DECLARATION OF PERFORMANCE

No. DoP-21/1082-R-HPTIII

1. Unique identification code of the product type: **R-HPTIII**
2. Intended use or uses: **Torque controlled expansion anchor R-HPTIII for use in cracked and uncracked concrete**
3. Producer: **RAWLPLUG S.A., ul. Kwidzyńska 6, 51-416 Wrocław, Poland**
4. System(s) of assessment and verification of constancy of performance: **System 1**
5. European Assessment Document: **EAD 330232-01-0601; December 2019**
6. European Technical Assessment: **ETA-21/1082; 2024-04-26**

   Technical Assessment Unit: **ZAG - Zavod za gradbeništvo Slovenije**

   Notified body or bodies: **1488 ITB**

   Certificate numer and type: **1488-CPR-1062/W**
7. Declared performance characteristics:

Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance (static and quasi-static loads)	Table C1, C2, C5, C6; ETA-21/1082
Characteristic resistance for seismic loading Category C1 and C2	Table C13 - C15; ETA-21/1082

Safety in case of fire (BWR 2)

Essential characteristic	Performance
Fire resistance	Table C9 - C12; ETA-21/1082

Table C1: Characteristic values for tension loads in case of static and quasi-static loading for design acc. to EOTA TR 055 or EN 1992-4:2018 for R-HPTIII sizes M8-M12

Essential characteristics			R-HPTIII					
			M8		**M10**		**M12**	
Steel failure								
Characteristic tension steel failure	$N_{Rk,s}$	[kN]	19,8		31,1		48,7	
Partial safety factor	γ_{Ms}[1]	[-]	1,40		1,40		1,50	
Pull-out failure								
Effective embedment depth	h_{ef}	[mm]	33[2]-47	48-70	40-59	60-100	50-69	70-125
Characteristic resistance in **cracked** concrete C20/25	$N_{Rk,p}$	[kN]	7,1	7,5	16,0	16,0	20,2	20,2
Characteristic resistance in **uncracked** concrete C20/25	$N_{Rk,p}$	[kN]	8,5	12,0	22,9	22,9	30,0	30,0
Installation safety factor	γ_{inst}	[-]	1,0					
Increasing factor for $N_{Rk,p}$	Ψ_C	C30/37	1,20	1,12	1,17	1,10	1,08	1,18
		C40/50	1,37	1,22	1,30	1,19	1,15	1,33
		C50/60	1,51	1,29	1,42	1,25	1,20	1,47
Splitting								
Characteristic resistance	$N^0_{Rk,sp}$	[kN]	$\min(N_{Rk,p}\,;\,N^0_{Rk,c})$					
Characteristic edge distance	$c_{cr,sp}$	[mm]	$c_{cr,sp} = \min\left[\frac{A_{rqd} + 0,8(h_{min} - h_{ef})^2}{(3,14 \cdot h - 0,59 \cdot h_{ef})}; \frac{A_{rqd}}{(h_{min} \cdot 8^{0,5})}\right] \geq 1,5 \cdot h_{ef}$					
Characteristic spacing	$s_{cr,sp}$	[mm]	$2 \cdot c_{cr,sp}$					
Installation safety factor	γ_{inst}	[-]	1,0					
Concrete cone failure								
Minimum effective anchorage depth	$h_{ef,min}$	[mm]	33[2]		40		50	
Maximum effective anchorage depth	$h_{ef,max}$	[mm]	70		100		125	
Factor for cracked concrete	kcr	[-]	7,7					
Factor for uncracked concrete	k_{ucr}	[-]	11,0					
Spacing	$s_{cr,N}$	[mm]	3 h_{ef}					
Edge distance	$c_{cr,N}$	[mm]	1,5 h_{ef}					
Installation safety factor	γ_{inst}	[-]	1,0					
Displacement under tension load $\delta_{N0} = \delta_{N0-factor} \cdot N$ **N: acting tension load** $\delta_{N\infty} = \delta_{N\infty-factor} \cdot N$								
Cracked concrete C20/25 – C50/60								
Factors for short term displacement	$\delta_{N0-factor}$	[mm/kN]	0,11		0,06		0,05	
Factors for long term displacement	$\delta_{N\infty-factor}$	[mm/kN]	0,27		0,18		0,13	
Uncracked concrete C20/25 – C50/60								
Factors for short term displacement	$\delta_{N0-factor}$	[mm/kN]	0,01		0,02		0,01	
Factors for long term displacement	$\delta_{N\infty-factor}$	[mm/kN]	0,19		0,13		0,09	

[1] In absence of other national regulations

[2] Fastenings with anchorage depth h_{ef} < 40 mm are restricted to the use of structural components which are statically indeterminate and subjected to internal exposure conditions only

Table C2: Characteristic values for tension loads in case of static and quasi-static loading for design acc. to EOTA TR 055 or EN 1992-4:2018 for R-HPTIII sizes M16-M20

Essential characteristics			R-HPTIII			
			M16		M20	
Steel failure						
Characteristic tension steel failure	$N_{Rk,s}$	[kN]	69,7		121,4	
Partial safety factor	γ_{Ms} 1)	[-]	1,41			
Pull-out failure						
Effective embedment depth	h_{ef}	[mm]	65-84	85-160	80-99	100-180
Characteristic resistance in **cracked** concrete C20/25	$N_{Rk,p}$	[kN]	27,0	27,0	40,9	40,9
Characteristic resistance in **uncracked** concrete C20/25	$N_{Rk,p}$	[kN]	45,0	45,0	50,0	50,0
Installation safety factor	γ_{inst}	[-]	1,0			
Increasing factor for $N_{Rk,p}$	Ψ_C	C30/37	1,19	1,17	1,22	1,22
		C40/50	1,34	1,32	1,40	1,41
		C50/60	1,48	1,45	1,56	1,58
Splitting						
Characteristic resistance	$N^0_{Rk,sp}$	[kN]	$\min(N_{Rk,p}\ ;\ N^0_{Rk,c})$			
Characteristic edge distance	$c_{cr,sp}$	[mm]	$c_{cr,sp} = \min\left[\frac{A_{rqd} + 0{,}8(h_{min} - h_{ef})^2}{(3{,}14 \cdot h - 0{,}59 \cdot h_{ef})}; \frac{A_{rqd}}{(h_{min} \cdot 8^{0,5})}\right] \geq 1{,}5 \cdot h_{ef}$			
Characteristic spacing	$s_{cr,sp}$	[mm]	$2 \cdot c_{cr,sp}$			
Installation safety factor	γ_{inst}	[-]	1,0			
Concrete cone failure						
Minimum effective anchorage depth	$h_{ef,min}$	[mm]	65		80	
Maximum effective anchorage depth	$h_{ef,max}$	[mm]	160		180	
Factor for cracked concrete	kcr	[-]	7,7			
Factor for uncracked concrete	k_{ucr}	[-]	11,0			
Spacing	$s_{cr,N}$	[mm]	3 h_{ef}			
Edge distance	$c_{cr,N}$	[mm]	1,5 h_{ef}			
Installation safety factor	γ_{inst}	[-]	1,0			
Displacement under tension load $\delta_{N0} = \delta_{N0-factor} \cdot N$ **N: acting tension load** $\delta_{N\infty} = \delta_{N\infty-factor} \cdot N$						
Cracked concrete C20/25 – C50/60						
Factors for short term displacement	$\delta_{N0-factor}$	[mm/kN]	0,03		0,02	
Factors for long term displacement	$\delta_{N\infty-factor}$	[mm/kN]	0,15		0,02	
Uncracked concrete C20/25 – C50/60						
Factors for short term displacement	$\delta_{N0-factor}$	[mm/kN]	0,02		0,01	
Factors for long term displacement	$\delta_{N\infty-factor}$	[mm/kN]	0,09		0,02	

1) In absence of other national regulations

Table C5: Characteristic values for shear loads under static and quasi-static action for design acc. to EOTA TR 055 or EN 1992-4:2018 for R-HPTIII sizes M8-M12

Essential characteristics			R-HPTIII		
			M8	M10	M12
Steel failure without lever arm					
Characteristic resistance	$V^0_{Rk,s}$	[kN]	14,5	24,4	32,6
Partial safety factor	γ_{Ms}[1]	[-]	1,5	1,5	1,5
Factor for considering ductility	K_7	[-]	1,0		
Steel failure with lever arm					
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	30	57	104
Partial safety factor	γ_{Ms}[1]	[-]	1,5	1,5	1,5
Concrete pryout failure					
k-factor	k_8	[-]	2,9	3,6	3,6
Installation safety factor	γ_{inst}	[-]	1,0		
Concrete edge failure					
Effective length of anchor under shear load	l_{ef}	[mm]	h_{ef}[2]		
Outside diameter of anchor	d_{nom}	[mm]	8	10	12
Installation safety factor	γ_{inst}	[-]	1,0		
Displacement under shear load $\delta_{V0} = \delta_{V0-factor} \cdot V$ **V: acting shear load** $\delta_{V\infty} = \delta_{V\infty-factor} \cdot V$					
Factors for short term displacement	$\delta_{V0-factor}$	[mm/kN]	0,32	0,24	0,17
Factors for long term displacement	$\delta_{V\infty-factor}$	[mm/kN]	0,48	0,37	0,25

[1] In absence of other national regulations

[2] Fastenings with anchorage depth h_{ef} < 40 mm are restricted to the use of structural components which are statically indeterminate and subjected to internal exposure conditions only

Table C6: Characteristic values for shear loads under static and quasi-static action for design acc. to EOTA TR 055 or EN 1992-4:2018 for R-HPTIII sizes M16-M20

Essential characteristics			R-HPTIII	
			M16	M20
Steel failure without lever arm				
Characteristic resistance	$V^0_{Rk,s}$	[kN]	43,6	60,7
Partial safety factor	γ_{Ms}[1)]	[-]	1,5	1,5
Factor for considering ductility	K_7	[-]	1,0	
Steel failure with lever arm				
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	169	402
Partial safety factor	γ_{Ms}[1)]	[-]	1,5	1,5
Concrete pryout failure				
k-factor	k_8	[-]	3,5	3,7
Installation safety factor	γ_{inst}	[-]	1,0	
Concrete edge failure				
Effective length of anchor under shear load	l_{ef}	[mm]	h_{ef}	
Outside diameter of anchor	d_{nom}	[mm]	16	20
Installation safety factor	γ_{inst}	[-]	1,0	
Displacement under shear load $\delta_{V0} = \delta_{V0-factor} \cdot V$ $\delta_{V\infty} = \delta_{V\infty-factor} \cdot V$ **V: acting shear load**				
Factors for short term displacement	$\delta_{V0-factor}$	[mm/kN]	0,15	0,13
Factors for long term displacement	$\delta_{V\infty-factor}$	[mm/kN]	0,22	0,19

1) In absence of other national regulations

Table C9: Characteristic resistance under tension loads in case of fire exposure for design acc. to EN 1992-4:2018, Annex D for R-HPTIII and R-HPTIII-A4 sizes M8-M12

Essential characteristics			Anchor size											
			M8		M8-A4		M10		M10-A4		M12		M12-A4	
			$h_{ef,min}$	$h_{ef,max}$	$h_{ef,min}$	$h_{ef,max}$	$h_{ef,min}$	$h_{ef,max}$	$h_{ef,min}$	$h_{ef,max}$	$h_{ef,min}$	$h_{ef,max}$	$h_{ef,min}$	$h_{ef,max}$
Steel failure														
Characteristic resistance $\mathbf{N_{Rk,s,fi}}$	R30	[kN]	0,79		3,23		1,66		4,58		3,21		6,41	
	R60	[kN]	0,60		1,76		1,28		2,97		2,48		4,91	
	R90	[kN]	0,41		1,01		0,78		1,79		1,36		3,07	
	R120	[kN]	0,32		0,70		0,51		1,25		0,79		2,15	
Pull-out failure														
Characteristic resistance $\mathbf{N_{Rk,p,fi}}$	R30	[kN]	1,78	1,88	1,50	2,38	4,00	4,00	3,35	3,75	5,05	5,05	5,05	5,05
	R60	[kN]	1,78	1,88	1,50	2,38	4,00	4,00	3,35	3,75	5,05	5,05	5,05	5,05
	R90	[kN]	1,78	1,88	1,50	2,38	4,00	4,00	3,35	3,75	5,05	5,05	5,05	5,05
	R120	[kN]	1,42	1,50	1,20	1,90	3,20	3,20	2,68	3,00	4,04	4,04	4,04	4,04
Concrete cone and splitting failure[1)]														
The characteristic resistance $\mathbf{N^0_{Rk,c,fi}}$ of a single fastener not influenced by neighbouring fasteners or concrete edges installed in concrete C20/25 to C50/60 under fire exposure may be determined by: $N^0_{Rkc,fi} = \frac{h_{ef}}{200} x N^0_{Rk,c} (\leq R90)$ $N^0_{Rkc,fi} = 0{,}8 \frac{h_{ef}}{200} x N^0_{Rk,c} (R120)$ where $N^0_{Rk,c}$ is a characteristic resistance of a single fastener in cracked concrete C20/25 under normal temperature.														
$\mathbf{s_{cr,N,fi}}$	Spacing	[mm]	4 x h_{ef}											
$\mathbf{s_{min}}$		[mm]	40	35	40	35	40	40	40	40	50	50	50	50
$\mathbf{c_{cr,N,fi}}$	Edge distance	[mm]	2 x h_{ef}											
$\mathbf{c_{min}}$		[mm]	Fire attack from one side: c_{min} = 2 x h_{ef}											
			Fire attack from more than one side: $c_{min} \geq$ 300 mm i $\geq$ 2 x h_{ef}											

[1)] As a rule, splitting failure can be neglected when cracked concrete and reinforcement in assumed

Design under fire exposure is performed according to the design method given in EN 1992-4:2018, Annex D.

Under fire exposure usually cracked concrete is assumed. The design equations are given in EN 1992-4:2018, Annex D.

In the absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi}$=1,0 is recommended.

Table C10: Characteristic resistance under tension loads in case of fire exposure for design acc. to EN 1992-4:2018, Annex D for R-HPTIII and R-HPTIII-A4 sizes M16-M20

Essential characteristics			**Anchor size**					
			M16		**M16-A4**		**M20**	
			$h_{ef,min}$	$h_{ef,max}$	$h_{ef,min}$	$h_{ef,max}$	$h_{ef,min}$	$h_{ef,max}$
Steel failure								
Characteristic resistance $\mathbf{N_{Rk,s,fi}}$	R30	[kN]	4,38		9,89		7,74	
	R60	[kN]	3,39		7,56		5,99	
	R90	[kN]	1,85		4,74		2,77	
	R120	[kN]	1,09		3,32		1,92	
Pull-out failure								
Characteristic resistance $\mathbf{N_{Rk,p,fi}}$	R30	[kN]	9,00	9,00	7,30	7,30	10,55	10,55
	R60	[kN]	9,00	9,00	7,30	7,30	10,55	10,55
	R90	[kN]	9,00	9,00	7,30	7,30	10,55	10,55
	R120	[kN]	7,20	7,20	5,84	5,84	8,44	8,44
Concrete cone and splitting failure[1)]								
The characteristic resistance $\mathbf{N^0_{Rk,c,fi}}$ of a single fastener not influenced by neighbouring fasteners or concrete edges installed in concrete C20/25 to C50/60 under fire exposure may be determined by: $N^0_{Rkc,fi} = \frac{h_{ef}}{200} x N^0_{Rk,c} (\leq R90)$ $N^0_{Rkc,fi} = 0{,}8 \frac{h_{ef}}{200} x N^0_{Rk,c} (R120)$ where $N^0_{Rk,c}$ is a characteristic resistance of a single fastener in cracked concrete C20/25 under normal temperature.								
$\mathbf{s_{cr,N,fi}}$	Spacing	[mm]	4 x h_{ef}					
$\mathbf{s_{min}}$		[mm]	65	50	65	50	80	80
$\mathbf{c_{cr,N,fi}}$	Edge distance	[mm]	2 x h_{ef}					
$\mathbf{c_{min}}$		[mm]	Fire attack from one side: c_{min} = 2 x h_{ef}					
			Fire attack from more than one side: $c_{min} \geq$ 300 mm i $\geq$ 2 x h_{ef}					

1) As a rule, splitting failure can be neglected when cracked concrete and reinforcement in assumed

Design under fire exposure is performed according to the design method given in EN 1992-4:2018, Annex D.

Under fire exposure usually cracked concrete is assumed. The design equations are given in EN 1992-4:2018, Annex D.

In the absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi}$=1,0 is recommended.

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Table C11: Characteristic resistance under shear loads in case of fire exposure for design acc. to EN 1992-4:2018, Annex D for R-HPTIII and R-HPTIII-A4 sizes M8-M12

Essential characteristics			Anchor size											
			M8		M8-A4		M10		M10-A4		M12		M12-A4	
			$h_{ef,min}$	$h_{ef,max}$	$h_{ef,min}$	$h_{ef,max}$	$h_{ef,min}$	$h_{ef,max}$	$h_{ef,min}$	$h_{ef,max}$	$h_{ef,min}$	$h_{ef,max}$	$h_{ef,min}$	$h_{ef,max}$
Steel failure without lever arm														
Characteristic resistance $\mathbf{V_{Rk,s,fi}}$	R30	[kN]	1,25		5,07		2,70		7,43		5,00		10,00	
	R60	[kN]	0,95		2,78		2,08		4,81		3,87		9,17	
	R90	[kN]	0,65		1,59		1,26		2,90		2,12		5,74	
	R120	[kN]	0,50		1,10		0,82		2,02		1,21		4,06	
Steel failure with lever arm														
Characteristic resistance $\mathbf{M^0_{Rk,s,fi}}$	R30	[kN]	1,28		5,19		3,48		9,58		7,77		15,54	
	R60	[kN]	0,97		2,83		2,68		6,20		6,01		11,88	
	R90	[kN]	0,66		1,63		1,63		3,74		3,29		7,44	
	R120	[kN]	0,51		1,13		1,06		2,60		1,88		5,22	
Concrete pryout failure														
k-factor	k_8	[-]	2,9				3,6				3,6			
The characteristic resistance $\mathbf{V_{Rk,cp,fi}}$ in case of fasteners installed in concrete class C20/25 to C50/60 may be determined by: $V_{Rk,cp,fi} = k_8 \cdot N_{Rk,c,fi} (\leq R90)$ $V_{Rk,cp,fi} = k_8 \cdot N_{Rk,c,fi} (R120)$ where $N_{Rk,c,fi}$ is characteristic resistance of a single fastener not influenced by neighbouring fasteners or concrete edges installed in concrete C20/25 to C50/60 under fire exposure														
Concrete edge failure														
The initial value $V^0_{Rk,c,fi}$ of the characteristic resistance in concrete C20/25 to C50/60 under fire exposure may be determined by: $V^0_{Rk,c,fi} = 0{,}25 \text{ x } V^0_{Rk,c} (\leq R90)$ $V^0_{Rk,c,fi} = 0{,}20 \text{ x } V^0_{Rk,c} (R120)$ where $V^0_{Rk,c}$ initial value of the characteristic resistance in cracked concrete C20/25 under normal temperature														

Design under fire exposure is performed according to the design method given in EN 1992-4:2018, Annex D.
Under fire exposure usually cracked concrete is assumed. The design equations are given in EN 1992-4:2018, Annex D. Covers design for fire exposure from one side. For fire attack from more than one side the edge distance must be increased to $c_{min} \geq 300$ mm and $\geq 2 \text{ x } h_{ef}$.

In the absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi} = 1{,}0$ is recommended.

Table C12: Characteristic resistance under shear loads in case of fire exposure for design acc. to EN 1992-4:2018, Annex D for R-HPTIII and R-HPTIII-A4 sizes M16-M20

Essential characteristics			Anchor size					
			M16		M16-A4		M20	
			$h_{ef,min}$	$h_{ef,max}$	$h_{ef,min}$	$h_{ef,max}$	$h_{ef,min}$	$h_{ef,max}$
Steel failure without lever arm								
Characteristic resistance $\mathbf{V_{Rk,s,fi}}$	R30	[kN]	7,31		16,50		11,40	
	R60	[kN]	5,65		12,61		8,82	
	R90	[kN]	3,09		7,90		4,82	
	R120	[kN]	1,81		5,54		2,82	
Steel failure with lever arm								
Characteristic resistance $\mathbf{M^0_{Rk,s,fi}}$	R30	[kN]	15,50		34,99		30,21	
	R60	[kN]	11,99		26,75		23,37	
	R90	[kN]	6,56		16,75		12,78	
	R120	[kN]	3,84		11,75		7,48	
Concrete pryout failure								
k-factor	k_8	[-]	3,5				3,7	

The characteristic resistance $\mathbf{V_{Rk,cp,fi}}$ in case of fasteners installed in concrete class C20/25 to C50/60 may be determined by:

$$V_{Rk,cp,fi} = k_8 \cdot N_{Rk,c,fi} (\leq R90) \qquad V_{Rk,cp,fi} = k_8 \cdot N_{Rk,c,fi} (R120)$$

where $N_{Rk,c,fi}$ is characteristic resistance of a single fastener not influenced by neighbouring fasteners or concrete edges installed in concrete C20/25 to C50/60 under fire exposure

Concrete edge failure

The initial value $V^0_{Rk,c,fi}$ of the characteristic resistance in concrete C20/25 to C50/60 under fire exposure may be determined by:

$$V^0_{Rk,c,fi} = 0{,}25 \text{ x } V^0_{Rk,c} (\leq R90) \qquad V^0_{Rk,c,fi} = 0{,}20 \text{ x } V^0_{Rk,c} (R120)$$

where $V^0_{Rk,c}$ initial value of the characteristic resistance in cracked concrete C20/25 under normal temperature

Design under fire exposure is performed according to the design method given in EN 1992-4:2018, Annex D.
Under fire exposure usually cracked concrete is assumed. The design equations are given in EN 1992-4:2018, Annex D. Covers design for fire exposure from one side. For fire attack from more than one side the edge distance must be increased to $c_{min} \geq 300$ mm and $\geq 2 \times h_{ef}$.

In the absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi} = 1{,}0$ is recommended.

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Table C13: Characteristic resistance in case of seismic action for design acc. to EN 1992-4:2018: Performance Category C1 and C2 for R-HPTIII and R-HPTIII-A4 sizes M8-M12

			Anchor size					
			M8	**M8-A4**	**M10**	**M10-A4**	**M12**	**M12-A4**
Tension – steel failure								
Characteristic resistance **C1**	$N_{Rk,s,seis,C1}$	[kN]	19,8	19,4	31,1	30,4	48,7	46,0
Characteristic resistance **C2**	$N_{Rk,s,seis,C2}$	[kN]	-	-	31,1	30,4	48,7	46,0
Partial safety factor	$\gamma_{Ms,seis}$ 1)	[-]	1,40	1,42	1,40	1,40	1,50	1,42
Tension – pull-out failure								
Characteristic resistance **C1**	$N_{Rk,p,seis,C1}$	[kN]	7,05	9,03	14,88	13,80	20,20	16,56
Characteristic resistance **C2**	$N_{Rk,p,seis,C2}$	[kN]	-	-	10,73	8,05	9,71	10,37
Installation safety factor	γ_{inst}	[-]	1,0					
Concrete cone and splitting failure[2)]								
Effective anchorage depth	h_{ef}	[mm]	48		60		70	
Installation safety factor	γ_{inst}	[-]	1,0					
Shear – steel failure without lever arm								
Characteristic resistance **C1**	$V_{Rk,s,seis,C1}$	[kN]	9,43	8,08	17,32	15,50	26,08	24,48
Characteristic resistance **C2**	$V_{Rk,s,seis,C2}$	[kN]	-	-	17,32	15,50	26,08	24,48
Partial safety factor	$\gamma_{Ms,seis}$ 1)	[-]	1,5					
Concrete pryout and concrete edge failure[3)]								
Effective anchorage depth	h_{ef}	[mm]	48		60		70	
Installation safety factor	γ_{inst}	[-]	1,0					

1) As a rule, splitting failure can be neglected when cracked concrete and reinforcement in assumed

2) For concrete cone, splitting, pryout and edge failure, see EN 1992-4:2018

Table C14: Characteristic resistance in case of seismic action for design acc. to EN 1992-4:2018: Performance Category C1 and C2 for R-HPTIII and R-HPTIII-A4 sizes M16-M20

			Anchor size		
			M16	M16-A4	M20
Tension – steel failure					
Characteristic resistance **C1**	$N_{Rk,s,seis,C1}$	[kN]	69,67	87,08	121,36
Characteristic resistance **C2**	$N_{Rk,s,seis,C2}$	[kN]	69,67	87,08	121,36
Partial safety factor	$\gamma_{Ms,seis}$ [1)]	[-]	1,41	1,46	1,41
Tension – pull-out failure					
Characteristic resistance **C1**	$N_{Rk,p,seis,C1}$	[kN]	24,84	23,22	26,49
Characteristic resistance **C2**	$N_{Rk,p,seis,C2}$	[kN]	22,81	12,77	13,12
Installation safety factor	γ_{inst}	[-]	1,0		
Concrete cone and splitting failure[2)]					
Effective anchorage depth	h_{ef}	[mm]	85		100
Installation safety factor	γ_{inst}	[-]	1,0		
Shear – steel failure without lever arm					
Characteristic resistance **C1**	$V_{Rk,s,seis,C1}$	[kN]	39,24	45,00	54,63
Characteristic resistance **C2**	$V_{Rk,s,seis,C2}$	[kN]	39,24	45,00	54,63
Partial safety factor	$\gamma_{Ms,seis}$ [1)]	[-]	1,5		
Concrete pryout and concrete edge failure[3)]					
Effective anchorage depth	h_{ef}	[mm]	85		100
Installation safety factor	γ_{inst}	[-]	1,0		

1) As a rule, splitting failure can be neglected when cracked concrete and reinforcement in assumed

2) For concrete cone, splitting, pryout and edge failure, see EN 1992-4:2018

Table C15: Displacements in case of seismic action for design acc. to EN 1992-4:2018: Performance Category C2 for R-HPTIII and R-HPTIII-A4 sizes M10-M20

			Anchor size						
			M10	**M10-A4**	**M12**	**M12-A4**	**M16**	**M16-A4**	**M20**
Displacement under tension loads									
Displacement **DLS**	$d_{N,C2(DLS)}$	[mm]	4,05	4,79	6,16	5,83	6,31	6,90	6,89
Displacement **ULS**	$d_{N,C2(ULS)}$	[mm]	13,12	14,62	20,56	19,39	21,16	16,71	25,04
Displacement under shear loads									
Displacement **DLS**	$\delta_{V,C2(DLS)}$	[mm]	5,76	5,42	4,77	4,70	4,65	6,14	6,79
Displacement **ULS**	$\delta_{V,C2(ULS)}$	[mm]	10,28	11,88	10,77	8,81	8,07	11,91	11,98

The performance of the product identified above is in conformity with the set of declared performance characteristic. This declaration of performance is issued in accordance with Regulation (EU) No 305/2011 under the sole responsibility of the manufacturer identified above.

Signed for and on behalf of the manufacturer by:

Radosław Koelner
President of the Management Board
Wrocław, 2026-01-29

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