

Approval body for construction products
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and
Laender Governments



European Technical Assessment

ETA-15/0068
of 16 March 2015

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

MB/ MBR

Product family
to which the construction product belongs

Plastic anchor for multiple use in concrete and masonry
for non-structural applications

Manufacturer

Mungo Befestigungstechnik AG
Bornfeldstrasse 2
4603 OLTEN
SCHWEIZ

Manufacturing plant

Werk 1
Werk 2
Werk 3
Werk 4
Werk 5

This European Technical Assessment
contains

16 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

Guideline for European technical approval of "Plastic
anchors for multiple use in concrete and masonry for
non-structural applications", ETAG 020,
Edition March 2012,
used as European Assessment Document (EAD)
according to Article 66 Paragraph 3 of Regulation (EU)
No 305/2011.

European Technical Assessment
ETA-15/0068
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Specific Part

1 Technical description of the product

The MB/ MBR is a plastic anchor consisting of a plastic sleeve made of polyamide and an accompanying specific screw of galvanised steel 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 Mechanical resistance and stability (BWR 1)

The essential characteristics regarding mechanical resistance and stability are included under the Basic Works Requirement Safety in use.

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Anchorage satisfy requirements for Class A 1
Resistance to fire	See Annex C 1

3.3 Hygiene, health and the environment (BWR 3)

Not applicable

3.4 Safety and accessibility (BWR 4)

Essential characteristic	Performance
Characteristic resistance for tension and shear loads	See Annex C 1 – C 4
Characteristic resistance for bending moments	See Annex C 1
Displacements under shear and tension loads	See Annex C 1
Anchor distances and dimensions of members	See Annex B 2 – B 3

3.5 Protection against noise (BWR 5)

Not applicable

3.6 Energy economy and heat retention (BWR 6)

Not applicable

3.7 Sustainable use of natural resources (BWR 7)

The sustainable use of natural resources was not investigated.

3.8 General aspects

The verification of durability is part of testing the essential characteristics. Durability is only ensured if the specifications of intended use according to Annex B are taken into account.

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

According to Decision 97/463/EC of the Commission of 27 June 1997 (Official Journal of the European Communities L 198 of 25.07.1997, p. 31–32) the system of assessment and verification of constancy of performance (AVCP) (see Annex V and Article 65 Paragraph 2 to Regulation (EU) No 305/2011) given in the following table applies.

Product	Intended use	Level or class	System
Plastic anchors for use in concrete and masonry	For use in systems, such as façade systems, for fixing or supporting elements which contribute to the stability of the systems	—	2+

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document

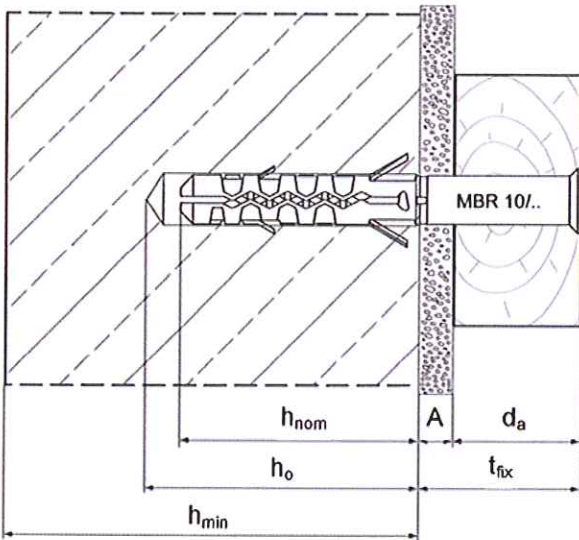
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at Deutsches Institut für Bautechnik.

Issued in Berlin on 16 March 2015 by Deutsches Institut für Bautechnik

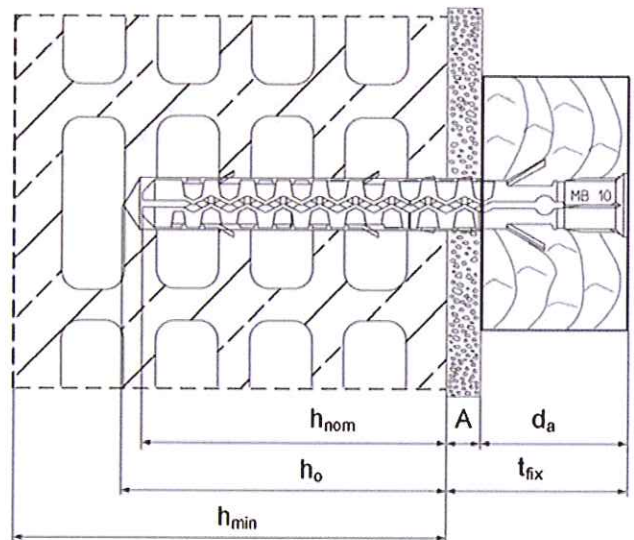
Andreas Kummerow
p.p. Head of Department

beglaubigt:
Aksünger

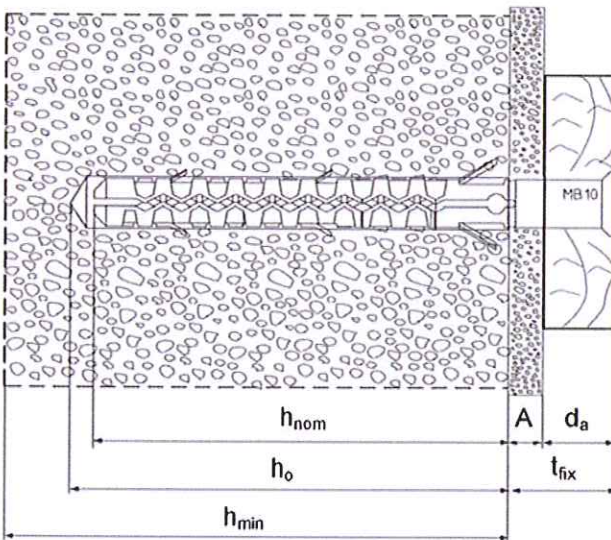
Installed condition for MB 10 and MBR 10



Installation in concrete and solid brick (e.g. MBR 10)



Installation in hollow brick (e.g. MB 10)



Installation in autoclaved aerated concrete (only for MB 10)

Legend

- h_{min} = thickness of structural part
- d_a = thickness of attached part
- h_{nom} = embedment depth
- h_o = drill hole depth
- A = tolerance compensation
- t_{fix} = thickness of fixture

MB/ MBR

Product description
Installed condition

Annex A 1

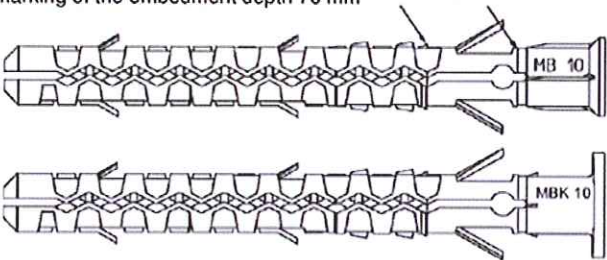
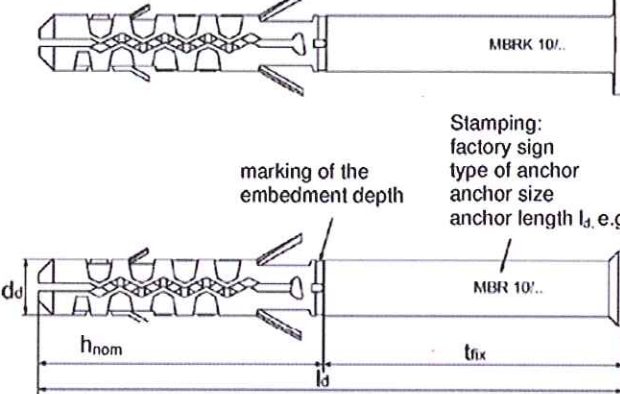
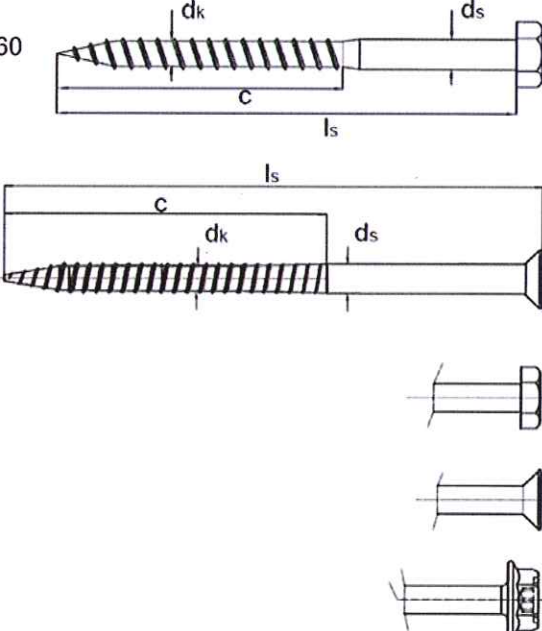
Anchor type	Embedment depth h_{nom} [mm]	Anchor sleeve
<p>MB 10</p>	<p>70 For autoclaved aerated concrete: 90</p>	<p>marking of the embedment depth 70 mm marking of the embedment depth 90 mm</p> 
<p>MBR 10</p>	<p>50</p>	 <p>marking of the embedment depth</p> <p>Stamping: factory sign type of anchor anchor size anchor length l_d, e.g. MBR 10/100</p>
<p>Special screws MB 10 and MBR 10</p>	<p>only for MBR 10x60 MBRK 10x60</p> <p>for MBR 10 MBRK 10 MB 10 MBK 10</p>	 <p>Stamping: factory sign e.g.: m</p>
<p>MB/ MBR</p>		
<p>Product description Anchor types and special screws</p>		<p>Annex A 2</p>

Table A1: Dimensions

Anchor ¹⁾	Plastic sleeve			Special screw ²⁾³⁾		
	d_d [mm]	h_{nom} [mm]	l_d [mm]	d_s [mm]	d_k [mm]	c [mm]
MBR 10/ 60 MBRK 10/ 60	10	50	60	7	6,1	50
MBR 10/ xx MBRK 10/ xx	10	50	80, 100, 120, 140, 160, 200, 240	7	6,1	75
MB10/ xx MBK10/ xx	10	70/ 90 ⁴⁾	80, 100, 120, 140, 160, 200, 240, 280, 300	7	6,1	75

- 1) For the anchor's description the plastic sleeve's length l_d is indicated additionally, e.g. for $l_d=140$ mm: anchor MBR 10/140.
- 2) The screw's length l_s amounts 5 mm longer than the plastic sleeve's length l_s , so the fastener penetrates correctly the appropriate plastic sleeve.
- 3) For attached metal parts the fastener with hexagonal drive may be used in the version zinc plated. See section 1.
- 4) When applied in autoclaved aerated concrete an embedment depth of 90 mm has to be used.

Table A2: Materials

Name	Material
Plastic sleeve	Polyamide, PA6, colour orange
Specific screw	steel 6.8 ($f_{uk} = 600 \text{ N/mm}^2$, $f_{yk} = 480 \text{ N/mm}^2$), zinc plated $\geq 5\mu\text{m}$ acc. to EN ISO 4042:2001-01
	non-corrosive steel A4 EN 10088-3:2014 mit $f_{uk} = 700 \text{ N/mm}^2$, $f_{yk} = 450 \text{ N/mm}^2$

MB/ MBR

Product description
Dimensions and materials

Annex A 3

Specifications of intended use

Anchorage subject to:

- Static and quasi-static loads
- Multiple fixing of non-structural applications

Table B1: Application categories in terms of base material and temperature range

Application categories		See annex	Anchor type	
			MB 10	MBR 10
Base material ³⁾				
a	Reinforced or unreinforced normal weight concrete with strength classes \geq C12/15 acc. to EN 206-1:2014	C 1	✓	✓
b	Solid brick masonry ¹⁾²⁾	C 2	✓	✓
c	Hollow brick masonry ²⁾	C 3 + C 4	✓	✓
d	Autoclaved aerated concrete	C 4	✓	-
Temperature range				
Tb	min T = -20°C to +80°C (maximum short term temperature +80°C and maximum long term temperature +50°C)		✓	✓
¹⁾ Note: The characteristic resistance is also valid for larger brick sizes and higher compressive strength. ²⁾ Clay bricks, calcium silicate bricks and concrete - or lightweight concrete blocks and mortar strength class \geq M2,5 acc. to EN 998-2:2010 ³⁾ For other base materials of the use categories b, c and d the characteristic resistance of the anchor may be determined by job site tests according to ETAG 020, Annex B, Edition March 2012.				

Use conditions (environmental conditions):

- Structures subject to dry internal conditions (zinc coated steel, stainless steel).
- The specific screw made of galvanised also may 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 (stainless steel).

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 the ETAG 020, Edition March 2012, Annex C under the responsibility of an engineer experienced in anchorages and 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.
- Fasteners are only to be used for multiple use for non-structural application according to ETAG 020, Edition March 2012.

Installation:

- Hole drilling by the drill modes according to Annex C1 - C4
- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site acc. to annex B 4 and B 5.
- Installation temperature from -20°C to +50°C
- Exposure to UV due to solar radiation of the anchor not protected \leq 6 weeks

MB/ MBR	Annex B 1
Intended use Specifications	

Table B2: Installation parameters

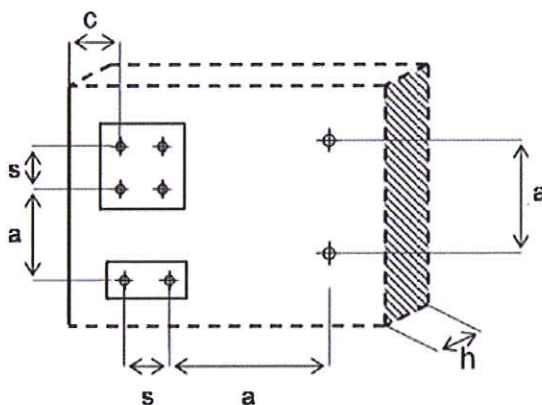
Anchor type			MBR 10	MB 10	MB 10
Base material			Concrete, solid brick and hollow brick	Concrete, solid brick and hollow brick	autoclaved aerated concrete (AAC)
Embedment depth	h_{nom}	[mm]	50	70	90
Nominal drill hole diameter	d_{nom}	[mm]	10	10	9
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	10,45	10,45	9,45
Depth of drill hole	h_o	[mm]	60	80	100
Diameter of clearance hole in fixture	d_f	[mm]	10,5		
max. thickness of member	max t_{fix}	[mm]	190	230	210
min. thickness of member	min t_{fix}	[mm]	0		

Table B3: Minimum thickness of member, edge distance and spacing in concrete

Anchor type	Strength category	Minimum thickness of member	Characteristic edge distance	Characteristic spacing	Minimum edge distance	Minimum spacing
		h_{min} [mm]	$c_{cr,N}$ [mm]	$s_{cr,N}$ [mm]	c_{min} [mm]	s_{min} [mm]
MB 10	C12/15	100	70	75	70	70
	\geq C16/20	100	50	55	50	50
MBR 10	C12/15	100	70	75	70	70
	\geq C16/20	100	50	55	50	50

Fixing points with a spacing $a \leq s_{cr,N}$ are considered as a group with a max. characteristic resistance $N_{Rk,p}$ acc. to Table C3. For a spacing $a > s_{cr,N}$ the anchors are considered as single anchors, each with a characteristic resistance $N_{Rk,p}$ acc. to Table C3.

Scheme of spacing and edge distances



MB/ MBR

Intended use
Installation parameters, edge distance and spacing in concrete

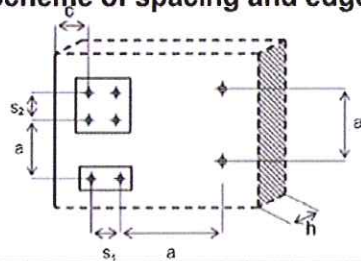
Annex B 2

Table B4: Minimum thickness of member, edge distance and spacing in solid brick, hollow brick and AAC

Anchor type	Base material	See Annex	Minimum thickness of structural part h_{min} [mm]	Minimum edge distance c_{min} [mm]	Minimum spacing	
					vertical to edge $s_{1,min}$ [mm]	parallel to edge $s_{2,min}$ [mm]
MB 10	Clay brick Mz 12-1,8-NF (DIN 105-100:2012-01)	C 2	112	120	240	480
MB 10	KSV 12-1,8-2DF (DIN V 106:2005-10)	C 2	115	120	240	480
MB 10 MBR 10	KS-Ratio flat element 20-2,0-8DF (DIN V 106:2005-10)	C 2	115	100	200	400
MB 10	Light concrete solid brick Vbl 2-0,8-2DF (DIN V 18152-100:2005-10)	C 2	115	120	240	480
MB 10	Light concrete –flat element PE12-0,5 Z-17.1-699 from 09.10.2012	C 2	115	120	240	480
MBR 10	Liapor solid brick	C 2	115	100	200	400
MB 10 MBR 10	ROGGWILL *QS/SZ* CE 21-12-13 SWISSMODUL 300x150x190	C 3	150	150	300	600
MBR 10	Block 37/17,5 brickyard 87727 Klosterbeuren, Germany Z-17.1-1038 from 16.07.2010	C 3	175	185	370	740
MB 10	Plan 30/24 brickyard 87727 Klosterbeuren, Germany Z-17.1-993 from 09.07.2010	C 3	240	150	300	600
MB 10	Calcium silicate hollow brick KSL 12-1,2-10DF (DIN V 106:2005-10)	C 3	240	150	300	600
MB 10 MBR 10	KS-Ratio flat element 12-1,6-8DF (DIN V 106:2005-10)	C 3	115	100	200	400
MBR 10	Concrete hollow block Hbn 6-1,2 8DF (DIN V 18153-100:2005-10)	C 4	115	100	200	400
MB 10	autoclaved aerated concrete (AAC) acc. to EN 771-3:2011	C 4	150	125	250	500
MB 10	Reinforced autoclaved aerated concrete acc. to EN 12602:2013	C 4	150	125 (150 ¹⁾)	250 (300 ¹⁾)	500 (600 ¹⁾)

1) For slabs of width ≤ 700 mm

Scheme of spacing and edge distances in solid and hollow brick and AAC



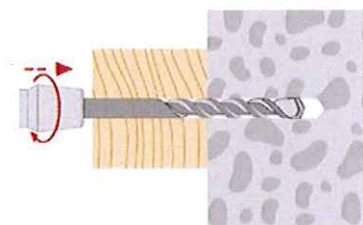
$$a \geq \max(250 \text{ mm}; s_{1,min}; s_{2,min})$$

MB/ MBR

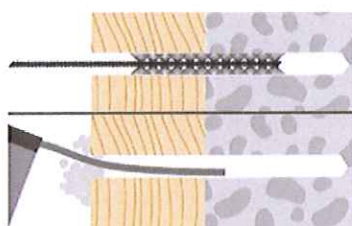
Intended use
Installation instructions in concrete and solid brick

Annex B 3

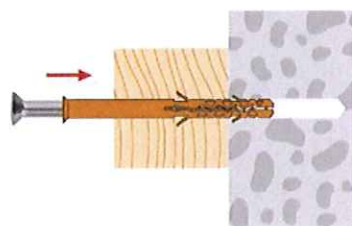
Installation instructions in concrete and solid brick:



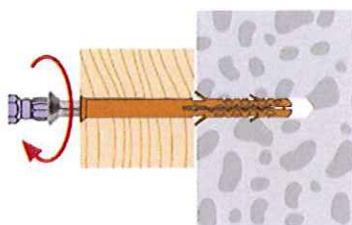
Drilling hole by hammer drilling
Drill hole diameter and drill hole depth according to table B2
Temperature of base material $\geq -20^{\circ}\text{C}$



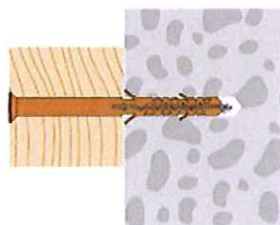
Pre-cleaning the drill hole with a brush, then hole-blowing with a pump



Setting the anchor with the preassembled fastener through the part to be fixed



Push the anchor till the waistband contacts the part to be fixed, then fix the part with screw



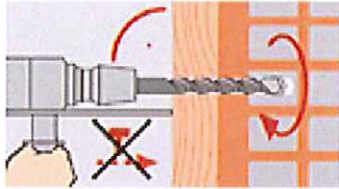
Tightening the fastener till head contact

MB/ MBR

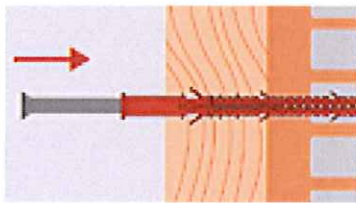
Intended use
Installation instructions in concrete and solid brick

Annex B 4

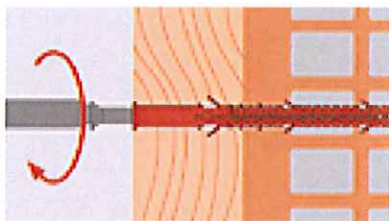
Installation instructions in hollow brick and autoclaved aerated concrete (AAC):



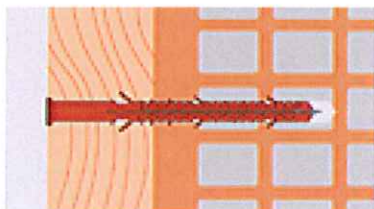
Drilling hole without hammering
Drill hole diameter and drill hole depth according to table B2
Temperature of base material $\geq -20^{\circ}\text{C}$



Setting the anchor with the preassembled fastener through the the part to be fixed



Push the anchor till the waistband contacts the part to be fixed, then fix the part with screw



Tighten the fastener till head contact

MB/ MBR

Intended use
Installation instructions in hollow brick and autoclaved aerated concrete

Annex B 5

Table C1: Characteristic bending resistance of the special screw

Steel type		Steel zinc plated	Stainless steel
Anchor type		MBR 10 MB 10	MBR 10 MB 10
Characteristic bending resistance $M_{Rk,s}$	[Nm]	15,3	17,8
Partial safety factor γ_{Ms} ¹⁾	[-]	1,25	1,56

¹⁾ In absence of other national regulations.

Table C2: Characteristic resistance of the screw

Steel type		Steel zinc plated		Stainless steel	
Anchor type		MBR 10	MB 10	MBR 10	MB 10
Total anchor length in base material	h_{nom} [mm]	50	70	50	70
Failure of expansion element (special screw)					
Characteristic tension resistance	$N_{Rk,s}$ [kN]	17,0		19,8	
Partial safety factor for $N_{Rk,s}$	γ_{Ms} ¹⁾ [-]	1,5		1,87	
Characteristic shear resistance	$V_{Rk,s}$ [kN]	8,5		8,5	
Partial safety factor for $V_{Rk,s}$	γ_{Ms} ¹⁾ [-]	1,25		1,56	

¹⁾ In absence of other national regulations.

Table C3: Characteristic resistance in concrete (use category a)

Steel type		Steel zinc plated		Stainless steel	
Anchor type		MBR 10	MB 10	MBR 10	MB 10
Total anchor length in base material	h_{nom} [mm]	50	70	50	70
Drilling method: hammer drilling					
Pullout failure (plastic sleeve)					
concrete C12/15					
Characteristic resistance $50^\circ\text{C}^{2)}$ / $80^\circ\text{C}^{3)}$	$N_{Rk,p}$ [kN]	0,9	1,5	0,9	1,5
Partial safety factor for $N_{Rk,p}$	γ_{Mc} ¹⁾ [-]	1,8			
concrete \geq C16/20					
Characteristic resistance $50^\circ\text{C}^{2)}$ / $80^\circ\text{C}^{3)}$	$N_{Rk,p}$ [kN]	1,5	2,5	1,5	2,5
Partial safety factor for $N_{Rk,p}$	γ_{Mc} ¹⁾ [-]	1,8			

¹⁾ In absence of other national regulations.

²⁾ Maximum long term temperature

³⁾ Maximum short term temperature

Table C4: Displacements¹⁾ under tension and shear load in concrete and masonry

Anchor type	Embedment depth	Tension load			Shear load		
	h_{nom}	F ²⁾	δ_{N0}	$\delta_{N\infty}$	F ²⁾	δ_{V0}	$\delta_{V\infty}$
	[mm]	[kN]	[mm]	[mm]	[kN]	[mm]	[mm]
MB 10	70 AAC: 90	1,0	0,2	0,4	4,8	3,4 ³⁾	5,1 ³⁾
MBR 10	50	0,8	0,2	0,4	4,8	3,4 ³⁾	5,1 ³⁾

¹⁾ Valid for all temperature ranges.

²⁾ Intermediate values by linear interpolation.

³⁾ The displacements under shear load can increase in case of annular gap in fixture.

Table C5: Characteristic values under fire exposure in concrete C20/25 to C50/60 in any load direction, no permanent centric tension load and without lever arm.

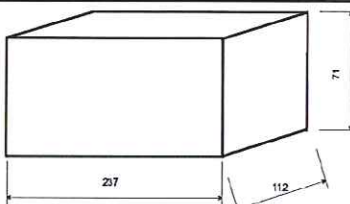
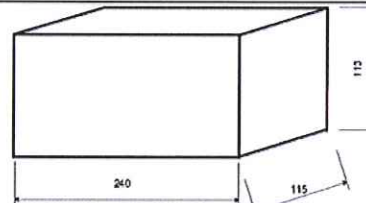

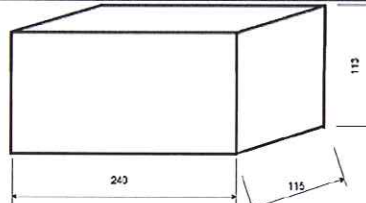
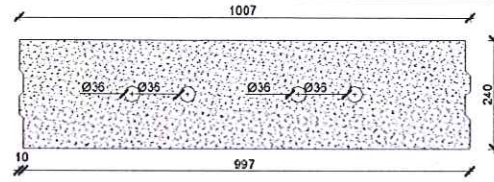
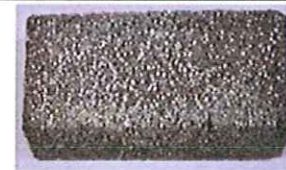
Anchor type	Fire resistance class	F_{Rk}
MB 10 and MBR 10	R 90	$\leq 0,8$ kN

MB/ MBR

Performances
Characteristic resistances,
displacements under tension and shear load in concrete and masonry

Annex C 1

Table C6: Characteristic resistance for MBR 10 and MB 10 in solid masonry (use category b) – clay brick, calcium silicate brick and lightweight concrete blocks

Base material (supplier)	Geometry (format/ length/ width/ height) [mm]	Min. compressive strength f_b [N/mm ²] bulk density $\geq \rho$ [kg/dm ³]	Drilling method ¹⁾	Characteristic resistance F_{Rk} [kN]		
				MBR 10	MB 10	
Solid brick acc. to EN 771-1:2011						
Clay brick Mz 12-1,8-NF (DIN 105-100:2012-01)		10 / 1,8	H	-	1,5	
		20 / 1,8	H	-	2,0	
Calcium silicate solid brick acc. to EN 771-2:2011						
KSV 12-1,8-2DF (DIN V 106:2005-10)		10 / 1,8	H	-	1,5	
		20 / 1,8	H	-	2,0	
KS-Ratio-flat element 20-2,0-8DF (DIN V 106:2005-10)		10 / 2,0	H	2,0	1,5	
		20 / 2,0	H	2,5	2,0	
Solid brick made of concrete (with dense and lightweight aggregates) acc. to EN 771-3:2011						
Lightweight concrete solid brick- Vbl 2-0,8-2DF (DIN 18152-100:2005-10)		2 / 0,5	H	-	0,3	
		4 / 0,8	H	-	0,4	
		10 / 1,2	H	-	1,2	
		20 / 2,0	H	-	1,5	
Lightweight concrete flat element PE12-0,5 Z-17.1-699 from 09.10.2012		2 / 0,5	H	-	0,3	
		4 / 0,8	H	-	0,4	
Liapor solid brick	240 115 95		10 / 1,2	H	0,9	-
Partial safety factor (in absence of other national regulations)			γ_{Mm}	2,5		

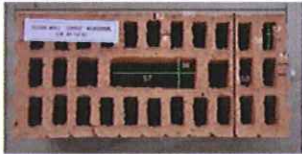
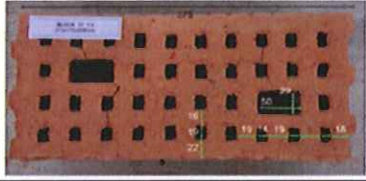

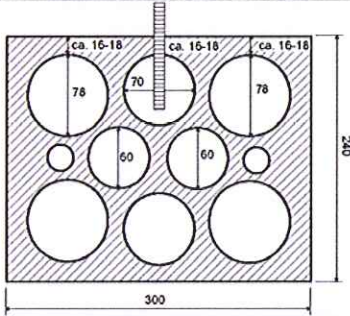
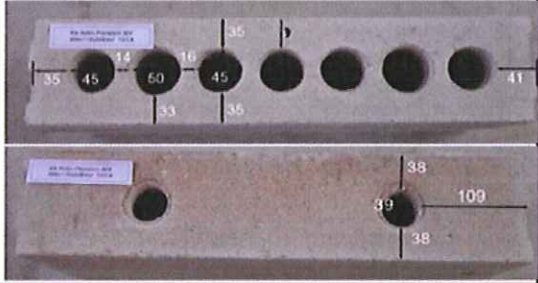
¹⁾ H = Hammer drilling; R = Rotary drilling

MB/ MBR

Performances
Characteristic resistances in solid masonry

Annex C 2

Table C7: Characteristic resistance for MBR 10 and MB 10 in hollow or perforated masonry (use category c) – clay brick and calcium silicate brick, lightweight concrete blocks

Base material (supplier)	Geometry (format/ length/ width/ height) [mm]	Min. compressive strength f_b [N/mm ²] bulk density $\geq \rho$ [kg/dm ³]	Drilling method ¹⁾	Characteristic resistance F_{Rk} [kN]	
				MBR 10	MB 10
Clay brick with perforation acc. to EN 771-1:2011					
ROGG WILL *QS/SZ* ROGGWILL CE 21-12-13 SWISSMODUL 300x150x190	 300 150 190	25 / 0,80	R	0,4 ²⁾	0,75 ²⁾
Block 37/17,5 brickyard 87727 Klosterbeuren, Germany Z-17.1-1038 from 16.07.2010	 373 175 238	12 / 1,4	R	0,6 ²⁾	-
Plan 30/24 brickyard 87727 Klosterbeuren, Germany Z-17.1-993 from 09.07.2010	 308 240 249	12 / 1,2	R	-	0,5 ²⁾
Calcium silicate brick with perforation acc. to EN 771-1:2011					
Calcium silicate hollow brick - KSL 12-1,2-10DF (DIN V 106: 2005-10)	 10DF 300 240 238	12 / 1,2	R	-	0,4 ²⁾
KS-Ratio flat element 12-1,6-8DF (DIN V 106: 2005-10)	 8DF 498 115 248	12 / 1,6	R	1,2	0,75
Partial safety factor (in absence of other national regulations)			γ_{Mm}	2,5	

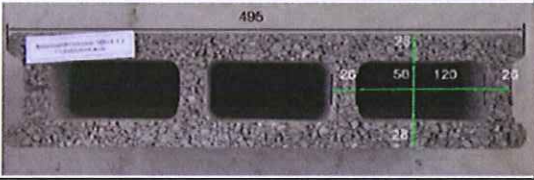
¹⁾ H = Hammer drilling; R = Rotary drilling; ²⁾ shear load with lever arm is not allowed.

MB/ MBR

Performances
Characteristic resistances in hollow masonry

Annex C 3

Table C8: Characteristic resistance for MBR 10 and MB 10 in hollow masonry (use category c) – lightweight concrete blocks

Base material (supplier)	Geometry (format/ length/ width/ height) [mm]	Min. compressive strength f_b [N/mm ²] bulk density $\geq \rho$ [kg/dm ³]	Drilling method ¹⁾	Characteristic resistance F_{Rk} [kN]	
				MBR 10	MB 10
Concrete masonry units (with dense and lightweight aggregates) acc. to EN 771-3:2011					
Concrete hollow block Hbn 6-1,2 8DF (DIN V 18153-100:2005-10)	8DF 495 115 238 	6 / 1,2	R	0,3	-
Partial safety factor (in absence of other national regulations)			γ_{Mm}	2,5	

¹⁾ H = Hammer drilling; R = Rotary drilling

Table C9: Characteristic resistance for MB 10 in [kN] in autoclaved aerated concrete / AAC (use category d)

Base material (supplier)	Geometry (format/ length/ width/ height) [mm]	Min. compressive strength f_b [N/mm ²] bulk density $\geq \rho$ [kg/dm ³]	Drilling method ¹⁾	Characteristic resistance F_{Rk} [kN]
				MB 10
Autoclaved aerated concrete masonry units acc. to EN 771-4 :2011				
AAC	250	-	R	0,4
	150 240			5,2 / 0,55
Reinforced autoclaved aerated concrete acc. to EN 12602:2013				
AAC	250	-	R	0,3
	150 240			5,2 / 0,55
Partial safety factor (in absence of other national regulations)			γ_{MAAC}	2,0

¹⁾ H = Hammer drilling; R = Rotary drilling

MB/ MBR

Performances

Characteristic resistances in hollow masonry and autoclaved aerated concrete

Annex C 4