Deutsches Institut für Bautechnik

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Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

Designated according to Article 29 of Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

European Technical Assessment

ETA-21/0324 of 25 August 2022

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	fischer frame fixing DuoXpand
Product family to which the construction product belongs	Plastic anchors for redundant non-structural systems in concrete and masonry
Manufacturer	fischerwerke GmbH & Co. KG Klaus-Fischer-Straße 1 72178 Waldachtal DEUTSCHLAND
Manufacturing plant	fischerwerke
This European Technical Assessment contains	25 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330284-00-0604 edition December 2020
This version replaces	ETA-21/0324 issued on 10 December 2021

Deutsches Institut für Bautechnik
Kolonnenstraße 30 B | 10829 Berlin | GERMANY | Phone: +49 30 78730-0 | Fax: +49 30 78730-320 | Email: dibt@dibt.de | www.dibt.de

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Specific part

1 Technical description of the product

The fischer frame fixing DuoXpand 8 and DuoXpand 10 is a plastic anchor consisting of a plastic sleeve made of polyamide and polyoxymethylene and an accompanying specific screw of galvanised steel, of galvanised steel with an additional organic layer or of stainless steel.

The plastic sleeve is expanded by screwing in the specific screw which presses the sleeve against the wall of the drilled hole.

The product description is given in Annex A.

2 Specification of the intended use in accordance with the applicable European Assessment Document

The performances given in Section 3 are only valid if the anchor is used in compliance with the specifications and conditions given in Annex B.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the anchors of at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and references to the methods used for its assessment

3.1 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	No performance assessed

3.2 Mechanical resistance and stability (BWR 4)

Essential characteristic	Performance
Resistance to steel failure under tension loading	See Annex C 1
Resistance to steel failure under shear loading	See Annex C 1
Resistance to pull-out or concrete failure under tension loading (base material group a)	See Annex C 1
Resistance in any load direction without lever arm (base material group b, c, d)	See Annexes C 7 – C 13
Edge distance and spacing (base material group a)	See Annex B 2
Edge distance and spacing (base material group b, c, d)	See Annex B 3 and B 4
Displacements under short-term and long-term loading	See Annex C 2
Durability	See Annex B 1

4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

In accordance with European Assessment Document EAD 330284-00-0604 the applicable European legal act is: 97/463/EC.

The system to be applied is: 2+

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

The following standards and documents are referred to in this European Technical Assessment:

- EOTA European Assessment Document EAD 330284-00-0604, edition December 2020: Plastic anchors for redundant non-structural systems in concrete and masonry
- EOTA Technical Report TR 051, Edition April 2018: Recommendations for job site tests of plastic anchors and screws
- EOTA Technical Report TR 064, Edition May 2018: Design of plastic anchors in conrete and masonry
- EN 206:2013+A1:2016: Concrete – Specification, performance, production and conformity
- EN 771-1:2011+A1:2015: Specification for masonry units – Part 1: Clay masonry units
- EN 771-2:2011+A1:2015: Specification for masonry units – Part 2: Calcium silicate
- EN 771-3:2011+A1:2015: Specification for masonry units – Part 3: Aggregate concrete masonry units (dense and lightweight aggregates)
- EN 771-4:2011+A1:2015: Specification for masonry units – Part 4: autoclaved aerated concrete masonry units
- EN 998-2:2010: Specification for mortar for masonry - Part 2: Masonry mortar
- EN 1993-1-4:2006 + A1:2015: Eurocode 3: Design of steel structures - Part 1-4: General rules - Supplementary rules for stainless steels
- EN 12602:2016: Prefabricated reinforced components of autoclaved aerated concrete
- EN ISO 4042:2018: Fasteners – Electroplated coating systems

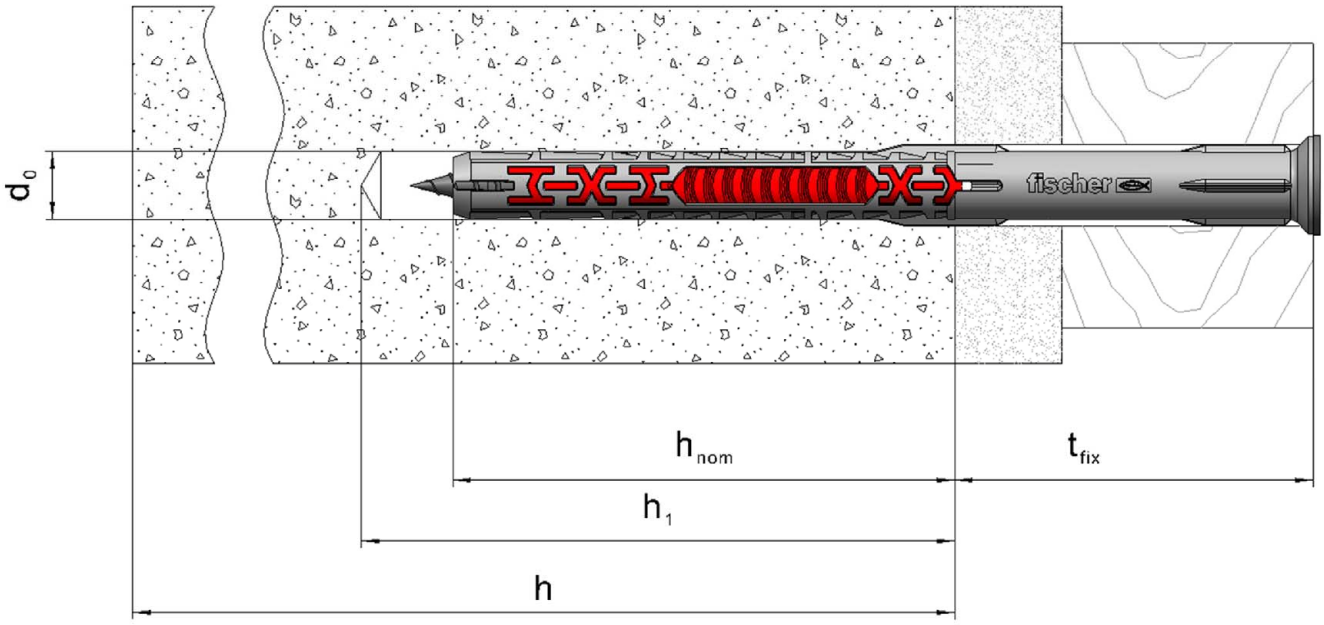
Issued in Berlin on 25 August 2022 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Ziegler

Deutsches Institut für Bautechnik DIBt

Installed anchor DuoXpand



Legend

d_0	=	Nominal drill hole diameter
h_{nom}	=	Overall plastic anchor embedment depth in the base material
h_1	=	Depth of drill hole to deepest point
h	=	Thickness of member (base material)
t_{fix}	=	Thickness of fixture and / or non-load-bearing layer

Figure not to scale

fischer frame fixing DuoXpand	**Annex A 1**
Product description Installed anchor	

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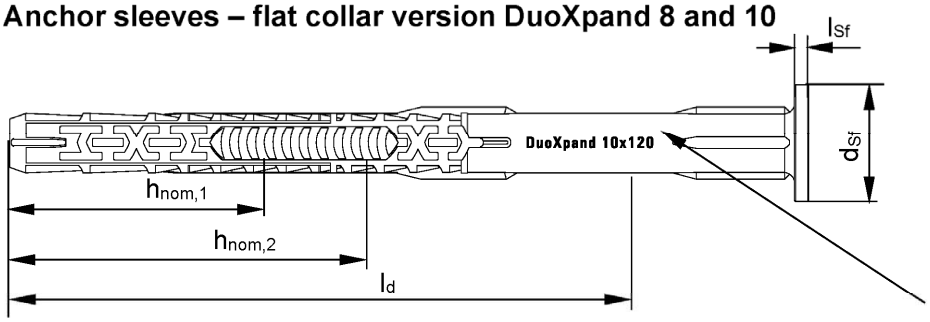
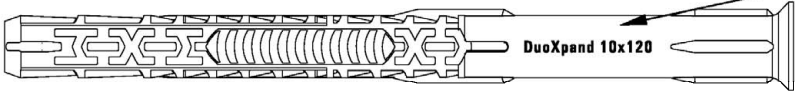
Anchor sleeves – flat collar version DuoXpand 8 and 10

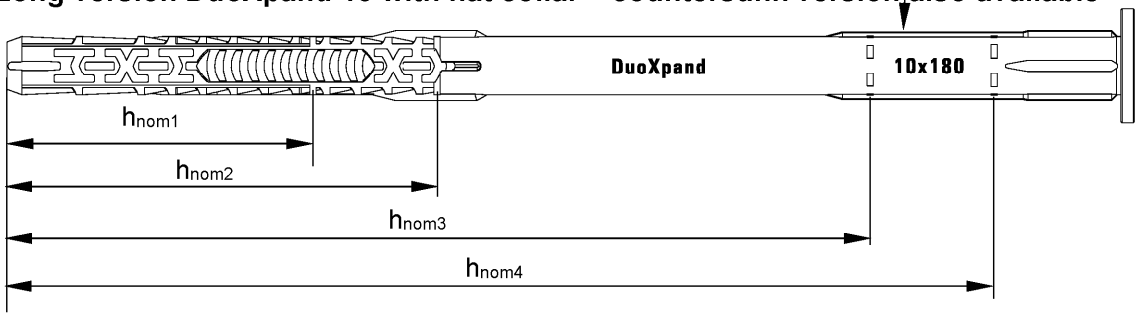


Marking:
Brand
Anchor type
Size
e.g. DuoXpand 10x120
e.g. DuoXpand 10x180

Countersunk version DuoXpand 8 and 10

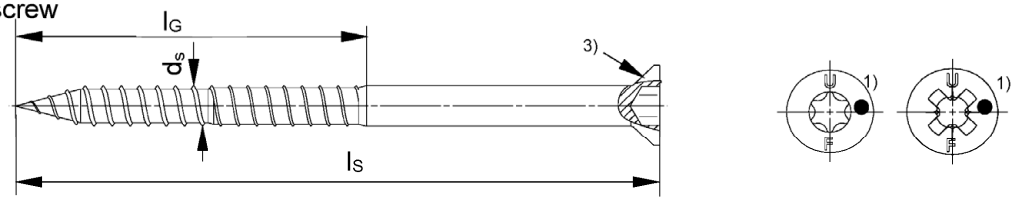


Long version DuoXpand 10 with flat collar – countersunk version also available

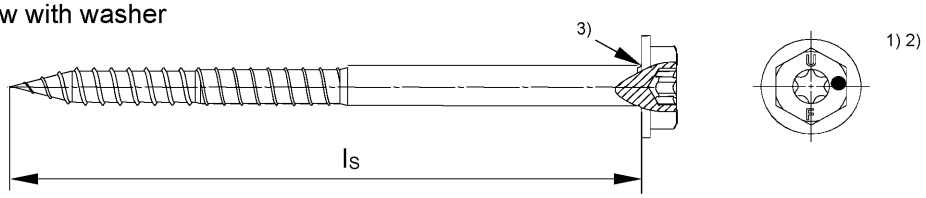


Special screws

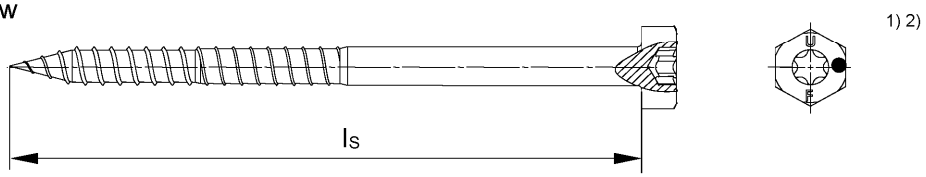
Countersunk screw



Hexagonal screw with washer



Hexagonal screw



1) Additional marking for the special screw, stainless steel version: e.g. "A4" or "R" or "A2".
2) Internal driving feature for TX bit is optional for hexagonal head.
3) Optional additional version with underhead ribs.

Figures not to scale

fischer frame fixing DuoXpand

Annex A 2

Product description
Anchor types, special screws
Marking and dimensions

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Table A3.1: Dimensions

Anchor type	Anchor sleeve							Special screw		
	h_{nom} [mm]	d_{nom} [mm]	t_{fix} [mm]	min. l_d [mm]	max. l_d [mm]	l_{Sf} [1] [mm]	d_{Sf} [1] [mm]	d_s [mm]	l_G [mm]	l_s [mm]
DuoXpand 8	50	8	≥ 1	80	120	1,6	14,0	6,0	77	$l_d + d_s$
	70									
DuoXpand 10	50	10	≥ 1	80	230	2,2	18,5	7,0	77	$l_d + d_s$
	70									
	140 [2]									
	160 [2]									

[1] Only valid for flat collar version.

[2] For base material Sepa Parpaing (see Annex C 11), additional h_{nom} available at $l_d \geq 160$ mm.

Table A3.2: Materials

Name	Material
Anchor sleeve	- Polyamide, PA6, colour grey - Polyoxymethylene POM, colour red
Special screw	- Galvanised steel gvz with Zn5/Ag or Zn5/An in accordance with EN ISO 4042 **or** - Galvanised steel gvz with Zn5/Ag or Zn5/An in accordance with EN ISO 4042 with additional organic layer (Zn5/Ag/T7 or Zn5/An/T7, respectively) in three layers (total layer thickness ≥ 6 µm) **or** - Stainless steel "A2" of corrosion resistance class CRC II in accordance with EN 1993-1-4 **or** - Stainless steel "A4" or "R" of corrosion resistance class CRC III in accordance with EN 1993-1-4

fischer frame fixing DuoXpand

Annex A 3

Product description
Dimensions and materials

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Specifications of intended use

Anchorages subject to:

- Static and quasi-static loads: DuoXpand 8 und DuoXpand 10.
- Redundant non-structural systems.

Base materials:

- Reinforced or unreinforced compacted normal weight concrete without fibres, strength classes ≥ C12/15 (base material group "a"), as per EN 206, see Annex C 1 and C 3.
- Solid brick masonry (base material group "b") as per EN 771-1, EN 771-2 or EN 771-3, see Annex C 3, C 7 and C 8.
  Note: The characteristic resistance is also valid for larger brick sizes and higher compressive strength of the masonry unit.
- Hollow brick masonry (base material group "c"), as per EN 771-1, EN 771-2 or EN 771-3, see Annex C 3 – C 6 and C 8 – C 12.
- Reinforced autoclaved aerated concrete (base material group "d"), as per EN 12602, and unreinforced autoclaved aerated concrete (base material group "d") as per EN 771-4, see Annex C 3 + C 13.
- Mortar strength class of the masonry ≥ M2,5 in accordance with EN 998-2.
- For other comparable base materials of the base material group "a", "b", "c" and "d" the characteristic resistance of the anchor may be determined by job site tests in accordance with TR 051.

Temperature Range:

- c: - 40 °C to 50 °C (max. short term temperature + 50 °C and max long term temperature + 30 °C)
- b: - 40 °C to 80 °C (max. short term temperature + 80 °C and max long term temperature + 50 °C)

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions: Special screw made of zinc coated steel or stainless steel.
- The specific screw made of galvanised steel or galvanised steel with an additional organic layer may also be used in structures subject to external atmospheric exposure, if the area of the head of the screw is protected against moisture and driving rain after mounting of the fixing unit in this way, that intrusion of moisture into the anchor shaft is prevented. Therefore, there shall be an external cladding or a ventilated rainscreen mounted in front of the head of the screw and the head of the screw itself shall be coated with a soft plastic, permanently elastic bitumen-oil-combination coating (e.g. undercoating or body cavity protection for cars).
- Structures subject to external atmospheric exposure (including industrial and marine environment) and to permanently damp internal condition, if no particular aggressive conditions exist: Special screw made of stainless steel of corrosion resistance class CRC III.
  Note: Particular aggressive conditions are e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with extreme chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used).

Design:

- The anchorages are to be designed in accordance with TR 064 under the responsibility of an engineer experienced in anchorages and concrete/masonry work.
- Verifiable calculation notes and drawings shall be prepared taking account of the loads to be anchored, the nature and strength of the base materials and the dimensions of the anchorage members as well as of the relevant tolerances. The position of the anchor is indicated on the design drawings.

Installation:

- Hole drilling by the drilling method in accordance with Annex C 1 for base material group "a", and in accordance with Annexes C 7 – C 13 for base material group "b", "c" and "d".
- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- Installation temperature: - 20 °C to + 40 °C.
- Exposure to UV due to solar radiation of the anchor not protected by rendering ≤ 6 weeks.
- No ingress of water in the borehole at temperatures < 0°C.

fischer frame fixing DuoXpand	**Annex B 1**
Intended use Specifications	

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Table B2.1: Installation parameters

Anchor type			DuoXpand 8	DuoXpand 10
Nominal drill hole diameter	d_0	= [mm]	8	10
Cutting diameter of drill bit	d_{cut}	≤ [mm]	8,45	10,45
Overall plastic anchor embedment depth in the base material[1)]	h_{nom1}	≥ [mm]	50	50
	h_{nom2}	≥ [mm]	70	70
	h_{nom3}[2)]	≥ [mm]	-	140
	h_{nom4}[2)]	≥ [mm]	-	160
Depth of drill hole to deepest point	$h_{1,1}$	≥ [mm]	60	60
	$h_{1,2}$	≥ [mm]	80	80
	$h_{1,3}$[2)]	≥ [mm]	-	150
	$h_{1,4}$[2)]	≥ [mm]	-	170
Diameter of clearance hole in the fixture	d_f	≤ [mm]	8,5	10,5

[1)] For base material group "c": If the embedment depth is higher than h_{nom} given in the Table B2.1, job site tests have to be carried out in accordance with TR 051.

[2)] Only valid for Sepa Parpaing see Annex C 11 at anchor length $l_d \geq 160$ mm.

Table B2.2: Minimum thickness of member, edge distances and spacing in concrete – base material group „a"[1)]

Anchor Type	Embed-ment depth h_{nom} [mm]	Concrete strength class	Minimum thickness of member h_{min} [mm]	Charac-teristic edge distance $c_{cr,N}$ [mm]	Charac-teristic spacing $s_{cr,N}$ [mm]	Minimum spacing and edge distances[2)] s_{min}, c_{min} [mm]
DuoXpand 8	≥ 50	C12/15	80	70	90	s_{min} =70 for c ≥ 140 c_{min} =70 for s ≥ 140
		≥ C16/20		50	65	s_{min} =50 for c ≥ 100 c_{min} =50 for s ≥ 100
	≥ 70	C12/15	100	70	100	s_{min} =70 for c ≥ 140 c_{min} =70 for s ≥ 140
		≥ C16/20		50	70	s_{min} =50 for c ≥ 100 c_{min} =50 for s ≥ 100
DuoXpand 10	≥ 50	C12/15	80	70	100	s_{min} =70 for c ≥ 140 c_{min} =70 for s ≥ 140
		≥ C16/20		50	70	s_{min} =50 for c ≥ 100 c_{min} =50 for s ≥ 100
	≥ 70	C12/15	100	70	115	s_{min} =70 for c ≥ 140 c_{min} =70 for s ≥ 140
		≥ C16/20		50	80	s_{min} =50 for c ≥ 100 c_{min} =50 for s ≥ 100

[1)] See scheme of edge distances and spacing Annex B 3.

[2)] Intermediate values by linear interpolation.

Fixing points with spacing a ≤ $s_{cr,N}$ are considered as a group with a maximum characteristic resistance $N_{Rk,p}$ as per Table C1.2. For spacing a > $s_{cr,N}$ the anchors are considered as single anchors, each with characteristic resistance $N_{Rk,p}$ as per Table C1.2.

fischer frame fixing DuoXpand	**Annex B 2**
Intended use Installation parameters Minimum thickness of member, edge distances and spacing for use in concrete	

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Table B3.1: Minimum thickness of member, edge distances and spacing in solid and hollow or perforated masonry – base material group "b" and "c"

Anchor Type			DuoXpand 8	DuoXpand 10
Minimum thickness of member[1)]	h_{min}	[mm]	115	115
Spacing between anchor groups and / or single anchors	a_{min}	[mm]	250	250
Single anchor				
Minimum edge distance	c_{min}	[mm]	100	100
Anchor group				
Minimum spacing perpendicular to free edge	$s_{1,min}$	[mm]	100	100
Minimum spacing parallel to free edge	$s_{2,min}$	[mm]	100	100
Minimum edge distance	c_{min}	[mm]	100	100

[1)] Member thickness according to Annex C 3 – C 6.

Scheme of edge distances and spacing in concrete, solid and hollow or perforated masonry – base material group "a", "b" and "c"

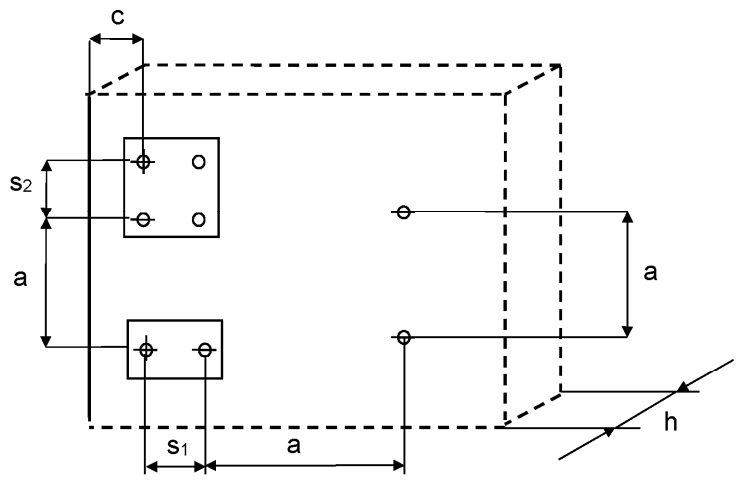

Figure not to scale

fischer frame fixing DuoXpand	**Annex B 3**
Intended use Minimum thickness of member, edge distances and spacing for use in solid, hollow or perforated masonry	

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Table B4.1: Minimum thickness of member, edge distances and spacing in reinforced and unreinforced autoclaved aerated concrete – base material group "d"

Anchor type			DuoXpand 8		DuoXpand 10	
Compressive strength[1)]	f_{ck} $f_{cm,decl}$	[N/mm²]	≥ 2	≥ 6	≥ 2	≥ 6
Nominal embedment depth	$h_{nom} \geq$	[mm]	70	70	70	70
Spacing between anchor groups and / or single anchors	a_{min}	[mm]	250	250	250	250
Single anchor						
Minimum thickness of member	h_{min}	[mm]	100	100	100	100
Minimum edge distance	c_{min}	[mm]	100	100	100	100
Anchor group						
Minimum thickness of member	h_{min}	[mm]	100	175	100	175
Minimum edge distance	c_{min}	[mm]	100	100	100	100
Minimum spacing perpendicular to free edge	$s_{1,min}$	[mm]	100	100	100	100
Minimum spacing parallel to free edge	$s_{2,min}$	[mm]	100	80	100	80

[1)] See table C13.1 and C13.2.

Scheme of edge distances and spacing in reinforced and unreinforced autoclaved aerated concrete – base material group "d"

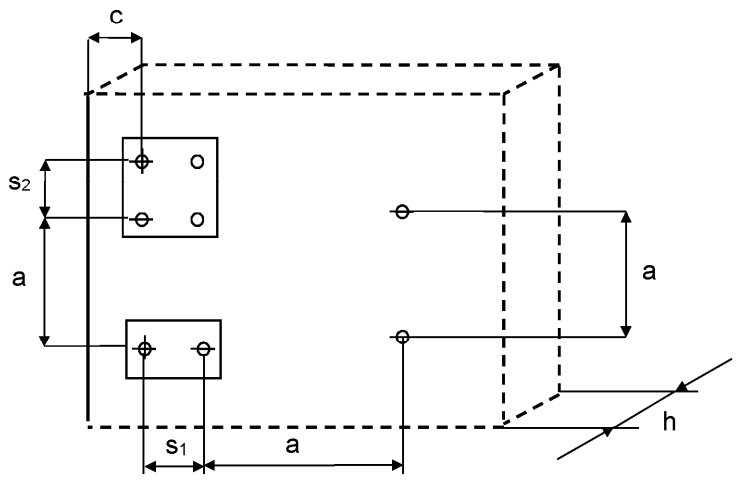

Figure not to scale

fischer frame fixing DuoXpand

Annex B 4

Intended use
Minimum thickness of member, edge distances and spacing for use in reinforced and unreinforced autoclaved aerated concrete

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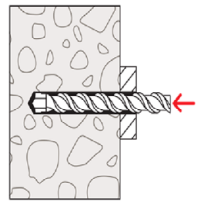
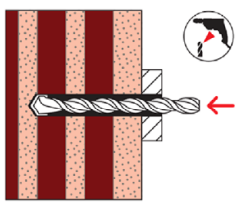
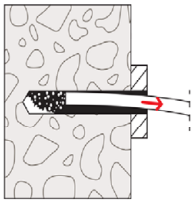
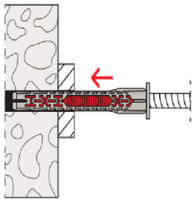
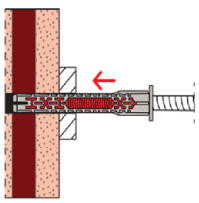
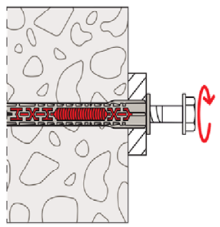
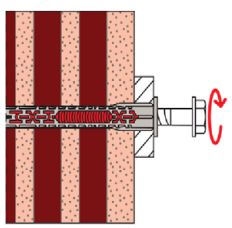
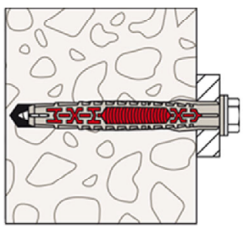
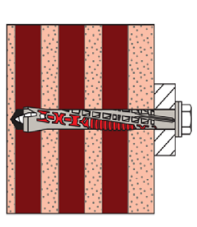
Installation instructions

The following pictures show fixing through timber in concrete and hollow brick
Summary of all kind of masonry bricks see Annex C 3 – C 6.

Solid bricks	Hollow or perforated bricks	
		1. Drill the bore hole as per Table B2.1 using the drilling method described in the corresponding Annex C.
	For application in hollow or perforated bricks, removal of bore dust is not necessary.	2. For use in base material group “a“ (concrete), “b“ (solid bricks), “d” (autoclaved aerated concrete): Remove dust from borehole.
		3. Insert anchor (screw and sleeve) by using a hammer until the collar of the plastic sleeve is flush with the surface of the fixture.
		4. The screw is screwed-in until the head of the screw touches the sleeve. The anchor is correctly installed, if the head of the screw fits tight on the surface and nor the anchor sleeve neither the screw cannot be turned-in any further.
		5. Correctly installed anchor.

fischer frame fixing DuoXpand	**Annex B 5**
Intended use Installation instructions	

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Table C1.1: Characteristic resistance of the screws

Failure of expansion element (special screw)			**DuoXpand 8**		**DuoXpand 10**	
			galvanised steel	stainless steel	galvanised steel	stainless steel
Characteristic tension resistance	$N_{Rk,s}$	[kN]	**14,8**	**14,3**	**21,7**	**21,7**
Partial safety factor	γ_{Ms} [1)]	[-]	**1,50**	**1,55**	**1,55**	**1,55**
Characteristic shear resistance	$V_{Rk,s}$	[kN]	**7,4**	**7,1**	**10,8**	**10,8**
Partial safety factor	γ_{Ms} [1)]	[-]	**1,25**	**1,29**	**1,29**	**1,29**
Characteristic bending resistance of the screw						
Characteristic bending resistance	$M_{Rk,s}$	[Nm]	**12,4**	**12,0**	**20,6**	**20,6**
Partial safety factor	γ_{Ms} [1)]	[-]	**1,25**	**1,29**	**1,29**	**1,29**

1) In absence of other national regulations.

Table C1.2: Characteristic resistance due to pullout-failure for use in concrete – base material group "a"[1)]

Pull-out failure (plastic sleeve)				**DuoXpand 8**		**DuoXpand 10**	
Embedment depth h_{nom} [mm]			≥	50	70	50	70
Concrete ≥ C12/15							
Characteristic tension resistance (30/50 °C)	$N_{Rk,p}$	[kN]		**3,5**	**4,0**	**3,5 / 4,0[2)]**	**5,0**
Characteristic tension resistance (50/80 °C)	$N_{Rk,p}$	[kN]		**3,5**	**4,0**	**3,0 / 4,0[2)]**	**4,5**
Partial safety factor	γ_{Mc} [3)]	[-]		**1,8**			

1) Drilling method: hammer drilling.
2) Valid for concrete ≥ C16/20.
3) In absence of other national regulations.

fischer frame fixing DuoXpand

Annex C 1

Performances
Characteristic resistance and characteristic bending resistance of the screw
Characteristic resistance for use in concrete

Deutsches Institut für Bautechnik DIBt

Table C2.1: Displacements[1] under tension and shear loading in concrete, in solid bricks, in hollow or perforated bricks

Displacements under			Tension load[2]		Shear load[2]	
Anchor type	h_{nom} [mm]	F [kN]	δ_{NO} [mm]	$\delta_{N\infty}$ [mm]	δ_{VO} [mm]	$\delta_{V\infty}$ [mm]
DuoXpand 8	**50**	1,4	0,46	0,92	0,60	0,90
	70	1,6	0,45	0,90	0,63	0,95
DuoXpand 10	**50**	1,6	0,59	1,18	0,68	1,02
	70	2,0	0,58	1,16	0,88	1,32
	140[3]	1,6	0,59	1,18	0,68	1,02
	160[3]	2,0	0,58	1,16	0,88	1,32

1) Valid for all ranges of temperatures.
2) Intermediate values by linear interpolation.
3) Only valid for Sepa Parpaing see Annex C 11.

Table C2.2: Displacements[1] under tension and shear loading in reinforced and unreinforced autoclaved aerated concrete

Displacements under				Tension load[2]		Shear load[2]	
Anchor type	f_{ck} / $f_{cm,decl}$ [N/mm²]	h_{nom} [mm]	F [kN]	δ_{NO} [mm]	$\delta_{N\infty}$ [mm]	δ_{VO} [mm]	$\delta_{V\infty}$ [mm]
DuoXpand 8	**≥ 2**	**70**	0,11	0,13	0,26	0,22	0,33
	≥ 6	**70**	0,71	0,68	1,36	1,42	2,13
DuoXpand 10	**≥ 2**	**70**	0,18	0,12	0,24	0,36	0,54
	≥ 6	**70**	0,32	0,66	1,32	0,64	0,96

1) Valid for all ranges of temperatures.
2) Intermediate values by linear interpolation.

fischer frame fixing DuoXpand

Annex C 2

Performances
Displacements under tension and shear loading in concrete, masonry and autoclaved aerated concrete

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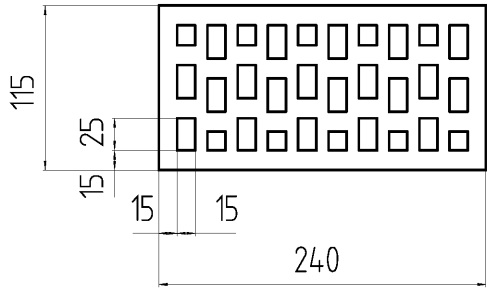
Table C3.1: Summary of base materials concrete group "a", solid bricks group "b"[1] and autoclaved aerated concrete group "d"

Base material	Format	Dimensions (L x W x H) [mm]	Mean compressive strength as per EN 771 [N/mm²]	Bulk density ρ [kg/dm³]	See Annex
Concrete ≥ **C12/15** as per EN 206					C 1
Autoclaved aerated concrete, AAC, as per EN 771-4					C 13
Reinforced autoclaved aerated concrete, AAC as per EN 12602					C 13
Clay brick Mz, as per EN 771-1, *e.g. Mz Ziegelwerk Nordhausen, DE*	NF	240x115x71	≥ 10	≥ 1,8	C 7
Calcium silicate solid brick KS, as per EN 771-2, *e.g. KS Wemding, DE*	NF	240x115x71	≥ 10	≥ 2,0	C 7
Calcium silicate solid brick KS, as per EN 771-2, *e.g. KS Wemding, DE*	12 DF	498x175x248	≥ 10	≥ 1,8	C 7
Lightweight solid brick Vbl, as per EN 771-3, *e.g. Vbl KLB, DE*	2 DF	240x115x113	≥ 2,5	≥ 1,4	C 8

[1] Vertically perforation ≤ 15%; cross section reduced by perforation vertically to the resting area.

Table C3.2: Summary of hollow or perforated bricks – base material group "c"[1]

Base material	Format/ Dimensions (L x W x H) [mm]	Brick drawing [mm]	Mean compressive strength as per EN 771 [N/mm²] / bulk density ρ [kg/dm³]	See Annex
Perforated clay brick Hlz as per EN 771-1, *e.g. Wienerberger Hlz, DE*	2 DF 240 x 115 x 113		≥ 5,0 / ≥ 0,9	C 8

[1] Vertically perforation > 15 % and ≤ 50 %, cross section reduced by perforation vertically to the resting area.

fischer frame fixing DuoXpand	**Annex C 3**
Performances Summary of base materials concrete, solid bricks, autoclaved aerated concrete and hollow or perforated bricks	

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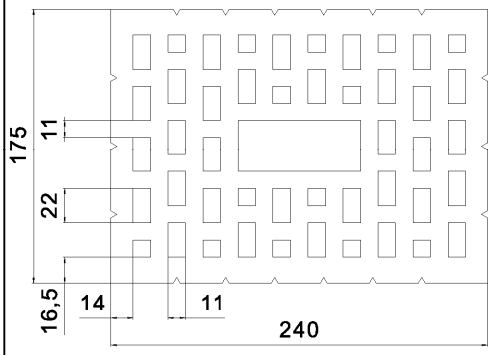
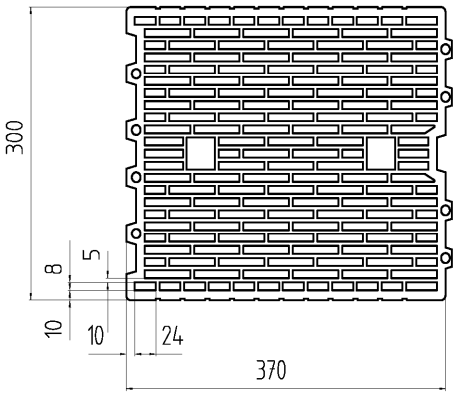
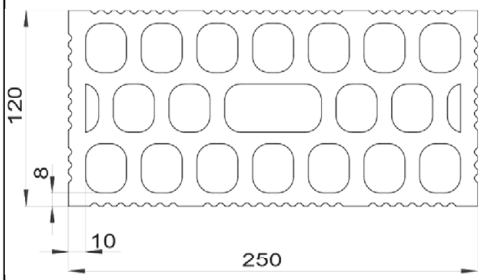
Table C4.1: Summary of hollow or perforated bricks – base material group "c"[1)]

Base material	Format/ Dimensions (L x W x H) [mm]	Brick drawing [mm]	Mean compressive strength as per EN 771 [N/mm²] / bulk density ρ [kg/dm³]	See Annex
Perforated clay brick Hlz, as per EN 771-1, *e.g. Schlagmann, DE*	3 DF 240x175x113		≥ 5,0 / ≥ 0,9	C 8
Perforated clay brick HLz as per EN 771-1, *e.g. Wienerberger Porotherm 30 R, FR*	370x300x250		≥ 7,5 / ≥ 0,7	C 9
Perforated clay brick HLz, as per EN 771-1, e.g. Doppio Uni IT Wienerberger, IT	250x120x190		≥ 5,0 / ≥ 0,9	C 9

[1)] Vertically perforation > 15 % and ≤ 50 %, cross section reduced by perforation vertically to the resting area.

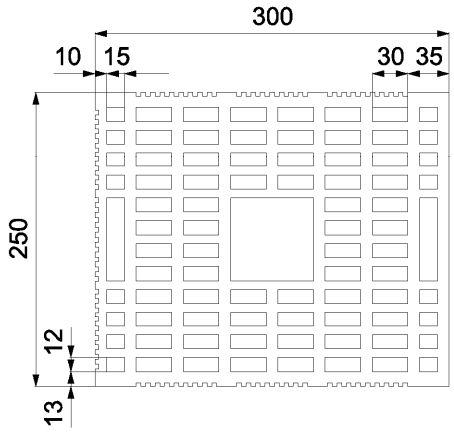
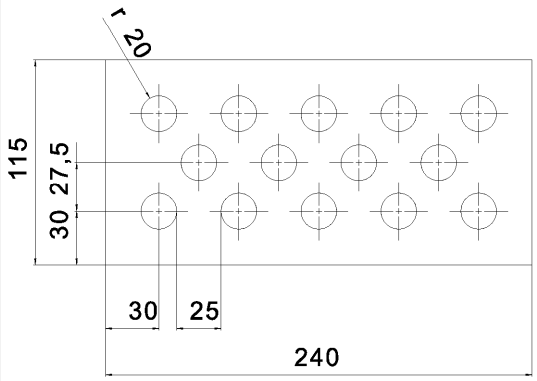
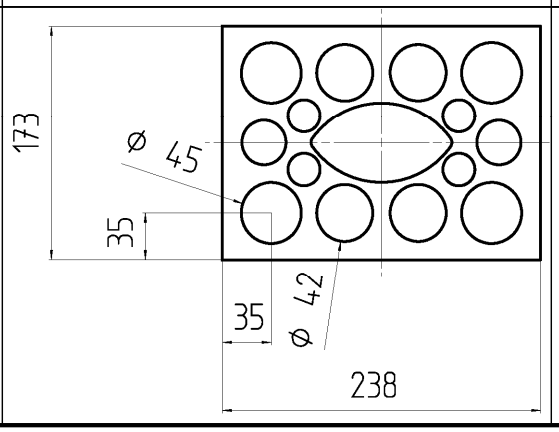
fischer frame fixing DuoXpand

Performances
Summary of base materials hollow or perforated bricks

Annex C 4

Deutsches Institut für Bautechnik DIBt

Table C5.1: Summary of hollow or perforated bricks – base material group "c"[1)]

Base material	Format/ Dimensions (L x W x H) [mm]	Brick drawing [mm]	Mean compressive strength as per EN 771 [N/mm²] / bulk density ρ [kg/dm³]	See Annex
Perforated clay brick HLz as per EN 771-1, *e.g. Wienerberger Pth Bio Modulare, DE*	8 DF 300x250x190		≥ 7,5 / ≥ 1,0	C 9
Calcium silicate hollow brick KSL, as per EN 771-2, *e.g. Bösel, DE*	2 DF 240x115x113		≥ 10 / ≥ 1,6	C 10
Calcium silicate hollow brick KSL, as per EN 771-2, *e.g. KS Wemding, DE*	3 DF 240x175x113		≥ 10 / ≥ 1,4	C 10

[1)] Vertically perforation > 15 % and ≤ 50 %, cross section reduced by perforation vertically to the resting area.

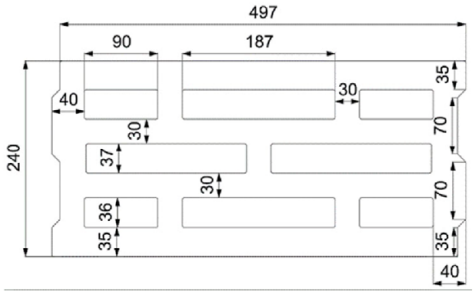
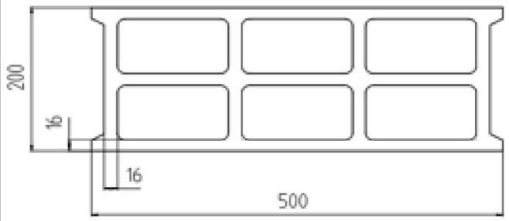
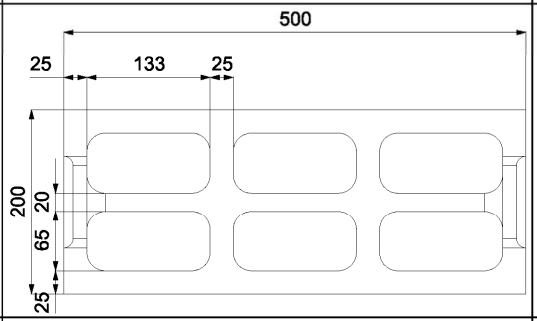
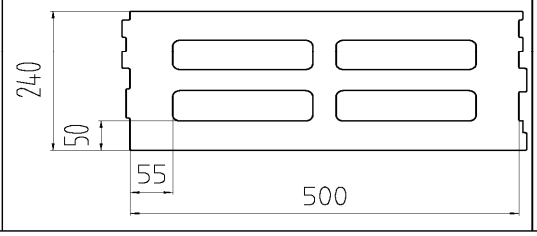
fischer frame fixing DuoXpand

Performances
Summary of base materials hollow or perforated bricks

Annex C 5

Deutsches Institut für Bautechnik DIBt

Table C6.1: Summary of hollow or perforated bricks – base material group "c"[1)]

Base material	Format/ Dimensions (L x W x H) [mm]	Brick drawing [mm]	Mean compressive strength as per EN 771 [N/mm²] / bulk density ρ [kg/dm³]	See Annex
Hollow brick lightweight concrete Hbl, as per EN 771-3, *e.g. Knobel, DE*	16DF 495x240x248		≥ 2,5 / ≥ 0,7	C 10
Hollow brick lightweight concrete Hbl, as per EN 771-3, *e.g. Sepa Parpaing, FR*	500x200x200		≥ 2,5 / ≥ 1,0	C 11
Hollow brick lightweight concrete Hbl, as per EN 771-3, *e.g. Indelasa, ES*	500x200x200		≥ 2,5 / ≥ 1,0	C12
Hollow brick lightweight concrete Hbl, as per EN 771-3, *e.g. Knobel, DE*	500x240x240		≥ 2,5 / ≥ 0,9	C 12

[1)] Vertically perforation > 15 % and ≤ 50 %, cross section reduced by perforation vertically to the resting area.

fischer frame fixing DuoXpand

Performances
Summary of base materials hollow or perforated bricks

Annex C 6

Deutsches Institut für Bautechnik DIBt

Table C7.1: Characteristic resistance F_{Rk} in [kN] for use in solid masonry - base material group "b"

Base material; bulk density [kg/dm³] [*Supplier Title, country*] Geometry, DF or nominal size (L x W x H) [mm] and drilling method	Mean compressive strength / Minimum compressive strength single brick[9] as per EN 771 [N/mm²]	Characteristic resistance F_{Rk} [kN] Temperature range 30/50 °C and 50/80 °C			
		DuoXpand 8		DuoXpand 10	
		h_{nom} [mm]			
		≥ 50	≥ 70	≥ 50	≥ 70
Clay brick Mz; ρ ≥ 1,8 as per EN 771-1 *e.g. Mz Ziegelwerk Nordhausen, DE* NF (240x115x71) Hammer drilling	12,5/10,0	**1,5**	**1,5**	**0,9 / 1,5**[7]	**0,9 / 2,0**[7]
	15,0/12,0	**2,0**	**2,0**	**1,2 / 2,0**[7]	**1,2 / 2,0**[7]
	20,0/16,0	**2,5**	**2,5**	**1,5 / 2,5**[7]	**1,5 / 3,0**[7]
	25,0/20,0	**3,0**	**3,5**	**2,0 / 3,0**[7]	**2,0 / 3,5**[7]
	35,0/28,0	**4,5**	**5,0**	**3,0 / 4,5**[7]	**3,0 / 5,0**[7]
	37,3/-	**4,5**	**5,0**	**3,0 / 4,5**[7]	**3,0 / 5,5**[7]
Clay brick Mz; ρ ≥ 1,8 as per EN 771-1 *e.g. Mz Ziegelwerk Nordhausen, DE* NF (240x115x71) Rotary drilling	10,0/8,0	**1,5**	**2,0**	**1,5**	**2,0 / 2,5**[2]
	12,5/10,0	**2,0**	**2,5**	**2,0**	**2,5 / 3,0**[2] **/ 3,5**[5]
	15,0/12,0	**2,5**	**3,0**	**2,5**	**3,0 / 4,0**[2]
	18,5/-	**3,0**	**3,5**	**3,0**	**4,0 / 4,5**[2] **/ 5,0**[3]
Calcium silicate solid brick KS; ρ ≥ 2,0 as per EN 771-2 *e.g. KS Wemding, DE* NF (240x115x71) Hammer drilling	10,0/8,0	**1,2 / 1,5**[1]	**1,5**	**1,5**	**1,5 / 2,0**[6]
	12,5/10,0	**1,5**	**2,0**	**2,0**	**2,0 / 2,5**[2]
	15,0/12,0	**2,0**	**2,5**	**2,5**	**2,5 / 3,0**[2]
	20,0/16,0	**2,5**	**3,0 / 3,5**[4]	**3,0 / 3,5**[2]	**3,5 / 4,0**[2]
	25,0/20,0	**3,5**	**4,0**	**4,0 / 4,5**[4]	**4,0 / 4,5**[6] **/ 5,0**[2]
	30,0/-	**4,0**	**4,5 / 5,0**[2]	**4,5 / 5,0**[2]	**5,0 / 5,5**[6] **/ 6,0**[2]
Calcium silicate solid brick KS; ρ ≥ 1,8 as per EN 771-2 *e.g. KS Wemding, DE* 12 DF (498x175x248) Hammer drilling	10,0/8,0	**1,5**	**2,0**	**2,0**	**2,0 / 2,5**[6]
	12,5/10,0	**2,0**	**2,5**	**2,5**	**2,5 / 3,0**[6]
	15,0/12,0	**2,5**	**3,0**	**3,0**	**3,0 / 3,5**[6] **/ 4,0**[2]
	20,0/16,0	**3,5**	**3,5**	**3,5**	**4,0 / 4,5**[6] **/ 5,0**[2]
	25,0/20,0	**4,5**	**4,5**	**4,5**	**5,0 / 6,0**[6] **/ 6,5**[2]
	26,5/-	**4,5**	**5,0**	**5,0**	**5,5 / 6,0**[6] **/ 6,5**[2]
Partial safety factor γ_{Mm}[8] [-]		**2,5**			

1) Only valid for temperature range "c" (30/50 °C).
2) Only valid for c_{1min} 120 mm and c_{2min} 180 mm.
3) Only valid for c_{1min} 130 mm and c_{2min} 195 mm.
4) Only valid for c_{1min} 120 mm and c_{2min} 180 mm for temperature range "c" (30/50 °C).
5) Only valid for c_{1min} 130 mm and c_{2min} 195 mm for temperature range "c" (30/50 °C).
6) Only valid for c_{1min} 110 mm and c_{2min} 165 mm.
7) Only valid for $s_{2,min}$ 250 mm.
8) In absence of other national regulations.
9) The compressive strength of the single brick must not be less than 80% of the mean compressive strength.

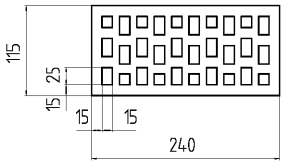
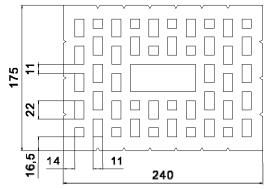
fischer frame fixing DuoXpand

Performances
Characteristic resistance for use in solid masonry

Annex C 7

Deutsches Institut für Bautechnik DIBt

Table C8.1: Characteristic resistance F_{Rk} in [kN] for use in solid and in hollow or perforated masonry - base material group "b" and "c"

Base material; bulk density [kg/dm³] [*Supplier Title, country*] Geometry, DF or nominal size (L x W x H) [mm] and drilling method	Mean compressive strength / Minimum compressive strength single brick[4] as per EN 771 [N/mm²]	Characteristic resistance F_{Rk} [kN] Temperature range 30/50 °C and 50/80 °C			
		DuoXpand 8		DuoXpand 10	
		h_{nom} [mm][1]			
		50	70	50	70
Lightweight solid brick Vbl; ρ ≥ 1,4 as per EN 771-3 *e.g. Vbl KLB, DE* 2 DF (240x115x113) Rotary drilling	2,5/2,0	**0,4**	**0,6**	**0,3**	**0,6 / 0,75[2]**
	5,0/4,0	**0,75 / 0,9[2]**	**1,2**	**0,6 / 0,75[2]**	**1,2 / 1,5[2]**
Perforated clay brick Hlz; ρ ≥ 0,9 as per EN 771-1 *e.g. Wienerberger Hlz, DE*  2 DF (240x115x113) Rotary drilling	5,0/4,0	**0,5**	**0,4**	**0,4**	**0,4**
	7,5/6,0	**0,75**	**0,6**	**0,6**	**0,6**
	10,0/8,0	**0,9**	**0,75**	**0,9**	**0,75**
	10,9/-	**0,9**	**0,75**	**0,9**	**0,9**
Perforated clay brick Hlz; ρ ≥ 0,9 as per EN 771-1 *e.g. Schlagmann, DE*  3 DF (240x175x113) Rotary drilling	5,0/4,0	**0,3**	**0,5 / 0,6[2]**	**0,3**	**0,5 / 0,6[2]**
	7,5/6,0	**0,4**	**0,75 / 0,9[2]**	**0,4 / 0,5[2]**	**0,75 / 0,9[2]**
	10,0/8,0	**0,6**	**0,9 / 1,2[2]**	**0,6**	**1,2**
	12,5/12,0	**0,75**	**1,2 / 1,5[2]**	**0,75**	**1,2 / 1,5[2]**
	15,0/10,0	**0,9**	**1,5**	**0,9**	**1,5 / 2,0[2]**
	16,2/-	**0,9**	**1,5 / 2,0[2]**	**0,9**	**1,5 / 2,0[2]**
Partial safety factor	γ_{Mm}[3] [-]	**2,5**			

1) The lowest resistance of two consecutive embedment depths may be used for the intermediate embedment depths. Exception for "Lightweight solid brick Vbl": here ≥ h_{nom} is valid.
2) Only valid for temperature range "c" (30/50 °C).
3) In absence of other national regulations.
4) The compressive strength of the single brick must not be less than 80% of the mean compressive strength.

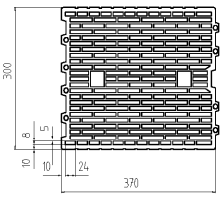
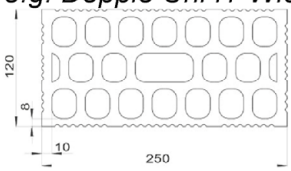
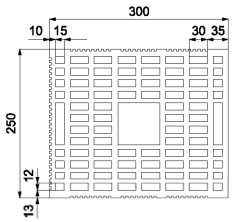
fischer frame fixing DuoXpand

Performances
Characteristic resistance for use in solid masonry, hollow or perforated masonry

Annex C 8

Deutsches Institut für Bautechnik DIBt

Table C9.1: Characteristic resistance F_{Rk} in [kN] for use in hollow or perforated masonry - base material group "c"

Base material; bulk density [kg/dm³] [*Supplier Title, country*] Geometry, DF or nominal size (L x W x H) [mm] and drilling method	Mean compressive strength / Minimum compressive strength single brick[4] as per EN 771 [N/mm²]	Characteristic resistance F_{Rk} [kN] Temperature range 30/50 °C and 50/80 °C			
		DuoXpand 8		DuoXpand 10	
		h_{nom} [mm][1]			
		50	70	50	70
Perforated clay brick HLz; ρ ≥ 0,7 as per EN 771-1 *e.g. Wienerberger Porotherm 30 R, FR*  370x300x250 Rotary drilling	7,5/6,0	**0,3**	**0,3**	**0,3**	**0,3**
	10,0/8,0	**0,4**	**0,4**	**0,4**	**0,4**
	12,5/10,0	**0,5**	**0,5**	**0,5**	**0,5 / 0,6[2]**
	15,0/12,0	**0,6**	**0,6**	**0,6**	**0,6**
	17,6/-	**0,75**	**0,75**	**0,75**	**0,75**
Perforated clay brick HLz; ρ ≥ 0,9 as per EN 771-1 *e.g. Doppio Uni IT Wienerberger, IT*  250x120x190 Rotary drilling	5,0/4,0	**0,4**	**0,4**	**0,5**	**0,5**
	7,5/6,0	**0,6**	**0,5**	**0,75**	**0,75**
	10,0/8,0	**0,75**	**0,75**	**0,9**	**0,9**
	12,5/10,0	**0,9**	**0,9**	**1,2**	**1,2**
	15,0/12,0	**1,2**	**1,2**	**1,5**	**1,5**
	18,7/-	**1,5**	**1,2**	**2,0**	**2,0**
Perforated clay brick HLz; ρ ≥ 1,0 as per EN 771-1 *e.g. Wienerberger Pth Bio Modulare, IT*  8 DF (300x250x190) Rotary drilling	7,5/6,0	**0,75**	**0,75**	**0,75**	**0,75**
	10,0/8,0	**0,9**	**0,9**	**0,9**	**0,9**
	12,5/10,0	**1,2**	**1,2**	**1,2**	**1,2**
	15,0/12,0	**1,5**	**1,5**	**1,5**	**1,5**
	20,0/16,0	**2,0**	**2,0**	**2,0**	**2,0**
	23,6/-	**2,5**	**2,5**	**2,5**	**2,5**
Partial safety factor	γ_{Mm}[3] [-]	**2,5**			

1) The lowest resistance of two consecutive embedment depths may be used for the intermediate embedment depths.
2) Only valid for temperature range "c" (30/50 °C).
3) In absence of other national regulations.
4) The compressive strength of the single brick must not be less than 80% of the mean compressive strength.

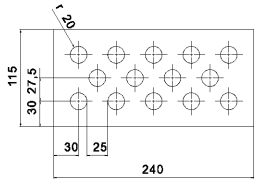
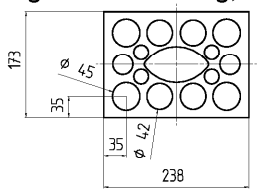
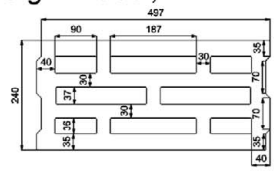
fischer frame fixing DuoXpand

Performances
Characteristic resistance for use in hollow or perforated masonry

Annex C 9

Deutsches Institut für Bautechnik DIBt

Table C10.1: Characteristic resistance F_{Rk} in [kN] for use in hollow or perforated masonry - base material group „c“

Base material; bulk density [kg/dm³] [*Supplier Title, country*] Geometry, DF or nominal size (L x W x H) [mm] and drilling method	Mean compressive strength / Minimum compressive strength single brick[4] as per EN 771 [N/mm²]	Characteristic resistance F_{Rk} [kN] Temperature range 30/50 °C and 50/80 °C			
		DuoXpand 8		DuoXpand 10	
		h_{nom} [mm][1]			
		50	70	50	70
Calcium silicate hollow brick KSL; ρ ≥ 1,6 as per EN 771-2 *e.g. Bösel, DE*  2 DF (≧ 240x115x113) Hammer drilling	10,0/8,0	**0,75 / 0,9[2]**	**0,9**	**0,9 / 1,2[2]**	**1,2**
	12,5/10,0	**0,9 / 1,2[2]**	**1,2**	**1,2 / 1,5[2]**	**1,5**
	15,0/12,0	**1,2 / 1,5[2]**	**1,5**	**1,5**	**2,0**
	20,0/16,0	**1,5 / 2,0[2]**	**2,0**	**2,0 / 2,5[2]**	**2,5**
	25,0/20,0	**2,0**	**2,5**	**2,5 / 3,0[2]**	**3,0**
	25,7/-	**2,0 / 2,5[2]**	**2,5**	**2,5 / 3,0[2]**	**3,5**
Calcium silicate hollow brick KSL; ρ ≥ 1,4 as per EN 771-2 *e.g. KS Wemding, DE*  3 DF (240x175x113) Hammer drilling	10,0/8,0	**0,9**	**0,75 / 0,9[2]**	**0,6 / 0,75[2]**	**0,9 / 1,2[2]**
	12,5/10,0	**1,2**	**0,9 / 1,2[2]**	**0,75 / 0,9[2]**	**1,2 / 1,5[2]**
	15,0/12,0	**1,2 / 1,5[2]**	**1,2 / 1,5[2]**	**0,9 / 1,2[2]**	**1,5**
	20,0/16,0	**1,5 / 2,0[2]**	**1,5 / 2,0[2]**	**1,2 / 1,5[2]**	**2,0**
	21,4/-	**1,5 / 2,0[2]**	**1,5 / 2,0[2]**	**1,2 / 1,5[2]**	**2,0 / 2,5[2]**
Hollow brick lightweight concrete Hbl; ρ ≥ 0,7 as per EN 771-3 *e.g. Knobel, DE*  16 DF (495x240x248) Rotary drilling	2,5/2,0	**0,5 / 0,6[2]**	**0,5 / 0,6[2]**	**0,75**	**0,75**
	5,0/4,0	**0,9 / 1,2[2]**	**0,9 / 1,2[2]**	**1,5**	**1,5**
Partial safety factor	γ_{Mm}[3] [-]	**2,5**			

1) The lowest resistance of two consecutive embedment depths may be used for the intermediate embedment depths.
2) Only valid for temperature range “c” (30/50 °C).
3) In absence of other national regulations.
4) The compressive strength of the single brick must not be less than 80% of the mean compressive strength.

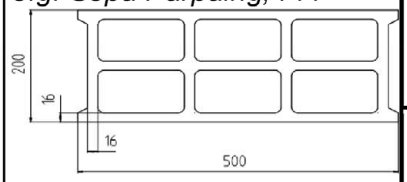
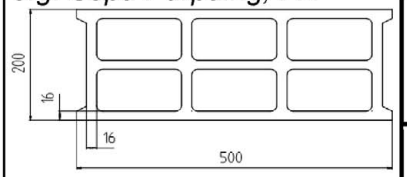
fischer frame fixing DuoXpand

Performances
Characteristic resistance for use in hollow or perforated masonry

Annex C 10

Deutsches Institut für Bautechnik DIBt

Table C11.1: Characteristic resistance F_{Rk} in [kN] for use in hollow or perforated masonry - base material group „c“

Base material; bulk density [kg/dm³] [*Supplier Title, country*] Geometry, DF or nominal size (L x W x H) [mm] and drilling method	Mean compressive strength / Minimum compressive strength single brick[5] as per EN 771 [N/mm²]	Characteristic resistance F_{Rk} [kN] Temperature range 30/50 °C and 50/80 °C					
		DuoXpand 8		DuoXpand 10			
		h_{nom} [mm][1]					
		50	70	50	70	140	160
Hollow brick lightweight concrete Hbl; ρ ≥ 1,0 as per EN 771-3 *e.g. Sepa Parpaing, FR*  500x200x200 Rotary drilling	2,5/2,0	**0,3 / 0,4**[2]	[3]	**0,5**	**0,5**	[3]	**0,3**
	5,0/4,0	**0,75**	**0,5**	**0,9**	**0,9**	**0,5**	**0,5**
	6,9/-	**0,9 / 1,2**[2]	**0,6**	**1,5**	**1,5**	**0,6**	**0,75**
Hollow brick lightweight concrete Hbl; ρ ≥ 1,0 as per EN 771-3 *e.g. Sepa Parpaing, FR*  500x200x200 Hammer drilling	2,5/2,0	[3]	[3]	[3]	**0,3**	[3]	[3]
	5,0/4,0	**0,3**	[3]	**0,3 / 0,4**[2]	**0,6**	[3]	**0,3 / 0,4**[2]
	6,9/-	**0,4 / 0,5**[2]	[3]	**0,4 / 0,5**[2]	**0,75 / 0,9**[2]	[3]	**0,4 / 0,6**[2]
Partial safety factor	γ_{Mm}[4] [-]	**2,5**					

1) The lowest resistance of two consecutive embedment depths may be used for the intermediate embedment depths.
2) Only valid for temperature range “c” (30/50 °C).
3) No performance assessed.
4) In absence of other national regulations.
5) The compressive strength of the single brick must not be less than 80% of the mean compressive strength.

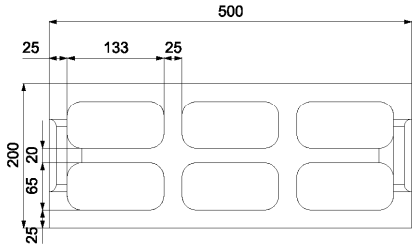
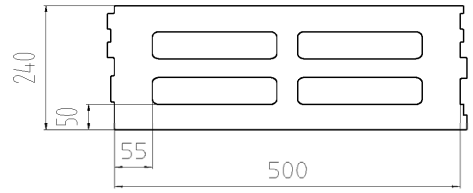
fischer frame fixing DuoXpand

Performances
Characteristic resistance for use in hollow or perforated masonry

Annex C 11

Deutsches Institut für Bautechnik DIBt

Table C12.1: Characteristic resistance F_{Rk} in [kN] for use in hollow or perforated masonry - base material group „c“

Base material; bulk density [kg/dm³] [*Supplier Title, country*] Geometry, DF or nominal size (L x W x H) [mm] and drilling method	Mean compressive strength / Minimum compressive strength single brick[4] as per EN 771 [N/mm²]	Characteristic resistance F_{Rk} [kN] Temperature range 30/50 °C and 50/80 °C			
		DuoXpand 8		DuoXpand 10	
		h_{nom} [mm][1]			
		50	70	50	70
Hollow brick lightweight concrete Hbl; ρ ≥ 1,0 as per EN 771-3 *e.g. Indelasa, ES*  500x200x200 Rotary drilling	2,5/2,0	**0,6**	**0,5**	**0,4**	**0,6**
	4,8/-	**1,2**	**0,9**	**0,75**	**0,9 / 1,2[2]**
Hollow brick lightweight concrete Hbl; ρ ≥ 0,9 as per EN 771-3 *e.g. Knobel, DE*  500x240x240 Rotary drilling	2,5/2,0	**0,9**	**0,75 / 0,9[2]**	**0,9**	**0,6**
	5,0/4,0	**1,5 / 2,0[2]**	**1,5 / 2,0[2]**	**2,0**	**1,5**
	6,2/-	**2,0 / 2,5[2]**	**2,0 / 2,5[2]**	**2,5**	**1,5**
Partial safety factor	γ_{Mm}[3] [-]	**2,5**			

1) The lowest resistance of two consecutive embedment depths may be used for the intermediate embedment depths.
2) Only valid for temperature range “c” (30/50 °C).
3) In absence of other national regulations.
4) The compressive strength of the single brick must not be less than 80% of the mean compressive strength.

fischer frame fixing DuoXpand

Performances
Characteristic resistance for use in hollow or perforated masonry

Annex C 12

Deutsches Institut für Bautechnik DIBt

Table C13.1: Characteristic resistance F_{Rk} in [kN] for use in autoclaved aerated concrete - base material group „d“

Base material Size (L x W x H) [mm] and drilling method	Mean compressive strength as per EN 771-4 $f_{cm,decl}$ [N/mm²]	Characteristic resistance F_{Rk} [kN] Temperature range 30/50 °C and 50/80 °C	
		DuoXpand 8	DuoXpand 10
		h_{nom} [mm]	
		≥ 70	
Autoclaved aerated concrete, AAC as per EN 771-4 e.g. (500x120x300) e.g. (500x250x300) Hammer drilling	**2,8**	**0,3**	**0,4 / 0,5**[1]
	4,0	**0,75**	**0,6**
	5,0	**0,9 / 1,2**[1]	**0,75**
	6,9	**1,5 / 2,0**[1]	**0,9**
Partial safety factor	γ_{MAAC}[2] [-]	**2,0**	

[1] Only valid for temperature range “c” (30/50 °C).
[2] In absence of other national regulations.

Table C13.2: Characteristic resistance F_{Rk} in [kN] for use in reinforced autoclaved aerated concrete - base material group „d“

Base material minimum member thickness h_{min} and drilling method	Compressive strength f_{ck} [N/mm²] (compressive strength class) as per EN 12602	Characteristic resistance F_{Rk} [kN] Temperature range 30/50 °C and 50/80 °C	
		DuoXpand 8	DuoXpand 10
		h_{nom} [mm]	
		≥ 70	
Reinforced autoclaved aerated concrete, AAC as per EN 12602 h_{min} = 100 mm[3] Hammer drilling	**≥ 2,0 (AAC 2)**	[2]	[2] **/ 0,3**[1]
	≥ 2,5 (AAC 2,5)	[2]	**0,3 / 0,4**[1]
	≥ 3,0 (AAC 3)	[2]	**0,4**
	≥ 3,5 (AAC 3,5)	[2]	**0,4 / 0,5**[1]
	≥ 4,0 (AAC 4)	[2]	**0,5 / 0,6**[1]
	≥ 4,5 (AAC 4,5)	[2]	**0,6 / 0,75**[1]
	≥ 5,0 (AAC 5)	[2]	**0,75**
	≥ 6,0 (AAC 6)	[2]	**0,9**
Partial safety factor	γ_{MAAC}[4] [-]	**2,0**	

[1] Only valid for temperature range “c” (30/50 °C).
[2] No performance assessed.
[3] For anchor groups in AAC 6 h_{min} = 175 mm.
[4] In absence of other national regulations.

fischer frame fixing DuoXpand	**Annex C 13**
Performances Characteristic resistance for use in autoclaved aerated concrete and in reinforced autoclaved aerated concrete	