



YTELSESERKLÆRING

Nr: DoP-170566 [NO]

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Varetypens unike identifikasjonskode:

Ekspansjonsanker (Wedge Anchor) EST1

Produsent:

ESSVE Produkter AB

BOX 7091

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Europeisk teknisk bedømmelse (ETA)	Dimensjon & Materiale	Artikkelnummer
ETA-17/0566 (2017-08-10)	M8 to M27 Zinc plated	123301, 123303, 123305, 123307, 123309, 123311, 123313, 123315, 123317, 123319, 123321, 123323, 123325, 123327, 123329, 123331, 123333, 123335, 123337, 123339, 123341, 123343, 123345, 123347, 123349, 123351, 123353, 123355, 123357, 123359, 123361, 123363, 123365, 123367, 123369, 123371, 123373, 123375, 123377, 123379, 123381, 123383, 123385
ETA-17/0566 (2017-08-10)	M8 to M24 A4 / HCR	123387, 123389, 123391, 123393, 123395, 123397, 123399, 123401, 123403, 123405, 123407, 123409, 123411, 123413, 123415, 123417, 123419, 123421, 123423, 123425, 123427, 123429, 123431, 123433, 123435, 123437, 123439, 123441, 123443, 123445, 123447, 123449, 123451, 123453, 123455, 123457, 123459, 123461, 123463, 123465, 123467, 123469, 123471

Europeisk teknisk bedømmelse (ETA)	Tilsiktet bruksområde	Betongkvalitet
ETA-17/0566 (2017-08-10)	Anchor(s) for use in structural applications under static or quasi-static actions in cracked and non-cracked concrete.	Reinforced or unreinforced normal weight concrete according to EN 206-1:2000. Strength classes C20/25 to C50/60 according to EN 206-1:2000

Europeisk teknisk bedømmelse (ETA)	System for vurdering og verifikasjon av byggevarers ytelser (AVCP)	Europeisk bedømmelsesdokument	Teknisk bedømmelsesorgan (TAB)	Teknisk(e) kontrollorgan (NB)
ETA-17/0566 (2017-08-10)	1	EAD 330232-00-0601, (2016-10)	DEUTSCHES INSTITUT FÜR BAUTECHNIK (DIBt)	1343 (FPC)



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Europeisk teknisk bedømmelse (ETA)	Dimensjon & Materiale	Egenskap	Ytelse
ETA-17/0566 (2017-08-10)	M8 to M27 Zinc plated	Characteristic resistance for static and quasi-static loading	Table C1, C3 & C5
		Displacements under tension and shear loads	Table C9 & C10
ETA-17/0566 (2017-08-10)	M8 to M24 A4 / HCR	Characteristic resistance for static and quasi-static loading	Table C2, C4 & C5
		Displacements under tension and shear loads	Table C9 & C10
ETA-17/0566 (2017-08-10)	M8 to M20 Zinc plated / A4 / HCR	Characteristic resistance for seismic performance category C1 and C2	Table C6
ETA-17/0566 (2017-08-10)	M8 to M27 Zinc plated	Reaction to fire	Class A1
	M8 to M24 A4 / HCR	Resistance to fire	Table C7 & C8
ETA-17/0566 (2017-08-10)	EST1-IG M6 to M12 Zinc plated / A4 / HCR	Characteristic resistance for static and quasi-static loading	Table C11, C12 & C13
		Reaction to fire	Class A1
		Resistance to fire	Table C14
		Displacements under tension and shear loads	Table C15 & C16

Ytelser for denne byggevaren som er anført ovenfor, er i overensstemmelse med de angitte ytelsene. Denne ytelseserklæringen er utarbeidet i overensstemmelse med forordning (EU) nr. 305/2011 under produsentens eneansvar, som anført ovenfor.

Underskrevet for produsenten og på dennes vegne:

Viktor Bukowski
Product Developer/Technical expert – Fasteners

Kista 2017-08-21



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Table C1 - Characteristic values for tension loads ESSVE EST1 zinc plated, cracked concrete, static and quasi-static action

Anchor size			M8	M10	M12	M16	M20	M24	M27	
Installation safety factor		$\gamma_2 = \gamma_{inst}$	$[-]$	1,0						
Steel failure										
Characteristic tension resistance		$N_{Rk,s}$	[kN]	16	27	40	60	86	126	196
Partial safety factor		γ_{Ms}	$[-]$	1,53		1,5		1,6	1,5	
Pull-out										
Standard anchorage depth										
Characteristic resistance in concrete C20/25		$N_{Rk,p}$	[kN]	5	9	16	25	1)	1)	1)
Reduced anchorage depth										
Characteristic resistance in concrete C20/25		$N_{Rk,p}$	[kN]	5	7,5	1)	1)	-	-	-
Increasing factor for $N_{Rk,p}$		ψ_c	$[-]$	$\left(\frac{f_{ck}}{20}\right)^{0,5}$						
Concrete cone failure										
Effective anchorage depth		h_{ef}	[mm]	46	60	70	85	100	115	125
Reduced anchorage depth		$h_{ef,red}$	[mm]	35 2)	40	50	65	-	-	-
Factor k_1 for cracked concrete		$k_{cr,N}$	$[-]$	7,7						

¹⁾ Pull-out is not decisive.

²⁾ Use restricted to anchoring of structural components statically indeterminate



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Table C2 - Characteristic values for tension loads, ESSVE EST1 A4 / HCR, cracked concrete, static and quasi-static action

Anchor size			M8	M10	M12	M16	M20	M24	
Installation safety factor		γ_{inst}	$[-]$	1,0					
Steel failure									
Characteristic tension resistance		$N_{Rk,s}$	[kN]	16	27	40	64	108	110
Partial safety factor		γ_{Ms}	$[-]$	1,5			1,68	1,5	
Pull-out									
Standard anchorage depth									
Characteristic resistance in concrete C20/25		$N_{Rk,p}$	[kN]	5	9	16	25	1)	40
Reduced anchorage depth									
Characteristic resistance in concrete C20/25		$N_{Rk,p}$	[kN]	5	7,5	1)	1)	-	-
Increasing factor for $N_{Rk,p}$		ψ_c	$[-]$	$\left(\frac{f_{ck}}{20}\right)^{0,5}$					
Concrete cone failure									
Effective anchorage depth		h_{ef}	[mm]	46	60	70	85	100	125
Reduced anchorage depth		$h_{ef,red}$	[mm]	35 2)	40	50	65	-	-
Factor k_1 for cracked concrete		$k_{cr,N}$	$[-]$	7,7					

¹⁾ Pull-out is not decisive.

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Table C3 - Characteristic values for tension loads, ESSVE EST1 zinc plated, non-cracked concrete, static and quasi-static action

Anchor size			M8	M10	M12	M16	M20	M24	M27
Installation safety factor	γ_{inst}	[-]	1,0						
Steel failure									
Characteristic tension resistance	$N_{Rk,s}$	[kN]	16	27	40	60	86	126	196
Partial safety factor	γ_{Ms}	[-]	1,53		1,5		1,6	1,5	
Pull-out									
Standard anchorage depth									
Characteristic resistance in non-cracked concrete C20/25	$N_{Rk,p}$	[kN]	12	16	25	35	1)	1)	1)
Reduced anchorage depth									
Characteristic resistance in non-cracked concrete C20/25	$N_{Rk,p}$	[kN]	7,5	9	1)	1)	-	-	-
Splitting									
Standard anchorage depth									
Splitting for standard thickness of concrete member (The higher resistance of case 1 and case 2 may be applied; the values $s_{cr,sp}$ and $c_{cr,sp}$ may be linearly interpolated for the member thickness $h_{min,2} < h < h_{min,1}$ (Case 2); $\psi_{h,sp}= 1,0$)									
Standard thickness of concrete	$h_{min,1} \geq$	[mm]	100	120	140	170	200	230	250
Case 1									
Characteristic resistance in non-cracked concrete C20/25	$N^0_{Rk,sp}$	[kN]	9	12	20	30	40	62,3	50
Spacing (edge distance)	$c_{cr,sp}$	[mm]	1,5 h_{ef}						
Case 2									
Characteristic resistance in non-cracked concrete C20/25	$N^0_{Rk,sp}$	[kN]	12	16	25	35	50,5	62,3	70,6
Spacing (edge distance)	$c_{cr,sp}$	[mm]	2 h_{ef}				2,2 h_{ef}	1,5 h_{ef}	2,5 h_{ef}
Splitting for minimum thickness of concrete member									
Minimum thickness of concrete	$h_{min,2} \geq$	[mm]	80	100	120	140	-	-	-
Characteristic resistance in non-cracked concrete C20/25	$N^0_{Rk,sp}$	[kN]	12	16	25	35			
Spacing (edge distance)	$c_{cr,sp}$	[mm]	2,5 h_{ef}						
Reduced anchorage depth									
Minimum thickness of concrete	$h_{min,3} \geq$	[mm]	80	80	100	140	-	-	-
Characteristic resistance in non-cracked concrete C20/25	$N^0_{Rk,sp}$	[kN]	7,5	9	17,9	26,5			
Spacing (edge distance)	$c_{cr,sp}$	[mm]	100	100	125	150			
Increasing factor for $N_{Rk,p}$ and $N^0_{Rk,sp}$	ψ_c	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,5}$						
Concrete cone failure									
Effective anchorage depth	h_{ef}	[mm]	46	60	70	85	100	115	125
Reduced anchorage depth	$h_{ef,red}$	[mm]	35 ²⁾	40	50	65	-	-	-
Factor k_1 for non-cracked concrete	$k_{ucr,N}$	[-]	11,0						

¹⁾ Pull-out is not decisive.

²⁾ Use restricted to anchoring of structural components statically indeterminate



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Table C4 - Characteristic values for tension loads, ESSVE EST1 A4 / HCR, non-cracked concrete, static and quasi-static action

Anchor size			M8	M10	M12	M16	M20	M24	
Installation safety factor		γ_{inst}	[-]		1,0				
Steel failure									
Characteristic tension resistance		$N_{Rk,s}$	[kN]	16	27	40	64	108	110
Partial safety factor		γ_{Ms}	[-]		1,5			1,68	1,5
Pull-out									
Standard anchorage depth									
Characteristic resistance in non-cracked concrete C20/25		$N_{Rk,p}$	[kN]	12	16	25	35	1)	1)
Reduced anchorage depth									
Characteristic resistance in non-cracked concrete C20/25		$N_{Rk,p}$	[kN]	7,5	9	1)	1)	-	-
Splitting									
Standard anchorage depth									
Splitting for standard thickness of concrete member (The higher resistance of case 1 and case 2 may be applied; the values $s_{cr,sp}$ and $c_{cr,sp}$ may be linearly interpolated for the member thickness $h_{min,2} < h < h_{min,1}$ (Case 2); $\psi_{h,sp} = 1,0$)									
Standard thickness of concrete		$h_{min,1} \geq$	[mm]	100	120	140	160	200	250
Case 1									
Characteristic resistance in non-cracked concrete C20/25		$N^0_{Rk,sp}$	[kN]	9	12	20	30	40	-
Spacing (edge distance)		$c_{cr,sp}$	[mm]	1,5 h_{ef}					
Case 2									
Characteristic resistance in non-cracked concrete C20/25		$N^0_{Rk,sp}$	[kN]	12	16	25	35	50,5	70,6
Spacing (edge distance)		$c_{cr,sp}$	[mm]	115	125	140	200	220	250
Splitting for minimum thickness of concrete member									
Minimum thickness of concrete		$h_{min,2} \geq$	[mm]	80	100	120	140	-	-
Characteristic resistance in non-cracked concrete C20/25		$N^0_{Rk,sp}$	[kN]	12	16	25	35		
Spacing (edge distance)		$s_{cr,sp} (= 2 c_{cr,sp})$	[mm]	5 h_{ef}					
Reduced anchorage depth									
Minimum thickness of concrete		$h_{min,3} \geq$	[mm]	80	80	100	140	-	-
Characteristic resistance in non-cracked concrete C20/25		$N^0_{Rk,sp}$	[kN]	7,5	9	17,9	26,5		
Spacing (edge distance)		$c_{cr,sp}$	[mm]	100	100	125	150		
Increasing factor for $N_{Rk,p}$ and $N^0_{Rk,sp}$		ψ_c	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,5}$					
Concrete cone failure									
Effective anchorage depth		h_{ef}	[mm]	46	60	70	85	100	125
Reduced anchorage depth		$h_{ef,red}$	[mm]	35 ²⁾	40	50	65	-	-
Factor k_1 for non-cracked concrete		$k_{ucr,N}$	[-]	11,0					

¹⁾ Pull-out is not decisive.

²⁾ Use restricted to anchoring of structural components statically indeterminate



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Table C5 - Characteristic values for shear loads, ESSVE EST1, cracked and non-cracked concrete, static or quasi static action

Anchor size			M8	M10	M12	M16	M20	M24	M27	
Installation safety factor		γ_{inst}	[-]	1,0						
Steel failure without lever arm, Steel zinc plated										
Characteristic shear resistance		$V_{Rk,s}$	[kN]	12,2	20,1	30	55	69	114	169,4
Factor for ductility		k_7	[-]	1,0						
Partial safety factor		γ_{Ms}	[-]	1,25			1,33	1,25	1,25	
Steel failure without lever arm, Stainless steel A4, HCR										
Characteristic shear resistance		$V_{Rk,s}$	[kN]	13	20	30	55	86	123,6	-
Factor for ductility		k_7	[-]	1,0						
Partial safety factor		γ_{Ms}	[-]	1,25			1,4	1,25		
Steel failure with lever arm, Steel zinc plated										
Characteristic bending resistance		$M^0_{Rk,s}$	[Nm]	23	47	82	216	363	898	1331,5
Partial safety factor		γ_{Ms}	[-]	1,25			1,33	1,25	1,25	
Steel failure with lever arm, Stainless steel A4, HCR										
Characteristic bending resistance		$M^0_{Rk,s}$	[Nm]	26	52	92	200	454	785,4	-
Partial safety factor		γ_{Ms}	[-]	1,25			1,4	1,25		
Concrete pry-out failure										
Factor		k_8	[-]	2,4			2,8			
Concrete edge failure										
Effective length of anchor in shear loading with h_{ef}	Steel zinc plated	l_f	[mm]	46	60	70	85	100	115	125
	Stainless steel A4, HCR	l_f	[mm]	46	60	70	85	100	125	-
Effective length of anchor in shear loading with $h_{ef,red}$	Steel zinc plated	$l_{f,red}$	[mm]	35 ¹⁾	40	50	65	-	-	-
	Stainless steel A4, HCR	$l_{f,red}$	[mm]	35 ¹⁾	40	50	65			
Outside diameter of anchor		d_{nom}	[mm]	8	10	12	16	20	24	27

¹⁾ Use restricted to anchoring of structural components statically indeterminate.



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Table C6 - Characteristic resistance for seismic loading, ESSVE EST1 standard anchorage depth, performance category C1 and C2

Anchor size			M8	M10	M12	M16	M20	
Tension loads								
Installation safety factor		γ_{inst}	[-]	1,0				
Steel failure, Steel zinc plated								
Characteristic resistance C1		$N_{Rk,s,eq,C1}$	[kN]	16	27	40	60	86
Characteristic resistance C2		$N_{Rk,s,eq,C2}$	[kN]	16	27	40	60	86
Partial safety factor		γ_{Ms}	[-]	1,53		1,5		1,6
Steel failure, Stainless steel A4, HCR								
Characteristic resistance C1		$N_{Rk,s,eq,C1}$	[kN]	16	27	40	64	108
Characteristic resistance C2		$N_{Rk,s,eq,C2}$	[kN]	16	27	40	64	108
Partial safety factor		γ_{Ms}	[-]	1,5				1,68
Pull-out (steel zinc plated, stainless steel A4 and HCR)								
Characteristic resistance C1		$N_{Rk,p,eq,C1}$	[kN]	5	9	16	25	36
Characteristic resistance C2		$N_{Rk,p,eq,C2}$	[kN]	2,3	3,6	10,2	13,8	24,4
Shear loads								
Steel failure without lever arm, Steel zinc plated								
Characteristic resistance C1		$V_{Rk,s,eq,C1}$	[kN]	9,3	20	27	44	69
Characteristic resistance C2		$V_{Rk,s,eq,C2}$	[kN]	6,7	14	16,2	35,7	55,2
Partial safety factor		γ_{Ms}	[-]	1,25				1,33
Steel failure without lever arm, Stainless steel A4, HCR								
Characteristic resistance C1		$V_{Rk,s,eq,C1}$	[kN]	9,3	20	27	44	69
Characteristic resistance C2		$V_{Rk,s,eq,C2}$	[kN]	6,7	14	16,2	35,7	55,2
Partial safety factor		γ_{Ms}	[-]	1,25				1,4



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Table C7 - Characteristic values for tension and shear load under fire exposure, ESSVE EST1, standard anchorage depth, cracked and non-cracked concrete C20/25 to C50/60

Anchor size			M8	M10	M12	M16	M20	M24	M27	
Tension load										
Steel failure										
Steel, galvanised										
Characteristic resistance	R30	N _{Rk,s,fi}	[kN]	1,5	2,6	4,1	7,7	9,4	13,6	17,6
	R60			1,1	1,9	3,0	5,6	8,2	11,8	15,3
	R90			0,8	1,4	2,4	4,4	6,9	10,0	13,0
	R120			0,7	1,2	2,2	4,0	6,3	9,1	11,8
Stainless steel A4, HCR										
Characteristic resistance	R30	N _{Rk,s,fi}	[kN]	3,8	6,9	12,7	23,7	33,5	48,2	-
	R60			2,9	5,3	9,4	17,6	25,0	35,9	
	R90			2,0	3,6	6,1	11,5	16,4	23,6	
	R120			1,6	2,8	4,5	8,4	12,1	17,4	
Shear load										
Steel failure without lever arm										
Steel, galvanised										
Characteristic resistance	R30	V _{Rk,s,fi}	[kN]	1,6	2,6	4,1	7,7	11	16	20,6
	R60			1,5	2,5	3,6	6,8	11	15	19,8
	R90			1,2	2,1	3,5	6,5	10	15	19,0
	R120			1,0	2,0	3,4	6,4	10	14	18,6
Stainless steel A4, HCR										
Characteristic resistance	R30	V _{Rk,s,fi}	[kN]	3,8	6,9	12,7	23,7	33,5	48,2	-
	R60			2,9	5,3	9,4	17,6	25,0	35,9	
	R90			2,0	3,6	6,1	11,5	16,4	23,6	
	R120			1,6	2,8	4,5	8,4	12,1	17,4	
Steel failure with lever arm										
Steel, galvanised										
Characteristic resistance	R30	M ⁰ _{Rk,s,fi}	[Nm]	1,7	3,3	6,4	16,3	29	50	75
	R60			1,6	3,2	5,6	14	28	48	72
	R90			1,2	2,7	5,4	14	27	47	69
	R120			1,1	2,5	5,3	13	26	46	68
Stainless steel A4, HCR										
Characteristic resistance	R30	M ⁰ _{Rk,s,fi}	[Nm]	3,8	9,0	19,7	50,1	88,8	153,5	-
	R60			2,9	6,8	14,6	37,2	66,1	114,3	
	R90			2,1	4,7	9,5	24,2	43,4	75,1	
	R120			1,6	3,6	7,0	17,8	32,1	55,5	

The characteristic resistance for pull-out failure, concrete cone failure, concrete pry-out and concrete edge failure can be calculated according to EN 1992-4, Annex D. If pull-out is not decisive in equation (D.4) and (D.5), $N_{Rk,p}$ must be replaced by $N^0_{Rk,c}$.



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Table C8 - Characteristic values for tension and shear load under fire exposure, ESSVE EST1, reduced anchorage depth, cracked and non-cracked concrete C20/25 to C50/60

Anchor size				M8	M10	M12	M16
Tension load							
Steel failure							
Steel, galvanised							
Characteristic resistance	R30	N _{Rk,s,fi}	[kN]	1,5	2,6	4,1	7,7
	R60			1,1	1,9	3,0	5,6
	R90			0,8	1,3	1,9	3,5
	R120			0,6	1,0	1,3	2,5
Stainless steel A4, HCR							
Characteristic resistance	R30	N _{Rk,s,fi}	[kN]	3,2	6,9	12,7	23,7
	R60			2,5	5,3	9,4	17,6
	R90			1,9	3,6	6,1	11,5
	R120			1,6	2,8	4,5	8,4
Shear load							
Steel failure without lever arm							
Steel, galvanised							
Characteristic resistance	R30	V _{Rk,s,fi}	[kN]	1,5	2,6	4,1	7,7
	R60			1,1	1,9	3,0	5,6
	R90			0,8	1,3	1,9	3,5
	R120			0,6	1,0	1,3	2,5
Stainless steel A4, HCR							
Characteristic resistance	R30	V _{Rk,s,fi}	[kN]	3,2	6,9	12,7	23,7
	R60			2,5	5,3	9,4	17,6
	R90			1,9	3,6	6,1	11,5
	R120			1,6	2,8	4,5	8,4
Steel failure with lever arm							
Steel, galvanised							
Characteristic resistance	R30	M ⁰ _{Rk,s,fi}	[Nm]	1,5	3,3	6,4	16,3
	R60			1,2	2,5	4,7	11,9
	R90			0,8	1,7	3,0	7,5
	R120			0,6	1,2	2,1	5,3
Stainless steel A4, HCR							
Characteristic resistance	R30	M ⁰ _{Rk,s,fi}	[Nm]	3,2	8,9	19,7	50,1
	R60			2,6	6,8	14,6	37,2
	R90			2,0	4,7	9,5	24,2
	R120			1,6	3,6	7,0	17,8

The characteristic resistance for pull-out failure, concrete cone failure, concrete pry-out and concrete edge failure can be calculated according to EN 1992-4, Annex D. If pull-out is not decisive in equation (D.4) and (D.5), $N_{Rk,p}$ must be replaced by $N^0_{Rk,c}$.



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Table C9 - Displacements under tension load, ESSVE EST1

Anchor size			M8	M10	M12	M16	M20	M24	M27
Standard anchorage depth									
Steel zinc plated									
Tension load in cracked concrete	N	[kN]	2,4	4,3	7,6	11,9	17,1	21,1	24
Displacement	δ_{N0}	[mm]	0,6	1,0	0,4	1,0	0,9	0,7	0,9
	$\delta_{N\infty}$	[mm]	1,4	1,2	1,4	1,3	1,0	1,2	1,4
Tension load in non-cracked concrete	N	[kN]	5,7	7,6	11,9	16,7	23,8	29,6	34
Displacement	δ_{N0}	[mm]	0,4	0,5	0,7	0,3	0,4	0,5	0,3
	$\delta_{N\infty}$	[mm]	0,8		1,4	0,8			1,4
Displacements under seismic tension loads C2									
Displacements for DLS	$\delta_{N,eq,(DLS)}$	[mm]	2,3	4,1	4,9	3,6	5,1	-	-
Displacements for ULS	$\delta_{N,eq(ULS)}$	[mm]	8,2	13,8	15,7	9,5	15,2		
Stainless steel A4, HCR									
Tension load in cracked concrete	N	[kN]	2,4	4,3	7,6	11,9	17,1	19,0	-
Displacement	δ_{N0}	[mm]	0,7	1,8	0,4	0,7	0,9	0,5	
	$\delta_{N\infty}$	[mm]	1,2	1,4	1,4	1,4	1,0	1,8	
Tension load in non-cracked concrete	N	[kN]	5,8	7,6	11,9	16,7	23,8	33,5	-
Displacement	δ_{N0}	[mm]	0,6	0,5	0,7	0,2	0,4	0,5	
	$\delta_{N\infty}$	[mm]	1,2	1,0	1,4	0,4	0,8	1,1	
Displacements under seismic tension loads C2									
Displacements for DLS	$\delta_{N,eq(DLS)}$	[mm]	2,3	4,1	4,9	3,6	5,1	-	-
Displacements for ULS	$\delta_{N,eq(ULS)}$	[mm]	8,2	13,8	15,7	9,5	15,2		
Reduced anchorage depth									
Steel zinc plated, stainless steel A4, HCR									
Tension load in cracked concrete	N	[kN]	2,4	3,6	6,1	9,0	-	-	-
Displacement	δ_{N0}	[mm]	0,8	0,7	0,5	1,0			
	$\delta_{N\infty}$	[mm]	1,2	1,0	0,8	1,1			
Tension load in non-cracked concrete	N	[kN]	3,7	4,3	8,5	12,6	-	-	-
Displacement	δ_{N0}	[mm]	0,1	0,2	0,2	0,2			
	$\delta_{N\infty}$	[mm]	0,7	0,7	0,7	0,7			



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Table C10 - Displacements under shear load, ESSVE EST1

Anchor size			M8	M10	M12	M16	M20	M24	M27
Standard anchorage depth									
Steel zinc plated									
Shear load in cracked and non-cracked concrete	V	[kN]	6,9	11,4	17,1	31,4	36,8	64,9	96,8
Displacement	δ_{V0}	[mm]	2,0	3,2	3,6	3,5	1,8	3,5	3,6
	$\delta_{V\infty}$	[mm]	3,0	4,7	5,5	5,3	2,7	5,3	5,4
Displacements under seismic shear loads C2									
Displacements for DLS	$\delta_{V,eq}(DLS)$	[mm]	3,0	2,7	3,5	4,3	4,7	-	-
Displacements for ULS	$\delta_{V,eq}(ULS)$	[mm]	5,9	5,3	9,5	9,6	10,1		
Stainless steel A4, HCR									
Shear load in cracked and non-cracked concrete	V	[kN]	7,3	11,4	17,1	31,4	43,8	70,6	-
Displacement	δ_{V0}	[mm]	1,9	2,4	4,0	4,3	2,9	2,8	
	$\delta_{V\infty}$	[mm]	2,9	3,6	5,9	6,4	4,3	4,2	
Displacements under seismic shear loads C2									
Displacements for DLS	$\delta_{V,eq}(DLS)$	[mm]	3,0	2,7	3,5	4,3	4,7	-	-
Displacements for ULS	$\delta_{V,eq}(ULS)$	[mm]	5,9	5,3	9,5	9,6	10,1		
Reduced anchorage depth									
Steel zinc plated									
Shear load in cracked and non-cracked concrete	V	[kN]	6,9	11,4	17,1	31,4	-	-	-
Displacement	δ_{V0}	[mm]	2,0	3,2	3,6	3,5			
	$\delta_{V\infty}$	[mm]	3,0	4,7	5,5	5,3			
Stainless steel A4, HCR									
Shear load in cracked and non-cracked concrete	V	[kN]	7,3	11,4	17,1	31,4	-	-	-
Displacement	δ_{V0}	[mm]	1,9	2,4	4,0	4,3			
	$\delta_{V\infty}$	[mm]	2,9	3,6	5,9	6,4			



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Table C11 - Characteristic values for tension loads, ESSVE EST1-IG, cracked concrete, static and quasi-static action

Anchor size			M6	M8	M10	M12
Installation safety factor	γ_{inst}	[-]	1,2			
Steel failure						
Characteristic tension resistance, steel zinc plated	$N_{Rk,s}$	[kN]	16,1	22,6	26,0	56,6
Partial safety factor	γ_{Ms}	[-]	1,5			
Characteristic tension resistance, stainless steel A4, HCR	$N_{Rk,s}$	[kN]	14,1	25,6	35,8	59,0
Partial safety factor	γ_{Ms}	[-]	1,87			
Pull-out failure						
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	5	9	12	20
Increasing factor for $N_{Rk,p}$	ψ_c	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,5}$			
Concrete cone failure						
Effective anchorage depth	h_{ef}	[mm]	45	58	65	80
Factor for k_1	$k_{cr,N}$	[-]	7,7			



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Table C12 - Characteristic values for tension loads, ESSVE EST1-IG, non-cracked concrete, static and quasi-static action

Anchor size			M6	M8	M10	M12
Installation safety factor	γ_{inst}	[-]	1,2			
Steel failure						
Characteristic tension resistance, steel zinc plated	$N_{Rk,s}$	[kN]	16,1	22,6	26,0	56,6
Partial safety factor	γ_{Ms}	[-]	1,5			
Characteristic tension resistance, stainless steel A4, HCR	$N_{Rk,s}$	[kN]	14,1	25,6	35,8	59,0
Partial safety factor	γ_{Ms}	[-]	1,87			
Pull-out						
Characteristic resistance in non-cracked concrete C20/25	$N_{Rk,p}$	[kN]	12	16	20	30
Splitting (The higher resistance of Case 1 and Case 2 may be applied)						
Minimum thickness of concrete member	h_{min}	[mm]	100	120	130	160
Case 1						
Characteristic resistance in non-cracked concrete C20/25	$N^0_{Rk,sp}$	[kN]	9	12	16	25
Spacing (edge distance)	$c_{cr,sp}$	[mm]	$1,5 h_{ef}$			
Case 2						
Characteristic resistance in non-cracked concrete C20/25	$N^0_{Rk,sp}$	[kN]	12	16	20	30
Spacing (edge distance)	$c_{cr,sp}$	[mm]	$2,5 h_{ef}$			
Increasing factor for $N_{Rk,p}$ and $N^0_{Rk,sp}$	ψ_c	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,5}$			
Concrete cone failure						
Effective anchorage depth	h_{ef}	[mm]	45	58	65	80
Factor k_1 for non-cracked concrete	$k_{ucr,N}$	[-]	11,0			



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Table C13 - Characteristic values for shear loads, ESSVE EST1-IG, cracked and non-cracked concrete, static and quasi-static action

Anchor size			M6	M8	M10	M12
Installation safety factor	γ_{inst}	[-]	1,0			
steel zinc plated						
Steel failure without lever arm, Installation type V						
Characteristic shear resistance	$V_{Rk,s}$	[kN]	5,8	6,9	10,4	25,8
Steel failure without lever arm, Installation type D						
Characteristic shear resistance	$V_{Rk,s}$	[kN]	5,1	7,6	10,8	24,3
Steel failure with lever arm, Installation type V						
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	12,2	30,0	59,8	104,6
Steel failure with lever arm, Installation type D						
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	36,0	53,2	76,0	207
Partial safety factor for $V_{Rk,s}$ and $M^0_{Rk,s}$	γ_{Ms}	[-]	1,25			
Factor of ductility	k_7	[-]	1,0			
stainless steel A4, HCR						
Steel failure without lever arm, Installation type V						
Characteristic shear resistance	$V_{Rk,s}$	[kN]	5,7	9,2	10,6	23,6
Partial safety factor	γ_{Ms}	[-]	1,25			
Steel failure without lever arm, Installation type D						
Characteristic shear resistance	$V_{Rk,s}$	[kN]	7,3	7,6	9,7	29,6
Partial safety factor	γ_{Ms}	[-]	1,25			
Steel failure with lever arm, Installation type V						
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	10,7	26,2	52,3	91,6
Partial safety factor	γ_{Ms}	[-]	1,56			
Steel failure with lever arm, Installation type D						
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	28,2	44,3	69,9	191,2
Partial safety factor	γ_{Ms}	[-]	1,25			
Factor of ductility	k_7	[-]	1,0			
Concrete pry-out failure						
Factor	k_8	[-]	1,5	1,5	2,0	2,0
Concrete edge failure						
Effective length of anchor in shear loading	l_f	[mm]	45	58	65	80
Effective diameter of anchor	d_{nom}	[mm]	8	10	12	16



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Table C14 - Characteristic values for tension and shear load under fire exposure, ESSVE EST1-IG, cracked and non-cracked concrete C20/25 to C50/60

Anchor size				M6	M8	M10	M12
Tension load							
Steel failure							
Steel zinc plated							
Characteristic resistance	R30	N _{Rk,s,fi}	[kN]	0,7	1,4	2,5	3,7
	R60			0,6	1,2	2,0	2,9
	R90			0,5	0,9	1,5	2,2
	R120			0,4	0,8	1,3	1,8
Stainless steel A4, HCR							
Characteristic resistance	R30	N _{Rk,s,fi}	[kN]	2,9	5,4	8,7	12,6
	R60			1,9	3,8	6,3	9,2
	R90			1,0	2,1	3,9	5,7
	R120			0,5	1,3	2,7	4,0
Shear load							
Steel failure without lever arm							
Steel zinc plated							
Characteristic resistance	R30	V _{Rk,s,fi}	[kN]	0,7	1,4	2,5	3,7
	R60			0,6	1,2	2,0	2,9
	R90			0,5	0,9	1,5	2,2
	R120			0,4	0,8	1,3	1,8
Stainless steel A4, HCR							
Characteristic resistance	R30	V _{Rk,s,fi}	[kN]	2,9	5,4	8,7	12,6
	R60			1,9	3,8	6,3	9,2
	R90			1,0	2,1	3,9	5,7
	R120			0,5	1,3	2,7	4,0
Steel failure with lever arm							
Steel zinc plated							
Characteristic resistance	R30	M ⁰ _{Rk,s,fi}	[Nm]	0,5	1,4	3,3	5,7
	R60			0,4	1,2	2,6	4,6
	R90			0,4	0,9	2,0	3,4
	R120			0,3	0,8	1,6	2,8
Stainless steel A4, HCR							
Characteristic resistance	R30	M ⁰ _{Rk,s,fi}	[Nm]	2,2	5,5	11,2	19,6
	R60			1,5	3,9	8,1	14,3
	R90			0,7	2,2	5,1	8,9
	R120			0,4	1,3	3,5	6,2



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Table C15 - Displacements under tension load, ESSVE EST1-IG

Anchor size			M6	M8	M10	M12
Tension load in cracked concrete	N	[kN]	2,0	3,6	4,8	8,0
Displacements	δ_{N0}	[mm]	0,6	0,6	0,8	1,0
	$\delta_{N\infty}$	[mm]	0,8	0,8	1,2	1,4
Tension load in non-cracked concrete	N	[kN]	4,8	6,4	8,0	12,0
Displacements	δ_{N0}	[mm]	0,4	0,5	0,7	0,8
	$\delta_{N\infty}$	[mm]	0,8	0,8	1,2	1,4

Table C16 - Displacements under shear load, ESSVE EST1-IG

Anchor size			M6	M8	M10	M12
Shear load in cracked and non-cracked concrete	V	[kN]	4,2	5,3	6,2	16,9
Displacements	δ_{V0}	[mm]	2,8	2,9	2,5	3,6
	$\delta_{V\infty}$	[mm]	4,2	4,4	3,8	5,3