CHEMOFAST®

TECHNICAL DATA SHEET

EASF EASF-EX EASF-Tro EASF Blue

2K Reaction resin mortar based on Polyester resin styrene-free

Application in non-cracked concrete

Application in hollow masonry

Application in solid masonry

Content Page

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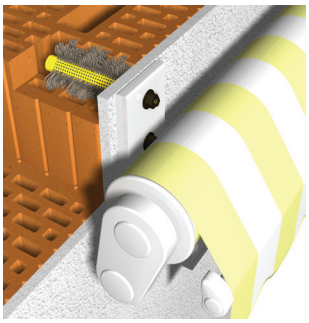
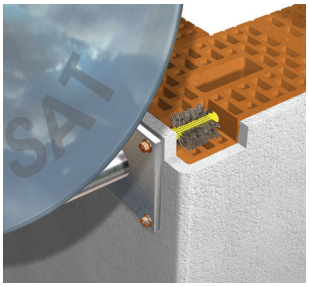




Product description

The EASF is a 2-component reaction resin mortar based on a styrene-free polyester and will be delivered in a 2-C cartridge (standard cartridge; foil tube cartridge) system. This product may be used in combination of a hand-, battery-, or pneumatic tool and a static mixer. It was designed as a costeffective alternative for the anchoring of threaded rods and internal threaded rod sleeves for approved applications. By using a screen sleeve, an easy and save application in hollow bricks is guaranteed. The EASF product is characterised by good applications with an ambiance temperature up to 80°C.

Properties and benefits

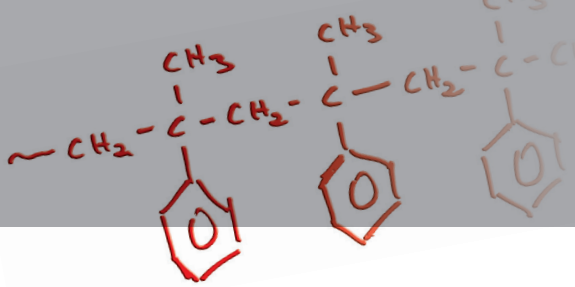
- European Technical Assessment acc. to ETAG 029 for use in masonry: ETA-12/0536
- European Technical Assessment acc. to ETAG 001-5 for use concrete: ETA-12/0106
- overhead application
- Suitable for attachment points close to the edge, since anchoring is free of expansion forces
- reduced chemical resistance
- high bending- and pressure strength
- Cartridge can be reused up to the end of the shelf life by replacing the static mixer or resealing cartridge with the screw cap

Applications samples

Suitable for the fixation of facades, roofs, wood construction, metal construction; metal profils, console, railing, sanitary devices, cable trays, piping, etc.

Handling and storage

- **Storage:**
  store in a cold and dark place, storage temperature: from +5°C up to +25 °C
- **Shelf life:**
  18 months for cartridges (ST), 9 months for foil tubes (SF)



EASF EASF-EX EASF-Tro EASF Blue

2K Reaction resin mortar based on Polyester resin styrene-free

Applications and intended use

- **Underground:**
  non-cracked concrete, light-concrete, porous-concrete, solid masonry, hollow brick, natural stone (Attention! natural stone, can discolour; shall be checked in advance); hammer drilled holes
- **Anchor elements:**
  Threaded rods (zinc plated or hot dip, stainless steel and high corrosion resistance steel), reinforcing bars, internal threaded rods, profiled rod, steel section with undercuts (e.g. perforated section)
- **Temperature range:**
  Installation temperature see table Reactivity
  Cartridge temperature see table Reactivity
  -40°C to +80°C base material temperature after full curing

Mortar properties

Properties	Test Method	Result
UV resistance		Pass
Watertightness	DIN EN 12390-8	0 mm
Temperature stability		120 °C
pH-value		› 12
Density		1,79 kg / dm³
Compressive strength	EN 196 Teil1	88 N / mm²
Flexural strength	EN 196 Teil1	31 N / mm²
E modulus	EN 196 Teil1	14000 N / mm²

Reactivity

	EASF Tro (Tropical)		EASF; EASF Blue[1)]		EASF Ex (Express)	
Temperature of base material	max. working time	Min. curing time	max. working time	Min. curing time	max. working time	Min. curing time
-10 °C to -6°C					60 Min.	4 h
-5 °C to -1°C			90 Min.	6 h	45 Min.	2 h
0 °C to +4°C			45 Min.	3 h	25 Min.	80 Min.
+5 °C to +9°C			25 Min.	2 h	10 Min.	45 Min.
+10 °C to +14°C	30 Min.	5 h	20 Min.	100 Min.	4 Min.	25 Min.
+15 °C to +19°C	20 Min.	210 Min.	15 Min.	80 Min.	3 Min.	20 Min.
+20 °C to +29°C	15 Min.	145 Min.	6 Min.	45 Min.	2 Min.	15 Min.
+30 °C to +34°C	10 Min.	80 Min.	4 Min.	25 Min.		
+35 °C to +39°C	6 Min.	45 Min.	2 Min.	20 Min.		
+40°C to +44°C	4 Min.	25 Min.				
+45°C	2 Min.	20 Min.				
Cartridge temperature	+5°C to +45°C		+5°C to +40°C		-5°C to +30°C	

1) The EASF Blue injection mortar has a curing time proof by changing the color from blue to gray after curing minimum time. The curing time proof is only valid for the standard version of the mortar.

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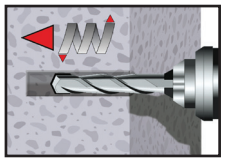
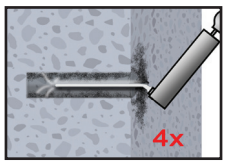
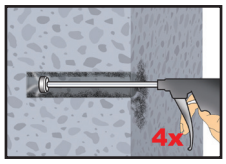
Usage instructions - concrete



1. Drill with hammer drill mode a hole into the base material to the size and embedment depth required by the selected anchor (see page 6). In case of aborted drill hole: the drill hole shall be filled with mortar

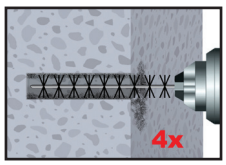


or

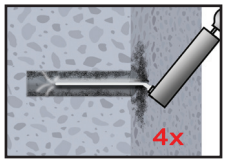


Attention! Standing water must be removed before cleaning.

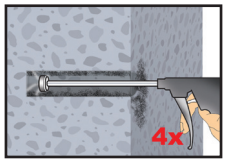
2a. Starting from the bottom or back of the bore hole, blow the hole clean with compressed air (min. 6 bar) or a hand pump (see page 6) a minimum of four times. If the bore hole ground is not reached an extension shall be used. The hand pump can only be used for anchor sizes up to bore hole diameter 20 mm or embedment depth up to 240mm. Compressed air (min. 6 bar) can be used for all sizes.



2b. Check brush diameter (page 6) and attach the brush to a drilling machine or a battery screwdriver. Brush the hole with an appropriate sized wire brush > $d_{b,min}$ (see page 6) a minimum of four times. If the bore hole ground is not reached with the brush, a brush extension shall be used.

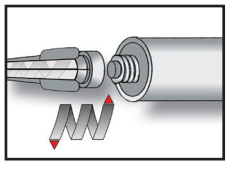


or

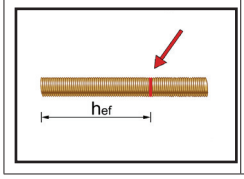


2c. Finally blow the hole clean again with compressed air (min. 6 bar) or a hand pump a minimum of four times. If the bore hole ground is not reached an extension shall be used. The hand pump can only be used for anchor sizes up to bore hole diameter 20 mm or embedment depth up to 240mm. Compressed air (min. 6 bar) can be used for all sizes.

After cleaning, the bore hole has to be protected against re-contamination in an appropriate way, until dispensing the mortar in the bore hole. If necessary, the cleaning has to be repeated directly before dispensing the mortar. In-flowing water must not contaminate the bore hole again.



3. Attach a supplied static-mixing nozzle to the cartridge and load the cartridge into the correct dispensing tool. After every working interruption longer than the recommended working time as well as for new cartridges, a new static-mixer shall be used.



4. Prior to inserting the anchor rod into the filled bore hole, the position of the embedment depth shall be marked on the anchor rods.

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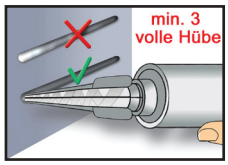
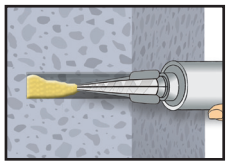
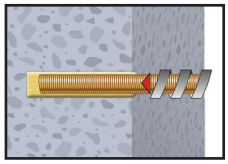
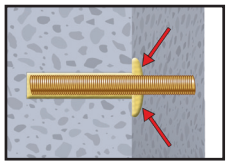
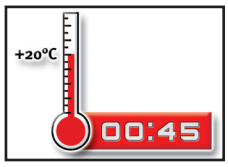
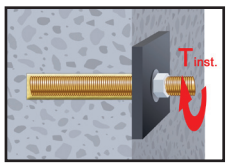
	5. Prior to dispensing into the anchor hole, squeeze out separately a minimum of three full strokes and discard non-uniformly mixed adhesive components until the mortar shows a consistent grey colour.
	6. Starting from the bottom resp. back of the cleaned anchor hole fill the hole up to approximately two-thirds with adhesive. Slowly withdraw of the static mixing nozzle as the hole is filled avoids creating air pockets. For embedments larger than 190mm an extension nozzle shall be used. For overhead and horizontal installation in bore holes bigger than 20mm resp. deeper than 240mm a piston plug shall be used. Observe the gel-/ working times given.
	7. Push the threaded rod or reinforcing bar into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached. The anchor should be free of dirt, grease, oil or other foreign material.
	8. Be sure that the anchor is fully seated at the bottom of the hole and that excess mortar is visible at the top of the hole. If these requirements are not maintained, the application has to be renewed.
	9. Allow the adhesive to cure to the specified time prior to applying any load or torque. Do not move or load the anchor until it is fully cured.
	10. After full curing, the add-on part can be installed with the max. torque by using a calibrated torque wrench.

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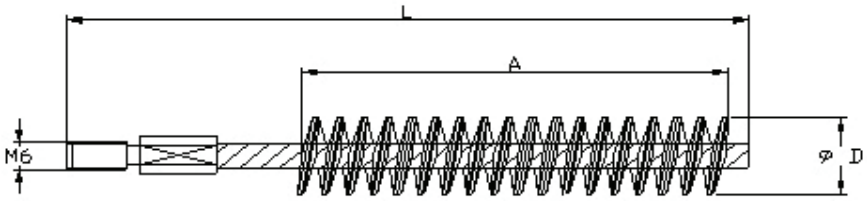
Cleaning of the drill hole - concrete



Brush:
∅ 0,20 mm (A2) Steel wire
Brush length: 80 mm
M6 thread for drilling machine connection

Blower

Threaded rod	Bore hole-∅	Brush-∅	Min. brush-∅
(mm)	(mm)	d_b (mm)	$d_{b,min}$ (mm)
M 8	10,0	12,0	10,5
M 10	12,0	14,0	12,5
M 12	14,0	16,0	14,5
M 16	18,0	20,0	18,5
M 20	24,0	26,0	24,5
M 24	28,0	30,0	28,5

Setting parameter

Anchor size (Threaded rod)				M8	M10	M12	M16	M20	M24
Edge distance	1,0 x h_{ef}	$C_{cr,N}$	[mm]	80	90	110	125	170	210
Min. edge distance	5,0 x d	C_{min}	[mm]	40	50	60	80	100	120
Axial distance	2,0 x h_{ef}	$S_{cr,N}$	[mm]	160	180	220	250	340	420
Min. axial distance	5,0 x d	S_{min}	[mm]	40	50	60	80	100	120
Embedment depth		h_{ef}	[mm]	80	90	110	125	170	210
Min. part thickness		h_{min}	[mm]	h_{ef} + 30 mm			h_{ef} + 2d_o		
Anchor diameter		d	[mm]	8	10	12	16	20	24
Drill diameter		d_o	[mm]	10	12	14	18	24	28
Max. installation torque		$T_{inst.}$	[Nm]	10	20	40	60	120	150

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2K Reaction resin mortar based on Polyester resin styrene-free

Performance data - concrete (Threaded rod) [1)]

TENSION LOADS - Design method acc. to Technical Report TR 029, characteristic values for tension loading

Anchor size (Threaded rod)				M8	M10	M12	M16	M20	M24
Steel failure									
Characteristic tension resistance, Steel, zinc plated or hot dip, property class 4.6		$N_{Rk,s}$	[kN]	15	23	34	63	98	141
Partial safety factor		$\gamma_{Ms,N}$		2,0					
Characteristic tension resistance, Steel, zinc plated or hot dip, property class 5.8		$N_{Rk,s}$	[kN]	18	29	42	78	122	176
Characteristic tension resistance, Steel, zinc plated or hot dip, property class 8.8		$N_{Rk,s}$	[kN]	29	46	67	125	196	282
Partial safety factor		$\gamma_{Ms,N}$		1,50					
Characteristic tension resistance, Stainless steel A4 and HCR		$N_{Rk,s}$	[kN]	26	41	59	110	171	247
Partial safety factor		$\gamma_{Ms,N}$		1,87					
Pullout and concrete cone failure [2)]									
Characteristic bond resistance in concrete C20/25									
40°C/24°C [3)]		$N_{Rk,p} = N^{0}_{Rk,c}$	[kN]	17,1	22,6	33,2	50,3	85,5	126,7
80°C/50°C [3)]				13,1	17,0	24,9	37,7	64,1	95,0
Partial safety factor		$\gamma_{Mp} = \gamma_{Mc}$		1,8					
Embedment depth		h_{ef}	[mm]	80	90	110	125	170	210
Edge distance		$c_{cr,N}$	[mm]	74	89	107	143	179	215
Axial distance		$s_{cr,N}$	[mm]	$2 \times c_{cr,N}$					
Increasing factors for concrete ψ_c				$(f_{ck}{}^{0,11})/1,42$					
Splitting failure									
Edge distance		$c_{cr,sp}$	[mm]	$c_{cr,N} \leqq 2\ h_{ef}\ (2,5 - h/h_{ef}) \leqq 2,4\ h_{ef}$					
Axial distance		$s_{cr,sp}$	[mm]	$2 \times c_{cr,sp}$					
Partial safety factor		γ_{Msp}		1,8					

The data in this table are intended to use together with the design provisions of TR029

1) For more details, see ETA 12 / 0106.

2) Shall be determined acc. to this table or to TR 029. The smaller value is decisive.

3) Short term temperature/ Long term temperature. Long term concrete temperatures are roughly constant over significant periods of time. Short term elevated temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

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Performance data - concrete (Threaded rod) [1)]

SHEAR LOADS - Design method acc. to Technical Report TR 029, characteristic values for shear loading

Anchor size (Threaded rod)			M8	M10	M12	M16	M20	M24	M27	M30
Steel failure without leaver arm										
Characteristic shear resistance, Steel, zinc plated or hot dip, property class 4.6	$V_{Rk,s}$	[kN]	7	12	17	31	49	71	92	112
Partial safety factor	$\gamma_{Ms,V}$		1,67							
Characteristic shear resistance, Steel, zinc plated or hot dip, property class 5.8	$V_{Rk,s}$	[kN]	9	15	21	39	61	88	115	140
Characteristic shear resistance, Steel, zinc plated or hot dip, property class 8.8	$V_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
Partial safety factor	$\gamma_{Ms,V}$		1,25							
Characteristic shear resistance, Stainless steel A4 and HCR	$V_{Rk,s}$	[kN]	13	20	30	55	86	124	115	140
Partial safety factor	$\gamma_{Ms,V}$		1,56						2,38	
Steel failure with leaver arm										
Characteristic bending moment, Steel, zinc plated or hot dip, property class 4.6	$M^0_{Rk,s}$	[kN]	15	30	52	133	260	449	666	900
Partial safety factor	$\gamma_{Ms,V}$		167							
Characteristic bending moment, Steel, zinc plated or hot dip, property class 5.8	$M^0_{Rk,s}$	[Nm]	19	37	65	166	324	560	833	1123
Characteristic bending moment, Steel, zinc plated or hot dip, property class 8.8	$M^0_{Rk,s}$	[kN]	30	60	105	266	519	896	1333	1797
Partial safety factor	$\gamma_{Ms,V}$		1,25							
Characteristic bending moment, Stainless steel A4 and HCR	$M^0_{Rk,s}$	[kN]	26	52	92	232	454	784	832	1125
Partial safety factor	$\gamma_{Ms,V}$		1,56						2,38	
Concrete Pryout failure										
Factor k in equation (5.7) of TR 029			2,0							
Partial safety factor	γ_{Msp} [1)]		1,5							
Concrete edge failure										
Partial safety factor	γ_{Msp}		1,5							

The data in this table is intended to used together with the design provisions of TR029.

1) For more details, as well as values in water filled concrete see ETA 12 / 0106

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Recommended loads - concrete

The recommended loads are only valid for single anchor for a roughly design, if the following conditions are valid:
$c \geq 1{,}5 \times h_{ef}$ $s \geq 3{,}0 \times h_{ef}$ $h \geq 2 \times h_{ef}$

If the conditions are not fulfilled the loads must be calculated acc. to EOTA Technical Report TR 029
The safety factors are already included in the recommended loads.

Anchor size (Steel quality 5.8)				**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Recommended tension load	**40°C/24°C** [2]	$N_{Rec,stat}$	[kN]	6,1	8,5	13,2	19,9	33,9	50,3
	80°C/50°C [2]	$N_{Rec,stat}$	[kN]	4,7	6,4	9,9	15,0	25,4	37,7
Recommended shear load without leaver arm[1]		$V_{Rec,stat}$	[kN]	5,1	8,6	12,0	22,9	35,4	50,9
Embedment depth		h_{ef}	[mm]	80	90	110	125	170	210
Edge distance		$c_{cr,N}$	[mm]	80	90	110	125	170	210
Axial distance		$s_{cr,N}$	[mm]	$2 \times c_{cr,N}$					

1) Shear load with leaver arm acc. TR 029, for seismic load acc. to TR 045

2) Short term temperature/ Long term temperature

$N_{Rec,stat}$, $V_{Rec,stat}$ = Recommended Load under static and quasi-static action
$N_{Rec,seis}$, $V_{Rec,seis}$ = Recommended Load under seismic action

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Anchorage in masonry

STPASF can also be used for anchorages in masonry, both hollow and solid bricks. For application in hollow bricks perforated sleeves need to be used.

solid bricks			M8	M10	M12	M16	IG-M6	IG-M8	IG-M10
nominal drill hole diameter	d_o	[mm]	10	12	14	18	10	12	16
embedment depth	h_{ef}	[mm]	80	90	100	100	90	100	100
bore hole depth	h_o	[mm]	80	90	100	100	90	100	100
diameter of clearance hole in fixture	d_f	[mm]	9	12	14	18	7	9	12
diameter of steel brush	$d_b \geq$	[mm]	12	14	16	20	12	14	18

hollow and solid bricks			M8	M8	M10	M12	M16	IG-M6	IG-M8	IG-M10
perforated sleeve			12x80	16x85 16x130 16x200	16x85 16x130 16x200	20x85 20x130 20x200	20x85 20x130 20x200	16x85 16x130 16x200	20x85 20x130 20x200	20x85 20x130 20x200
nominal drill hole diameter	d_o	[mm]	12	16	16	20	20	16	20	20
embedment depth	h_{ef}	[mm]	80	85 130 200	85 130 200	85 130 200	85 130 200	85 130 200	85 130 200	85 130 200
bore hole depth	h_o	[mm]	85	90 135 205	90 135 205	90 135 205	90 135 205	90 135 205	90 135 205	90 135 205
diameter of clearance hole in fixture	d_f	[mm]	9	9	12	14	18	7	9	12
diameter of steel brush	$d_b \geq$	[mm]	14	18	18	22	22	18	22	22

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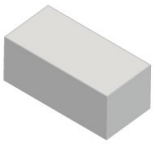
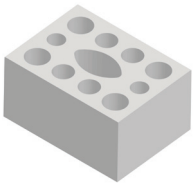
Tested stones

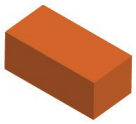
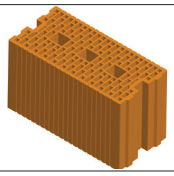
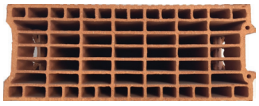
The later on described loads are only valid for anchorages in the following stones. When using different stones, construction site tests are necessary. The results can be compared with a similar stone from this ETA / TDS.

	type	figure	dimensions l x b x h [mm]	compressive strength [N/mm²]	density [kg/dm³]	producer
calcium silica bricks	solid calcium silica brick KS-NF		≥ 240 x 115 x 71	≥ 10	≥ 2,0	e.g. Wemding (D)
	hollow calcium silica brick KSL-3DF		240 x 175 x 113	≥ 8	≥ 1,4	e.g. Wemding (D)
	hollow calcium silica brick KSL-12DF		498 x 175 x 238	≥ 10	≥ 1,4	e.g. Wemding (D)
concrete bricks	Bloc Creux B40		495 x 195 x 190	≥ 4	≥ 0,8	e.g. Sepa (FR)
	solid light weight concrete brick LAC		≥ 300 x 123 x 248	≥ 2	≥ 0,6	e.g. Bisotherm (D)
	Hollow concrete brick Leca Lex Harkko RUH-200		≥ 498 x 200 x 195	≥ 2,7	≥ 0,7	e.g. Saint Gobain Weber (FIN)
	Solid concrete brick Leca Lex Harkko RUH-200 Kulma		≥ 498 x 200 x 195	≥ 3	≥ 0,78	e.g. Saint Gobain Weber (FIN)

EASF EASF-EX EASF-Tro EASF Blue

2K Reaction resin mortar based on Polyester resin styrene-free

Tested stones

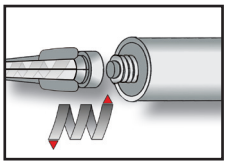
	type	figure	dimensions l x b x h [mm]	compressive strength [N/mm²]	density [kg/dm³]	producer
Clay bricks	solid clay brick Mz-1DF		≥ 240 x 115 x 55	≥ 10	≥ 1,6	e.g. Unipor (D)
	hollow clay brick Hlz-16DF		497 x 240 x 238	≥ 6	≥ 0,8	e.g. Unipor (D)
	Porotherm Homebric		500 x 200 x 299	≥ 4	≥ 0,7	e.g. Wienerberger (FR)
	BGV Thermo		500 x 200 x 314	≥ 4	≥ 0,6	e.g. Leroux (FR)
	Calibric R+		500 x 200 x 314	≥ 6	≥ 0,6	e.g. Terreal (FR)
	Urbanbric		500 x 200 x 274	≥ 6	≥ 0,7	e.g. Imerys (FR)
	Blocchi Leggeri		250 x 120 x 250	≥ 4	≥ 0,6	e.g. Wienerberger (IT)
	Doppio Uni		250 x 120 x 120	≥ 10	≥ 0,9	e.g. Wienerberger (IT)
AAC	autoclaved aerated concrete AAC		≥ 499 x 240 x 249	≥ 2	≥ 0,6	e.g. Porrit (D)

EASF EASF-EX EASF-Tro EASF Blue

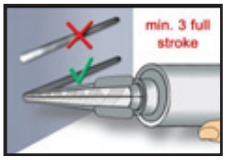
2K Reaction resin mortar based on Polyester resin styrene-free

Installation instructions

Preparation of cartridge

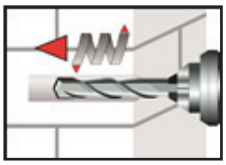


1. Remove the cap and attach the supplied static-mixing nozzle to the cartridge and load the cartridge into the correct dispensing tool. In case of a foil tube cartridge, cut off the clip before use. For every working interruption longer than the recommended working time (Table B4) as well as for new cartridges, a new static-mixer shall be used.

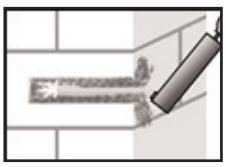


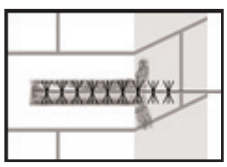
2. Initial adhesive is not suitable for fixing the anchor. Prior to dispensing into the anchor hole, squeeze out separately a minimum of three full strokes, for foil tube cartridges six full strokes and discard non-uniformly mixed adhesive components until the mortar shows a consistent grey colour.

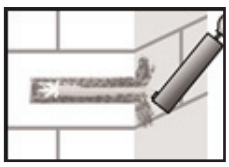
Installation in solid masonry (without sleeve)



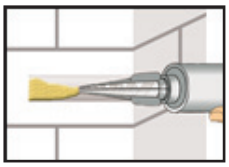
3. Holes to be drilled perpendicular to the surface of the base material by using a hard-metal tipped hammer drill bit. Drill a hole, with drilling method according to Annex C4-C45, into the base material, with nominal drill hole diameter and bore hole depth according to the size and embedment depth required by the selected anchor. In case of aborted drill hole the drill hole shall be filled with mortar.



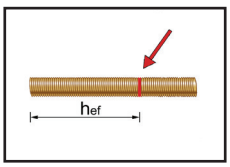




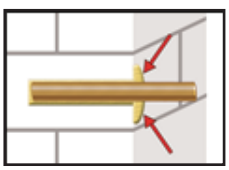
4. Blow out from the bottom of the bore hole two times. Attach the brush to a drilling machine or a battery screwdriver, brush the hole clean two times, and finally blow out the hole again two times.

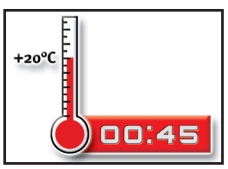


5. Starting from the bottom or back of the cleaned anchor hole, fill the hole up to min two-thirds with adhesive. Slowly withdraw the static mixing nozzle will avoid creating air pockets. Observe the gel-/ working times given in Table B4.

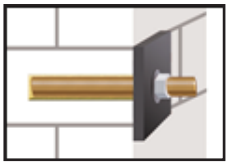


6. The position of the embedment depth shall be marked on the threaded rod. Push the threaded rod into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached. The anchor shall be free of dirt, grease, oil or other foreign material.





7. Be sure that the anular gap is fully filled with mortar. If no excess mortar is visible at the top of the hole, the application has to be renewed.
8. Allow the adhesive to cure to the specified curing time prior to applying any load or torque. Do not move or load the anchor until it is fully cured (attend Table B4).



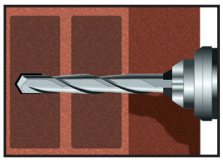
9. After full curing, the fixture can be installed with up to the max. installation torque (see parameters of brick Annex C4 to Annex C45) by using a calibrated torque wrench.

EASF EASF-EX EASF-Tro EASF Blue

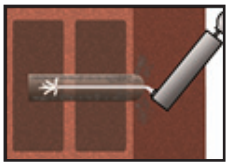
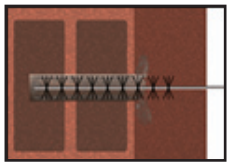
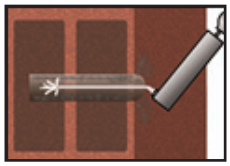
2K Reaction resin mortar based on Polyester resin styrene-free

Installation instructions

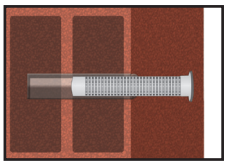
Installation in solid and hollow masonry (with sleeve)



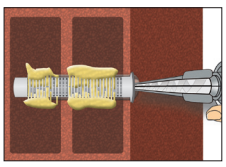
3. Holes to be drilled perpendicular to the surface of the base material by using a hard-metal tipped hammer drill bit. Drill a hole, with drill method according to Annex C4 – C45, into the base material, with nominal drill hole diameter and bore hole depth according to the size and embedment depth required by the selected anchor.

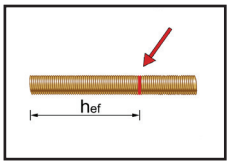
4. Blow out from the bottom of the bore hole two times. Attach the brush to a drilling machine or a battery screwdriver, brush the hole clean two times, and finally blow out the hole again two times.

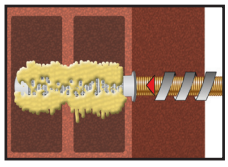


5. Insert the perforated sleeve flush with the surface of the masonry or plaster. Only use sleeves that have the right length. Never cut the sleeve.

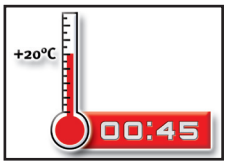


6. Starting from the bottom or back fill the sleeve with adhesive. For embedment depth equal to or larger than 130 mm an extension nozzle shall be used. For quantity of mortar attend cartridges label installation instructions.Observe the gel-/ working times given in Table B4.

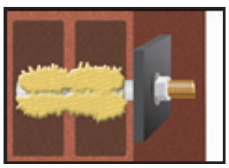




7. The position of the embedment depth shall be marked on the threaded rod. Push the threaded rod into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached. The anchor shall be free of dirt, grease, oil or other foreign material.



8. Allow the adhesive to cure to the specified curing time prior to applying any load or torque. Do not move or load the anchor until it is fully cured (attend Table B4).



9. After full curing, the fixture can be installed with up to the max. installation torque (See parameters of brick Annex C4 to Annex C45) by using a calibrated torque wrench.

EASF EASF-EX EASF-Tro EASF Blue

2K Reaction resin mortar based on Polyester resin styrene-free

Cleaning - masonry

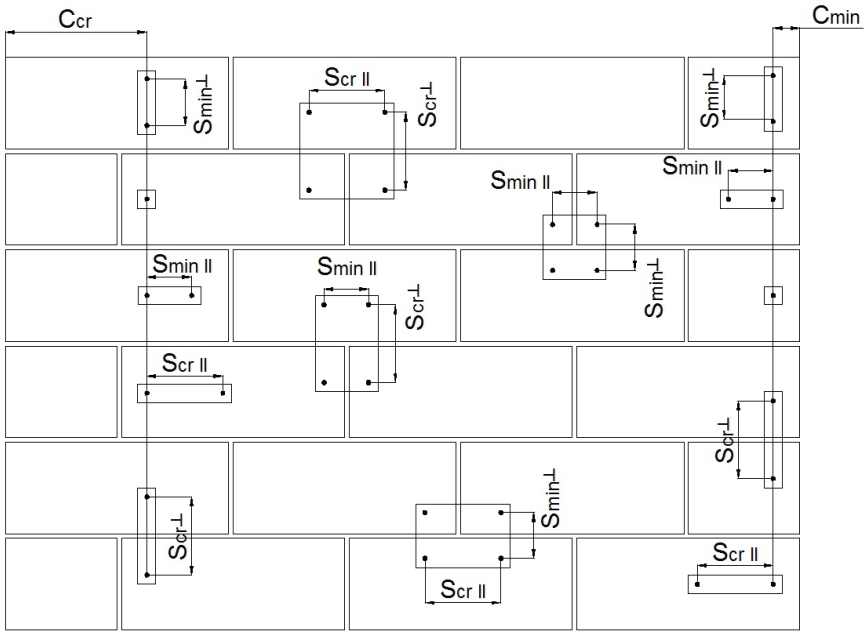
- Brush:

- Blower

Calculation of recommended loads

The recommended loads are only valid under the following conditions. For a more detailed design see ETA:

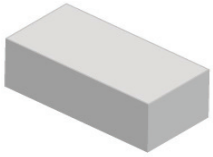
- dry environment
- spacing $s \geq s_{cr}$
- edge distance $c \geq c_{cr}$
- masonry mortar of strength class M2,5 to M9
- no prestressing force on the wall
- visible joints
- vertical joints are filled with mortar
- steel strength of anchor rod 5.8 or higher
- the partial safety factors for material and load are already considered
- no interaction of tension and shear loads considered



EASF EASF-EX EASF-Tro EASF Blue

2K Reaction resin mortar based on Polyester resin styrene-free

recommended loads in masonry

solid calcium silica brick KS-NF		**dimensions** ≥ 240 x 115 x 71	**compressive strength** ≥ 10 N/mm²	**density** ≥ 2,0 kg/dm³	**producer** e.g. Wemding (D)

usage without perforated sleeve			M8	M10	M12	M16	IG M6 [3]	IG M8 [3]	IG M10 [3]
perforated sleeve			-	-	-	-	-	-	-
anchorage depth	h_{ef}	mm	80	90	100	100	90	100	100
minimum wall thickness	h_{min}	mm	115	240	240	240	240	240	240
installation torque	T_{inst}	Nm	2						
drilling method			hammer drilling						
critical edge distance	c_{cr}	mm	120	135	150	150	135	150	150
critical axial distance parallel to horizontal joint	$s_{cr,II}$	mm	240	270	300	300	270	300	300
critical axial distance perpendicular to horizontal joint	$s_{cr,T}$	mm	240	270	300	300	270	300	300
minimal edge distance [2]	c_{min}	mm	c_{cr}						
minimal axial distance [2]	s_{min}	mm	s_{cr}						
recommended tension load [1]	N_{zul}	kN	0,86						
recommended vertical shear load [1]	$V_{vert.}$	kN	0,86						
recommended horizontal shear load [1]	$V_{hori.}$	kN	0,86						

usage with perforated sleeve			M8	M8	M10	M12	M16	IG M6 [3]	IG M8 [3]	IG M10 [3]
perforated sleeve			12	16	16	20	20	16	20	20
anchorage depth	h_{ef}	mm	80	85; 130; 200						
minimum wall thickness	h_{min}	mm	115	h_{ef} + 30mm						
installation torque	T_{inst}	Nm	2							
drilling method			hammer drilling							
critical edge distance	c_{cr}	mm	120	127,5						
critical axial distance parallel to horizontal joint	$s_{cr,II}$	mm	240	255						
critical axial distance perpendicular to horizontal joint	$s_{cr,T}$	mm	240	255						
minimal edge distance [2]	c_{min}	mm	c_{cr}							
minimal axial distance [2]	s_{min}	mm	s_{cr}							
recommended tension load [1]	N_{zul}	kN	0,71							
recommended vertical shear load [1]	$V_{vert.}$	kN	0,71	0,86						
recommended horizontal shear load [1]	$V_{hori.}$	kN	0,71	0,86						

[1] Conditions and assumtions for the recommended loads see page 15

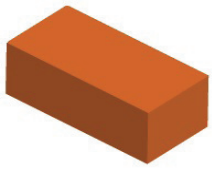
[2] Reduction factors see ETA 12/0536

[3] not covered by ETA

EASF EASF-EX EASF-Tro EASF Blue

2K Reaction resin mortar based on Polyester resin styrene-free

recommended loads in masonry

solid clay brick Mz-1DF		**dimensions** ≥ 240 x 115 x 55	**compressive strength** ≥ 10 N/mm²	**density** ≥ 1,6 kg/dm³	**producer** e.g. Unipor (D)

usage without perforated sleeve			M8	M10	M12	M16	IG M6 [3]	IG M8 [3]	IG M10 [3]
perforated sleeve			-	-	-	-	-	-	-
anchorage depth	h_{ef}	mm	80	90	100	100	90	100	100
minimum wall thickness	h_{min}	mm	115	240	240	240	240	240	240
installation torque	T_{inst}	Nm	2						
drilling method			hammer drilling						
critical edge distance	c_{cr}	mm	120	135	150	150	135	150	150
critical axial distance parallel to horizontal joint	$s_{cr,II}$	mm	240	270	300	300	270	300	300
critical axial distance perpendicular to horizontal joint	$s_{cr,T}$	mm	240	270	300	300	270	300	300
minimal edge distance [2]	c_{min}	mm	c_{cr}						
minimal axial distance [2]	s_{min}	mm	s_{cr}						
recommended tension load [1]	N_{zul}	kN	0,43						
recommended vertical shear load [1]	$V_{vert.}$	kN	0,86	1,0	1,43	1,43	0,86	1,0	1,43
recommended horizontal shear load [1]	$V_{hori.}$	kN	0,86	1,0	1,43	1,43	0,86	1,0	1,43

usage with perforated sleeve			M8	M8	M10	M12	M16	IG M6 [3]	IG M8 [3]	IG M10 [3]
perforated sleeve			12	16	16	20	20	16	20	20
anchorage depth	h_{ef}	mm	80	85; 130; 200						
minimum wall thickness	h_{min}	mm	115	h_{ef} + 30mm						
installation torque	T_{inst}	Nm	2							
drilling method			hammer drilling							
critical edge distance	c_{cr}	mm	120	127,5						
critical axial distance parallel to horizontal joint	$s_{cr,II}$	mm	240	255						
critical axial distance perpendicular to horizontal joint	$s_{cr,T}$	mm	240	255						
minimal edge distance [2]	c_{min}	mm	c_{cr}							
minimal axial distance [2]	s_{min}	mm	s_{cr}							
recommended tension load [1]	N_{zul}	kN	0,57							
recommended vertical shear load [1]	$V_{vert.}$	kN	0,86	0,86	1,0	1,0	1,0	0,86	1,0	1,0
recommended horizontal shear load [1]	$V_{hori.}$	kN	0,86	0,86	1,0	1,0	1,0	0,86	1,0	1,0

[1] Conditions and assumtions for the recommended loads see page 15

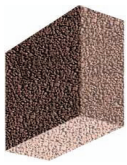
[2] Reduction factors see ETA 12/0536

[3] not covered by ETA

EASF EASF-EX EASF-Tro EASF Blue

2K Reaction resin mortar based on Polyester resin styrene-free

recommended loads in masonry

solid light weight concrete brick LAC		**dimensions** ≥ 300 x 123 x 248	**compressive strength** ≥ 2 N/mm²	**density** ≥ 0,6 kg/dm³	**producer** e.g. Bisotherm (D)

usage without perforated sleeve			M8	M10	M12	M16	IG M6 [3]	IG M8 [3]	IG M10 [3]
perforated sleeve			-	-	-	-	-	-	-
anchorage depth	h_{ef}	mm	80	90	100	100	90	100	100
minimum wall thickness	h_{min}	mm	300						
installation torque	T_{inst}	Nm	2						
drilling method			hammer drilling						
critical edge distance	c_{cr}	mm	120	135	150	150	135	150	150
critical axial distance parallel to horizontal joint	$s_{cr,II}$	mm	240	270	300	300	270	300	300
critical axial distance perpendicular to horizontal joint	$s_{cr,T}$	mm	240	270	300	300	270	300	300
minimal edge distance [2]	c_{min}	mm	c_{cr}						
minimal axial distance [2]	s_{min}	mm	s_{cr}						
recommended tension load [1]	N_{zul}	kN	0,57						
recommended vertical shear load [1]	$V_{vert.}$	kN	0,86	1,00	1,14	1,14	1,00	1,14	1,14
recommended horizontal shear load [1]	$V_{hori.}$	kN	0,60	0,78	0,98	1,07	0,78	0,98	1,07

solid light weight concrete brick Leca Lex Harkko RUH-200 kulma		**dimensions** ≥ 498 x 200 x 195	**compressive strength** ≥ 3 N/mm²	**density** ≥ 0,78 kg/dm³	**producer** e.g. Saint Gobain Weber (FIN)

usage without perforated sleeve			M8	M10	M12	M16	IG M6 [3]	IG M8 [3]	IG M10 [3]
perforated sleeve			-	-	-	-	-	-	-
anchorage depth	h_{ef}	mm	80	90	100	100	90	100	100
minimum wall thickness	h_{min}	mm	300						
installation torque	T_{inst}	Nm	2						
drilling method			hammer drilling						
critical edge distance	c_{cr}	mm	120	135	150	150	135	150	150
critical axial distance parallel to horizontal joint	$s_{cr,II}$	mm	240	270	300	300	270	300	300
critical axial distance perpendicular to horizontal joint	$s_{cr,T}$	mm	240	270	300	300	270	300	300
minimal edge distance [2]	c_{min}	mm	c_{cr}						
minimal axial distance [2]	s_{min}	mm	s_{cr}						
recommended tension load [1]	N_{zul}	kN	0,57	0,86					
recommended vertical shear load [1]	$V_{vert.}$	kN	0,86	1,14					
recommended horizontal shear load [1]	$V_{hori.}$	kN	0,73	0,95	1,14	1,14	0,95	1,14	1,14

[1] Conditions and assumtions for the recommended loads see page 15

[2] Reduction factors see ETA 12/0536

[3] not covered by ETA

EASF EASF-EX EASF-Tro EASF Blue

2K Reaction resin mortar based on Polyester resin styrene-free

recommended loads in masonry

hollow concrete brick Leca Lex Harkko RUH-200		**dimensions** ≥ 498 x 200 x 195 mm	**compressive strength** ≥ 2,7 N/mm²	**density** ≥ 0,7 kg/dm³	**producer** e.g. Saint Gobain Weber (FIN)

			M8	M8	M10	M12	M16	IG M6 [3]	IG M8 [3]	IG M10 [3]
perforated sleeve			12	16	16	20	20	16	20	20
anchorage depth	h_{ef}	mm	80	85; 130						
minimum wall thickness	h_{min}	mm	200							
installation torque	T_{inst}	Nm	2							
drilling method			rotation drilling							
critical edge distance	c_{cr}	mm	100	100	100	120	120	100	120	120
critical axial distance parallel to horizontal joint	$s_{cr,II}$	mm	498							
critical axial distance perpendicular to horizontal joint	$s_{cr,T}$	mm	195							
minimal edge distance [2]	c_{min}	mm	c_{cr}							
minimal axial distance [2]	s_{min}	mm	s_{cr}							
recommended tension load [1]	N_{zul}	kN	0,57			0,71	0,71	0,57	0,71	0,71
recommended vertical shear load [1]	$V_{vert.}$	kN	0,71	1,00						
recommended horizontal shear load [1]	$V_{hori.}$	kN	0,26							

hollow concrete brick bloc creux B40		**dimensions** ≥ 499 x 200 x 190 mm	**compressive strength** ≥ 4 N/mm²	**density** ≥ 0,8 kg/dm³	**producer** e.g. Sepa (FR)

			M8	M8	M10	M12	M16	IG M6 [3]	IG M8 [3]	IG M10 [3]
perforated sleeve			12	16	16	20	20	16	20	20
anchorage depth	h_{ef}	mm	80	85; 130						
minimum wall thickness	h_{min}	mm	200							
installation torque	T_{inst}	Nm	2							
drilling method			rotation drilling							
critical edge distance	c_{cr}	mm	100	100	100	120	120	100	120	120
critical axial distance parallel to horizontal joint	$s_{cr,II}$	mm	495							
critical axial distance perpendicular to horizontal joint	$s_{cr,T}$	mm	190							
minimal edge distance [2]	c_{min}	mm	c_{cr}							
minimal axial distance [2]	s_{min}	mm	s_{cr}							
recommended tension load [1]	N_{zul}	kN	0,11	0,17	0,17	0,26	0,26	0,17	0,26	0,26
recommended vertical shear load [1]	$V_{vert.}$	kN	0,35	0,86						
recommended horizontal shear load [1]	$V_{hori.}$	kN	0,26							

[1] Conditions and assumtions for the recommended loads see page 15

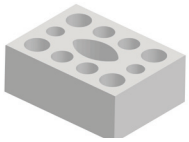
[2] Reduction factors see ETA 12/0536

[3] not covered by ETA

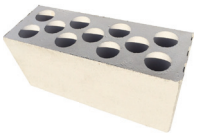
EASF EASF-EX EASF-Tro EASF Blue

2K Reaction resin mortar based on Polyester resin styrene-free

recommended loads in masonry

hollow silica brick KS-L-3DF		**dimensions** ≥ 240 x 175 x 113 mm	**compressive strength** ≥ 12 N/mm²	**density** ≥ 1,4 kg/dm³	**producer** e.g. Wemding (D)

			M8	M8	M10	M12	M16	IG M6 [3]	IG M8 [3]	IG M10 [3]
perforated sleeve			12	16	16	20	20	16	20	20
anchorage depth	h_{ef}	mm	80	85; 130						
minimum wall thickness	h_{min}	mm	175							
installation torque	T_{inst}	Nm	2							
drilling method			rotation drilling							
critical edge distance	c_{cr}	mm	120							
critical axial distance parallel to horizontal joint	$s_{cr,II}$	mm	240							
critical axial distance perpendicular to horizontal joint	$s_{cr,T}$	mm	120							
minimal edge distance [2]	c_{min}	mm	c_{cr}							
minimal axial distance [2]	s_{min}	mm	s_{cr}							
recommended tension load [1]	N_{zul}	kN	0,43							
recommended vertical shear load [1]	$V_{vert.}$	kN	0,57	0,71	0,71	0,86		0,71	0,86	0,86
recommended horizontal shear load [1]	$V_{hori.}$	kN	0,26	0,43						

hollow silica brick KS-L 12DF		**dimensions** ≥ 498 x 175 x 238 mm	**compressive strength** ≥ 12 N/mm²	**density** ≥ 1,4 kg/dm³	**producer** e.g. Wemding (D)

			M8	M8	M10	M12	M16	IG M6 [3]	IG M8 [3]	IG M10 [3]
perforated sleeve			12	16	16	20	20	16	20	20
anchorage depth	h_{ef}	mm	80	85; 130						
minimum wall thickness	h_{min}	mm	175							
installation torque	T_{inst}	Nm	2							
drilling method			rotation drilling							
critical edge distance	c_{cr}	mm	120							
critical axial distance parallel to horizontal joint	$s_{cr,II}$	mm	500							
critical axial distance perpendicular to horizontal joint	$s_{cr,T}$	mm	240							
minimal edge distance [2]	c_{min}	mm	c_{cr}							
minimal axial distance [2]	s_{min}	mm	s_{cr}							
recommended tension load [1]	N_{zul}	kN	0,11	0,34						
recommended vertical shear load [1]	$V_{vert.}$	kN	0,86	1,71						
recommended horizontal shear load [1]	$V_{hori.}$	kN	0,36							

[1] Conditions and assumtions for the recommended loads see page 15

[2] Reduction factors see ETA 12/0536

[3] not covered by ETA

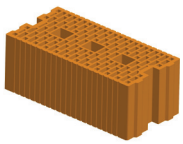
EASF EASF-EX EASF-Tro EASF Blue

2K Reaction resin mortar based on Polyester resin styrene-free

recommended loads in masonry

autocalved aerated concrete AAC		**dimensions** ≥ 499 x 249 x 240 mm	**compressive strength** ≥ 2 N/mm²	**density** ≥ 0,2 kg/dm³	**producer** e.g. Porit (D)

			M8	M10	M12	M16	IG M6 [3]	IG M8 [3]	IG M10 [3]
perforated sleeve			-	-	-	-	-	-	-
anchorage depth	h_{ef}	mm	80	90	100	100	90	100	100
minimum wall thickness	h_{min}	mm	240						
installation torque	T_{inst}	Nm	2						
drilling method			hammer drilling						
critical edge distance	c_{cr}	mm	120	135	150	150	135	150	150
critical axial distance parallel to horizontal joint	$s_{cr,II}$	mm	240	270	300	300	270	300	300
critical axial distance perpendicular to horizontal joint	$s_{cr,T}$	mm	240	270	300	300	270	300	300
minimal edge distance [2]	c_{min}	mm	75						
minimal axial distance [2]	s_{min}	mm	100						
recommended tension load [1]	N_{zul}	kN	0,89	1,43	1,79	2,32	1,43	1,79	2,32
recommended vertical shear load [1]	$V_{vert.}$	kN	2,14	3,03	3,57	3,57	1,79	3,21	3,57
recommended horizontal shear load [1]	$V_{hori.}$	kN	1,29	1,68	2,13	2,32	1,44	1,88	2,01

hollow clay brick Hlz-16DF		**dimensions** ≥ 497 x 240 x 238 mm	**compressive strength** ≥ 8 N/mm²	**density** ≥ 0,8 kg/dm³	**producer** e.g. Unipor (D)

			M8	M8	M10	M12	M16	IG M6 [3]	IG M8 [3]	IG M10 [3]
perforated sleeve			12	16	16	20	20	16	20	20
anchorage depth	h_{ef}	mm	80	85; 130; 200						
minimum wall thickness	h_{min}	mm	240							
installation torque	T_{inst}	Nm	2							
drilling method			rotation drilling							
critical edge distance	c_{cr}	mm	120							
critical axial distance parallel to horizontal joint	$s_{cr,II}$	mm	500							
critical axial distance perpendicular to horizontal joint	$s_{cr,T}$	mm	240							
minimal edge distance [2]	c_{min}	mm	c_{cr}							
minimal axial distance [2]	s_{min}	mm	s_{cr}							
recommended tension load [1]	N_{zul}	kN	0,34	0,43	0,43	0,57	0,57	0,43	0,57	0,57
recommended vertical shear load [1]	$V_{vert.}$	kN	0,71	1,14						
recommended horizontal shear load [1]	$V_{hori.}$	kN	0,36							

[1] Conditions and assumtions for the recommended loads see page 15

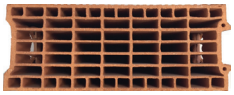
[2] Reduction factors see ETA 12/0536

[3] not covered by ETA

EASF EASF-EX EASF-Tro EASF Blue

2K Reaction resin mortar based on Polyester resin styrene-free

recommended loads in masonry

hollow clay brick BGV Thermo		**dimensions** ≥ 500 x 200 x 314 mm	**compressive strength** ≥ 6 N/mm²	**density** ≥ 0,6 kg/dm³	**producer** e.g. Leroux (FR)

			M8	M8	M10	M12	M16	IG M6 [3]	IG M8 [3]	IG M10 [3]
perforated sleeve			12	16	16	20	20	16	20	20
anchorage depth	h_{ef}	mm	80	85; 130						
minimum wall thickness	h_{min}	mm	200							
installation torque	T_{inst}	Nm	2							
drilling method			rotation drilling							
critical edge distance	c_{cr}	mm	120							
critical axial distance parallel to horizontal joint	$s_{cr,II}$	mm	500							
critical axial distance perpendicular to horizontal joint	$s_{cr,T}$	mm	314							
minimal edge distance [2]	c_{min}	mm	c_{cr}							
minimal axial distance [2]	s_{min}	mm	s_{cr}							
recommended tension load [1]	N_{zul}	kN	0,11	0,14			0,17	0,14		
recommended vertical shear load [1]	$V_{vert.}$	kN	0,57							
recommended horizontal shear load [1]	$V_{hori.}$	kN	0,36							

hollow clay brick Calibric R+		**dimensions** ≥ 500 x 200 x 314 mm	**compressive strength** ≥ 6 N/mm²	**density** ≥ 0,6 kg/dm³	**producer** e.g. Terreal (FR)

			M8	M8	M10	M12	M16	IG M6 [3]	IG M8 [3]	IG M10 [3]
perforated sleeve			12	16	16	20	20	16	20	20
anchorage depth	h_{ef}	mm	80	85; 130						
minimum wall thickness	h_{min}	mm	200							
installation torque	T_{inst}	Nm	2							
drilling method			rotation drilling							
critical edge distance	c_{cr}	mm	120							
critical axial distance parallel to horizontal joint	$s_{cr,II}$	mm	500							
critical axial distance perpendicular to horizontal joint	$s_{cr,T}$	mm	314							
minimal edge distance [2]	c_{min}	mm	c_{cr}							
minimal axial distance [2]	s_{min}	mm	s_{cr}							
recommended tension load [1]	N_{zul}	kN	0,21							
recommended vertical shear load [1]	$V_{vert.}$	kN	0,71	1,0	1,0	1,71	1,71	1,0	1,71	1,71
recommended horizontal shear load [1]	$V_{hori.}$	kN	0,36							

[1] Conditions and assumtions for the recommended loads see page 15

[2] Reduction factors see ETA 12/0536

[3] not covered by ETA

EASF EASF-EX EASF-Tro EASF Blue

2K Reaction resin mortar based on Polyester resin styrene-free

recommended loads in masonry

hollow clay brick Urbanbric		**dimensions** ≥ 560 x 200 x 274 mm	**compressive strength** ≥ 9 N/mm²	**density** ≥ 0,7 kg/dm³	**producer** e.g. Imerys (FR)

			M8	M8	M10	M12	M16	IG M6	IG M8	IG M10
perforated sleeve			12	16	16	20	20	16	20	20
anchorage depth	h_{ef}	mm	80	85; 130						
minimum wall thickness	h_{min}	mm	200							
installation torque	T_{inst}	Nm	2							
drilling method			rotation drilling							
critical edge distance	c_{cr}	mm	120							
critical axial distance parallel to horizontal joint	$s_{cr,II}$	mm	500							
critical axial distance perpendicular to horizontal joint	$s_{cr,T}$	mm	274							
minimal edge distance [2]	c_{min}	mm	c_{cr}							
minimal axial distance [2]	s_{min}	mm	s_{cr}							
recommended tension load [1]	N_{zul}	kN	0,26	0,34						
recommended vertical shear load [1]	$V_{vert.}$	kN	0,86	1,0	1,0	1,14	1,14	1,0	1,14	1,14
recommended horizontal shear load [1]	$V_{hori.}$	kN	0,36							

hollow clay brick Porotherm Homebric		**dimensions** ≥ 500 x 200 x 300 mm	**compressive strength** ≥ 6 N/mm²	**density** ≥ 0,7 kg/dm³	**producer** e.g. Wienerberger (FR)

			M8	M8	M10	M12	M16	IG M6 [3]	IG M8 [3]	IG M10 [3]
perforated sleeve			12	16	16	20	20	16	20	20
anchorage depth	h_{ef}	mm	80	85; 130						
minimum wall thickness	h_{min}	mm	200							
installation torque	T_{inst}	Nm	2							
drilling method			rotation drilling							
critical edge distance	c_{cr}	mm	120							
critical axial distance parallel to horizontal joint	$s_{cr,II}$	mm	500							
critical axial distance perpendicular to horizontal joint	$s_{cr,T}$	mm	300							
minimal edge distance [2]	c_{min}	mm	c_{cr}							
minimal axial distance [2]	s_{min}	mm	s_{cr}							
recommended tension load [1]	N_{zul}	kN	0,26	0,34						
recommended vertical shear load [1]	$V_{vert.}$	kN	0,57			0,86		0,57	0,86	
recommended horizontal shear load [1]	$V_{hori.}$	kN	0,36							

[1] Conditions and assumtions for the recommended loads see page 15

[2] Reduction factors see ETA 12/0536

[3] not covered by ETA

EASF EASF-EX EASF-Tro EASF Blue

2K Reaction resin mortar based on Polyester resin styrene-free

recommended loads in masonry

hollow clay brick Blocchi Leggeri		**dimensions** ≥ 250 x 120 x 250 mm	**compressive strength** ≥ 8 N/mm²	**density** ≥ 0,6 kg/dm³	**producer** e.g. Wienerberger (IT)

			M8	M8	M10	M12	M16	IG M6 [3]	IG M8 [3]	IG M10 [3]
perforated sleeve			12	16	16	20	20	16	20	20
anchorage depth	h_{ef}	mm	80	85; 130; 200						
minimum wall thickness	h_{min}	mm	h_{ef} + 30mm							
installation torque	T_{inst}	Nm	2							
drilling method			rotation drilling							
critical edge distance	c_{cr}	mm	120							
critical axial distance parallel to horizontal joint	$s_{cr,II}$	mm	250							
critical axial distance perpendicular to horizontal joint	$s_{cr,T}$	mm	120							
minimal edge distance [2]	c_{min}	mm	c_{cr}							
minimal axial distance [2]	s_{min}	mm	s_{cr}							
recommended tension load [1]	N_{zul}	kN	0,17							
recommended vertical shear load [1]	$V_{vert.}$	kN	0,57							
recommended horizontal shear load [1]	$V_{hori.}$	kN	0,43							

hollow clay brick Doppio Uni		**dimensions** ≥ 250 x 120 x 120 mm	**compressive strength** ≥ 20 N/mm²	**density** ≥ 0,9 kg/dm³	**producer** e.g. Wienerberger (IT)

			M8	M8	M10	M12	M16	IG M6 [3]	IG M8 [3]	IG M10 [3]
perforated sleeve			12	16	16	20	20	16	20	20
anchorage depth	h_{ef}	mm	80	85; 130; 200						
minimum wall thickness	h_{min}	mm	h_{ef} + 30mm							
installation torque	T_{inst}	Nm	2							
drilling method			rotation drilling							
critical edge distance	c_{cr}	mm	120							
critical axial distance parallel to horizontal joint	$s_{cr,II}$	mm	250							
critical axial distance perpendicular to horizontal joint	$s_{cr,T}$	mm	120							
minimal edge distance [2]	c_{min}	mm	c_{cr}							
minimal axial distance [2]	s_{min}	mm	s_{cr}							
recommended tension load [1]	N_{zul}	kN	0,26							
recommended vertical shear load [1]	$V_{vert.}$	kN	0,57							
recommended horizontal shear load [1]	$V_{hori.}$	kN	0,34							

[1] Conditions and assumtions for the recommended loads see page 15

[2] Reduction factors see ETA 12/0536

[3] not covered by ETA