{Ed}}{\sqrt{N_{Ed}^2 + V_{Ed}^2 + V_{Yld}^2}} \right) < 15^\circ$$

$F_{Rd}$ with simultaneous tension and shear stress perpendicular to the channel axis and shear load parallel to the channel axis, the load resultant $F_{Rd}$ of the load pair must not exceed 4.9 kN.

⑧ If $\beta > 15^\circ$ the design load must be reduced to 4.9 kN.
**HALFEN HZA CAST-IN CHANNELS**

**Dimensioning**

**Minimum spacing** \( a_r, a_e, a_a, a_f \) and \( h \)

**Minimal spacing HALFEN Channel HZA [mm]**

<table>
<thead>
<tr>
<th>HZA 64/44</th>
<th>( a_r )</th>
<th>( a_e )</th>
<th>( a_a )</th>
<th>( a_f )</th>
<th>( b^{(\circ)} )</th>
<th>( h_{\text{min}} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>345</td>
<td>600</td>
<td>250</td>
<td>690</td>
<td>1200</td>
<td>500</td>
<td>225</td>
</tr>
<tr>
<td>HZA 53/34</td>
<td>340</td>
<td>535</td>
<td>200</td>
<td>680</td>
<td>1070</td>
<td>400</td>
</tr>
<tr>
<td>HZA 38/23</td>
<td>200</td>
<td>335</td>
<td>150</td>
<td>400</td>
<td>670</td>
<td>300</td>
</tr>
<tr>
<td>HZA 29/20</td>
<td>120</td>
<td>190</td>
<td>110</td>
<td>240</td>
<td>380</td>
<td>140</td>
</tr>
<tr>
<td>HZA 41/22</td>
<td>90</td>
<td>150</td>
<td>110</td>
<td>180</td>
<td>300</td>
<td>120</td>
</tr>
</tbody>
</table>

1. Minimum component width \( b = 2 \times a_r \) applies to single channel configuration.
2. Values are minimum values. \( h_{\text{min}} \geq h_{\text{inst}} + c_{\text{nom}} \) must always be observed.
3. \( h_{\text{inst}} \) is determined by channel height and anchor length. Required concrete cover \( c_{\text{nom}} \) according to EN 1992-1-1 (EC2), section 4.4.1.
4. Only for centric tensile stress. To account for cracked concrete the spacings \( a_{r1} \) and \( a_{r2} \) must be doubled or alternatively the design resistances may be reduced by a factor of 1.4 (not required for HZA 41/22).
5. Reinforcement layout, see below.
6. All values (non-reinforced concrete) apply to non-cracked, concrete strength class C30/37 or higher. To account for cracked concrete the spacings must be increased by a factor of 1.5. Alternatively the design resistances may be reduced by factor 1.4. Reinforced concrete is assumed as cracked.
7. For concrete strength class C20/25 the spacings must be increased by 1.25, and for concrete strength class C25/30 by 1.15. Alternatively the design resistances may be reduced by the reciprocal values. (except for \( h_{\text{min}} \).)

**Minimum reinforcement**

<table>
<thead>
<tr>
<th>Profile</th>
<th>for load direction ( V_{x,\text{Ed}} )</th>
<th>for load direction ( V_{y,\text{Ed}} )</th>
<th>( A_{x,\text{Ed}} )</th>
<th>( A_{y,\text{Ed}} )</th>
<th>( \Sigma A_{x,\text{Ed}}) resp. ( \Sigma A_{y,\text{Ed}})</th>
</tr>
</thead>
<tbody>
<tr>
<td>HZA 64/44</td>
<td>2010</td>
<td>Ø10/200</td>
<td>2010</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HZA 53/34</td>
<td>208</td>
<td>Ø8/200</td>
<td>208</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HZA 38/23</td>
<td>208</td>
<td>Ø8/200</td>
<td>208</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HZA 29/20</td>
<td>206</td>
<td>Ø6/200</td>
<td>206</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HZA 41/22</td>
<td>206</td>
<td>Ø6/200</td>
<td>206</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Symmetrically arranged, distributed over the whole anchor channel and beyond the channel length by \( a_r \) (\( c_{\text{min}} \) must be observed);
2. Anchoring length \( l_b \) according to EN 1992-1-1
3. At least one reinforcement bar installed at the edges.
4. Close to the anchors.
HALFEN HZA CAST-IN CHANNELS
Dimensioning

Reduced edge distance \( a_r \), with full centrical tensile stress

Preconditions for reducing the edge distance to 50 mm
Where minimum structural spacing cannot be maintained when installing HALFEN Channels, HZA 41/22, 29/20 and 38/23, for example, in thin façade panels, the distance to the edge \( a_r \) may be reduced to 50 mm, if additional anchor reinforcement as shown in figure 1 is used for the anchor loads and tensile splitting.

\[ \text{Steel stress } \sigma_{Rd} = 11.0 \text{kN/cm}^2 \]

\[ \text{Required reinforcement cross section } \]
\[ A_s [\text{cm}^2] \text{ stirrup rebar: } \]
\[ \text{req. } A_s = \frac{F_{Ed} [\text{kN}]}{4 \times \sigma_{Rd} [\text{kN/cm}^2]} = \frac{F_{Ed}}{44} \text{ cm}^2 \]

Approval no. Z-21.4-145 (HZA), Z-21.4-1691 (HZA DYNAGRIP) for this example.

Additional reinforcement for edge distance for HALFEN Channels HZA 41/22 from 75 mm \( \leq a_r < 100 \) mm and loads perpendicular to the edge (figure 2). According to approval, Z-21.4-145 annex 6.

\[ \text{req. } A_s = \frac{F_{Ed} [\text{kN}]}{\sigma_{Rd} [\text{kN/cm}^2]} = \frac{F_{Rd}}{11.2} \text{ cm}^2 \]

\( \sigma_{Rd} \) ~ see above

Figure 1: Additional reinforcement

Figure 2: Additional reinforcement placement
## HALFEN HZA CAST-IN CHANNELS
### HALFEN Bolts: Dimensioning

### HALFEN HZS Bolts — Load capacity and bending moment

<table>
<thead>
<tr>
<th>Bolt type</th>
<th>Grade 8.8</th>
<th>Bending moment for each bolt</th>
<th>Stainless steel A4-50, HCR-50</th>
<th>Stainless steel A4-70</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>F_Rd [kN]</td>
<td>MRd [Nm]</td>
<td></td>
</tr>
<tr>
<td>29/20 - M 12</td>
<td></td>
<td>27.0</td>
<td>83.8</td>
<td>–</td>
</tr>
<tr>
<td>38/23 - M 12</td>
<td></td>
<td>27.0</td>
<td>83.8</td>
<td>–</td>
</tr>
<tr>
<td>38/23 - M 16</td>
<td></td>
<td>50.2</td>
<td>213.1</td>
<td>–</td>
</tr>
<tr>
<td>41/22 - M 12</td>
<td></td>
<td>27.0</td>
<td>83.8</td>
<td>10.6</td>
</tr>
<tr>
<td>41/22 - M 16</td>
<td></td>
<td>50.2</td>
<td>213.1</td>
<td>19.8</td>
</tr>
<tr>
<td>53/34 - M 16</td>
<td></td>
<td>50.2</td>
<td>213.1</td>
<td>42.2</td>
</tr>
<tr>
<td>53/34 - M 20</td>
<td></td>
<td>78.4</td>
<td>415.4</td>
<td>66.0</td>
</tr>
<tr>
<td>64/44 - M 20</td>
<td></td>
<td>78.4</td>
<td>415.4</td>
<td>66.0</td>
</tr>
<tr>
<td>64/44 - M 24</td>
<td></td>
<td>113.0</td>
<td>718.4</td>
<td>95.1</td>
</tr>
</tbody>
</table>

① Observe profile load bearing capacity! If the load bearing capacity of the bolt and the HALFEN Cast-in channel differ, use the smaller of both values.

② Bending moment in the profile or concrete edge; see note below if bending with additional centric or diagonal tensile stress occurs.

### Variable bending stress:
For façades renders subjected to variable stress conditions (e.g. due to temperature change), the alternating stress amplitude must not exceed a value of \( \sigma_A = \pm 50 \text{ N/mm}^2 \) (\( \gamma = 1.0 \)) with a mean value of \( \sigma_M \) (relative to the stressed cross section of the bolt).

\[
N_{Ed} \leq F_{Rd} \times (1 - M_{Ed} / M_{Rd})
\]

\( F_{Rd} = \) Bolt design load capacity
\( M_{Rd} = \) Design value of possible bending moment
\( N_{Ed} = \) Design value of actual tensile load
\( M_{Ed} = \) Design value of actual bending moment

### Note:
Combine stress values if bending occurs with additional centric or diagonal tensile stress.

### Torque values for HALFEN Bolts

<table>
<thead>
<tr>
<th>Bolt type Material / Grade</th>
<th>HZS 64/44 8.8</th>
<th>HZS 64/44 A4-70</th>
<th>HZS 53/34 8.8</th>
<th>HZS 53/34 A4-70</th>
<th>HZS 41/22 8.8</th>
<th>HZS 41/22 A4-50</th>
<th>HZS 38/23 8.8</th>
<th>HZS 38/23 A4-70</th>
<th>HZS 29/20 8.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thread</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M12</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>50</td>
<td>50</td>
<td>80</td>
<td>–</td>
<td>80</td>
</tr>
<tr>
<td>M16</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>200</td>
<td>200</td>
<td>120</td>
<td>80</td>
<td>120</td>
<td>120</td>
</tr>
<tr>
<td>M20</td>
<td>350</td>
<td>350</td>
<td>350</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>M24</td>
<td>450</td>
<td>450</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

Torque values apply only for bolts in delivery condition (unlubricated).
HALFEN CAST-IN CHANNELS HZA AND HTA
Dynamic Loading

Dynamic loads for hot-rolled HALFEN Cast-in channels

The stress amplitudes shown here only apply to anchor channels made of the specified material and with the specified anchor types. Only the corresponding bolts according to the tables on this page are allowed.

Allowable amplitude / HALFEN HZA Channels, serrated

<table>
<thead>
<tr>
<th>Profile, anchor configuration</th>
<th>Material</th>
<th>Allow. stress amplitude $\Delta F = F_o - F_u$ [kN] for tensile stress</th>
<th>Approved bolts</th>
</tr>
</thead>
<tbody>
<tr>
<td>20/20_B6, 20/20-Q 1.0044 2.0 0.0</td>
<td>M12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>38/23_B6, 38/23-Q 1.0044 3.0</td>
<td>M16</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

53/34_B6, 38/34-Q 1.0044 6.0/12.0 | M16, 20 |

64/44_Q, L 1.0044 15.0 | M20, 24 |

Anchor configuration:
- B6: with bolt anchor
- Q: with I-anchor welded transverse to the channel
Also see approval Z-21.4-1691

Example:

HZA 38/23 profile - FV (standard, hot-dip galvanized), channel length = 250 mm
max. load: $F_{RD} = N_0 = 16.8$ kN

of which dynamic load:

3 kN (stress amplitude $\Delta F$)

Load F

$N_0 = $ highest load

$N_u = $ lowest load

Diagram: HTA-CE 52/34 - FV for n = 2 x 10^6 load cycles

Example (also see diagram to the right):

Profile HTA-CE 52/34 - FV (standard, hot-dip galvanized), for n = 2 x 10^6 load cycles:

$N_{RD} = 55 \div 1.8 = 30.6$ (taken from the ETA)

$N_{ED}$ from permanent load = 10 kN (assumption)

$\Delta N_{RD,E,n} = (30.6 - 10) \times 4.9/30.6 = 3.3$ kN

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HGB HANDRAIL CONNECTIONS

The advantages at a glance

Construction specialists consider the HALFEN HGB Handrail connections to be particularly suited for fastening railings and banisters to the thin front faces of balcony slabs

Safe and reliable
- statically verified installation
- no damage to visible surfaces of concrete slabs
- also suitable to secure mandatory safety rails during construction (Refer to: EN 795 “Guard rails”)
- use with HALFEN high-strength bolts to ensure a reliable and statically sound connection of railing/banister components

Fast and cost-effective
- adjustable anchorage
- can also be used in slabs as thin as h ≥ 100 mm
- installed with bolts instead of welding or drilling
- pre-planning reduces on-site construction time
- all attached components remain fully adjustable or are easily replaced as required
HALFEN HGB HANDRAIL CONNECTION

Application Examples

SAFETY BARRIERS IN STADIUMS

1-8: Safety barrier installation, multi purpose arena in Berlin

Fixing of safety rails, Rheinenergiestadion Cologne

RAILINGS

Used to secure safety rails during the construction phase

Fixing of safety rails, Rheinenergiestadion Cologne

Cast-in HGB Channel, residential building
HALFEN HGB HANDRAIL CONNECTION

General

Regulatory requirements

Balconies are part of the structural system. "They must be designed, constructed, maintained and modified in such a fashion that public order and safety, especially to health or life, is not endangered". Model building code and construction guidelines (Musterbauordnung MBO 07 und Ausführungs- vorschriften).

Technical guidelines issued by public notice as technical building regulations must be observed.* Technical rules provide information on load parameters, calculation, dimensioning of structural products, construction types, structural layouts etc. A requirement of regional building codes refers to structural stability: "All structures must, as a whole and in their individual components, be structurally self-supporting". This stability must be statically verifiable based on current technical standards.

A further building regulation addresses traffic loads, for example: Balconies and loggias must be fitted with safety rails to prevent falls when they border on to an area with a drop of more than one metre. For a drop height up to 12 m the minimum railing height is 0.90 m measured from the upper surface of the finished floor surface or accessible ledge. For drop heights greater than 12 m the banister height must be at least 1.10 m. For exceptions see the German federal building regulations / Deutsche LandesBauOrdnung.

Other regulations, not covered here, address the design, dimensioning, required spacings in the guard rail design, fire protection, thermal/sound insulation and rainwater drainage.

* issued by the highest construction supervision authorities of the German Federal States

Regulations, standards and directives (to be observed when designing safety rails)

Regional Building Codes

VOB — Part B, § 4, execution of construction:

BVM Directive

Other applicable regulations and standards (Extract):

Individual regional states have their own building codes and regulations. All current technical regulations require proof of structural safety and integrity. A static calculation or a building authority certificate is required when designing and dimensioning the fixings for guard rails.

§ 4.2 (1) It is the contractor’s responsibility to provide the static documentation in accordance with the contract. He has to observe the recognized standards of practice as well as with the provisions of the law and regulatory directives. Tender and Contract Regulations for the German building industry (VOB Vergabe- und Vertragsordnung für Bauleistungen) Part B, §4.3, requires the contractor to report to the customer, in writing, any obvious design flaws, which he as the expert must be able to recognize. He alone is responsible for any resulting defect and consequential expenses. If he has satisfied his reporting obligation, the responsibility for the defect passes to the customer (defect example: banister attachment mounted in a concrete slab which is too thin).


• Accident Prevention Regulation “General Provisions” (DGUV Regulation 1)
• Industrial Safety Regulations
• ETB – Directive “Fall Prevention Installations”, Publ. 1985
• Stainless Steels, EC3 part 1-4

EN 1991 (EC1): General effects on load structures; with National Annex (NA)
EN 1993 (EC3): design and construction of steel structures; with National Annex (NA)
HALFEN HGB HANDRAIL CONNECTION
Materials/Corrosion Protection

Stainless Steel A4:
Chromium is the most important alloy element in stainless steel. A specific chromium concentration ensures the generation of a passive layer on the surface of the steel that protects the base material against corrosion. This explains the high corrosion resistance of stainless steel.

“Anchor channels in stainless steel may be used outdoors — also in an industrial and coastal environment, but may not be directly exposed to salt water”.

See guidelines for “Metal railings, banisters and balustrades” issued by the German Association of Metalworkers (BVM Bundesverband der Metallverarbeiter).

### HALFEN Cast-in channels, stainless steel

<table>
<thead>
<tr>
<th>Description</th>
<th>Stainless steel</th>
<th>Corrosion resistance class according to EN 1993-1-4, table A.3</th>
</tr>
</thead>
</table>
| Channel profile        | 1.4404 or 1.4571                | EN 10 088
|                        |                                  | III                                                           |
| Ribbed-head anchor     | Reinforcing steel B500B          | EN 10 088
|                        | Reinforcing steel BSt 500 NR     | DIN 488                                                       |

### HALFEN Bolts, stainless steel

<table>
<thead>
<tr>
<th>Description</th>
<th>Stainless steel</th>
<th>Corrosion resistance class according to EN 1993-1-4, table A.3</th>
</tr>
</thead>
</table>
| Bolt                   | A4-70: 1.4404 or 1.4571          | EN 3506-1 and EN 10 088
|                        |                                  | III                                                           |
| Hexagonal nut          | A4-70: 1.4404 or 1.4571          | EN 3506-2 and EN 10 088
|                        |                                  | III                                                           |
| Washer                 | 1.4404 or 1.4571                | EN 10 088
|                        |                                  | III                                                           |

Galvanized:
Dipped in a galvanizing bath at a temperature of approximately 460°C, a method used primarily for open-profile channels.

Galvanized material for interior, dry rooms, for instance when installing staircase railings and banisters in residential buildings, schools or commercial retail stores.

Available on request

Identification of HALFEN HGB Cast-in channels

Product identification
▷ on channel side
▷ additionally inside the profile
**HALFEN HGB HANDRAIL CONNECTION**

**Installation/Assembly**

1. Nail the HALFEN Cast-in channel to the formwork

   Where possible, use stainless steel nails to avoid corrosion. After striking the formwork remove the foam filler from the HALFEN Cast-in channels.

2. Installation and adjustment of balustrades

   Insert HGB-M Bolts into the HALFEN Cast-in channel (turn 90° until the bolt locks into place).

3. Tighten the bolts

   Tighten the nuts using a torque wrench. See table on the right for torque values

---

**Fixing position of the bolts**

**Short piece**

**Corner piece** (on request)

**Dimensions [mm]:**

\[ l_1 = 170, l_2 = 170, \alpha = 90^\circ \]

---

**Railing bolts**

<table>
<thead>
<tr>
<th>Material grade</th>
<th>Torque [Nm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>A4-70</td>
<td>60</td>
</tr>
<tr>
<td>M16</td>
<td>25</td>
</tr>
<tr>
<td>M12</td>
<td>45</td>
</tr>
<tr>
<td>M16</td>
<td>25</td>
</tr>
<tr>
<td>M12</td>
<td>40</td>
</tr>
<tr>
<td>M12</td>
<td>25</td>
</tr>
</tbody>
</table>

**Stainless steel**

<table>
<thead>
<tr>
<th>HS 50/30</th>
<th>M16</th>
<th>60</th>
</tr>
</thead>
<tbody>
<tr>
<td>for profile 49/30 and 54/33</td>
<td>M12</td>
<td>25</td>
</tr>
<tr>
<td>HS 40/22</td>
<td>M16</td>
<td>45</td>
</tr>
<tr>
<td>for profile 40/25</td>
<td>M12</td>
<td>25</td>
</tr>
<tr>
<td>HS 38/17</td>
<td>M16</td>
<td>40</td>
</tr>
<tr>
<td>for profile 38/17</td>
<td>M12</td>
<td>25</td>
</tr>
</tbody>
</table>
# HALFEN HGB HANDRAIL CONNECTION

## Product Range

### HALFEN HGB Cast-in channels and bolts

<table>
<thead>
<tr>
<th>Item description</th>
<th>Dimensions HGB-E [mm]</th>
<th>Dimensions HGB-EE [mm]</th>
<th>HALFEN HGB Bolts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>l</td>
<td>dA</td>
<td>hA</td>
</tr>
<tr>
<td>HGB E - 54/33-A4</td>
<td>100</td>
<td>14</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>150</td>
<td>170/170</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>1.543</td>
<td></td>
</tr>
<tr>
<td>HGB E - 49/30-A4</td>
<td>100</td>
<td>12</td>
<td>110</td>
</tr>
<tr>
<td></td>
<td>150</td>
<td>170/170</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>1.007</td>
<td></td>
</tr>
<tr>
<td>HGB E - 40/25-A4</td>
<td>100</td>
<td>10</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>150</td>
<td>170/170</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>0.822</td>
<td></td>
</tr>
<tr>
<td>HGB E - 38/17-A4</td>
<td>100</td>
<td>10</td>
<td>201</td>
</tr>
<tr>
<td></td>
<td>150</td>
<td>170/170</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>0.999</td>
<td></td>
</tr>
</tbody>
</table>

- **A4** = Stainless steel 1.4571/1.4404
- *Alternative for interior use* (on request)
- **FV** = Steel hot-dip galvanized 1.0038/1.0044

## Ordering and materials

**Ordering example HGB channel:**

HGB-E-49/30 - 200 - A4

- **Material**
- **Length [mm]**
- **Description**

**Ordering example HALFEN Bolt:**

HS-50/30 - M12x40 - A4-70

- **Material**
- **Thread-Ø × length**
- **Description**
**HALFEN HGB HANDRAIL CONNECTION**

**Dimensioning Fundamentals**

**Railing height**
The minimum height $h_b$ of a railing is 0.90 m from the top surface of the finished floor or accessible ledge to the upper edge of the rail. For drop heights of more than 12.0 m the railing must be at least 1.10 m in height. (Exceptions; as specified in regional building codes)

It would be advisable to have one uniform minimum height of 1.00 m as has already been mandated in the commercial sector and in a number of European countries.

**Balcony slab**
Anchor channels or dowel installations require concrete of at least C 20/25 grade. A case-by-case decision must be made if the concrete grade is less than C 20/25 grade or is unknown.

The thickness of the balcony slab must be at least $h = 100-150$ mm when the HGB is cast in the slab edge (depends on channel profile and according to the German HGB approval). Other types of installation and systems require a thicker slab. All weather-exposed concrete-embedded installations (e.g. for balconies) must be made of stainless steel.

**Spacings**
Any structural design must take all basic requirements for railings and banisters into account. As a general rule, all railings and banisters must be designed so that personal injury is ruled out, for instance with correct spacing of rails, lattice bars or panels. They should also be designed so as not to entice but instead to discourage anyone from climbing over.

The specific requirements for guard rail design are determined by the intended use (residential, public, commercial) and the drop height involved. Also observe the building codes of each country or region, the ETB guidelines “Fall Protection Components” and DIN 18065 (Stairs in Buildings — definition, rules, key measurements) and guard rail regulation applicable at the construction site. In Germany these are the Guardrail regulations 2012 set by the German Association of Metalworkers, ("Geländer-Richtlinie 2012, BVM Berufsverband Metall") .
HALFEN HGB HANDRAIL CONNECTION
Dimensioning

Dimensions
The forces acting on the railing must be transferred into the main building structure. It is necessary to verify that the forces
a) are wholly supported by the railing and
b) can be transferred via the connecting elements into the balcony slab.

\[ N_{Ed} = \frac{M_{Ed}}{(e - 0.41 \cdot x)} + H_{Ed} \]

- \( N_{Ed} \) = tensile force on the anchor
- \( e \) = distance between channel axis and outer edge of the railing base plate
- \( x \) = maximum concrete pressure zone level according to annex 8, table 8a and 8b

Railing heights

<table>
<thead>
<tr>
<th>Drop height</th>
<th>Minimum height of rails (recommended)</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 12 m</td>
<td>90 cm (100 cm)</td>
<td>Relevant regional building regulations and if necessary other regulations e.g. for civil constructions must be observed.</td>
</tr>
<tr>
<td>Greater than 12 m</td>
<td>110 cm</td>
<td></td>
</tr>
</tbody>
</table>

Calculation

1. Railing/banister load \( h \) according to EN 1991-1-1/NA Table 6.12 DE
"Calculation must assume 100% traffic load in drop direction and 50% of traffic load (but not less than 0.5 kN/m) in the opposite direction."

\[ q_k = \begin{cases} 
0.5 \text{kN/m} & \text{for example: residential buildings and communal areas with low foot traffic} \\
1.0 \text{kN/m} & \text{for example: rooms for mass assembly, commercial sales spaces, corridors} \\
2.0 \text{kN/m} & \text{for example: areas for large gatherings of people, factories, workshops} 
\end{cases} \]

2. Vertical loads \( v \) according to BVM guidelines
Load assumptions to calculate vertical loads are according to the BVM guidelines for guard rails/banisters.

\[ v_1 = 0.40 \text{kN/m} \]
\[ v_2 = 0.35 \text{kN/m} \]
\[ v_3 = 0.15 \text{kN/m} \]

3. Wind loads
\( F_w \) according to EN 1991-1-4 and EN 1991-1-4/NA
Velocity force \( q \) in kN/m² and and total wind pressure \( F_w \) are calculated according to EN 1991-1-4 with EN 1991-1-4/NA.
HALFEN HGB HANDRAIL CONNECTION

Dimensioning

Extract from HGB approval Z-21.4-1912, page 6

3.2.2 Actions and required verifications

The actions $H_{Ed}$, $V_{Ed}$, $M_{Ed}$ and $N_{Ed}$ have to be determined according to the calculation basics as in annex 7. The ratio in the design calculation between horizontal action and bending moment is limited to:

$$\frac{H_{Ed}}{M_{Ed}} \leq 1.5 \text{ [1/m] \quad } H_{Ed} \text{ [kN]; } M_{Ed} \text{ in [kNm]}$$

It has to be verified that the design action value $E_d$ does not exceed the design resistance value $R_d$:

$$E_d \leq R_d \quad \text{see table 3.1 and 3.2 below}$$

$E_d = $ Design action value ($N_{Ed}$, $V_{Ed}$, $M_{Ed}$)

$R_d = $ Design resistance value ($N_{Rd}$, $V_{Rd}$, $M_{Rd}$)

For a standard case the following equation for the design action value applies (permanent load and variable load acting in the same direction):

$$E_d = \gamma_G \cdot G_k + \gamma_Q \cdot Q_k$$

$G_k, Q_k = $ characteristic value of permanent load or variable load according to recognized standards for load assumptions

$\gamma_G, \gamma_Q = $ partial safety factors for permanent and variable action

### Table 3.1 Required verifications for tensile loads

| Steel failure | $N_{Ed} \leq N_{Rd,s}$
| Pull out failure | $N_{Ed} \leq 2 \cdot N_{Rd,s}$ (for two-bolt fixing)
| Concrete failure with anchor reinforcement |
| Spalling |

### Table 3.2 Required verifications for shear loads

| Steel failure | $V_{Ed} \leq V_{Rd,s}$
| Concrete failure with anchor reinforcement | $V_{Ed} \leq 2 \cdot V_{Rd,s}$ (for two-bolt fixing)
| Concrete edge failure with anchor reinforcement | $M_{Ed} \leq M_{Rd,c}$

With combined loads the following interactions must be verified:

1. $\max \left( \frac{N_{Ed}}{N_{Rd,s}} \right)^2 + \max \left( \frac{V_{Ed}}{V_{Rd,s}} \right)^2 \leq 1.0$

2. $\frac{M_{Ed}}{M_{Rd,c}} + 1.5 \frac{V_{Ed}}{V_{Rd,c}} \leq 1.5$

For $0.333 \leq \frac{V_{Ed}}{V_{Rd,c}} \leq 1.0$
HALFEN HGB HANDRAIL CONNECTION
Dimensioning

Extract from HGB-approval no. Z-21.4-1912, annex 6

<table>
<thead>
<tr>
<th>Description</th>
<th>Illustration</th>
<th>Anchor channels profiles</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>38/17 40/22 40/25 50/30 49/30 52/34 54/33</td>
</tr>
<tr>
<td>A) Profile shape and bolt positioning</td>
<td>annex 2</td>
<td>150 150 150 150</td>
</tr>
<tr>
<td>Minimum channel length required for a two-bolt fixing [mm]</td>
<td>see next page</td>
<td>80 80 80 (100)</td>
</tr>
<tr>
<td>Minimum bolt distance p [mm]</td>
<td></td>
<td>80 (100)○</td>
</tr>
<tr>
<td>B) Building element dimensions and anchor position in the element</td>
<td></td>
<td>100 120 140 150</td>
</tr>
<tr>
<td>Minimum thickness of concrete element h [mm]</td>
<td>annex 8</td>
<td>100 120 140 150</td>
</tr>
<tr>
<td>Minimum edge distance c₁ [mm] (channel axis to the upper and the lower edge of the concrete element)</td>
<td>annex 8</td>
<td>50 60 70 75</td>
</tr>
<tr>
<td>Minimum distance aₑ [mm] to edge of concrete element (from end of channel)</td>
<td>see next page</td>
<td>40 45 50 50</td>
</tr>
<tr>
<td>C) Size and position of anchor plate</td>
<td></td>
<td>30 30 35 37.5</td>
</tr>
<tr>
<td>Minimum distance e [mm] from the channel axis to the upper and the lower edge of the anchor plate</td>
<td></td>
<td>10 10 10 10</td>
</tr>
<tr>
<td>Minimum distance a₁ [mm] from the upper and lower edge of the anchor plate to the upper and lower edge of the concrete element ○</td>
<td></td>
<td>40 45 45 45</td>
</tr>
</tbody>
</table>
| Minimum distance a₂ [mm] from the outer edge of the anchor plate to the edge of the concrete element | | ○ The values in brackets apply when using M20 bolts ○ In components with a weather groove, the bottom of the groove is regarded as the concrete element edge
**HALFEN HGB HANDRAIL CONNECTION**

**Dimensioning**

Extract; HGB approval no. Z-21.4-1912, annex 6

- **Table 7: Size and position of required minimum reinforcement**

<table>
<thead>
<tr>
<th>Description</th>
<th>Anchor channels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>38/17</td>
</tr>
<tr>
<td>Stirrup / Quantity</td>
<td>3 Ø 8, l_b = 200 mm</td>
</tr>
<tr>
<td>Edge rebar, top and bottom [mm]</td>
<td>Ø 8</td>
</tr>
</tbody>
</table>

**Required minimum reinforcement:**
One stirrup is placed centrally between the channel anchors and one stirrup directly next to each anchor at the channel ends (if positioned near to the edge, between the anchor and component edge).

**Table 9: Design resistance for each bolt**

<table>
<thead>
<tr>
<th>Tensile</th>
<th></th>
<th>M12</th>
<th>M16</th>
<th>M20</th>
</tr>
</thead>
<tbody>
<tr>
<td>N_{Rd,1} [kN]</td>
<td>4.6</td>
<td>16.9</td>
<td>31.4</td>
<td>49.0</td>
</tr>
<tr>
<td></td>
<td>8.8</td>
<td>44.9</td>
<td>83.7</td>
<td>130.7</td>
</tr>
<tr>
<td></td>
<td>A4-, HC-50</td>
<td>14.8</td>
<td>27.4</td>
<td>42.8</td>
</tr>
<tr>
<td></td>
<td>A4-70*</td>
<td>31.6</td>
<td>58.8</td>
<td>91.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Shear</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>V_{Rd,1} [kN]</td>
<td>4.6</td>
<td>12.1</td>
<td>22.6</td>
<td>35.2</td>
</tr>
<tr>
<td></td>
<td>8.8</td>
<td>27.0</td>
<td>50.2</td>
<td>78.4</td>
</tr>
<tr>
<td></td>
<td>A4-, HC-50</td>
<td>10.6</td>
<td>19.8</td>
<td>30.9</td>
</tr>
<tr>
<td></td>
<td>A4-70*</td>
<td>22.7</td>
<td>42.2</td>
<td>66.0</td>
</tr>
</tbody>
</table>

* Values also apply for all stainless steels of strength class 70 (see also HGB approval, annex 4)

**Design resistance of concrete pressure zone**

\[
M_{Rd,c} = 0.81 \cdot x \cdot b \cdot \frac{f_{ck}}{\gamma_{Mc}} \cdot (e - 0.41 \cdot x)
\]

where:
- \(x\) = maximum height; concrete pressure zone (see table 8a and 8b)
- \(b\) = width of pressure zone = width of anchor plate \(b_p\)
- \(f_{ck}\) = characteristic compression strength of concrete in accordance with EN 206-1:2001-07, for concrete strength \(\geq C30/37\) only calculate using \(f_{ck} = 30\ \text{N/mm}^2\)
- \(e\) = distance between anchor channel axis and outer edge of the anchor plate (see illustration on page 47, table 6)
- \(\gamma_{Mc} = 1.5\) (partial safety factor)
HALFEN HGB HANDRAIL CONNECTION

Dimensioning

Extract, HGB-approval no. Z-21.4-1912, annex 8

Table 8a: Design resistance of the channel using single-bolt fixing

<table>
<thead>
<tr>
<th>Channel type</th>
<th>38/17</th>
<th>40/25</th>
<th>49/30</th>
<th>54/33</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum thickness of component h [mm]</td>
<td>100</td>
<td>120</td>
<td>140</td>
<td>150</td>
</tr>
<tr>
<td>Steel failure (single-bolt fixing)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tension $N_{rd,s} [kN]$</td>
<td>10.0</td>
<td>11.1</td>
<td>17.2</td>
<td>30.6</td>
</tr>
<tr>
<td>Shear $V_{rd,s} [kN]$</td>
<td>10.0</td>
<td>11.1</td>
<td>17.2</td>
<td>30.6</td>
</tr>
<tr>
<td>Concrete failure (single-bolt fixing)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{rd,c} [kN]$</td>
<td>6.7</td>
<td>9.0</td>
<td>11.7</td>
<td>12.7</td>
</tr>
<tr>
<td>Maximum height of concrete pressure zone $x \cdot 0.25 \cdot e^{0.25}$</td>
<td>0.25 \cdot e^{0.25}</td>
<td>0.25 \cdot e^{0.25}</td>
<td>0.30 \cdot e^{0.30}</td>
<td>0.40 \cdot e^{0.40}</td>
</tr>
</tbody>
</table>

Table 8b: Design resistance of the channel using a two-bolt fixing

<table>
<thead>
<tr>
<th>Profile</th>
<th>38/17</th>
<th>40/25</th>
<th>49/30</th>
<th>54/33</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum thickness of component h [mm]</td>
<td>100</td>
<td>120</td>
<td>140</td>
<td>150</td>
</tr>
<tr>
<td>Steel failure (two-bolt fixing)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tension $N_{rd,s} [kN]$</td>
<td>15.0</td>
<td>16.7</td>
<td>25.8</td>
<td>45.8</td>
</tr>
<tr>
<td>Shear $V_{rd,s} [kN]$</td>
<td>15.0</td>
<td>16.7</td>
<td>25.8</td>
<td>45.8</td>
</tr>
<tr>
<td>Concrete failure (two-bolt fixing)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{rd,c} [kN]$</td>
<td>6.7</td>
<td>9.0</td>
<td>11.7</td>
<td>12.7</td>
</tr>
<tr>
<td>Maximum height of concrete pressure zone $x \cdot 0.25 \cdot e^{0.25}$</td>
<td>0.25 \cdot e^{0.25}</td>
<td>0.25 \cdot e^{0.25}</td>
<td>0.30 \cdot e^{0.30}</td>
<td>0.40 \cdot e^{0.40}</td>
</tr>
</tbody>
</table>

$e$ = distance between the anchor channel axis and outer edges of the anchor plate. For asymmetrical anchor plates the smallest distance to the outer edge of the anchor plate is used for calculation.

Dimensioning example HALFEN HGB Guard rail fittings

$M_{Ed}$ = used to calculate applicable moment relative to the channel axis

$e_{V1}$, $e_{V2}$, $e_{V3}$ = distance of the vertical loads to the front edge of the channel

$e_{H1}$, $e_{Fw}$ = distance of the horizontal loads to the front edge of the channel

$H_{Ed}$ = used to calculate the applicable horizontal effect

$V_{Ed}$ = used to calculate the applicable vertical effect

h, $F_w$ = horizontal load effects

$v_1$, $v_2$, $v_3$ = vertical load effects

$b_p$, $h_p$ = anchor plate width and height
**HALFEN HGB HANDRAIL CONNECTION**

**Dimensioning/Calculation Example**

**Calculation example**

<table>
<thead>
<tr>
<th>Post spacing</th>
<th>1.5 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post height from FFL</td>
<td>1.0 m</td>
</tr>
<tr>
<td>Structure height</td>
<td>9.0 m &lt; 25.0 m</td>
</tr>
<tr>
<td>Railing/banister load</td>
<td>0.5 kN/m (residential buildings)</td>
</tr>
<tr>
<td>Concrete slab thickness</td>
<td>180 mm</td>
</tr>
<tr>
<td>Distance of channel axis to component edge</td>
<td>c₁ = 90 mm</td>
</tr>
<tr>
<td>Width of railing/banister anchor plate</td>
<td>bₚ = 150 mm</td>
</tr>
<tr>
<td>Height of railing/banister anchor plate</td>
<td>hₚ = 150 mm</td>
</tr>
<tr>
<td>Bolt spacing</td>
<td>p = 80 mm</td>
</tr>
<tr>
<td>Concrete strength</td>
<td>C30/37</td>
</tr>
</tbody>
</table>

**Load**

**Vertical loads:**
- Dead load, railing/banister including siding: v₁ = 0.40 kN/m
- Dead load, flower box: v₂ = 0.35 kN/m
- Vertical traffic load on the railing/banister: v₃ = 0.15 kN/m

**Horizontal loads:**
- Railing/banister load: h = 0.50 kN/m
- Wind force: q = 0.50 kN/m²

(according to EN 1991-1-4 NA. B.3)
(assumption: building height 9.0 m < 10.0 m, not prone to resonance frequency, inland wind zone 1)

**Cantilevers:**
- e₁ₜ = 1.0 + 0.06 + \frac{0.18}{2} = 1.15 m
- eₚₜ = \frac{(1.15 + 0.075)}{2} = 0.75 m + 0.075 = 0.53 m
- eₜ₁ = 0.10 m
- eₜ₂ = 0.20 m
- eₜ₃ = 0.10 m

**Wind load bearing zone:**
- A = (1.00 + 0.06 + \frac{0.18}{2} + \frac{0.15}{2}) · 1.5 = 1.84 m²

**External pressure coefficient (acc. to table 7.1 EN 1991-1-4):**
- \( \frac{h}{d} = 1 \), area B
- \( cₚₑ,ₜ = -1.1 \) (wind-suction)
- \( cₚₑ,₁₀ = -0.8 \) (wind-suction)

(according to EN 1991-1-4 chapter 7.2.1)

the following is valid:
- \( 1 \text{ m}² < A ≤ 10 \text{ m}² \)
- \( cₚₑ = cₚₑ,₁ + (cₚₑ,₁₀ - cₚₑ,ₜ) \cdot \lg A = -1.1 + (-0.8 + 1.1) \cdot \lg 1.84 = -1.02 \)

**Wind suction:**
- \( F_w = cₚₑ \cdot q \cdot A = -1.02 \cdot 0.50 \cdot 1.84 = -0.94 \text{ kN} \)

**Action per support:**
- **Wind load**
  - \( Fₚₑ,Ed = -0.94 \cdot 1.5 = -1.41 \text{ kN} \) (suction)
  - with \( \gamma_F = 1.5 \)
- **Railing/banister**
  - \( Hₚₑ,₁ = 0.5 \cdot 1.5 = 0.75 \text{ kN} \)
  - with \( \gamma_F = 1.5 \)
- **Dead load**
  - \( V₁ₚₑ,₁ = 0.4 \cdot 1.5 = 0.6 \text{ kN} \)
  - with \( \gamma_F = 1.5 \)
- **Load from flower box**
  - \( V₂ₚₑ,₁ = 0.35 \cdot 1.5 = 0.525 \text{ kN} \)
  - with \( \gamma_F = 1.5 \)
- **Vertical load on railing/banister**
  - \( V₃ₚₑ,₁ = 0.15 \cdot 1.5 = 0.225 \text{ kN} \)
  - with \( \gamma_F = 1.5 \)

**Determining bearing reactions** \( Hₚₑ,₁, Vₚₑ,₁ \) and \( Mₚₑ,₁ \)

Not classed as an utility (escape-route) balcony therefore combination with wind load is not required.

**Load case 1: V + railing/banister load**
- \( Mₚₑ,₁ = 0.81 \cdot 0.10 + 0.71 \cdot 0.20 + 0.34 \cdot 0.10 + 1.13 \cdot 1.15 = 1.56 \text{ kNm} \)
- \( Vₚₑ,₁ = 0.81 + 0.71 + 0.34 = 1.86 \text{ kN} \)
- \( Hₚₑ,₁ = 1.13 \text{ kN} \)

**Load case 2: V + wind**
- \( Mₚₑ,₁ = 0.81 \cdot 0.10 + 0.71 \cdot 0.20 + 1.41 \cdot 0.53 = 0.97 \text{ kNm} \)
- \( Vₚₑ,₁ = 0.81 + 0.71 = 1.52 \text{ kN} \)
- \( Hₚₑ,₁ = 1.41 \text{ kN} \)

**Selected:**
- HGB-E 49/30, l = 200 mm, A4 stainless steel
- Bolt spacing p = 80 mm
- 2 bolts HS 50/30 M12, A4-70

**Required minimum reinforcement:**
- Stirrups 3 Ø 10, lb = 300 mm

(see page 48 approval extract → annex 6, table 7)

**Edge rebar 2 Ø 10**

**Splitting the moment into a load pair**

\[ Nₚₑ = \frac{Mₚₑ}{(e - 0.41 \cdot x)} + Hₚₑ \]

\[ e = \frac{hₚ}{2} = 75 \text{ mm} \]

(see approval no. Z-21.4.1912 annex 7)

\[ x = 0.30 \cdot e = 0.30 \cdot 75 = 22.5 \text{ mm} \]

see page 49 (approval extract → annex 8 / table 8b)

\[ e = 0.41 \cdot x = 75 \cdot 0.41 = 22.5 \cdot 65.8 \text{ mm} \]
HALFEN HGB HANDRAIL CONNECTION
Calculation Example

Load case 1: V + railing/banister load

\[
\frac{N_{Ed}}{N_{Rd,s}} = \frac{1.56 \text{kNm}}{25.8} = 0.06 < 1 \quad \checkmark
\]

\[
\frac{V_{Ed}}{V_{Rd,s}} = \frac{1.86 \text{kN}}{25.8} = 0.07 < 1 \quad \checkmark
\]

Channel, interaction

\[
\left(\frac{N_{Ed}}{N_{Rd,s}}\right)^2 + \left(\frac{V_{Ed}}{V_{Rd,s}}\right)^2 = \left(\frac{24.84}{25.8}\right)^2 + \left(\frac{1.86}{25.8}\right)^2
\]

= 0.93 + 0.01 = 0.94 < 1 \quad \checkmark

Design resistance (steel) **bolt M12, A4-70**

\[
N_{Rd,s,s} = 31.6 \text{kN} \quad \text{see page } 48 \text{ (approval extract } \rightarrow \text{ annex 8, table 8b)}
\]

\[
V_{Rd,s,s} = 22.7 \text{kN} \quad \text{see page } 49 \text{ (annex 8, table 8b)}
\]

Bolt, centric pull load

\[
\frac{0.5 \cdot N_{Ed}}{N_{Rd,s,s}} = \frac{0.5 \cdot 24.84}{31.6} = 0.39 < 1 \quad \checkmark
\]

Bolt, shear load

\[
\frac{0.5 \cdot V_{Ed}}{V_{Rd,s,s}} = \frac{0.5 \cdot 1.86}{22.7} = 0.04 < 1 \quad \checkmark
\]

Load case 2: V + wind

\[
\frac{N_{Ed}}{N_{Rd,s}} = \frac{0.98 \text{kNm}}{25.8} = 0.04 < 1 \quad \checkmark
\]

\[
\frac{V_{Ed}}{V_{Rd,c}} = \frac{1.52 \text{kN}}{11.7 \text{kN}} = 0.13 < 1 \quad \checkmark
\]

Verification of concrete capacity

Design resistance concrete

\[
V_{Rd,c} = 11.7 \text{kN} \quad \text{see page } 49 \text{ (annex 8, table 8b)}
\]

\[
M_{Rd,c} = 0.81 \cdot x \cdot b \cdot f_{ck} \cdot (e - 0.41 \cdot x)
\]

\[
= 0.81 \cdot 22.5 \cdot 150 \cdot \frac{30}{1.5} \cdot 65.8 = 3597615 \text{Nmm}
\]

= 3.60 kNm

Concrete edge failure

\[
\frac{V_{Ed}}{V_{Rd,c}} = \frac{1.86}{11.7} = 0.16 < 1 \quad \checkmark
\]

\[
\frac{M_{Ed}}{M_{Rd,c}} = \frac{1.56}{3.60} = 0.43 < 1 \quad \checkmark
\]

Verifying the ratio between horizontal action and bending moment

\[
\frac{H_{Ed}}{M_{Ed}} = \frac{1.13 \text{kN}}{1.56 \text{kNm}} = 0.72 < 1.5
\]

\[
\rightarrow \text{Design model is applicable}
\]

see page 46 (approval extract / page 6)

Geometrical boundary conditions according to approval Z-21.4-1912 annex 6, table 6 have been met.

Verification of interaction

\[
\frac{V_{Ed}}{V_{Rd,c}} = \frac{1.86}{11.7} = 0.16 < 0.333 \quad \rightarrow \text{According to the approval verification of interaction is not required, see page } 46 \text{ (approval extract / page 7)}.
\]
HALFEN HTU CAST-IN CHANNEL FOR FIXING PROFILES METAL SHEETING

The benefits at a glance

The HALFEN HTU Cast-in channel is ideal for fixing all types of profiled sheeting — easy and simple with self-tapping screws. Suitable for both shear loads and tension loads.

Thanks to the innovative channel design with its corrugated sides and filler, the new generation of HALFEN HTU Cast-in channel is installed entirely in the required concrete cover. This avoids any problem with the required reinforcement.

Safe and reliable

- innovative geometry and corrugated edging ensure reliable anchorage
- polystyrene filler prevents the drill-bit or self-tapping screw from hitting concrete
- building authority approved
- the type stamp on the channel back ensures identification after installation

Efficient and economical

- simple installation in the required concrete cover
- one channel type irrespective of the reinforcement layout
- simple installation in the precast plant

HALFEN HTU Cast-in channel for fixing profiled metal sheeting

HALFEN HTU Cast-in channels in a pre-stressed concrete beam

Fixing of trapezoidal metal sheeting roof element

Vertical HALFEN HTU Cast-in channels for fixing façade panels

Façade fixed using HALFEN HTU Cast-in channels (Cologne Bonn Airport)
**HALFEN HTU CAST-IN CHANNELS**

**General/product range**

The HALFEN Cast-in channel for fixing trapezoidal metal sheeting has a U-shaped cross-section with the sides angled outwards. The corrugated sides of the channel provide a positive-lock with the concrete.

Both HTU Channel lengths (60 and 100mm) allow various bolt fixing and layout options. The HALFEN HTU Cast-in channels are building authority approved. Approval: DIBt no. Z-21.4-2096

---

### Area of application

Fixing of trapezoidal sheeting or wall-cladding elements using building authority or ETA approved self-tapping screws. Installed flush with the surface of precast concrete elements; concrete strength C25/30 up to C50/60, cracked or non-cracked.

### Materials/corrosion protection

HTU Channel made of zinc-plated steel may be installed in environments of C1 to C3 corrosion category acc. to EN ISO 12944-2:2018-04.

---

**Available lengths:**

HTU-Channels are available in 3000 or 6000 mm lengths.

---

**Order example HTU Channel:**

HTU 60/25/2,5-S 6000

- length [mm]
- product name

---

**Identification**

Original HALFEN Cast-in channels for fixing trapezoidal metal sheeting can be identified by the stamp on the back of the channel displaying the company name and the product description “HALFEN HTU”.

---

Detailed installation instructions for the self anchoring HALFEN HTU Channel can be found at:

[www.halfen.com ➤ Brochures ➤ Installation Instructions ➤ Fixing systems](www.halfen.com)
HALFEN HTU CAST-IN CHANNELS
Dimensioning

Anchorages must to be planned in accordance with engineering standards. Verification of direct local force transmission from the channel into the concrete has been provided if the approved values are complied with. Connecting accessories must be verified separately. Technical design must comply with building authority approval no. Z-21.4-2096.

Constructive boundary conditions

<table>
<thead>
<tr>
<th>Channel</th>
<th>Lmin [mm]</th>
<th>(E) Single (D) Double fixing</th>
<th>bmin [mm]</th>
<th>hmin [mm]</th>
<th>C1,min [mm]</th>
<th>C2,min [mm]</th>
<th>smin [mm]</th>
<th>FRd [kN]</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTU 60/25/2,5-S</td>
<td>150</td>
<td>E</td>
<td>2 x c1</td>
<td>200</td>
<td>90</td>
<td></td>
<td></td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>250</td>
<td>E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>125</td>
</tr>
<tr>
<td></td>
<td>310</td>
<td>E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>155</td>
</tr>
<tr>
<td>HTU 100/25/3-S</td>
<td>150</td>
<td>E</td>
<td>2 x c1</td>
<td>200</td>
<td>120</td>
<td></td>
<td></td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>250</td>
<td>E</td>
<td></td>
<td></td>
<td></td>
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<td>125</td>
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<tr>
<td></td>
<td>310</td>
<td>E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>155</td>
</tr>
</tbody>
</table>

① Resistance FRd applies for all load directions. The constant-load factor must be ≤ 0.15 FRd.
② For concrete strength class C20/25 the resistances must be reduced with factor 0.82. For concrete strength C25/30 with factor 0.91.
③ For concrete strength class ≥ C30/37 the resistance FRd may be increased by Ψc acc. to (appendix 5, table 2)
ROOF AND WALLS
The right solution for each application

The efficient and established installation systems for timber roof structures, masonry restraints and connectors for concrete façades are proven practical solutions for the construction industry, greatly improving construction time with significant cost-saving.

Suitable for horizontal forces acting on rafter and collar beam roofs.

Suitable for all acting loads e.g. wind loads in roof structures.

For connection of tension and compression loads from concrete walls elements.

For connection of brickwork to concrete walls and columns or steel elements.

Suitable for horizontal loads in concrete wall elements (loads perpendicular to the bracket).

Wall and column corner protector; application in industry and multi-storey car parks.

HALFEN HSF Rafter shoe

HALFEN HNA Timber fixing strap

HALFEN HKZ or SPV Restraint ties

HALFEN ML and BL Brick tie anchor system

HALFEN HVL-M Precast connection with HALFEN HVLE Cast-in channel

HALFEN HKW Corner guard
**ROOF AND WALLS**

**Application Examples**

- HALFEN HSF Rafter shoe 6/12
- HALFEN HKZ Restraint tie with serrated washer
- Airbus paintshop with HALFEN HVL Restraint tie
- HVL-System in precast building components
- Connecting construction timbers to concrete using HALFEN HNA
- Timber roof construction with HALFEN HNA Fixing straps
- Corner guards in an industrial environment
- HALFEN ML Brick-tie anchor system
In modern wood constructions, HSF 6/12 rafter shoes are used to support the horizontal forces in rafter and collar tie roofs.

The advantages at a glance:

- minimal planning; simply specify the profile and position of the HALFEN Cast-in channels in the concrete element
- clearly defined statics with flexible rafter shoes
- complex and therefore costly support structures are not necessary
- simple and straightforward roof construction:
  a) adjustable support plate
  b) adjustable nailing brackets for vertical anchorage for various rafter widths from 60 to 120 m
  c) adjustable in longitudinal rafter axis ± 15 mm
- freely adjustable rafter spacings in the longitudinal axis of the HALFEN Channel without additional measures
- hot-dip galvanized for excellent corrosion protection

The horizontal forces are transferred into the main concrete structure using (ETA) European Technical approved HALFEN HTA-CE Cast-in channels. During assembly ensure that the serration in the counter plates engages in the base plate. The marking on the counter plates must be at right angles to the slot in the base plate.

Rafter roof static system:

\[ F_{1,d} < F_{Rd} \]

1. The maximum rafter strength is limited by the design load of each individual component in the rafter shoe. Load tests resulted in a mean breaking load of 50 kN. With normal loads larger than the recommended load capacity (= about 1/3 of the breaking load), the rafter spacing will need to be reduced.
2. If lower loads are present, then the minimum edge distance \( C_{1,2} \) for the HALFEN Cast-in channels can be reduced. The distance to the concrete edge must be at least 170 mm.
3. Make sure that the HALFEN Cast-in channels are installed flush with the concrete surface. Use spacers if necessary.
ROOF AND WALLS
HALFEN HNA Timber Fixing Strap

To provide an optimal base for roof framework, continuous HALFEN HTA-CE Cast-in channels or HALFEN HTA-CE Cast-in channel short elements are cast in the concrete; suitable for concrete ring beams or slabs. The type of HALFEN HTA-CE Cast-in channels, nailing straps and nails depend on the assumed loads (ex. wind force).

For calculation and design criteria see:
• EN 1991-1-4 (EC1) and EN 1991-1-4/NA
• EN 1995-1-1 (EC5)

The timber fixing straps can be positioned on one or both sides of the timber beams or rafters. Refer to the following table for $F_{Rd}$ load capacities. The beams/framework must be secured against twisting when straps are used only on one side of the beams, (example by nailing to the upper wood roof boarding).

<table>
<thead>
<tr>
<th>Material/Finish</th>
<th>Design value for load capacity $F_{Rd}$ [kN] for each beam attachment</th>
<th>Attaching timber fixing straps to wooden beams/rafters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item name: Length [mm]</td>
<td>(Position of timber fixing straps)</td>
<td>Wire nails</td>
</tr>
<tr>
<td></td>
<td>Single-sided</td>
<td>Double-sided</td>
</tr>
<tr>
<td>N 95</td>
<td>4.2</td>
<td>2.8</td>
</tr>
<tr>
<td>BN 95</td>
<td>1.4</td>
<td>2.8</td>
</tr>
<tr>
<td>N 120</td>
<td>4.9</td>
<td>2.8</td>
</tr>
<tr>
<td>BN 120</td>
<td>5.6</td>
<td>2.8</td>
</tr>
<tr>
<td>WN 120</td>
<td>6.3</td>
<td>7.5</td>
</tr>
<tr>
<td>WN 185</td>
<td>1.4</td>
<td>2.8</td>
</tr>
</tbody>
</table>

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**ROOF AND WALLS**

*Brick Tie Anchor Systems ML + BL*

HALFEN ML and BL Brick tie anchors are tried and tested efficient installation systems for securing brick walls, masonry in-fills, partition walls, brick renders (with or without ventilation gap and heat insulation) to concrete walls, concrete supports, steel or wooden structures. The brick tie anchors are able to move freely in the brick tie channels, considerably reducing cracks caused by masonry settlement.

Plan view; attachment of facing brickwork

Plan view; wall attachment

All HTA-CE and HMS profiles have a foam filling to prevent concrete ingress. The channels are attached to the formwork using standard nails.

The HALFEN Brick tie anchors are inserted at the recommended intervals (static requirements) in the brick wall during construction (see page 62). The anchors are inserted in the brick tie channels, laid flat between the rows of brick and pressed into the mortar. The perforations in the anchors optimise anchorage with the mortar.

For spacing a — see HALFEN Technical Product Information façade, Brickwork Support

| Brick tie anchor ML in combination with HALFEN Cast-in channels 25/15-D and 28/15 |
|---|---|---|
| Embedded HTA-CE Cast-in channel | **HMS Cast-in channel with Brick-tie anchor** |
| HTA-CE 28/15 ETA approved | **1. Attach to formwork** |
| **Embedded length e ≥ 50 mm** | **2. Bend out lug anchors** |
| **Installation channel HM welded to steel supports HM 28/15** | **3. Pour the concrete** |
| **Lug anchors are bent out on-site by hand every 250 mm to ensure secure anchorage in the concrete.** |
**ROOF AND WALLS**

**Brick Tie Anchor System, ML + BL; HALFEN Anchor Bolt Systems**

HL slotted framing channels anchored to concrete or masonry

Top view

- HL 28/15
- ML

ETA 17/0196 (brickwork) and ETA 16/0691 (concrete)/Injection system HB-VMU plus

**Bolt anchor HB-BZ-U 8-15-26/80**
- galvanized or (A4) stainless steel
- approved for cracked and uncracked concrete
- with large washer DIN 9021/EN ISO 7093

**Anchor rod HB-VMU-A 8-20/110**
- galvanized or (A4) stainless steel
- approved for monolithic masonry
- with large washer DIN 9021/EN ISO 7093 (order separately)
- mortar cartridge HB-VMU plus 280 and static mixer (order separately)

**Anchor rod HB-VMU-A 8-20/110 with Perforated sleeve HB-VMU-SH 16×85**
- galvanized or (A4) stainless steel
- approved for perforated brick masonry
- with large washer DIN 9021/EN ISO 7093 (order separately)
- mortar cartridge HB-VMU plus 280 and static mixer (order separately)

For more information on application and assembly see the Technical Product Information catalogue, HALFEN HB Anchor bolt systems
**ROOF AND WALLS**

**Brick Tie Anchor System, ML + BL**

Brick tie anchors

**ML, BL**

- max. load $F_{Z,Ed} = 0.32$ kN per cm embedment length $e$
- max. $F_{Z,Ed} \leq 3.2$ kN $= F_{Z,Rd}$
- max. $F_{Q,Ed} \leq 2.7$ kN $= F_{Q,Rd}$

**ML 1**

- max. $F_{Z,Ed} \leq 2.5$ kN $= F_{Z,Rd}$
- max. $F_{Q,Ed} \leq 1.4$ kN $= F_{Q,Rd}$

Observe profile load capacity!

### Brick tie anchors

<table>
<thead>
<tr>
<th>Brick tie anchor</th>
<th>Brick tie anchor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HMS 25/15 D</strong></td>
<td>ML Standard 26 × 2 [mm]</td>
</tr>
<tr>
<td><strong>L = 2500 mm</strong></td>
<td>MLQ - D Double-sided 25 × 3 [mm]</td>
</tr>
<tr>
<td><strong>HTA-CE 28/15</strong></td>
<td>ML - 85 15</td>
</tr>
<tr>
<td><strong>L = 1050 mm</strong></td>
<td>ML - 120 15</td>
</tr>
<tr>
<td><strong>L = 6070 mm</strong></td>
<td>ML - 180 15</td>
</tr>
<tr>
<td><strong>HL 28/15</strong></td>
<td>ML - 85 15</td>
</tr>
<tr>
<td><strong>L = 6070 mm</strong></td>
<td>ML - 120 15</td>
</tr>
<tr>
<td><strong>HTA-CE 38/17</strong></td>
<td>ML - 85 15</td>
</tr>
<tr>
<td><strong>L = 1050 mm</strong></td>
<td>ML - 120 15</td>
</tr>
<tr>
<td><strong>L = 6070 mm</strong></td>
<td>ML - 180 15</td>
</tr>
</tbody>
</table>

**Material:**
- FV = Steel 1.0038, hot-dip galvanized
- SV = Steel DX51D + Z275, sendzimir galvanized
- A4 = Stainless steel 1.4571/1.4404
- A2 = Stainless steel 1.4307

Debond sleeve ML-G 150 for wall attachments, suitable for ML-anchors

Permits movement in the longitudinal anchor direction, e.g. in long masonry bonds or partition walls adjoining concrete load bearing structures; prevents cracks forming.

**ML-G 150**, material: soft PVC, material thickness 1.5 mm
**ROOF AND WALLS**

Firewall Connections with Wall Connecting System ML + BL

**Solid masonry fire walls**

Statically required connections of load bearing, room enclosing, masonry walls can also be designed as fire walls in accordance with DIN 4102-4 section 9.8.4 using HALFEN Brick tie channels.

The anchorage to adjacent components (steel reinforced concrete supports or walls) meet the requirements for stability and fire resistance if the anchorage conforms to the standards set in DIN 4102-4 section 9.8.4 (figure 9.13, variant 2).

**Definition, DIN regulations**

1. **HALFEN Cast-in channel**
2. **Insulation layer:**
   According to DIN 4102-4 section 9.2.14 insulation layers in connecting joint gaps must "[…] be made of non-flammable mineral fibre; have a melting point ≥ 1000°C as stated in DIN 4102-17; and have a gross density of ≥ 30 kg/m³ and must not smoulder".
3. **Masonry:**
   Bricks (gross density class) and minimum wall thickness according to EN 1996-1-2: 2011-04.
4. **Masonry connection** (vertically adjustable)
5. **Expansion joint**
6. **Concrete**

**Anchor spacings**

HALFEN Brick tie anchors can be used at any position along the whole length of the brick tie channel. Generally the standard spacing between the anchors is 250 mm (4 anchors per metre).
**Product description**

The restraint with turnbuckle SPV is suitable for compressive and tensile loads up to \( F_{Ed} = 14.0 \text{kN} \) and for clearances up to 200 mm. By turning the clamping sleeve (sleeve has a right and left-hand thread), the clearance can be freely adjusted within the given range. Connected to the building structure using HALFEN Cast-in channels (order separately).

**Included in delivery**

- Turnbuckle SPH
- 2 HALFEN Bolts (1 right-hand thread, 1 left-hand thread)
- 3 standard nuts
- 2 washers and 2 SIC locking washers

**Ordering example:**

Item name: SPV - 7.0 - 100 - A4

<table>
<thead>
<tr>
<th>Type</th>
<th>Stand-off distance</th>
<th>HALFEN Bolt left-hand thread</th>
<th>Sleeve</th>
<th>HALFEN Bolt right-hand thread</th>
<th>Sleeve</th>
<th>HALFEN Bolt left-hand thread</th>
<th>Sleeve</th>
<th>HALFEN Bolt left-hand thread</th>
<th>Sleeve</th>
</tr>
</thead>
<tbody>
<tr>
<td>100±10</td>
<td>50</td>
<td>60</td>
<td>40</td>
<td>50</td>
<td>60</td>
<td>40</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>120±15</td>
<td>50</td>
<td>75</td>
<td>60</td>
<td>50</td>
<td>75</td>
<td>60</td>
<td>80</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>140±15</td>
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</tr>
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<td>160±15</td>
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</tr>
<tr>
<td>180±15</td>
<td>50</td>
<td>115</td>
<td>60</td>
<td>50</td>
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<td>60</td>
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<td>135</td>
<td>60</td>
<td>80</td>
<td>135</td>
<td>60</td>
</tr>
</tbody>
</table>

**HALFEN Cast-in channel**

<table>
<thead>
<tr>
<th>HTA-CE 38/17</th>
<th>HTA-CE 38/17</th>
<th>HTA-CE 49/30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short elements 150, 200 and 250</td>
<td>With ( F_{Ed} )-load group 9.8 kN restricted to negative tolerance</td>
<td></td>
</tr>
</tbody>
</table>

For further concrete façades accessories see the FB Concrete Façade catalogue
### Halfen HKZ Restraint Tie

#### Product characteristics

The serrations in the bracket and in the washer ensure positive static load transmission.

Two Halfen Cast-in channels embedded at right angle in the concrete ensure three-dimensional adjustability.

Please order Halfen Cast-in channels and Halfen Bolts and washers separately.

#### Halfen HKZ Restraint tie

<table>
<thead>
<tr>
<th>Characteristics:</th>
<th>Type selection: A4 = Stainless steel grade 1.4571/1.4404</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Length</td>
<td>Spacing</td>
</tr>
<tr>
<td>Type clearance (a_1)</td>
<td>(l)</td>
<td>(a_1)</td>
</tr>
<tr>
<td>HKZ 28/15 - 75 - GV</td>
<td>HKZ 28/15 - 75 - A4</td>
<td>115</td>
</tr>
<tr>
<td>HKZ 28/15 - 100 - GV</td>
<td>HKZ 28/15 - 100 - A4</td>
<td>140</td>
</tr>
<tr>
<td>HKZ 28/15 - 125 - GV</td>
<td>HKZ 28/15 - 125 - A4</td>
<td>165</td>
</tr>
<tr>
<td>HKZ 28/15 - 150 - GV</td>
<td>HKZ 28/15 - 150 - A4</td>
<td>190</td>
</tr>
<tr>
<td>HKZ 28/15 - 175 - GV</td>
<td>HKZ 28/15 - 175 - A4</td>
<td>215</td>
</tr>
<tr>
<td>HKZ 28/15 - 200 - GV</td>
<td>HKZ 28/15 - 200 - A4</td>
<td>240</td>
</tr>
<tr>
<td>HKZ 28/15 - 250 - GV</td>
<td>HKZ 28/15 - 250 - A4</td>
<td>290</td>
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<td>HKZ 38/17 - 75 - GV</td>
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<td>HKZ 38/17 - 100 - A4</td>
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<tr>
<td>HKZ 38/17 - 125 - GV</td>
<td>HKZ 38/17 - 125 - A4</td>
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<td>HKZ 38/17 - 200 - A4</td>
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<td>HKZ 38/17 - 225 - GV</td>
<td>HKZ 38/17 - 225 - A4</td>
<td>265</td>
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<tr>
<td>HKZ 38/17 - 250 - GV</td>
<td>HKZ 38/17 - 250 - A4</td>
<td>290</td>
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<tr>
<td>HKZ 38/17 - 275 - GV</td>
<td>HKZ 38/17 - 275 - A4</td>
<td>315</td>
</tr>
<tr>
<td>HKZ 38/17 - 300 - GV</td>
<td>HKZ 38/17 - 300 - A4</td>
<td>340</td>
</tr>
</tbody>
</table>

\(a_1\) The load capacities apply for the HKZ-restraint ties. The channel A and the fixing dowel/channel B must be verified, depending on the edge distance \(c_1\), the concrete grade and the reinforcement, for each application.
**ROOF AND WALLS**

**Restraint Tie HKZ - GF/GU**

The serrations in the bracket and in the washer ensure positive static load transmission. The double-sided attachment using a HALFEN Bolt and a threaded plate ensures positive and slippage-free wind anchoring when used in combination with HALFEN HTA-CE Cast-in channels set in concrete; the connection is three-dimensionally adjustable.

Please order HALFEN Cast-in channels and HALFEN Bolts and washers separately.

### Product description

The load capacities apply for the HKZ-restraint ties. The channel A and the fixing dowel/channel B must be verified, depending on the edge distance $c_1$, the concrete grade and the reinforcement, for each application.

**HALFEN Restraint ties, type HKZ-GF and type HKZ-GU**

<table>
<thead>
<tr>
<th>Characteristics:</th>
<th>Type selection:</th>
<th>Type</th>
<th>$a_1$ [mm]</th>
<th>Length $l$ [mm]</th>
<th>Spacing $a_1$ [mm]</th>
<th>Tolerance</th>
<th>Slot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load capacity $F_{Ed}$ [kN]</td>
<td>GV = galvanized not suitable for façades with ventilation gap</td>
<td>Type</td>
<td>$a_1$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>±4.9</td>
<td>HKZ - GF 28/15 - 75 - GV</td>
<td>HKZ - GF 28/15 - 100 - A4</td>
<td>115</td>
<td>75</td>
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<td></td>
<td></td>
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<tr>
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<td>HKZ - GF 28/15 - 125 - A4</td>
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<tr>
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<td>HKZ - GF 28/15 - 125 - GV</td>
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<td>165</td>
<td>125</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>HKZ - GF 28/15 - 150 - GV</td>
<td>HKZ - GF 28/15 - 175 - A4</td>
<td>190</td>
<td>150</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>HKZ - GF 28/15 - 175 - GV</td>
<td>HKZ - GF 28/15 - 175 - A4</td>
<td>215</td>
<td>175</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| ±9.8 | HKZ - GF 38/17 - 100 - GV | HKZ - GF 38/17 - 125 - A4 | 140 | 100 | | | |
| | HKZ - GF 38/17 - 125 - GV | HKZ - GF 38/17 - 150 - A4 | 165 | 125 | | | |
| | HKZ - GF 38/17 - 150 - GV | HKZ - GF 38/17 - 175 - A4 | 190 | 150 | | | |
| | HKZ - GF 38/17 - 175 - GV | HKZ - GF 38/17 - 200 - A4 | 215 | 175 | | | |
| | HKZ - GF 38/17 - 200 - GV | HKZ - GF 38/17 - 225 - A4 | 240 | 200 | | | |
| | HKZ - GF 38/17 - 225 - GV | HKZ - GF 38/17 - 225 - A4 | 265 | 225 | | | |
| | HKZ - GF 38/17 - 225 - GV | HKZ - GF 38/17 - 250 - A4 | 290 | 250 | | | |
| ±16.8 | HKZ - GF 50/30 - 200 - GV | HKZ - GF 50/30 - 225 - A4 | 240 | 200 | | | |
| | HKZ - GF 50/30 - 225 - GV | HKZ - GF 50/30 - 225 - A4 | 265 | 225 | | | |
| | HKZ - GF 50/30 - 250 - GV | HKZ - GF 50/30 - 250 - A4 | 290 | 250 | | | |
| | HKZ - GF 50/30 - 250 - GV | HKZ - GF 50/30 - 275 - A4 | 315 | 275 | | | |
| | HKZ - GF 50/30 - 275 - GV | HKZ - GF 50/30 - 300 - A4 | 340 | 300 | | | |

Please order HALFEN Cast-in channels and HALFEN Bolts and washers separately.
**ROOF AND WALLS**

**HVL Precast Connection**

**Assembly:**
The connecting strap is delivered ready to be installed: The bolt fastening sets and the counter plate are pre-assembled for fast installation.

**Assembly part HVL-M**
Pre-assembled, consisting of:
- serrated hammer-head strap
- 1 serrated counter plate
- 2 bolt sets
(Bolt HS 38/17 - M12 × 50 + washer + tapered compressed spring)

**Installation component 1 HVL-E:**
HALFEN Cast-in channel HTA 38/17-300-SK with 2 bolt anchors and one loop end anchor.

**Installation component 2:**
HALFEN Cast-in channel HTA-CE 38/17-150 with 2 bolt anchors.

**Corrosion protection**
- hammer-head strap, cast-in channel: hot-dip galvanized
- HALFEN Bolts, nuts, washers and springs: galvanized
These parts are covered by mortar after installation.

**Longitudinal section**

**Cross section**

**Plan view**

**On-site reinforcement ∅28**
ROOF AND WALLS
HALFEN HKW Corner Guard

Column edge, typical cross-section

Advantages:
- 92° angle ensures a tight fit to the formwork. This prevents concrete seeping between the formwork and the corner profile, resulting in a smoother finish.
- U-shaped concrete reinforced anchors do not restrict the corner reinforcement and allow easy installation of the reinforcement.
- Anchors are of reinforcement steel quality to guarantee optimal anchorage.
- Competitive pricing through serial production.

Material/Finish:
- FV - Corner profile: Steel hot-dip galvanized 1.0038
  Anchor: B500B (BSt 500 S)
- A2 - Corner profile: Stainless steel 1.4307
  Anchor: B500B/A NR

Ordering example:
HKW 50/5 - A2 - 2000/4

<table>
<thead>
<tr>
<th>Corner guard HKW</th>
<th>Material/Finish:</th>
<th>Anchor</th>
<th>Length / no. of anchors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Material/Finish:</td>
<td>Dimensions</td>
<td>Radius</td>
</tr>
<tr>
<td>HKW 50/5 -</td>
<td>FV - hot-dip galvanized</td>
<td>A2 - Stainless steel</td>
<td></td>
</tr>
<tr>
<td>500 / 2</td>
<td>FV</td>
<td>A2</td>
<td>75 × 55</td>
</tr>
<tr>
<td>750 / 2</td>
<td>FV</td>
<td>A2</td>
<td></td>
</tr>
<tr>
<td>1000 / 2</td>
<td>FV</td>
<td>A2</td>
<td></td>
</tr>
<tr>
<td>1500 / 3</td>
<td>FV</td>
<td>A2</td>
<td></td>
</tr>
<tr>
<td>2000 / 4</td>
<td>FV</td>
<td>A2</td>
<td></td>
</tr>
<tr>
<td>HKW 80/6 -</td>
<td>FV</td>
<td>A2</td>
<td>100 × 85</td>
</tr>
<tr>
<td>500 / 2</td>
<td>FV</td>
<td>A2</td>
<td></td>
</tr>
<tr>
<td>750 / 2</td>
<td>FV</td>
<td>A2</td>
<td></td>
</tr>
<tr>
<td>1000 / 2</td>
<td>FV</td>
<td>A2</td>
<td></td>
</tr>
<tr>
<td>1500 / 3</td>
<td>FV</td>
<td>A2</td>
<td></td>
</tr>
<tr>
<td>2000 / 4</td>
<td>FV</td>
<td>A2</td>
<td></td>
</tr>
<tr>
<td>HKW 100/8 -</td>
<td>FV</td>
<td>A2</td>
<td>110 × 85</td>
</tr>
<tr>
<td>500 / 2</td>
<td>FV</td>
<td>A2</td>
<td></td>
</tr>
<tr>
<td>750 / 2</td>
<td>FV</td>
<td>A2</td>
<td></td>
</tr>
<tr>
<td>1000 / 2</td>
<td>FV</td>
<td>A2</td>
<td></td>
</tr>
<tr>
<td>1500 / 3</td>
<td>FV</td>
<td>A2</td>
<td></td>
</tr>
<tr>
<td>2000 / 4</td>
<td>FV</td>
<td>A2</td>
<td></td>
</tr>
</tbody>
</table>
HALFEN CURTAIN WALL SYSTEM

The advantages at a glance

Modern buildings require façades of the highest quality that can be installed quickly and safely. This is the reason the HALFEN Curtain Wall System is chosen more and more frequently by architects and investors.

**Fast and cost-effective**
- 3-dimensional adjustable connection when used with cast-in channels
- uses bolts instead of welding
- fast assembly reduces installation time

For modular façades. Anchored to the top surface of floor slabs.

**HCW-B2 Bracket**

For post and beam façades. Anchored to the edges of slabs.

**HCW-ED/-EW Brackets**

For post and beam façades. Anchored to the top surface of floor slabs.

**HCW-B1 Bracket**
HALFEN CURTAIN WALL SUPPORT SYSTEMS

General

HALFEN Curtain wall system

This type of construction is characterized by an outer wall with a continual outer skin (see figure 1).

The façade is attached to the main structure of the building using only the required number of point-load connections.

Curtain wall façades protect the interior of buildings from external, unwanted environmental influences whilst still permitting visual contact with the outside environment with structural components that can be opened or are transparent. Specifically, this includes sufficient stability against wind loads, adequate insulation against frost in winter, heat in summer as well as against external noise.

In addition, various requirements must be met to protect against fire and other critical situations.

Post and beam façade and the modular façade

Basically, we distinguish between two methods of curtain wall façades:

› the post and beam façade
› and the modular façade.

Post and beam façade

One basic distinctive difference is the way expansion in the façade is distributed (for example; thermal expansion).

With the post and beam façade (see figure 2) the vertical and horizontal frame supports are installed in spacings corresponding to the façade elements. The supports are installed with an expansion gap between components allowing for sufficient expansion.

The respective longitudinal and transverse connections have an expandable joint. The filler elements (glass or panel) installed in a post and beam structure permit movement within the tolerance of the designed expansion joint. The glass and filler elements are delivered separately and are then installed on site, requiring on-site scaffolding.

Modular façade

With the modular façade method (see figure 3), the façade is made of prefabricated elements, in which glass, natural stone or infills are pre-installed. The façade profiles are designed as a key and slot system to allow for expansion.

This method provides immediate weather protection and allows the building contractor to start interior work on the respective floor directly after the prefabricated modules have been installed.

Scaffolding is not required with this method of construction.
HALFEN CURTAIN WALL SUPPORT SYSTEMS

Product range

Load conditions and required HALFEN Cast-in channels

Standard slab thickness
with standard tensile and transverse tensile loads
HALFEN Channels with bolt anchors and weld-on I-anchors

see pages 14-15, 30

Thin slabs (thickness ≥ 12.5 cm)
with high transverse tensile loads
and small edge distance
HALFEN Curtain wall channel
HCW 52/34
(not included in the HTA-CE approval)

see pages 72-73

Thin slabs (thickness ≥ 10 cm)
with high tension loads
HALFEN Channels HTA-R or HZA-R
with rebar anchors
(not included in the HTA-CE and HZA approvals)

see page 75

Hot-rolled serrated channels and bolts

<table>
<thead>
<tr>
<th>Load conditions and required HALFEN Cast-in channels</th>
<th>Hot-rolled serrated channels and bolts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard slab thickness with standard tensile and...</td>
<td>HZS 29/20 M12</td>
</tr>
<tr>
<td>transverse tensile loads</td>
<td>HZS 38/23 M12, M16</td>
</tr>
<tr>
<td>HALFEN Channels with bolt anchors and weld-on I-...</td>
<td>HZS 53/34 M16, M20</td>
</tr>
<tr>
<td>anchors</td>
<td>HZS 64/44 M20, M24</td>
</tr>
<tr>
<td></td>
<td>HZA 29/20 M12</td>
</tr>
<tr>
<td></td>
<td>HZA 38/23 M12, M16</td>
</tr>
<tr>
<td></td>
<td>HZA 53/34 M16, M20</td>
</tr>
<tr>
<td></td>
<td>HZA 64/44 M20, M24</td>
</tr>
</tbody>
</table>

Thin slabs (thickness ≥ 10 cm)
with high tension loads
HALFEN Channels HTA-R or HZA-R
with rebar anchors
(not included in the HTA-CE and HZA approvals)

see page 75

Hot-rolled serrated channels with rebar anchors and bolts

<table>
<thead>
<tr>
<th>Load conditions and required HALFEN Cast-in channels</th>
<th>Hot-rolled serrated channels with rebar anchors and bolts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard slab thickness with standard tensile and...</td>
<td>HZS 29/20 M12</td>
</tr>
<tr>
<td>transverse tensile loads</td>
<td>HZS 38/23 M12, M16</td>
</tr>
<tr>
<td>HALFEN Channels with bolt anchors and weld-on I-...</td>
<td>HZS 53/34 M16, M20</td>
</tr>
<tr>
<td>anchors</td>
<td>HZA-R 29/20 M12</td>
</tr>
<tr>
<td></td>
<td>HZA-R 38/23 M16, M20</td>
</tr>
<tr>
<td></td>
<td>HZA-R 53/34 M16, M20</td>
</tr>
</tbody>
</table>

see page 75
### Hot-rolled (standard) channels and bolts

<table>
<thead>
<tr>
<th>Channel Type</th>
<th>Dimensions</th>
<th>Bolt Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS 40/22 M12, M16</td>
<td>59.5 mm x 50 mm</td>
<td>M12, M16, M20</td>
</tr>
<tr>
<td>HS 50/30 M12, M16, M20</td>
<td>49 mm x 50 mm</td>
<td>M12, M16</td>
</tr>
<tr>
<td>HS 72/48 M20, M24, M27, M30</td>
<td>52.5 mm x 101 mm</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Channel Type</th>
<th>Dimensions</th>
<th>Bolt Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTA-CE 40/22P</td>
<td>22.5 mm x 39 mm</td>
<td></td>
</tr>
<tr>
<td>HTA-CE 50/30P</td>
<td>22.5 mm x 113 mm</td>
<td></td>
</tr>
<tr>
<td>HTA-CE 52/34</td>
<td>22.5 mm x 102 mm</td>
<td></td>
</tr>
<tr>
<td>HTA-CE 72/48</td>
<td>32.5 mm x 191 mm</td>
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</table>

### Cold-rolled (standard) channels and bolts

<table>
<thead>
<tr>
<th>Channel Type</th>
<th>Dimensions</th>
<th>Bolt Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS 38/17 M12, M16</td>
<td>52.5 mm x 81 mm</td>
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</tr>
<tr>
<td>HS 40/22 M12, M16</td>
<td>22 mm x 103 mm</td>
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</tr>
<tr>
<td>HS 50/30 M12, M16, M20</td>
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</tr>
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</table>

### Hot-rolled (smooth) channels with rebar anchors and bolts

<table>
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<tr>
<th>Channel Type</th>
<th>Dimensions</th>
<th>Bolt Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS 40/22 M12, M16</td>
<td>39.5 mm x 50 mm</td>
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</tr>
<tr>
<td>HS 50/30 M12, M16, M20</td>
<td>49 mm x 50 mm</td>
<td></td>
</tr>
<tr>
<td>HTA-R 40/22</td>
<td>22 mm x 72 mm</td>
<td></td>
</tr>
<tr>
<td>HTA-R 50/30</td>
<td>22 mm x 113 mm</td>
<td></td>
</tr>
<tr>
<td>HTA-R 52/34</td>
<td>22 mm x 102 mm</td>
<td></td>
</tr>
</tbody>
</table>

### Cold-rolled (smooth) channels with rebar anchors and bolts

<table>
<thead>
<tr>
<th>Channel Type</th>
<th>Dimensions</th>
<th>Bolt Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS 38/17 M12, M16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HS 40/22 M12, M16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HS 50/30 M12, M16, M20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Accessories

- **Curtain Wall Support Systems**
- **Product Range**
- **HCW 52/34 with bolts and bracket**
- **Cold-rolled (smooth) channels with rebar anchors and bolts**
- **Cold-rolled (standard) channels and bolts**
- **Hot-rolled (standard) channels and bolts**
- **Hot-rolled (smooth) channels with rebar anchors and bolts**

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HALFEN CURTAIN WALL SUPPORT SYSTEMS
HALFEN Channel HCW 52/34

Typical installation

Curtain wall mullion
Bracket (example)
HALFEN Curtain wall channel HCW 52/34
Concrete slab

Product description

Identification: HCW 52/34
Material: hot-dip galvanized

Dimensions in [mm]

Note: HALFEN Channel HCW 52/34 is not included in the HTA-CE/HZA approval.
HALFEN CURTAIN WALL SUPPORT SYSTEMS
HALFEN Cast-in Channel HCW 52/34

Channel load data
The following load failure were averaged from three tests:

- $F_{V, failure} = 142.3 \text{ kN}$
- $F_{N, failure} = 47.4 \text{ kN}$
- $F_{res, failure} = \sqrt{F_{V, failure}^2 + F_{N, failure}^2} = 150.0 \text{ kN}$

The load deformation diagram (see right) may be used to determine allowable loads based on acceptable displacement and the required safety factor according to local building codes. The diagram is based on the following:

- tensile and transverse loads were increased at a ratio of 1:3 up to breaking point
- concrete slab thickness ≥ 125 mm and reinforcement as shown on page 72
- concrete strength class ≥ C 20/25 N/mm²
- load is transferred into the channel via two HALFEN Bolts HS 50/30 M20 Grade 8.8. The bolt spacing is 150 mm. A sample calculation is shown below.

The safety factor is freely selected. However, it must be determined which factors are actually to be implemented, whether these are based on project specific boundary condition or on valid building regulations.

Calculation example: Assumed safety factor $\nu = 3$
(failure test load / working load)

Average failure load from the tests:
- Transverse tensile stress $F_{V, ultimate} = 142.3 \text{ kN}$
- Tensile stress $F_{N, ultimate} = 47.4 \text{ kN}$
- Res. diagonal tensile load $F_{res, ultimate} = 150.0 \text{ kN}$

Actual working loads at bolts (specification by façade engineer):
- Transverse tensile stress $F_V = 35 \text{ kN}$
- Tensile stress $F_N = 10 \text{ kN}$

Allowable load with $\nu = 3$ against average ultimate load from tests:
- perm. $F_V = 142.3 / 3 = 47.4 \text{ kN}$
- perm. $F_N = 47.4 / 3 = 15.8 \text{ kN}$
- perm. $F_{res} = 150 / 3 = 50.0 \text{ kN}$

Control: Working load $F_V = 35 \text{ kN} < 47.4 \text{ kN}$
- Working load $F_N = 10 \text{ kN} < 15.8 \text{ kN}$
- Working load $F_{res} = \sqrt{(10)^2 + (35)^2} = 36.4 \text{ kN} < 50.0 \text{ kN}$

Displacement at working load < 1 mm (see diagram).
Actual safety factor for average ultimate load $\gamma_1 = (150 / 36.4) = 4.12$.

Corresponding HALFEN Bolts HS 50/30
Depending on the load size, we also recommend using HALFEN Bolts HS 50/30 M16 or M20, grade 8.8 in combination with HALFEN Cast-in channel HCW 52/34. The bolts stated below are zinc galvanized with a special coating.

For interior use this design is considered equivalent to a hot-dip galvanized design. Other bolt sizes and materials can be supplied. Please contact us for detailed information. Addresses can be found at the back of this catalogue.

Type selection HALFEN Bolts HS 50/30 GV Grade 8.8

<table>
<thead>
<tr>
<th>Thread</th>
<th>Material grade</th>
<th>Available length [mm]</th>
<th>Allowable resulting bolt load (all directions) perm. $F_r$ [kN]</th>
<th>Allowable bending moment [Nm]</th>
<th>Recommended torque [Nm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 16</td>
<td>8.8</td>
<td>40, 60, 80, 100</td>
<td>36.1</td>
<td>111</td>
<td>60</td>
</tr>
<tr>
<td>M 20</td>
<td>8.8</td>
<td>45, 60, 80, 100</td>
<td>56.4</td>
<td>216</td>
<td>120</td>
</tr>
</tbody>
</table>

⚠️ If the bolt is stressed in the direction of a slot its load capacity must be verified taking bolt flexure into account.
HALFEN CURTAIN WALL SUPPORT SYSTEMS
Application Examples

Fixing of a curtain wall system using HCW-B2 Brackets connected to HTA-CE Cast-in channels

Fixing of a post and beam façade using HCW-ED Brackets on HTA-CE Cast-in channels

Fixing of a modular façade using HCW-ED Brackets on HTA-CE Cast-in channels

Typical curtain wall fixing with HTA-CE Cast-in channels

Liberty Life, Johannesburg

Torre Espacio, Madrid

Post office Tower, Bonn

Sage Centre, Gateshead

Burj Chalifa, Dubai

Edificio Gas Natural, Barcelona

Westin Libertador Hotel, Lima

World Financial Center, Shanghai
HALFEN CURTAIN WALL SUPPORT SYSTEMS
HALFEN Cast-in Channels with Rebar Anchor HTA-R and HZA-R

Design basics

Structural analysis

Material resistance shear

Material resistance tension

Material resistance resulting diagonal pull

Material resistance Design load

Shear

Tension

Material resistance shear

Material resistance tension

Material resistance resulting diagonal pull

HALFEN Channels HTA-R and HZA-R — Design values for material resistance

The minimum edge distance shown in the table applies to reinforced concrete

**HALFEN Cast-in channel type**

<table>
<thead>
<tr>
<th>Concrete strength grade ⩾ C20/25</th>
<th>HTA-R 38/17 ⊕</th>
<th>HTA-R 40/25 ⊕</th>
<th>HTA-R 49/30 ⊕</th>
<th>HTA-R 54/33 ⊕</th>
</tr>
</thead>
<tbody>
<tr>
<td>f_{ck,cyl.} = 20 N/mm²</td>
<td>350 mm 3 anchors</td>
<td>350 mm 3 anchors</td>
<td>350 mm 3 anchors</td>
<td>350 mm 3 anchors</td>
</tr>
<tr>
<td>f_{ck,cube} = 25 N/mm²</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material:</td>
<td>Channel ⊕</td>
<td>Channel ⊕</td>
<td>Channel ⊕</td>
<td>Channel ⊕</td>
</tr>
<tr>
<td>hot-dip galvanized</td>
<td>1.0038</td>
<td>1.0044</td>
<td>1.4571</td>
<td>1.4404 ⊕</td>
</tr>
<tr>
<td>Material:</td>
<td>Anchor ⊕</td>
<td>Anchor ⊕</td>
<td>Anchor ⊕</td>
<td>Anchor ⊕</td>
</tr>
<tr>
<td>stainless steel</td>
<td>B5008 (BSt 500S)</td>
<td>B5008 (BSt 500S)</td>
<td>B5008 (BSt 500S)</td>
<td>B5008 (BSt 500S)</td>
</tr>
</tbody>
</table>

**Notes:**
HALFEN Cast-in channels HTA-R / HZA-R are not included in the HTA-CE/HZA approval

Other channel lengths from 150–6070 mm are available.
HALFEN CURTAIN WALL SUPPORT SYSTEMS
Edge of Slab Brackets HCW-ED Post and Beam Façades

Application example

HALFEN Edge of slab brackets are connected in pairs, one each side of the mullion, and are available in two types:

› Type HCW-ED Brackets are designed to support both vertical and horizontal loads.

› Type HCW-EW Brackets are designed to support only horizontal wind loads.

The brackets guarantee a simple adjustable connection. The HALFEN Bolts (connection: bracket to HALFEN Channel) and the standard hexagonal bolts M12 (connection: bracket to façade mullion) must be grade strength 8.8.

A round auxiliary hole in the long arm of the brackets can be used for temporary attachments. For example; temporary fixing of brackets to support the post with self-tapping screws until the final connection is made.

The brackets are made of high quality aluminium material. Special nylon discs are placed between the “Wind load” Bracket HCW-EW and support post.

To guarantee correct installation, the HCW-ED brackets are marked ‘R’ for right, ‘L’ for left and ‘UP’ for top.

Bracket dimensions [mm]

HCW-ED Brackets for dead loads and wind loads

<table>
<thead>
<tr>
<th>Size</th>
<th>Bracket code</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>J</th>
<th>L</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>HCW-ED 1</td>
<td>108</td>
<td>70</td>
<td>114</td>
<td>10</td>
<td>57</td>
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<td>25</td>
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<td>57</td>
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<td></td>
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<td></td>
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<td></td>
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<tr>
<td>Medium</td>
<td>HCW-ED 2</td>
<td>133</td>
<td>70</td>
<td>127</td>
<td>10</td>
<td>64</td>
<td>64</td>
<td>51</td>
<td>51</td>
<td>36</td>
<td>40</td>
<td>82</td>
</tr>
<tr>
<td>Large</td>
<td>HCW-ED 3</td>
<td>159</td>
<td>70</td>
<td>140</td>
<td>10</td>
<td>70</td>
<td>64</td>
<td>76</td>
<td>51</td>
<td>36</td>
<td>40</td>
<td>108</td>
</tr>
</tbody>
</table>

HCW-EW Brackets wind loads only

<table>
<thead>
<tr>
<th>Size</th>
<th>Bracket code</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>J</th>
<th>L</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>HCW-EW 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>HCW-EW 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>HCW-EW 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large</td>
<td>HCW-EW 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Serrated washers must be ordered separately
HALFEN CURTAIN WALL SUPPORT SYSTEMS

Dimensioning

**Interaction diagram for type HCW-ED1 (small)**

![Interaction diagram for type HCW-ED1 (small)](image)

- Design value of the vertical acting load $F_{vd}$ [kN]
- Design value of the horizontal acting load $F_{hd}$ [kN]
- Required connecting bolt M12 Grade 8.8

**Interaction diagram for type HCW-ED2 (medium)**

![Interaction diagram for type HCW-ED2 (medium)](image)

- Design value of the vertical acting load $F_{vd}$ [kN]
- Design value of the horizontal acting load $F_{hd}$ [kN]
- Required connecting bolt M12 Grade 8.8

**Interaction diagram for type HCW-ED3 (large)**

![Interaction diagram for type HCW-ED3 (large)](image)

- Design value of the vertical acting load $F_{vd}$ [kN]
- Design value of the horizontal acting load $F_{hd}$ [kN]
- Required connecting bolt M12 Grade 8.8

**Calculation basis**

![Calculation basis](image)

- Permitted load interaction area

**Definition of loads at bracket / post connection**

- $F_{vd}$
- $F_{hd}$

**Design value of the horizontal acting load $F_{hd}$ [kN]**

-25 25 20 -20 -15 15 -10 10 -5 5

**Design value of the vertical acting load $F_{vd}$ [kN]**

-7.0 3.5 6.8 6.8 7.0 7.0 6.8 6.8

**Permitted load interaction area**

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HALFEN CURTAIN WALL SUPPORT SYSTEMS
Design Loads using two HCW-EW Brackets, Loads in the HALFEN Bolts (HCW-ED)

Design wind loads for type HCW-EW

<table>
<thead>
<tr>
<th>Size</th>
<th>Bracket code</th>
<th>max. Fvd [kN]</th>
<th>max. Fhd [kN]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>HCW-EW 1</td>
<td>0</td>
<td>8.5</td>
</tr>
<tr>
<td>Large</td>
<td>HCW-EW 3</td>
<td>0</td>
<td>13.96</td>
</tr>
</tbody>
</table>

HCW-EW Brackets are only suitable for wind loads.

Forces acting on the T-head bolts at the channel (HCW-ED)

The components of the design-reaction forces in the HALFEN Bolts at the connection of the curtain wall bracket to HALFEN Cast-in channel, are calculated by multiplying the design loads Fvd and Fhd at connection curtain wall bracket and façade support post with the factors sx, sy and sz.

The factors are dependent on the bracket geometry, the load direction and the bolt position (see figure on the right). See table below for multiplication factors for determining the design reaction forces in the HALFEN Bolts.

### Lower installation position of HALFEN Bolt (Position 3)

<table>
<thead>
<tr>
<th>Bracket</th>
<th>Dead load $S_x = (Fvd / 2) \times s_x$</th>
<th>Wind load $S_y = (Fhd / 2) \times s_y$</th>
<th>Resulting load 45° $S_z = (res. Fd / 2) \times s_z$</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCW-ED 1</td>
<td>0.5 3.2 −1.0 1.0 0.0  −0.3 3.0  −0.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCW-ED 2</td>
<td>0.5 3.6 −1.0 −0.5 1.0 0.0  0.0 3.3  −0.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCW-ED 3</td>
<td>0.5 4.0 −1.0 −0.4 1.0 0.0  0.1 3.5  −0.7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Upper installation position of HALFEN Bolt (Position 1)

<table>
<thead>
<tr>
<th>Bracket</th>
<th>Dead load $S_x = (Fvd / 2) \times s_x$</th>
<th>Wind load $S_y = (Fhd / 2) \times s_y$</th>
<th>Resulting load 45° $S_z = (res. Fd / 2) \times s_z$</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCW-ED 1</td>
<td>0.6 1.3 −1.0 −1.0 3.6 0.0 −0.3 3.4  −0.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCW-ED 2</td>
<td>0.6 1.6 −1.0 −0.5 3.1 0.0 0.0 3.4  −0.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCW-ED 3</td>
<td>0.6 1.9 −1.0 −0.4 2.9 0.0 0.1 3.4  −0.7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Calculation example

**Assumed:** slab thickness = 200 mm, width of mullion = 80 mm, projection a = 80 mm (install. position see page 79)

design dead load $Fvd = +3.5$ kN

design wind load (wind suction) $Fhd = +7.0$ kN

**Selected:** HALFEN Bracket type HCW-ED 2

⇒ possible projection M = 82 ± 25 mm

⇒ Interaction diagram type HCW-ED 2 (see page 77) proves that the assumed load is within the permitted load interaction zone

### Determination of the design reaction forces in a HALFEN Bolt

#### Lower installation position (Position 3)

- $S_x = (3.5/2) \times 0.5 + (7/2) \times (-0.5) = -0.88$ kN
- $S_y = (3.5/2) \times 3.6 + (7/2) \times 1.0 = +9.80$ kN
- $S_z = (3.5/2) \times (-1.0) = 1.75$ kN

⇒ Resulting bolt load

$S_d = \sqrt{(-0.88)^2 + (9.80)^2 + (1.75)^2} = 9.99$ kN per bolt

#### Upper installation position (Position 1)

$S_x = (3.5/2) \times 0.6 + (7/2) \times (-0.5) = -0.70$ kN

$S_y = (3.5/2) \times 1.6 + (7/2) \times 3.1 = +13.65$ kN

$S_z = (3.5/2) \times (-1.0) = 1.75$ kN

⇒ Resulting bolt load

$S_d = \sqrt{(-0.70)^2 + (13.65)^2 + (1.75)^2} = 13.78$ kN ⇒ each bolt
determining factor for bolt selection

Selected HALFEN Channel:

- **HTA-R 50/30 - 350 - 3 Anchor - FV** see page 75
  with $V_{yd} = 2 \times 5.6$ kN $> 2 \times |S_d| = 2 \times 1.75$
  $(a = 75$ mm)$
  $F_{rd} = 2 \times 14.0$ kN $> 2 \times$ res. $S_d = 2 \times 13.78$ kN

Check: bolt spacing: $P = 80 + 2 \times 36 = 152$ mm

Selected HALFEN Channel: $> 150$ mm

**HS 50/30 - M12 × 60 GV 8.8**

Requirement according to interaction diagram see page 77
HALFEN CURTAIN WALL SUPPORT SYSTEMS
Top of Slab Brackets HCW-B1

Support brackets for horizontal and vertical loads

HALFEN Brackets HCW-B1
HALFEN Brackets HCW-B1 for installing to the top of concrete slabs, are available in two load ranges and three cantilever sizes.
The brackets are made in grade S355 quality galvanized steel. Vertical adjustibility is ±10 mm.
Three-dimensional adjustibility is ensured when used in combination with HALFEN HTA-CE Cast-in channels.

Typical installation

The lateral connecting plates are connected to the façade posts using M8 screws (not included). The façade planner is responsible for providing the static verification for the support posts. Use M16 HALFEN Bolts, grade 8.8 (order separately), to connect the base bracket to the HALFEN Cast-in channel. Depending on the façade type, the connection between the connecting plate and the base bracket can be designed either laterally adjustable or as a fixed point.

Dimensioning / Type selection

<table>
<thead>
<tr>
<th>Load range</th>
<th>dead load $F_{vd}$ [kN]</th>
<th>wind load $F_{hd}$ [kN] (wind suction + compression)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/12</td>
<td>4</td>
<td>±12</td>
</tr>
<tr>
<td>7/20</td>
<td>7</td>
<td>±20</td>
</tr>
</tbody>
</table>

$F_{vd}, F_{hd}$: allowable design loads with a partial safety factor $\gamma_f = 1.35$ for dead load and $\gamma_f = 1.5$ for wind load.

Type selection

<table>
<thead>
<tr>
<th>Load range</th>
<th>a [mm]</th>
<th>Item name</th>
<th>L [mm]</th>
<th>W [mm]</th>
<th>HALFEN Channel ○</th>
<th>Recommended HALFEN Bolt</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/12</td>
<td>50</td>
<td>...-4/12-50</td>
<td>270</td>
<td>150</td>
<td>HTA-CE 40/22</td>
<td>HS 40/22 M16-60 8.8</td>
</tr>
<tr>
<td></td>
<td>75</td>
<td>...-4/12-75</td>
<td>295</td>
<td>150</td>
<td>2 Anchors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>...-4/12-100</td>
<td>320</td>
<td>150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7/20</td>
<td>50</td>
<td>...-7/20-50</td>
<td>270</td>
<td>175</td>
<td>HTA-CE 50/30P-300</td>
<td>HS 50/30 M16-60 8.8</td>
</tr>
<tr>
<td></td>
<td>75</td>
<td>...-7/20-75</td>
<td>295</td>
<td>175</td>
<td>3 Anchors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>...-7/20-100</td>
<td>320</td>
<td>200</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

○ Recommended HALFEN Channel exploiting full load capacity of bracket

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HALFEN CURTAIN WALL SUPPORT SYSTEMS
Top of Slab Brackets HCW-B2

Brackets for horizontal and vertical loads

HALFEN Brackets HCW-B2
HALFEN Brackets HCW-B2 are made in grade S355 quality galvanized steel. The vertical adjustability is ±24 mm. Three-dimensional adjustability is ensured when used in combination with HALFEN Cast-in channels HTA-CE. The lateral connecting plates are connected to the façade posts using M12 screws (not included in delivery).

The façade planner is responsible for providing the static verification for the support posts. Use M16 HALFEN Bolts, grade 8.8 (order separately), to connect the base bracket to the HALFEN Cast-in channel. Depending on the façade type, the connection between the connecting plate and the base bracket can be designed either laterally adjustable or as a fixed point.

Dimensioning

Required edge reinforcement ≥ ∅12 (B500B)
ACCESSORIES/FRAMING CHANNELS

The advantages at a glance

To complement the product range we have a wide range of accessories. We can supply everything you need for your project; everything from one source.

HALFEN Framing channels, used in combination with matching HALFEN Bolts (or threaded plates) have all the benefits needed for versatile bolt and frame constructions.

HALFEN Framing channels, used in combination with matching HALFEN Bolts (or threaded plates) have all the benefits needed for versatile bolt and frame constructions.

The HALFEN Framing channels range includes hot and cold-rolled channel profiles with standard or serrated channel lips.

HALFEN Framing channels are available, mill-finished, hot-dip galvanized or in stainless steel materials; slotted or non-slotted.

Quick and economical
- full flexibility in positioning and dimensioning of the bolt connection
- quick installation and adjustability of plant equipment or building components
- dirt and noise free on-site modifications
- innovative modular assembly system; numerous complementary accessories available
- no more welding in hazardous environments
- bolted connections do not damage the corrosion protection of plant components

The complete, available product range for industrial application can be found in the technical product information catalogues; MT-FBC (Flexible Bolt connections) or MT-FFC (Flexible framing connections).
## ACCESSORIES

### Nuts, Washers

#### Accessories: Nuts, Washers

### MU

**Hexagonal nuts**

**EN ISO 4032/DIN 934**

<table>
<thead>
<tr>
<th>Galvanized bolts</th>
<th>Stainless steel bolts</th>
<th>S/m DIN</th>
<th>S/m ISO</th>
</tr>
</thead>
<tbody>
<tr>
<td>M6</td>
<td>M6</td>
<td>10/5</td>
<td>10/5,2</td>
</tr>
<tr>
<td>M8</td>
<td>M8</td>
<td>13/6.5</td>
<td>13/6.8</td>
</tr>
<tr>
<td>M10</td>
<td>M10</td>
<td>17/8</td>
<td>16/8.4</td>
</tr>
<tr>
<td>M12</td>
<td>M12</td>
<td>19/10</td>
<td>18/10.8</td>
</tr>
<tr>
<td>M16</td>
<td>M16</td>
<td>24/13</td>
<td>24/14.8</td>
</tr>
<tr>
<td>M20</td>
<td>M20</td>
<td>30/16</td>
<td>30/18</td>
</tr>
<tr>
<td>M24</td>
<td>-</td>
<td>36/19</td>
<td>36/21.5</td>
</tr>
</tbody>
</table>

**FV**

**Hot-dip galvanized washers**

<table>
<thead>
<tr>
<th>Galvanized bolts</th>
<th>Stainless steel bolts</th>
<th>S/m DIN</th>
<th>S/m ISO</th>
</tr>
</thead>
<tbody>
<tr>
<td>M6</td>
<td>-</td>
<td>10/5</td>
<td>10/6</td>
</tr>
<tr>
<td>M8</td>
<td>M8</td>
<td>13/6.5</td>
<td>13/7.5</td>
</tr>
<tr>
<td>M10</td>
<td>M10</td>
<td>17/8</td>
<td>16/9.5</td>
</tr>
<tr>
<td>M12</td>
<td>M12</td>
<td>19/10</td>
<td>18/9.5</td>
</tr>
<tr>
<td>M16</td>
<td>M16</td>
<td>24/13</td>
<td>24/15.5</td>
</tr>
</tbody>
</table>

**VUS**

**Square washers**

<table>
<thead>
<tr>
<th>Galvanized bolts</th>
<th>Stainless steel bolts</th>
<th>a × b × d</th>
</tr>
</thead>
<tbody>
<tr>
<td>M10</td>
<td>M10</td>
<td>40 × 40</td>
</tr>
<tr>
<td>M12</td>
<td>M12</td>
<td>40 × 40</td>
</tr>
<tr>
<td>M16</td>
<td>M16</td>
<td>40 × 40</td>
</tr>
</tbody>
</table>

**VUS 40/25**

**For profile 40/25, HZA 41/22**

| M10              | M10                   | 37 × 37  |
| M12              | M12                   | 37 × 37  |
| M16              | M16                   | 37 × 37  |
| M20              | M20                   | 50 × 50  |

**VUS 49/30**

**For profile 54/33, 49/30**

| M10              | M10                   | 37 × 37  |
| M12              | M12                   | 37 × 37  |
| M16              | M16                   | 37 × 37  |
| M20              | M20                   | 50 × 50  |

**VUS 52/34**

**For profile 52/34, 50/30**

| M16              | M16                   | 50 × 50  |
| M20              | M20                   | 50 × 50  |

**VUS 72/49**

**For profile 72/48, 72/49**

| M20              | M20                   | 54 × 54  |
| M24              | M24                   | 54 × 54  |
| M27              | M27                   | 54 × 54  |
| M30              | M30                   | 54 × 54  |

**VUS 41/41**

**For all 41 profiles**

| M6               | M6                    | 40 × 40  |
| M10              | M10                   | 40 × 40  |
| M12              | M12                   | 40 × 40  |

**Ordering example:** VUS 52/34 - FV - M20

### Application VUS:

For shimming non-flush installations

### Application SIC:

For securing HALFEN Bolts; prevents bolts turning when tightening the nuts

### SIC

**Locking washer**

<table>
<thead>
<tr>
<th>Galvanized bolts</th>
<th>Stainless steel bolts</th>
<th>Suitable for HALFEN Bolts</th>
<th>Type</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIC-50/30-GV</td>
<td>SIC-50/30-A4</td>
<td>M16, M20</td>
<td>50/30</td>
<td>------------</td>
</tr>
<tr>
<td>SIC-40/22-GV</td>
<td>SIC-40/22-A4</td>
<td>M16</td>
<td>38/17</td>
<td>40/22</td>
</tr>
<tr>
<td>SIC-38/23-GV</td>
<td>-</td>
<td>M16</td>
<td>38/23</td>
<td>------------</td>
</tr>
<tr>
<td>SIC-29/20-GV</td>
<td>-</td>
<td>M16</td>
<td>29/20</td>
<td>------------</td>
</tr>
<tr>
<td>SIC-38/17-GV</td>
<td>SIC-38/17-A4</td>
<td>M12, M10</td>
<td>38/17</td>
<td>40/22</td>
</tr>
<tr>
<td>SIC-28/15-GV</td>
<td>SIC-28/15-A4</td>
<td>M8, M10</td>
<td>28/15</td>
<td>------------</td>
</tr>
<tr>
<td>SIC-20/12-GV</td>
<td>SIC-20/12-A4</td>
<td>M8</td>
<td>20/12</td>
<td>------------</td>
</tr>
</tbody>
</table>

**Ordering example:** SIC-38/17-GV

### Assembly scheme:

[Diagram of HALFEN Channel, HALFEN Bolt, Locking washer SIC]
ACCESSORIES
Threaded Rods, Hex Bolts, Coupler Sleeves, Ring Nuts

Accessories: Threaded Rods, Hex Bolts, Coupler Sleeves, Ring Nuts

GVS
Threaded rods  
DIN 976-1

<table>
<thead>
<tr>
<th>GV galvanized FK 4.6</th>
<th>A4 stainless steel</th>
<th>Length</th>
<th>F_{RD} (kN)</th>
<th>perm. F (kN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M6</td>
<td>M6</td>
<td>1000</td>
<td>3.1</td>
<td>2.2</td>
</tr>
<tr>
<td>M8</td>
<td>M8</td>
<td>1000</td>
<td>5.6</td>
<td>4.0</td>
</tr>
<tr>
<td>M10</td>
<td>M10</td>
<td>1000</td>
<td>9.0</td>
<td>6.4</td>
</tr>
<tr>
<td>M12</td>
<td>M12</td>
<td>1000</td>
<td>13.0</td>
<td>9.3</td>
</tr>
<tr>
<td>M16</td>
<td>M16</td>
<td>1000</td>
<td>24.2</td>
<td>17.3</td>
</tr>
<tr>
<td>M20</td>
<td>M20</td>
<td>1000</td>
<td>37.8</td>
<td>27.0</td>
</tr>
<tr>
<td>M24</td>
<td>-</td>
<td>1000</td>
<td>54.3</td>
<td>38.8</td>
</tr>
</tbody>
</table>

Ordering example: GVS • M12 x 1000 • GV

HSK
Hexagonal head bolts  
EN ISO 4017/  
DIN 933  
(without nut)

<table>
<thead>
<tr>
<th>GV 8.8 galvanized FK 8.8</th>
<th>A4 stainless steel</th>
<th>S DIN (mm)</th>
<th>S EN ISO (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M6 x 12</td>
<td>-</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>M6 x 25</td>
<td>-</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>M8 x 25</td>
<td>M8 x 25</td>
<td>17</td>
<td>16</td>
</tr>
<tr>
<td>M8 x 40</td>
<td>-</td>
<td>19</td>
<td>18</td>
</tr>
<tr>
<td>M10 x 20</td>
<td>-</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>M10 x 30</td>
<td>M10 x 30</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>M10 x 45</td>
<td>M10 x 45</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>M10 x 60</td>
<td>-</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>M10 x 70</td>
<td>-</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>M12 x 22</td>
<td>-</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>M12 x 25</td>
<td>M12 x 25</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>M12 x 30</td>
<td>M12 x 30</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>M12 x 40</td>
<td>M12 x 40</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>M12 x 50</td>
<td>-</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>M12 x 60</td>
<td>M12 x 60</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>M12 x 80</td>
<td>M12 x 80</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>M12 x 90</td>
<td>-</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>M16 x 40</td>
<td>M16 x 40</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>M16 x 60</td>
<td>M16 x 60</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>M16 x 90</td>
<td>M16 x 90</td>
<td>24</td>
<td>24</td>
</tr>
</tbody>
</table>

Ordering example: HSK • A4 • M 12 x 75
**ACCESSORIES**

**Rail Clips**

### KLP-S Rail clips, steel 1.0038 forged

<table>
<thead>
<tr>
<th>No.</th>
<th>Ø × l [mm]</th>
<th>#</th>
<th>b</th>
<th>c</th>
<th>Ø d</th>
<th>h</th>
<th>k</th>
<th>m</th>
<th>F [kN]</th>
<th>σ allowable at $a$ [% N/mm²]</th>
<th>preferred for use with other beam, flange channels</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>M16 × 60</td>
<td>44.0</td>
<td>45</td>
<td>12</td>
<td>18</td>
<td>5</td>
<td>12.0</td>
<td>22.0</td>
<td></td>
<td>3.5</td>
<td>125</td>
</tr>
<tr>
<td>26</td>
<td>without heel</td>
<td>M16 × 60</td>
<td>62.5</td>
<td>64</td>
<td>21</td>
<td>18</td>
<td>9</td>
<td>16.5</td>
<td>34.5</td>
<td></td>
<td>3.5</td>
</tr>
<tr>
<td>20</td>
<td>M20 × 65</td>
<td>52.0</td>
<td>55</td>
<td>19</td>
<td>21</td>
<td>8</td>
<td>15.0</td>
<td>24.0</td>
<td></td>
<td>10.0</td>
<td>160 – 240</td>
</tr>
</tbody>
</table>

Ordering example: KLP - S - Nr. 26 - FV

---

**KLP - 60 Rail clips**

### Allowable load

<table>
<thead>
<tr>
<th>FV</th>
<th>Clamping height [mm]</th>
<th>Allowable load $F_1$ [kN]</th>
<th>Standard profile I</th>
<th>Preferred for use with Standard profile IPB</th>
<th>Crane and running tracks $F_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>60/10</td>
<td>10</td>
<td>$F_1 = 7.0$ HAFLEN Bolt M16 × 60, Grade 4.6</td>
<td>120 – 160</td>
<td>100</td>
<td>A65, S33, S41</td>
</tr>
<tr>
<td>60/12</td>
<td>12</td>
<td>$F_1 = 7.0$ HAFLEN Bolt M16 × 60, Grade 4.6</td>
<td>220 – 240</td>
<td>140</td>
<td>A100, S49, A75</td>
</tr>
<tr>
<td>60/14</td>
<td>14</td>
<td>$F_1 = 11.25$ HAFLEN Bolt M16 × 60, Grade 8.8</td>
<td>240 – 280</td>
<td>160 – 180</td>
<td>A120, S54</td>
</tr>
<tr>
<td>60/16</td>
<td>16</td>
<td>$F_1 = 11.25$ HAFLEN Bolt M16 × 60, Grade 8.8</td>
<td>300 – 340</td>
<td>200 – 220</td>
<td>S64</td>
</tr>
<tr>
<td>60/18</td>
<td>18 $^b$</td>
<td>$F_1 = 11.25$ HAFLEN Bolt M16 × 60, Grade 8.8</td>
<td>360 – 380</td>
<td>240 – 260</td>
<td>-</td>
</tr>
<tr>
<td>60/20</td>
<td>20 $^b$</td>
<td>$F_1 = 11.25$ HAFLEN Bolt M16 × 60, Grade 8.8</td>
<td>400 – 450</td>
<td>280 – 300</td>
<td>-</td>
</tr>
</tbody>
</table>

$^a$ Take the load capacity of HALFEN Channels into account (Cantilever must be considered when selecting the HALFEN Channels and bolts)

$^b$ Bolt M16 × 80 necessary

$^c$ Check flange thickness of profile!

**Order example:** KLP - 60/10 - FV

---

**Load diagram:**

- **KLP - 60**
- **Assembly example:**

**Assembly example:**

- **KLP - 60**
- e.g. HL 50/40

**Order example:** KLP - 60/10 - FV
### ACCESSORIES

**Framing Channels HM/HZM/HL/HZL — Type Overview**

#### Heavy Duty Framing System

<table>
<thead>
<tr>
<th>Hot-rolled</th>
<th>Cold-rolled</th>
<th>Hot-rolled</th>
<th>Cold-rolled</th>
<th>Hot-rolled, serrated</th>
</tr>
</thead>
<tbody>
<tr>
<td>HM 72/48</td>
<td>HM 55/42</td>
<td>HM 52/34</td>
<td>HM 49/30</td>
<td>HM 48/6</td>
</tr>
<tr>
<td>HM 49/30</td>
<td>HM 40/22</td>
<td>HM 40/25</td>
<td>HM 42/2</td>
<td>64/44</td>
</tr>
<tr>
<td>HM 40/25</td>
<td>HM 42/2</td>
<td>64/44</td>
<td>40/22</td>
<td>29/14</td>
</tr>
<tr>
<td>HS 38/17, GWP 38/17</td>
<td>50/30</td>
<td>HS 38/23, HS 28/15</td>
<td>29/20</td>
<td>HZS 64/44</td>
</tr>
</tbody>
</table>

#### Medium Duty Framing System

<table>
<thead>
<tr>
<th>Cold-rolled</th>
<th>Cold-rolled, serrated</th>
<th>Cold-rolled</th>
<th>Cold-rolled, serrated</th>
<th>Cold-rolled</th>
<th>Cold-rolled</th>
</tr>
</thead>
<tbody>
<tr>
<td>41/41</td>
<td>41/41</td>
<td>41/41</td>
<td>41/41</td>
<td>41/41</td>
<td>41/41</td>
</tr>
<tr>
<td>22</td>
<td>22</td>
<td>22</td>
<td>22</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>HZS/HS 41/41, HZS 41/22</td>
<td>GWP 41/41, GWP 41/22</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Light Duty Framing System

<table>
<thead>
<tr>
<th>Cold-rolled</th>
<th>Cold-rolled</th>
</tr>
</thead>
<tbody>
<tr>
<td>HM 36/36, HL 36/36</td>
<td>HM 20/12, HL 20/12</td>
</tr>
<tr>
<td>HM 38/17</td>
<td>HM 38/17, GWP 38/17</td>
</tr>
<tr>
<td>HM 28/15, HL 28/15</td>
<td>HS 28/15, GWP 28/15</td>
</tr>
<tr>
<td>HM 315</td>
<td>HS 20/12, GWP 20/12</td>
</tr>
</tbody>
</table>

Materials/Finish:
- FV Steel hot-dip galvanized or WB steel mill finished
- SV Steel, sendzimir galvanized
- A4 Stainless steel 1.4571/1.4404
- A2 Stainless steel 1.4307 (on request)
- HCR Stainless steel 1.4547/1.4529 (on request)

For information on materials → see page 9-10

HZM/HZL serrated profiles
ACCESSORIES
Framing Channels HM/HZM/HL/HZL – Application Examples

Type Overview

<table>
<thead>
<tr>
<th>Framing channel</th>
<th>Framing channel</th>
<th>Slotted framing channel</th>
<th>Slotted framing channel</th>
<th>Slotted framing channel</th>
<th>Double channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>HM 28/15</td>
<td>HZM 38/23</td>
<td>HL 28/15</td>
<td>HZL 41/22</td>
<td>HLL 41/41</td>
<td>HZM 41/22D</td>
</tr>
<tr>
<td>HZL 41/22</td>
<td>HZL 63/63</td>
<td>HZM 41/22D</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Application Examples

HALFEN Framing channels HM/HZM and slotted HALFEN Framing channels HL/HZL can be attached to a supporting structure using various methods:

1. Fastened to concrete or masonry with HB-VMU plus wedge anchors
2. Bolted to HALFEN HTA-CE and HZA Cast-in channels
3. Connected to threaded rods
4. Clamped to steel profile supports
5. Welded to steel components
6. Screwed or nailed to wood structures

HALFEN Framing channels are a part of the HALFEN Framing system:

- Installations for plant engineering
- Technical equipment in buildings
- Heavy and light installations

Typical application of the HALFEN Powerclick system

The HALFEN Framing system product range can be found in the following catalogues:
HALFEN Flexible bolt connections,
HALFEN Flexible framing connections
HALFEN Powerclick System.
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Innovative engineered products and construction solutions that allow the industry to build safer, stronger and faster.
Worldwide contacts for Leviat:

**Australia**
Leviat
98 Kurrajong Avenue,
Mount Druitt Sydney, NSW 2770
Tel: +61 - 2 8808 3100
Email: info.au@leviat.com

**Austria**
Leviat
Leonard-Bernstein-Str. 10
Saturn Tower, 1220 Wien
Tel: +43 - 1 - 259 6770
Email: info.at@leviat.com

**Belgium**
Leviat
Borkelstraat 131
2900 Schoten
Tel: +32 - 3 - 658 07 20
Email: info.be@leviat.com

**China**
Leviat
Room 601 Tower D, Vantone Centre
No. A6 Chao Yang Men Wai Street
Chaoyang District
Beijing · P.R. China 100020
Tel: +86 - 10 5907 3200
Email: info.cn@leviat.com

**Czech Republic**
Leviat
Business Center Šafránkova
Šafránkova 1238/1
155 00 Praha 5
Tel: +420 - 311 - 690 060
Email: info.cz@leviat.com

**France**
Leviat
18, rue Goubet
75019 Paris
Tel: +33 - 1 - 44 52 31 00
Email: info.fr@leviat.com

**Germany**
Leviat
Liebigstrasse 14
40764 Langenfeld
Tel: +49 - 2173 - 970 - 0
Email: info.de@leviat.com

**Italy**
Leviat
Via F.Lii Bronzetti N° 28
24124 Bergamo
Tel: +39 - 035 - 0760711
Email: info.it@leviat.com

**Malaysia**
Leviat
28 Jalan Anggerik Mokara 31/59
Kota Kemuning, 40460 Shah Alam
Selangor
Tel: +603 - 5122 4182
Email: info.my@leviat.com

**Netherlands**
Leviat
Oostermaat 3
7623 C5 Borne
Tel: +31 - 76 - 267 14 49
Email: info.nl@leviat.com

**New Zealand**
Leviat
2/19 Nuttall Drive, Hillsborough,
Christchurch 8022
Tel: +64 - 3 376 5205
Email: info.nz@leviat.com

**Norway**
Leviat
Vestre Svanholmen 5
4313 Sandnes
Tel: +47 - 51 82 34 00
Email: info.no@leviat.com

**Poland**
Leviat
Ul. Obornicka 287
60-601 Poznan
Tel: +48 - 61 - 622 14 14
Email: info.pl@leviat.com

**Singapore**
Leviat
14 Benoi Crescent
Singapore 629977
Tel: +65 - 6266 6802
Email: info.sg@leviat.com

**Spain**
Leviat
Polígono Industrial Santa Ana
c/ Ignacio Zuloaga, 20
28522 Rivas-Vaciamadrid
Tel: +34 - 91 632 18 40
Email: info.es@leviat.com

**Sweden**
Leviat
Vädursgatan 5
412 50 Göteborg
Tel: +46 - 31 - 98 58 00
Email: info.se@leviat.com

**Switzerland**
Leviat
Hertistrasse 25
8304 Wallisellen
Tel: +41 - 44 - 849 78 78
Email: info.ch@leviat.com

**United Kingdom**
Leviat
A1/A2 Portland Close
Houghton Regis LU5 5AW
Tel: +44 - 1582 - 470 300
E-Mail: info.uk@leviat.com

**United States of America**
Leviat
6467 S Falkenburg Rd.
Riverview, FL 33578
Tel: (800) 423-9140
Email: info.us@leviat.us

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