ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804

Owner of the Declaration	**HALFEN GmbH**
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-HAL-20160245-IBC1-EN
Issue date	14.02.2017
Valid to	13.02.2022

HALFEN cast-in anchor channel systems
HTA-CE (HTA) and HZA

HALFEN GmbH

Institut Bauen und Umwelt e.V.

www.ibu-epd.com / https://epd-online.com

1. General Information

HALFEN GmbH	HALFEN cast-in anchor channel systems HTA-CE (HTA) and HZA
Programme holder IBU - Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany	**Owner of the Declaration** HALFEN GmbH Liebigstraße 14 40764 Langenfeld Germany Europe
Declaration number EPD-HAL-20160245-IBC1-EN	**Declared product / Declared unit** The declared unit is one running metre with a weight of 2.6 kg per metre. HALFEN cast-in anchor channel systems HTA-CE (HTA) and HZA in hot-dipped galvanized quality depicted using the example of HALFEN HTA-CE (HTA 40/22) with corresponding hook-head channel bolts type HS 40/22. HS 40/22 M12x40 mm bolts are assumed per running metre channel (4x at HTA-CE; 6.5x at HTA).
This Declaration is based on the Product Category Rules: Thin walled profiles and profiled panels of metal, 07.2014 (PCR tested and approved by the SVR)	**Scope:** This document refers to the HALFEN cast-in anchor channel systems HTA-CE (HTA) and HZA and corresponding HS and HZS channel bolts (hook-head channel bolts and hammer-head channel bolts). Halfen cast-in anchor channels type HTA-CE and HZA are produced at Halfen plant Langenfeld / Germany and Halfen cast-in anchor channels type HTA and HZA are produced at HALFEN plant Windcrest / USA. Specific data from the HALFEN production facility in Langenfeld / Germany and Windcrest / USA was recorded for the LCA. The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.
Issue date 14.02.2017	
Valid to 13.02.2022	**Verification** The CEN Norm /EN 15804/ serves as the core PCR Independent verification of the declaration according to /ISO 14025/ ☐ internally ☒ externally
 Prof. Dr.-Ing. Horst J. Bossenmayer (President of Institut Bauen und Umwelt e.V.)	
 Dr. Burkhart Lehmann (Managing Director IBU)	 Matthias Klingler (Independent verifier appointed by SVR)

2. Product

2.1 Product description

The product portfolio of HALFEN cast-in anchor channel systems compromises cast-in anchor channels type HTA-CE (HTA) and type HZA and corresponding hook-head channel bolts and hammer-head channel bolts named as HS (for HTA-CE and HTA) and HZS (for HZA).
The anchor channel comprises a C-shaped steel profilel with mounted anchors on the channel back. These anchors are formed as round bolt anchors or as I-anchors. The anchors are mounted on the channel back by riveting or welding process. Hot-dipped galvanized quality was considered for this EPD.

The inner section of the anchor channel is filled with a PE foam which prevents an entry of concrete slurry during casting.

The various anchor channels differ in terms of mass in relation to running metres.

The declared reference product is the cast-in anchor channel system HTA-CE (HTA) 40/22 with HS 40/22 bolts with a weight of 2.6 kg/m.

In order to calculate the LCA results for the following cast –in anchor channel types the conversion factors listed in chapter 3.10 can be applied.

- HTA-CE (HTA) 28/15
- HTA-CE (HTA) 38/17
- HTA-CE (HTA) 40/25
- HTA-CE (HTA) 40/22
- HTA-CE (HTA) 40/22P
- HTA-CE (HTA) 49/30
- HTA-CE (HTA) 50/30
- HTA-CE (HTA) 50/30P
- HTA-CE (HTA) 54/33
- HTA-CE (HTA) 52/34
- HTA-CE (HTA) 55/42
- HTA-CE (HTA) 72/48
- HZA 41/22
- HZA 29/20
- HZA 38/23
- HZA 41/27
- HZA 53/34
- HZA 64/44

2.2 Application

Cast-in anchor channels are cast in concrete. Prior to the casting process, they are positioned in the component and fastened in their position to the formwork, to the reinforcement or by appropriate auxiliary construction. Anchor channels serve towards subsequent fastening of fixtures.

Typical areas of application include curtain wall façades, fastening elevator installations in shafts, fastening of overhead wires and utility service pipes and cables in tunnel, fastening of handrails, platforms or seats as well as applications in the area of installation technology.

2.3 Technical Data

For the placing on the market in the EU/EFTA (with the exception of Switzerland) the Regulation (EU) No 305/2011 applies. The products need a Declaration of Performance taking into consideration the respective European Technical Assessment and the CE marking.

All geometrical dimensions, product-specific parameters and the static load capacities of the different cast-in anchor channel systems HTA-CE (HTA) and HZA are given in the following technical specifications:

HTA-CE (HTA) system:

- /ETA 09/0339/
- /ETA 16/0453/
- /CABR-YMC-1A-(2016) by CABR/
- /ICC-ESR 1008 by ICC-ES/

HZA system:

- /Z-21.4-145/
- /Z-21.4-1691/

Some types of cast-in anchor channels HTA-CE (HTA) and HZA are also approved for transfer of fatigue cyclic loads and for fire exposure.

Please refer to the mentioned approval documents for a detailed design of the anchor channel and other data related to the specific application condition.

Technical constructional data HTA-CE (HTA) 40/22

Name	Value	Unit
Minimum anchoring depth min h(ef)	79	mm
Minimum edge distance c(min)	50	mm
Anchor channel width b(ch)	39.5	mm
Anchor channel height h(ch)	23	mm
Profile thickness t[nom]	2.4	mm

2.4 Application rules

For the application and use the respective national provision apply.

HALFEN cast-in anchor channel systems (exclude HZA 41/27) are designed in accordance with:

- /CEN/TS 1992-4/ "Design of fastenings for use in concrete" and the European Technical Approval /ETA 09/0339/ or
- /EOTA TR 047/ „Calculation Method for the Performance of Anchor Channels“ or /EN 1992-4/ „Eurocode 2: Design of concrete structures – Part 4: Design of fastenings for use in concrete“ and the European Technical Assessment /ETA 16/0453/ or
- /AC 232/, /ACI 318/ and /ICC-ESR 1008/ or
- /CEN/TS 1992-4/ "Design of fastenings for use in concrete" and the Chinese technical building approval /CABR-YMC-1A-(2016)/ or
- National technical building approvals /Z-21.4-145/ and /Z-21.4-1691/ from German Institute for Building Technology (DIBt)

2.5 Delivery status

HALFEN cast-in anchor channels and HALFEN channel bolts are packed separately and can also be ordered separately. (further information available in section 2.10).

2.6 Base materials / Ancillary materials

Name	Value	Unit
Channel profile: galvanized steel	82	%
Channel anchor: galvanized steel	6	%
Channel bolt set: galvanized steel	11	%
Channel Filler: PE Foam	1	%

The product weight with respect to the declared unit HTA-CE (HTA) 40/22 in hot-dipped galvanized quality is ca. 2.6 kg per metre (average value).

2.7 Manufacture

The materials needed for the final assembly of the HALFEN cast-in anchor channel systems HTA-CE (HTA) and HZA are manufactured in-house or purchased from qualified vendors.
The HALFEN cast-in anchor channels are made of cold-formed or hot-rolled channel profiles. The cold-formed channel profiles are produced at HALFEN plant Langenfeld / Germany.
The anchors are mounted on the channel back by riveting or welding process. HALFEN cast-in anchor channels with riveted bolt anchors are produced at HALFEN plant Langenfeld / Germany. HALFEN cast-in

anchor channels with welded I-anchors are produced at HALFEN plant Langenfeld / Germany and HALFEN plant Windcrest / USA.
The anchor channels are hot-dipped galvanised after the mounting process of the anchors.
The filler is assembled after the galvanising process at HALFEN plant Langenfeld / Germany or HALFEN plant Windcrest / USA.

2.8 Environment and health during manufacturing

The criteria for environmental and energy management and the requirements for the Health and Safety at work follow all statutory requirements and HALFEN standards.

HALFEN was certified according to /DIN EN ISO 50001/ on the 15th April 2016 for all its 18 locations inside Europe, the United States of America and China by the SWEDAC Certification Institute International GmbH.
Since 1994 all HALFEN Locations are certified according to /ISO 9001/ (ISO 9001:2015) by DNV GL.
The continuous production and product quality according to the product specifications and approval specifications of HALFEN cast-in anchor channel systems HTA-CE (HTA) and HZA are ensured by an in-process quality control by HALFEN and by regularly third party quality inspections by /MPA NRW/ and /IAS/ certified bodies.

All types of waste such as steel, PE foam, wood (wood pallets) and packaging materials (cardboard) that are incurred in the production of the product or remain as excess material will be separated according to type and recycled.

2.9 Product processing/Installation

The HALFEN cast-in anchor channel systems HTA-CE (HTA) and HZA are supplied as a ready to install anchor channel element.
The HALFEN cast-in anchor channel is positioned in the building shell or in the precast concrete plant during or alternatively after the reinforcement installation without the use of lifting equipment. The HALFEN cast-in anchor channel is positioned in the component and fastened in position to the formwork, to the reinforcement or by appropriate auxiliary construction and secured against slippage during subsequent concreting.
No special environmental protection measures need to be taken while processing HALFEN cast-in anchor channels HTA-CE (HTA) and HZA.

2.10 Packaging

The HALFEN cast-in anchor channels are delivered packed and strapped in bundles as long goods.
Up to a length of 1.05 metres, the anchor channels are delivered on Euro pallets or cardboards.
Depending on the size and length, HALFEN channel bolts are packed in packing Units of several sizes in cardboard boxes.
The individual packaging materials should be separated according to their type and recycled.

2.11 Condition of use

After installation and casting, the foam is usually removed and disposed of.
All supplied materials are protected in the installed condition against external influences and designed for the service life of the respective construction. No risks can arise to water, air and soil if the products are used as designated.

2.12 Environment and health during use

When used as designated, there is no impact on the environment or health.

2.13 Reference service life

A service life of at least 50 years confirmed by approval procedures is applicable for HALFEN cast-in anchor channel systems HTA-CE (HTA) and HZA, which are in line with the safety concepts outlined in the /Eurocode/ or /ACI/. The practical service life can however be considerably longer. A further condition for the service life is that the HALFEN cast-in anchor channel is used in accordance with the designed application. This service life refers to static design approach and not to reference service life according to /ISO 15686/.

2.14 Extraordinary effects

Fire
HALFEN cast-in anchor channel systems HTA-CE (HTA) and HZA are approved for the effects of fire in accordance with several technical building approvals (see section 2.4) and are not allocated to any building material class.

Water
The declared HALFEN cast-in anchor channel systems comprise hot-dipped galvanised steel. There are no environmental risks attributable to the effects of water.

Mechanical destruction
In the event of unintentional mechanical destruction, there is no risk for users or the environment if the product has been installed correctly.

2.15 Re-use phase

Cast-in anchor channels can not be re-used but material recycling is possible.
All components of the described product can be returned and recycled into the material cycle. In view of an efficient recycling process it should be ensured that a separation of materials during decommissioning is possible.

2.16 Disposal

The disposal of non-recycled parts of HALFEN cast-in anchor channels can be disposed of at any waste disposal site with appropriate waste number /EWC/ 191001 (for steel components) or /EWC/ 170904 (other components) according to the /European Waste Code/ of the European Waste Catalogue.

2.17 Further information

www.halfen.com

3. LCA: Calculation rules

3.1 Declared Unit

The declared unit is 1 m length of cast-in anchor channel.
The calculation of the average of two production sites is based on actual production volumes.

Declared unit

Name	Value	Unit
Declared unit	1	m
Grammage	2,6	kg/m
Conversion factor to 1 kg	0.385	-

3.2 System boundary

Type of the EPD: cradle-to-gate - with options.
The declaration considers the life cycle stages of production (A1-A3),
including processes that provide
materials (mainly steel) and energy input for the system,
manufacturing (welding and niveting) and transport processes up to the factory gate, as well as waste processing. The production takes place in Germany and the USA, all main raw-materials are transported to factory in Germany and then distributed to the USA.
The end of life covers the recycling of the steel parts, with impacts in module C4 and module D which covers loads and benefits beyond the system boundaries are also considered.

3.3 Estimates and assumptions

No estimates and assumptions were made.

3.4 Cut-off criteria

In this assessment all data for the production process is considered. This includes input flows with a contribution of less than 1% of mass or energy. The transport expenditure for all raw materials are considered. Impacts relating to the production of machines and facilities required during production are outside the scope of this assessment.
The impacts arising from the dismantling of the products from the building structure (separating concrete, metal and other building materials) are not considered. The impacts are estimated to contribute less than 1% to the overall result.

3.5 Background data

For life cycle modelling of the considered products, the /GaBi ts Software/ ,
developed by thinkstep AG, has been
used. All relevant background datasets are taken from the /GaBi ts Software/ database. The datasets from the GaBi database are documented in the online documentation /GaBi ts Data/.

3.6 Data quality

The data quality can be described as good. The primary data collection was done thoroughly, all flows were considered. Technological, geographical and temporal representativeness is given. Primary data refers to the year 2015. Background datasets were taken from the /Gabi ts Data/ database. The last update of the database was 2016.

3.7 Period under review

The period under review is the year 2015.

3.8 Allocation

The overall production of Halfen comprises further products beside the product considered in this study. Data for thermal and electrical energy as well as auxiliary material refer to the declared product. During data collection the allocation is done via linear meter (m).
Specific information on allocation within the background data is given in the GaBi dataset documentation
(http://www.gabi-software.com/international/databases/gabi-data-search/).

3.9 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to /EN 15804/ and the building context, respectively the product-specific characteristics of performance, are taken into account.

3.10 Factors for minimum and maximum variants

The HALFEN anchor channel is available with different lengths, widths and anchor types. In order to enable the user of this EPD to calculate the LCA results for the product types listed in chapter 2.1, the specific weight can be multiplied by the 1 kg results listed in the following
table.

Results for 1 kg anchor channel		
Parameter \ Module	A1-A3	D
GWP	1,72E+00	-6,04E-01
ODP	-2,75E-10	2,70E-12
AP	5,00E-03	-2,32E-03
EP	5,00E-04	-1,83E-04
POCP	5,73E-04	-3,38E-04
ADPE	3,47E-05	4,96E-08
ADPF	1,88E+01	-5,65E+00
PERT	3,36E+00	2,96E-01
PENRT	2,08E+01	-5,42E+00

4. LCA: Scenarios and additional technical information

The following technical information is a basis for the declared modules or can be used for developing specific scenarios in the context of a building assessment if modules are not declared (MND).

End of life (C1-C4)

Name	Value	Unit
Collected as mixed construction waste	2.59	kg
Recycling	2.59	kg

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
Steel scrap input volume	1,67	kg
Steel scrap EoL volume	2,59	kg
Net steel scrap volume	0,87	kg

The net steel scrap volume is 0,87 kg, resulting from an input steel scrap of 1,67 kg and an EoL steel scrap volume of 2,59 kg, under consideration of 5% recycling loss.

The collection rate is assumed to be 100%, the loss of recycling 5%.

5. LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: cast-in anchor channel system, 1m

Parameter	Unit	A1-A3	C3	C4	D
Global warming potential	[kg CO_2-Eq.]	4.46E+0	0.00E+0	0.00E+0	-1.57E+0
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	-7.16E-10	0.00E+0	0.00E+0	7.01E-12
Acidification potential of land and water	[kg SO_2-Eq.]	1.30E-2	0.00E+0	0.00E+0	-6.03E-3
Eutrophication potential	[kg $(PO_4)^{3-}$-Eq.]	1.30E-3	0.00E+0	0.00E+0	-4.75E-4
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	1.49E-3	0.00E+0	0.00E+0	-8.80E-4
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	9.01E-5	0.00E+0	0.00E+0	1.29E-7
Abiotic depletion potential for fossil resources	[MJ]	4.90E+1	0.00E+0	0.00E+0	-1.47E+1

RESULTS OF THE LCA - RESOURCE USE: cast-in anchor channel system, 1m

Parameter	Unit	A1-A3	C3	C4	D
Renewable primary energy as energy carrier	[MJ]	8.64E+0	0.00E+0	0.00E+0	7.70E-1
Renewable primary energy resources as material utilization	[MJ]	9.51E-2	0.00E+0	0.00E+0	0.00E+0
Total use of renewable primary energy resources	[MJ]	8.73E+0	0.00E+0	0.00E+0	7.70E-1
Non-renewable primary energy as energy carrier	[MJ]	5.33E+1	0.00E+0	0.00E+0	-1.41E+1
Non-renewable primary energy as material utilization	[MJ]	7.87E-1	0.00E+0	0.00E+0	0.00E+0
Total use of non-renewable primary energy resources	[MJ]	5.41E+1	0.00E+0	0.00E+0	-1.41E+1
Use of secondary material	[kg]	1.67E+0	0.00E+0	0.00E+0	0.00E+0
Use of renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Use of non-renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Use of net fresh water	[m^3]	2.42E-2	0.00E+0	0.00E+0	-1.03E-3

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: cast-in anchor channel system, 1m

Parameter	Unit	A1-A3	C3	C4	D
Hazardous waste disposed	[kg]	6.24E-7	0.00E+0	0.00E+0	-1.99E-8
Non-hazardous waste disposed	[kg]	7.53E-2	0.00E+0	0.00E+0	-2.23E-2
Radioactive waste disposed	[kg]	2.03E-3	0.00E+0	0.00E+0	2.54E-4
Components for re-use	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Materials for recycling	[kg]	0.00E+0	2.59E+0	0.00E+0	0.00E+0
Materials for energy recovery	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Exported electrical energy	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Exported thermal energy	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0

6. LCA: Interpretation

The steel profile has a significant influence and dominates all impact categories with exception of **ADPE** (Abiotic depletion potential for non-fossil resources) and **ODP** (Ozone depletion potential). In all other impact categories than **ADPE** and **ODP**, the fixing material has a minor influence, all other pre-products a minor or negligible influence. Abiotic depletion of resources is dominated by the fixing material, the steel profile has a relevant influence. A special case is the impact category **ODP**, where a negative impact is achieved by the steel profile and steel anchor. This is due to benefits in the background system of the hot-dip galvanization of those steel parts.

7. Requisite evidence

No evidence required.

8. References

AC 232
Acceptance Criteria for Anchor Channels in Concrete Elements
International Code Council – Evaluation Service (ICC-ES)
2016

ACI 318
Building Code Requirements for Structural Concrete
ACI American Concrete Institute
1995

CABR-YMC-1A-2016
Technical Approval China
Halfen HTA anchor channels and HS channel bolts
CABR Certification Centre
2016

CEN TS 1992-4
Design of fastenings for use in concrete
Part 4-2: Headed fasteners
2009

DIN EN ISO 50001
Energy management systems - Requirements with guidance for use ISO 50001:2011
2011

EN 1992-4
Eurocode 2: Design of concrete structures
Part 4: Design of fastenings for use in concrete

EOTA TR 047
Technical Report TR 047
Calculation Method for the performance of Anchor Channels European Organisation for Technical Assessment
September 2015

ETA 09/0339
European Technical Approval ETA-09/0339
Halfen anchor channel HTA
German Institute for Building Technology - DIBt
Dated: 27.06.2013

ETA 16/0453
European Technical Assessment ETA-16/0453
Halfen Anchor Channel HTA 40/22P and HTA 50/30P
German Institute for Building Technology - DIBt
Dated: 23.09.2016

EWC
European Waste Code according to European Waste Catalogue Directive 2008/98/EC
European Parliament and of the Council
2014

IAS
International Accreditation Service
Subsidiary of the International Code Council
Brea / California / USA

ICC ESR 1008
ICC Evaluation Report 1008
Halfen HTA anchor channels and HS channel bolts
International Code Council - Evaluation Service
2016

ISO 9001
Quality management systems
2015

ISO 15686
Building and constructed assets - servie life planning
2014

MPA NRW
Materialprüfungsamt Nordrhein-Westfalen
Dortmund / Germany

Z-21.4-145
General Construction Approval
Halfen anchor channel type HZA
German Institute for Building Technology - DIBt
Dated: 24.3.2016

Z-21.4-1691
General Construction Approval
Halfen anchor channel HZA 29/20, HZA 38/23, HZA 53/34 and HZA 64/44
German Institute for Building Technology - DIBt
Dated: 01.04.2015

Institut Bauen und Umwelt 2014, Part B
PCR – Part B: Requirements on the EPD for
Thin walled profiles and profiled panels of metal
Version 1.6,
Institut Bauen und Umwelt e.V., www.bau-umwelt.com,
2014

Institut Bauen und Umwelt
Institut Bauen und Umwelt e.V., Berlin(pub.):
Generation of Environmental Product Declarations (EPDs);
www.ibu-epd.de

ISO 14025
DIN EN ISO 14025:2011-10: Environmental labels and declarations — Type III environmental declarations — Principles and procedures

EN 15804
EN 15804:2012-04+A1 2013: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

GaBi ts Data
GaBi 7.3 dataset documentation for the software-system and databases, LBP, University of Stuttgart and thinkstep AG, Leinfelden-Echterdingen, 2016 (http://www.gabi-software.com/international/databases/gabi-data-search/)

GaBi ts Software
Software and database for life cycle Engineering, LBP, University of Stuttgart and thinkstep AG, Leinfelden-Echterdingen, 2016

Publisher
Institut Bauen und Umwelt e.V.
Panoramastr. 1
10178 Berlin
Germany

Tel +49 (0)30 3087748- 0
Fax +49 (0)30 3087748- 29
Mail info@ibu-epd.com
Web **www.ibu-epd.com**

Programme holder
Institut Bauen und Umwelt e.V.
Panoramastr 1
10178 Berlin
Germany

Tel +49 (0)30 - 3087748- 0
Fax +49 (0)30 – 3087748 - 29
Mail info@ibu-epd.com
Web **www.ibu-epd.com**

Author of the Life Cycle Assessment
thinkstep AG
Haupstraße 111
70771 Leinfelden-Echterdingen
Germany

Tel +49 (0)711 341817-0
Fax +49 (0)711 341817-25
Mail info@thinkstep.com
Web **www.thinkstep.com**

Owner of the Declaration
HALFEN GmbH
Liebigstraße 14
40764 Langenfeld
Germany

Tel +49 (0)3466 3268 200
Fax +49 (0)3466 3268 205
Mail raimo.fuellsack-koeditz@halfen.de
Web **www.halfen.com**