

DECLARATION OF PERFORMANCE

DEMU Bolt anchor

CONF-DOP_DEMU-BA 02/17-E

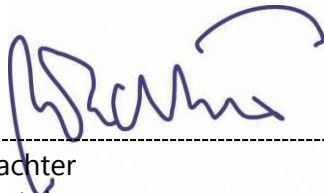
No. H03-13/0401

1.	Unique identification code of the product-type	DEMU Bolt anchor
2.	Type, batch or serial number or any other element allowing identification of the construction product as required pursuant to Article 11(4)	DEMU Bolt anchor, type 1988 - See ETA-13/0401, Annexes A4 and A5 DEMU Bolt anchor, type 1985 - See ETA-13/0401, Annexes A4 and A5
3.	Intended use or uses of the construction product, in accordance with the applicable harmonized technical specification, as foreseen by the manufacturer:	
	Generic type and use	Cast-in fixing anchor with internal threaded socket
	Product size covered	M12×55, M12×100, M12×150, M16×75, M16×140, M16×220, M20×90, M20×150, M20×180, M20×270, M24×110, M24×200, M24×320, M30×160, M30×240, M30×380, M36×300, M36×420, M42×300, M42×460
	For use in	Cracked and non-cracked concrete C20/25 to C90/105 according EN 206:2013
	Base material / base material strength	<ul style="list-style-type: none"> • Sleeve in electroplated steel for dry internal conditions, insignificant corrosion exposure • Sleeve in hot-dipped galvanised steel for low corrosion exposure • Sleeve in stainless steel (A4-50 and A4-80) for medium corrosion exposure
	Loading	Static & quasi static tension and shear loads or the combination of tension and shear loads
4.	Name, registered trade name or registered trade mark and contact address of the manufacturer as required pursuant to Article 11(5)	HALFEN GmbH, Liebigstraße 14, 40764 Langenfeld, Germany
5.	Where applicable, name and contact address of the authorized representative whose mandate covers the tasks specified in Article 12(2)	-
6.	System or systems of assessment and verification of constancy of performance of the construction product as set out in Annex V	System 1
7.	In case of the declaration of performance concerning a construction product covered by a harmonised standard	-
8.	In case of the declaration of performance concerning a construction product for which a European Technical Assessment has been issued	Deutsches Institut für Bautechnik (DIBt) issued ETA-13/0401 on the basis of EAD 330012-00-0601, Version September 2015, the notified body 2323 performed under system 1 (i) Determination of the product type on the basis of type testing (including sample-testing), type calculation, tabulated values or descriptive documentation of the product; (ii) Initial inspection of the manufacturing plant and of factory production control; (iii) Continuous surveillance, assessment and evaluation of factory production control and issued certificate 2323-CPR-0013.

	Declared performance			
	Essential Characteristics	Design Method	Performance	Harmonized Technical Specification
9.	Characteristic resistance for tension	CEN/TS 1992-4-1 and CEN/TS 1992-4-2	ETA-13/0401, Annexes C1 and C2	EAD 330012-00-0601, Version September 2015
	Characteristic resistance for shear		ETA-13/0401, Annexes C3 and C4	
	Displacement for serviceability limit state		ETA-13/0401, Annexes C2 and C4	
	Characteristic resistance for fire		ETA-13/0401, Annex C5	
	Where pursuant to Article 37 or 38 in the Specific Technical Documentation has been used, the requirements with which the product complies		-	
10.	The performance of the product identified in points 1 and 2 is in conformity with the declared performance in point 9.			
This declaration of performance is issued under the sole responsibility of the manufacturer identified in point 4.				

Langenfeld, 06.02.2017

Signed for and on behalf of the manufacturer by



Richard Wachter
(Managing Director)



ppa. Dr.-Ing. Dirk Albartus
(Manager Engineering)

Table C-1a: Characteristic values for tension loads

Thread size	d	[mm]	M12	M16	M20	M24	M30	M36	M42
Steel failure, bolt anchor (material 1 or 2) and screw (min. steel strength 4.6) made of electroplated / hot-dipped galvanized steel									
Characteristic resistance	$N_{Rk,s}$	[kN]	33.7	62.8	98.0	141.2	224.4	326.8	448.4 ²⁾
Partial safety factor	γ_{Ms} ¹⁾	[-]	2.00						
Steel failure, bolt anchor (material 1 or 2) and screw (min. steel strength 5.6) made of electroplated / hot-dipped galvanized steel									
Characteristic resistance	$N_{Rk,s}$	[kN]	42.2	78.5	122.5	176.5	280.5	408.5	560.5 ²⁾
Partial safety factor	γ_{Ms} ¹⁾	[-]	2.00						
Steel failure, bolt anchor (material 1 or 2) and screw (min. steel strength 8.8) made of electroplated / hot-dipped galvanized steel									
Characteristic resistance	$N_{Rk,s}$	[kN]	45.8	93.1	139.6	219.5	335.0	490.5	588.1 ²⁾
Partial safety factor	γ_{Ms} ¹⁾	[-]	1.58						
Steel failure, bolt anchor (material 3: A4-50) and screw (min. steel strength A4-50) made of stainless steel									
Characteristic resistance	$N_{Rk,s}$	[kN]	42.2	81.0	110.3				
Partial safety factor	γ_{Ms} ¹⁾	[-]	3.09						
Steel failure, bolt anchor (material 3: A4-50) and screw (min. steel strength A4-70) made of stainless steel									
Characteristic resistance	$N_{Rk,s}$	[kN]	46.4	81.0	110.3				
Partial safety factor	γ_{Ms} ¹⁾	[-]	3.09						
Steel failure, bolt anchor (material 4: A4-80) and screw (min. steel strength A4-80) made of stainless steel									
Characteristic resistance	$N_{Rk,s}$	[kN]	59.0	125.6	180.1	282.4	448.8		
Partial safety factor	γ_{Ms} ¹⁾	[-]	1.48	1.60	1.48	1.60	1.60		
Pull-out failure									
Charact. resistance in cracked concrete	$N_{Rk,p}$	[kN]	25.1	44.7	69.8	100.5	168.9	240.3	341.0
Charact. resistance in uncracked concrete	$N_{Rk,p}$	[kN]	35.2	62.5	97.7	140.7	236.4	336.4	477.4
Increasing factors for $N_{Rk,p}$ in cracked and uncracked concrete	C25/30	ψ_c	1.20						
	C30/37	ψ_c	1.48						
	C35/45	ψ_c	1.80						
	C40/50	ψ_c	2.00						
	C45/55	ψ_c	2.20						
Partial safety factor	C50/60	ψ_c	2.40						
	γ_{Rp} ¹⁾	[-]	1.50						

¹⁾ in absence of other national regulations; ²⁾ only available in GV (material 1, acc. to Annex A4)

DEMU Bolt anchor

Performances
Characteristic values for tension loads

Annex C1

Table C1b: Characteristic values for tension loads

	d	[mm]	M12	M16	M20	M24	M30	M36	M42	
Concrete cone failure										
Effective anchorage depth	$h_{ef}^{1)}$	[mm]	M12x55: 49.0 M16x75: 67.0 M20x90: 79.0 M24x110: 97.0 M30x150: 143.0 M36x200: 279.0 M42x300: 436.0	M12x100: 94.0 M16x140: 132.0 M20x150: 139.0 M24x200: 187.0 M30x240: 223.0 M36x420: 399.0 M42x460: 436.0	M12x150: 144.0 M16x220: 212.0 M20x180: 169.0 M24x320: 307.0 M30x380: 363.0					
Factor to take into account the influence of load transfer mechanisms in cracked and uncracked concrete	K_{cr}	[-]	8.5							
		[-]	11.9							
Characteristic spacing	$s_{cr,N}$	[mm]	$3.0 \cdot h_{ef}$							
		[mm]	$1.5 \cdot h_{ef}$							
Partial safety factor	$\gamma_{Mc}^{2)}$	[-]	1.50							
Splitting										
Effective anchorage depth	$h_{ef}^{1)}$	[mm]	M12x55: 49.0 M16x75: 67.0 M20x90: 79.0 M24x110: 97.0 M30x150: 143.0 M36x200: 279.0 M42x300: 436.0	M12x100: 94.0 M16x140: 132.0 M20x150: 139.0 M24x200: 187.0 M30x240: 223.0 M36x420: 399.0 M42x460: 436.0	M12x150: 144.0 M16x220: 212.0 M20x180: 169.0 M24x320: 307.0 M30x380: 363.0					
Characteristic spacing	$s_{cr,sp}$	[mm]	$4.0 \cdot h_{ef}$							
		[mm]	$2.0 \cdot h_{ef}$							
Partial safety factor	$\gamma_{t,sp}^{2)}$	[-]	1.50							

¹⁾ for bolt anchor type 1985 the values have to be decreased by 2.0 mm; ²⁾ in absence of other national regulations

Table C2: Displacements under tension loads

	d	[mm]	M12	M16	M20	M24	M30	M36	M42
Thread size	N	[mm]	14.0	20.0	29.0	40.0	63.0	83.0	113.0
		[kN]							

¹⁾ for long term tension loading the displacements $\delta_{N,t}$ can be increased to 1.8 mm

DEMU Bolt anchor

Performances
Characteristic values for tension loads, displacements under tension loads

Annex C2

Table C3a: Characteristic values for shear loads													
Thread size	d	[mm]	M12	M16	M20	M24	M30	M36	M42				
Shear loads without lever arm													
Group factor (CEN/TS 1992-4-2, 6.3.3.1)	k_g	[-]	1.0										
Steel failure, bolt anchor (material 1 or 2) and screw (min. steel strength 4.6) made of electroplated / hot-dipped galvanised steel	$V_{Rk,s}$	[kN]	16.9	31.4	49.0	70.6	112.2	163.4	224.2 ²⁾				
Characteristic resistance	$V_{Rk,s}$	[kN]	1.67										
Partial safety factor	γ_{M5}	[-]	1.67										
Steel failure, bolt anchor (material 1 or 2) and screw (min. steel strength 5.6) made of electroplated / hot-dipped galvanised steel	$V_{Rk,s}$	[kN]	21.1	39.3	61.3	88.3	140.3	204.3	280.3 ²⁾				
Characteristic resistance	$V_{Rk,s}$	[kN]	1.67										
Partial safety factor	γ_{M5}	[-]	1.67										
Steel failure, bolt anchor (material 1 or 2) and screw (min. steel strength 8.8) made of electroplated / hot-dipped galvanised steel	$V_{Rk,s}$	[kN]	22.9	46.5	69.8	109.7	167.5	245.2	294.1 ²⁾				
Characteristic resistance	$V_{Rk,s}$	[kN]	1.32										
Partial safety factor	γ_{M5}	[-]	1.32										
Steel failure, bolt anchor (material 3: A4-50) and screw (min. steel strength A4-50) made of stainless steel	$V_{Rk,s}$	[kN]	21.1	40.5	55.1								
Characteristic resistance	$V_{Rk,s}$	[kN]	1.67										
Partial safety factor	γ_{M5}	[-]	2.38	2.58									
Steel failure, bolt anchor (material 3: A4-50) and screw (min. steel strength A4-70) made of stainless steel	$V_{Rk,s}$	[kN]	23.2	40.5	55.1								
Characteristic resistance	$V_{Rk,s}$	[kN]	1.67										
Partial safety factor	γ_{M5}	[-]	2.58										
Steel failure, bolt anchor (material 4: A4-80) and screw (min. steel strength A4-80) made of stainless steel	$V_{Rk,s}$	[kN]	29.5	62.8	90.0	141.2	224.4						
Characteristic resistance	$V_{Rk,s}$	[kN]	1.33										
Partial safety factor	γ_{M5}	[-]	1.23	1.33	1.23	1.33							
Shear loads with lever arm: see Annex C4, Table C3b													
Pry-out failure													
Factor	k_s	[-]	M12x55: 1.0 M12x100: 2.0 M12x150: 2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Partial safety factor	γ_{M5}	[-]	1.50										
Concrete edge failure (without suppl. reinforcement)													
Effective length of fixing anchor (for shear loads)	l_f	[mm]	M12x55: 47.0 M16x75: 65.0 M20x90: 77.0 M24x110: 95.0 M30x160: 141.0 M36x300: 277.0 M42x300: 274.0 M12x100: 92.0 M16x140: 130.0 M20x150: 137.0 M24x200: 185.0 M30x240: 221.0 M36x420: 380.0 M42x460: 432.0 M12x150: 124.0 M16x220: 168.0 M20x180: 167.0 M24x320: 256.0 M30x380: 320.0										
Effective outside diameter	d_{nom}	[mm]	-	-	-	-	-	-	-	-	-	-	
Partial safety factor	γ_{M5}	[-]	15.5	21.0	26.0	32.0	40.0	47.5	54.0	1.50			
¹⁾ in absence of other national regulations; ²⁾ only available in GV (material 1 acc. to Annex A4)													

DEMU Bolt anchor

Performances
Characteristic values for shear loads

Annex C3

Table C3b: Characteristic values for shear loads

Thread size	d	[mm]	M12	M16	M20	M24	M30	M36	M42
Shear loads with lever arm									
Steel failure, bolt anchor (material 1 or 2) and screw (min. steel strength 4.6) made of electroplated / hot-dipped galvanized steel	$M_{Rk,s}^2$	[Nm]	52.4	133.2	259.6	449.0	899.6	1581.0	2541.1 ²⁾
Characteristic resistance	$Y_{Rk,s}^1$	[-]	1.67						
Partial safety factor									
Steel failure, bolt anchor (material 1 or 2) and screw (min. steel strength 5.6) made of electroplated / hot-dipped galvanized steel	$M_{Rk,s}^2$	[Nm]	65.5	166.5	324.5	561.3	1124.5	1976.3	3176.3 ²⁾
Characteristic resistance	$Y_{Rk,s}^1$	[-]	1.67						
Partial safety factor									
Steel failure, bolt anchor (material 1 or 2) and screw (min. steel strength 8.8) made of electroplated / hot-dipped galvanized steel	$M_{Rk,s}^2$	[Nm]	104.8	266.4	519.3	898.0	1799.2	3162.1	5082.1 ²⁾
Characteristic resistance	$Y_{Rk,s}^1$	[-]	1.25						
Partial safety factor									
Steel failure, bolt anchor (material 3: A4-50) and screw (min. steel strength A4-50) made of stainless steel	$M_{Rk,s}^2$	[Nm]	65.5	166.5	324.5				
Characteristic resistance	$Y_{Rk,s}^1$	[-]	2.38						
Partial safety factor									
Steel failure, bolt anchor (material 3: A4-50) and screw (min. steel strength A4-70) made of stainless steel	$M_{Rk,s}^2$	[Nm]	91.7	383.7	659.4				
Characteristic resistance	$Y_{Rk,s}^1$	[-]	2.58						
Partial safety factor									
Steel failure, bolt anchor (material 3: A4-50) and screw (min. steel strength A4-80) made of stainless steel	$M_{Rk,s}^2$	[Nm]	161.6	383.7	659.4				
Characteristic resistance	$Y_{Rk,s}^1$	[-]	2.58						
Partial safety factor									
Steel failure, bolt anchor (material 4: A4-80) and screw (min. steel strength A4-80) made of stainless steel	$M_{Rk,s}^2$	[Nm]	104.8	266.4	519.3	898.0	1799.2		
Characteristic resistance	$Y_{Rk,s}^1$	[-]	1.33						
Partial safety factor									

¹⁾ in absence of other national regulations; ²⁾ only available in GV (material 1 acc. to Annex A.4)

Table C4: Displacements under shear loads

Thread size	d	[mm]	M12	M16	M20	M24	M30	M36	M42
Displacements δ_{v0} to 1.5 mm for short term loading in cracked and uncracked concrete under following shear loads ¹⁾	V	[kN]	13.0	23.0	36.0	52.0	82.0	120.0	160.0

¹⁾ for long term shear loading the displacements $\delta_{v,t}$ can be increased to 2.0 mm

DEMU Bolt anchor

Performances
Characteristic values for shear loads, displacements under shear loads

Annex C4

Table C5: Characteristic values for resistance to fire

Thread size	d	[mm]	M12	M16	M20	M24	M30	M36	M42		
Steel failure for tension and shear load ($F_{Rk,s,fl} = N_{Rk,s,fl} = V_{Rk,s,fl}$), bolt anchor (material 1 or 2) and screw made of electroplated / hot-dipped galvanised steel											
Characteristic resistance	R30	$F_{Rk,s,fl}$	[kN]	1.5	3.0	4.5	7.1	10.8	15.8	19.0	
	R60	$F_{Rk,s,fl}$	[kN]	1.1	2.3	3.4	5.3	8.1	11.9	14.2	
	R90	$F_{Rk,s,fl}$	[kN]	1.0	2.0	2.9	4.6	7.0	10.3	12.3	
	R120	$F_{Rk,s,fl}$	[kN]	0.7	1.5	2.3	3.5	5.4	7.9	9.5	
Partial safety factor		$\gamma_{Ms,fl}^{1)}$	[-]	1.00							
Characteristic resistance	R30	$M_{Rk,s,fl}^0$	[Nm]	2.8	6.7	13.0	22.5	45.0	79.1	127.1	
	R60	$M_{Rk,s,fl}^0$	[Nm]	2.0	5.0	9.7	18.8	33.7	59.3	95.3	
	R90	$M_{Rk,s,fl}^0$	[Nm]	1.7	4.3	8.4	14.6	29.2	51.4	82.6	
	R120	$M_{Rk,s,fl}^0$	[Nm]	1.3	3.3	6.5	11.2	22.5	39.5	63.5	
Partial safety factor		$\gamma_{Ms,fl}^{1)}$	[-]	1.00							
Steel failure for tension and shear load ($F_{Rk,s,fl} = N_{Rk,s,fl} = V_{Rk,s,fl}$), bolt anchor (material 3 or 4) and screw made of stainless steel											
Characteristic resistance	R30	$F_{Rk,s,fl}$	[kN]	2.2 / 2.5 ²⁾	4.5 / 4.6 ²⁾	6.8	10.6	16.2			
	R60	$F_{Rk,s,fl}$	[kN]	1.8 / 2.1 ²⁾	3.8 / 3.9 ²⁾	5.6	8.8	13.5			
	R90	$F_{Rk,s,fl}$	[kN]	1.5 / 1.6 ²⁾	3.0 / 3.1 ²⁾	4.5	7.1	10.8			
	R120	$F_{Rk,s,fl}$	[kN]	1.2 / 1.3 ²⁾	2.4 / 2.5 ²⁾	3.6	5.6	8.6			
Partial safety factor		$\gamma_{Ms,fl}^{1)}$	[-]	1.00							
Characteristic resistance	R30	$M_{Rk,s,fl}^0$	[Nm]	3.9	10.0	19.5	33.7	87.5			
	R60	$M_{Rk,s,fl}^0$	[Nm]	3.3	8.3	18.2	28.1	56.2			
	R90	$M_{Rk,s,fl}^0$	[Nm]	2.6	6.7	13.0	22.5	45.0			
	R120	$M_{Rk,s,fl}^0$	[Nm]	2.1	5.3	10.4	18.0	38.0			
Partial safety factor		$\gamma_{Ms,fl}^{1)}$	[-]	1.00							
Pull-out failure											
Characteristic resistance	R90	$N_{Rk,p,fl}$	[kN]	$N_{Rk,p,fl(90)} = 0.25 \cdot N_{Rk,p}$							
	R120	$N_{Rk,p,fl}$	[kN]	$N_{Rk,p,fl(120)} = 0.20 \cdot N_{Rk,p}$							
Partial safety factor		$\gamma_{Mp,fl}^{1)}$	[-]	1.00							
Concrete cone failure											
Characteristic resistance	R90	$N_{Rk,c,fl}$	[kN]	$N_{Rk,c,fl(90)}^0 = h_{ef}/200 \cdot N_{Rk,c}^0 \leq N_{Rk,c}^0$							
	R120	$N_{Rk,c,fl}$	[kN]	$N_{Rk,c,fl(120)}^0 = 0.8 \cdot h_{ef}/200 \cdot N_{Rk,c}^0 \leq N_{Rk,c}^0$							
Characteristic spacing		$s_{cr,fl}$	[mm]	4.0 · h _{ef}							
Characteristic edge distance		$c_{cr,fl}$	[mm]	2.0 · h _{ef}							
Partial safety factor		$\gamma_{Mc,fl}^{1)}$	[-]	1.00							
Concrete pry-out failure											
Characteristic resistance	R90	$V_{Rk,cp,fl}$	[kN]	$V_{Rk,cp,fl(90)} = k_3 \cdot N_{Rk,c,fl(90)}$							
	R120	$V_{Rk,cp,fl}$	[kN]	$V_{Rk,cp,fl(120)} = k_3 \cdot N_{Rk,c,fl(120)}$							
Partial safety factor		$\gamma_{Mc,fl}^{1)}$	[-]	1.00							
Concrete edge failure											
Characteristic resistance	R90	$V_{Rk,c,fl}$	[kN]	$V_{Rk,c,fl(90)}^0 = 0.25 \cdot V_{Rk,c}^0$							
	R120	$V_{Rk,c,fl}$	[kN]	$V_{Rk,c,fl(120)}^0 = 0.20 \cdot V_{Rk,c}^0$							
Partial safety factor		$\gamma_{Mc,fl}^{1)}$	[-]	1.00							
1) in absence of other national regulations; 2) higher value applies for material 3 (acc. to Annex A4)											

DEMU Bolt anchor

Performances
Characteristic values for resistance to fire

Annex C5