m2r Throughbolt

Torque-controlled expansion anchor made of stainless steel for use in non-cracked concrete

ETA Option 7

1 SPECIFICATIONS OF INTENDED USE

Anchorages subject to:
-Static and quasi-static loading

Base materials:
-Concrete strength classes C20/25 to C50/60
according to EN 206:2013, Non-cracked concrete

Approvals:
-European Technical Approval option 7 for non-cracked concrete
-No performance assessed for product m2r-C

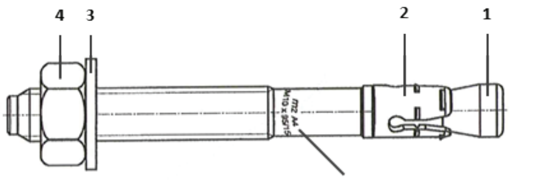
Reaction to fire:
-Anchorages satisfy requirements for Class A1

Resistance to fire:
-No performance assessed

Installation:
-Hole drilling by hammer drilling only
-Cleaning the holes
-The fastener may only be set once
-For further information see ETA-05/0199 Annex B 1 – B3

1.1 DESIGNATION OF ANCHOR PARTS AND MATERIALS

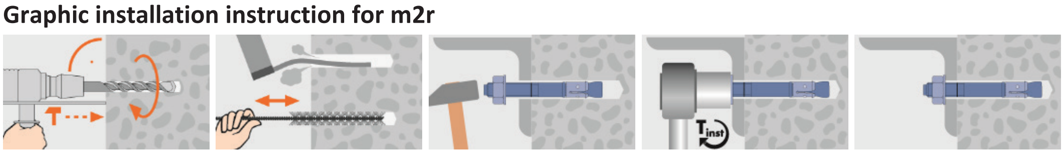
Part	Designation	Material	Steel, Tensile strength	Protection
1	Bolt	Stainless steel according to EN 1088	800 N/mm2	no coating (A4 1.4404)
2	Expansion sleeve	Stainless steel according to EN 1088	500 - 700 N/mm2	no coating (A4 1.4401)
3	Washer (m2r DIN 125A) Washer (m2r-C DIN 9021)	Stainless steel according to EN 1088	600 N/mm2	no coating (A4)
4	Hexagonal nut	Stainless steel A4 ISO3506, EN 10088	800 N/mm2	no coating (A4)



1.2 INSTALATION INSTRUCTIONS

1. Drilling the hole
2. Cleaning the hole
3. Fixing plug and building material
4. Tightening with the torque wrench and predetermined value of Tinst
5. Tightened fixation

Graphic installation instruction for m2r



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2 PRODUCT INFORMATION

m2r Throughbolt with washer DIN 125A, stainless steel A4/316

Article code	Dimensions [mm]	Length [mm] L	Length of screw in building material [mm] h_{nom}	Usable length [mm] t_{fix}	Effective anchorage depth [mm] h_{ef}
3300606	M6 x 65 / 10	65	46.9	10	40
3300808	M8 x 80 / 10	80	58.5	10	50
3300885	M8 x 85 / 15	85	58.5	15	50
3300809	M8 x 95 / 25	95	58.5	25	50
3300811	M8 x 115 / 45	115	58.5	45	50
3301009	M10 x 95 / 15	95	68.8	15	58
3301011	M10 x 110 / 30	110	68.8	30	58
3301012	M10 x 125 / 45	125	68.8	45	58
3301014	M10 x 140 / 60	140	68.8	60	58
3301016	M10 x 160 / 80	160	68.8	80	58
3301018	M10 x 180 / 100	180	68.8	100	58
3301211	M12 x 110 / 15	110	79.6	15	68
3301212	M12 x 125 / 30	125	79.6	30	68
3301214	M12 x 145 / 50	145	79.6	50	68
3301216	M12 x 165 / 70	165	79.6	70	68
3301218	M12 x 185 / 90	185	79.6	90	68
3301613	M16 x 130 / 15	130	96.4	15	80
3301614	M16 x 145 / 30	145	96.4	30	80
3301616	M16 x 160 / 45	160	96.4	45	80
3301618	M16 x 180 / 65	180	96.4	65	80

m2r-C Throughbolt with big washer DIN 9021 stainless steel A4/316

Article code	Dimensions [mm]	Length [mm] L	Length of screw in building material [mm] h_{nom}	Usable length [mm] t_{fix}	Effective anchorage depth [mm] h_{ef}
3310606	M6 x 65 / 10	65	46.9	10	40
3310808	M8 x 80 / 10	80	58.5	10	50
3311009	M10 x 95 / 15	95	68.8	15	58

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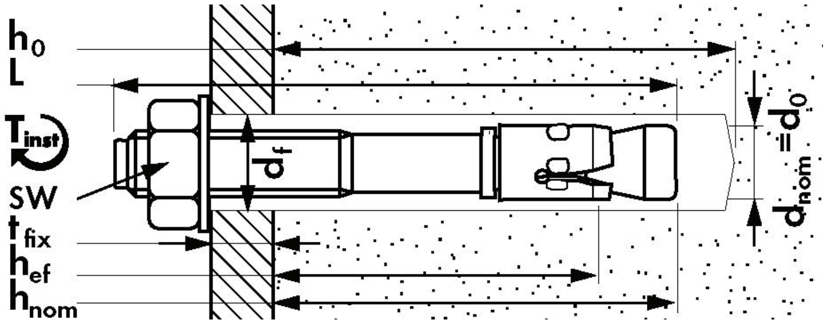
3 INSTALATION DATA m2r and m2r-C



FASTENER SIZE m2r and m2r-C*			M6	M8	M10	M12	M16
Anchor/Thread diameter	d	[mm]	6	8	10	12	16
Diameter of clearence hole in the fixture	d_f	[mm]	7	9	12	14	18
Installation torque	T_{inst}	[Nm]	6,5	15	30	50	140
Spanner	SW	[mm]	10	13	17	19	24
INSTALLATION PARAMETERS							
Drill hole diameter in substrate	d_0	[mm]	6	8	10	12	16
Max. cutting diameter (max. drill diameter)	$d_{cut,max}$	[mm]	6.4	8.45	10.45	12.5	16.5
Dept of drill hole in substrate	h_1	[mm]	60	65	80	90	110
Effective anchorage depth	h_{ef}	[mm]	40	50	58	68	80
Minimum thickness of concrete memeber	h_{min}	[mm]	100	100	120	140	160
Minimum edge distane	c_{min}	[mm]	40	45*	55*	75*	130
Corresponding spacing	s ≥	[mm]	80	45*	55*	75*	190
Minimum spacing	s_{min}	[mm]	40	45	55	75	100
Corresponding edge distance	c ≥	[mm]	70	45	55	75	190

* Not decisive in ETA-05/0199

3.1 BASIC PERFORMANCE DATA

Basic performance data for m2r in non-cracked concrete C20/25 without influence of edge distance, spacing and splitting failure due to dimensions of concrete member

FASTENER SIZE m2r AND m2r-C*			M6	M8	M10	M12	M16
Effective anchorage depth	h_{ef}	[mm]	40	50	58	68	80
CHARACTERISTIC RESISTANCE							
Tension load	N_{Rk}	[kN]	7.50	12.00	16.00	25.00	30.00
Shear load	V_{Rk}	[kN]	7.00[1)]	13.00[1)]	21.00[1)]	30.00[1)]	56.00[1)]
Bending moment, steel failure	$M^0_{Rk,s}$	[Nm]	12.00	30.00	60.00	105.00	266.00
DESIGN RESISTANCE							
Tension load	N_{Rd}	[kN]	5.00	8.00	10.67	16.67	20.00
Shear load	V_{Rd}	[kN]	5.26[1)]	9.77[1)]	15.79[1)]	22.56[1)]	42.11[1)]
Bending moment, steel failure	$M^0_{Rd,s}$	[Nm]	9.02	22.56	45.11	78.95	200.00
RECOMENDED RESISTANCE							
Tension load, partial safety factor 1,4	N_{rec}	[kN]	3.57	5.71	7.62	11.91	14.29
Shear load, partial safety factor 1,4	V_{rec}	[kN]	3.76[1)]	6.98[1)]	11.28[1)]	16.11[1)]	30.08[1)]
Bending moment, steel failure (safety fac. 1,4)	$M^0_{rec,s}$	[Nm]	6.4	16.1	32.2	56.4	142.9

1) Steel failure

* Anchor is not decisive in ETA-05/0199

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4 INCREASING DESIGN RESISTANCE FOR CONCRETE STRENGTH CLASSES

Increasing resistance to tension and shear load for concrete strength classes

FASTENER SIZE m2r and m2r-C*			M6	M8	M10	M12	M16
INCREASING DESIGN RESISTANCE FOR CONCRETE STRENGTH CLASSES							
Tension load, N_{Rd}	C20/25	[kN]	5.00	8.00	10.67	16.67	20.00
	C25/30		5.38	8.61	11.47	17.93	21.52
	C30/37		5.85	9.36	12.48	19.50	23.40
	C35/45		6.25	10.12	13.50	21.09	25.31
	C40/50		6.25	10.56	14.08	22.00	26.40
	C45/55		6.25	10.97	14.63	22.86	27.43
	C50/60		6.25	11.36	15.15	23.67	28.40
Shear load, V_{Rd}	C20/25 C25/30 C30/37 C35/45 C40/50 C45/55 C50/60	[kN]	5.26	9.77	15.79	22.56	42.11

* Anchor is not decisive in ETA-05/0199

Increasing resistance for pull-out failure based on ETA-05/0199

For minimum spacing, minimum edge distance and thickness of concrete member the above described loads have to be reduced.

5 REDUCE DESIGN RESISTANCE TO TENSION LOADS FOR LIMITED EDGE AND SPACING DISTANCE

REQUIRED PROOFS FOR DESIGN TENSION RESISTANCE FOLLOWING ETAG 001 Annex C:

1. $\mathbf{N_{Rd} = min(N_{Rd,s}; N_{Rd,p}; N_{Rd,c}; N_{Rd,sp})}$
2. Reduction design resistance to tension loads is only valid for one limited edge distance or one limited spacing
3. It may be assumed that splitting failure will not occur, if the edge distance in all directions is $c \geq 1.2\ c_{cr,sp}$ and the member depth is $h \geq 2\ h_{ef}$ (see ETA-05/0199 and ETAG 001 Annex C)

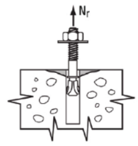
Anchor m2r-C is not decisive in ETA-05/0199

5.1 Steel failure $N_{Rd,s}$

Design resistance of one anchor in case of steel failure.

$N_{Rd,s} = N_{Rk,s} / \gamma_{Ms}$

FASTENER SIZE m2r and m2r-C			M6	M8	M10	M12	M16
STEEL FAILURE							
Tension load $\gamma_{Ms} = 1,6$	$N_{Rd,s}$	[kN]	6.25	11.88	20.63	28.75	51.25



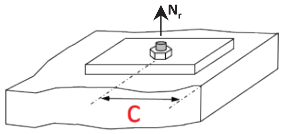
5.2 Pull-out failure $N_{Rd,p}$

Design resistance in case of failure of one anchor by pull-out.

$N_{Rd,p} = N_{Rk,p} / \gamma_{Mp}$

FASTENER SIZE m2r and m2r-C			M6	M8	M10	M12	M16
PULL-OUT FAILURE, NON-CRACKED CONCRETE C20/25							
Tension load $\gamma_{Mp} = 1,5$	$N_{Rd,p}$	[kN]	5.00	8.00	10.67	16.67	20.00

5.3 Concrete cone failure and splitting failure in case of one limited edge



5.3.1 Design tension resistance of one anchor in case of concrete cone failure ($N_{Rd,c}$) with one limited edge

Reduction factor $\Psi_{edge} = (A_{c,N}/A^0_{c,N}) \cdot \Psi_{s,N}$ for concrete cone failure is only valid for one limited edge and without influence of spacing

$N_{Rd,c} = N^0_{Rd,c} \cdot \Psi_{edge}$; $N^0_{Rd,c} = N^0_{Rk,c} / \gamma_{Mc}$

FASTENER SIZE m2r and m2r-C			M6	M8	M10	M12	M16
Minimum thickness of concrete memeber	h_{min}	[mm]	100	100	120	140	160
CONCRETE CONE FAILURE IN CASE OF ONE LIMITED EDGE, NON-CRACKED CONCRETE C20/25							
Tension load γ_{Mc} = 1,5	$N^0_{Rd,c}$	[kN]	8.52	11.90	14.87	18.88	24.09
			x	x	x	x	x
			Ψ_{edge}	Ψ_{edge}	Ψ_{edge}	Ψ_{edge}	Ψ_{edge}
	Edge distance [mm]	40	0.75				
		45	0.81	0.70			
		50	0.87	0.75			
		55	0.93	0.80	0.73		
		65	1.00	0.90	0.81		
		75	1.00	1.00	0.89	0.80	
		90	1.00	1.00	1.00	0.91	
		100	1.00	1.00	1.00	0.98	
		110	1.00	1.00	1.00	1.00	
		120	1.00	1.00	1.00	1.00	
		130	1.00	1.00	1.00	1.00	1.00
		140	1.00	1.00	1.00	1.00	1.00
		150	1.00	1.00	1.00	1.00	1.00
		200	1.00	1.00	1.00	1.00	1.00

5.3.2 Design tension resistance of one anchor in case of splitting failure ($N_{Rd,sp}$) with one limited edge

Reduction factor $\Psi_{edge} = (A_{c,N}/A^0_{c,N}) \cdot \Psi_{sp,N}$ for splitting failure is only valid for one limited edge and without influence of spacing

$N_{Rd,sp} = N^0_{Rd,sp} \cdot \Psi_{edge}$; $N^0_{Rd,sp} = N^0_{Rk,sp} / \gamma_{Msp}$

FASTENER SIZE m2r and m2r-C			M6	M8	M10	M12	M16
Minimum thickness of concrete memeber	h_{min}	[mm]	100	100	120	140	160
SPLITTING FAILURE IN CASE OF ONE LIMITED EDGE, NON-CRACKED CONCRETE C20/25							
Tension load γ_{Msp} = 1,5	$N^0_{Rd,sp}$	[kN]	8.52	11.90	14.87	18.88	24.09
			x	x	x	x	x
			Ψ_{edge}	Ψ_{edge}	Ψ_{edge}	Ψ_{edge}	Ψ_{edge}
	Edge distance [mm]	40	0.53				
		45	0.56	0.51			
		50	0.58	0.53			
		55	0.61	0.55	0.52		
		65	0.66	0.59	0.56		
		75	0.72	0.64	0.59	0.60	
		90	0.81	0.70	0.65	0.66	
		100	0.87	0.75	0.69	0.70	
		110	0.93	0.80	0.73	0.74	
		120	1.00	0.85	0.77	0.78	
		130	1.00	0.90	0.81	0.82	0.74
		140	1.00	0.95	0.85	0.86	0.77
		150	1.00	1.00	0.89	0.91	0.81
		200	1.00	1.00	1.00	1.00	1.00

Factor $\Psi_{h,sp}$ for splitting failure can be considered if $h > h_{min}$

$N_{Rd,sp} = N^0_{Rd,sp} \cdot \Psi_{edge} \cdot \Psi_{h,sp}$

$\Psi_{h,sp} = \left(\frac{h}{h_{min}}\right)^{2/3} \leq 1.5$

h = actual thickness of the member
hmin = minimum thickness of concrete member

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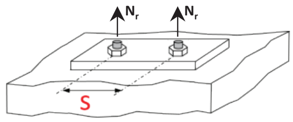
5.4 Concrete cone failure and splitting failure in case of limited spacing



5.4.1 Design tension resistance of one anchor in case of concrete cone failure ($N_{Rd,c}$) with one limited spacing

Reduction factor $\Psi_{spacing} = (A_{c,N}/A^0_{c,N})$ for concrete cone failure is only valid for one limited spacing and without influence of edge

$N_{Rd,c} = N^0_{Rd,c} \cdot \Psi_{spacing}$; $N^0_{Rd,c} = N^0_{Rk,c} / \gamma_{Mc}$

FASTENER SIZE m2r and m2r-C			M6	M8	M10	M12	M16
Minimum thickness of concrete memeber	hmin	[mm]	100	100	120	140	160
CONCRETE CONE FAILURE IN CASE OF LIMITED SPACING BETWEEN ANCHORS, NON-CRACKED CONCRETE C20/25							
Tension load γ_{Mc} = 1,5	$N^0_{Rd,c}$	[kN]	8.52	11.90	14.87	18.88	24.09
			x	x	x	x	x
			Ψspacing	Ψspacing	Ψspacing	Ψspacing	Ψspacing
	Spacing between anchors [mm]	40	0.67				
		45	0.69	0.65			
		50	0.71	0.67			
		55	0.73	0.68	0.66		
		65	0.77	0.72	0.69		
		75	0.81	0.75	0.72	0.68	
		90	0.88	0.80	0.76	0.72	
		100	0.92	0.83	0.79	0.75	
		110	0.96	0.87	0.82	0.77	
		120	1.00	0.90	0.84	0.79	
		130	1.00	0.93	0.87	0.82	0.77
		140	1.00	0.97	0.90	0.84	0.79
		150	1.00	1.00	0.93	0.87	0.81
		200	1.00	1.00	1.00	0.99	0.92
		300	1.00	1.00	1.00	1.00	1.00
		400	1.00	1.00	1.00	1.00	1.00

5.4.2 Design tension resistance of one anchor in case of splitting failure ($N_{Rd,sp}$) with one limited spacing

Reduction factor $\Psi_{spacing} = (A_{c,N}/A^0_{c,N})$ for splitting failure is only valid for one limited spacing and without influence of edge

$N_{Rd,sp} = N^0_{Rd,sp} \cdot \Psi_{spacing}$; $N^0_{Rd,sp} = N^0_{Rk,sp} / \gamma_{Msp}$

FASTENER SIZE m2r and m2r-C			M6	M8	M10	M12	M16
Minimum thickness of concrete memeber	hmin	[mm]	100	100	120	140	160
SPLITTING FAILURE IN CASE OF LIMITED SPACING BETWEEN ANCHORS, NON-CRACKED CONCRETE C20/25							
Tension load γ_{Msp} = 1,5	$N^0_{Rd,sp}$	[kN]	8.52	11.90	14.87	18.88	24.09
			x	x	x	x	x
			Ψspacing	Ψspacing	Ψspacing	Ψspacing	Ψspacing
	Spacing between anchors [mm]	40	1.00				
		45	1.00	0.58			
		50	1.00	0.58			
		55	1.00	0.59	1.00		
		65	1.00	0.61	1.00		
		75	1.00	0.63	1.00	1.00	
		90	1.00	0.65	1.00	1.00	
		100	1.00	0.67	1.00	1.00	
		110	1.00	0.68	1.00	1.00	
		120	1.00	0.70	1.00	1.00	
		130	1.00	0.72	1.00	1.00	0.66
		140	1.00	0.73	1.00	1.00	0.68
		150	1.00	0.75	1.00	1.00	0.69
		200	1.00	0.83	1.00	1.00	0.75
		300	1.00	1.00	1.00	1.00	0.88
		400	1.00	1.00	1.00	1.00	1.00

Factor $\Psi_{h,sp}$ for splitting failure can be considered if $h > h_{min}$

$N_{Rd,sp} = N^0_{Rd,sp} \cdot \Psi_{spacing} \cdot \Psi_{h,sp}$

$\Psi_{h,sp} = \left(\frac{h}{h_{min}}\right)^{2/3} \leq 1.5$

h = actual thickness of the member
hmin = minimum thickness of concrete member

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6 IMPORTANT NOTICE

Values given above are valid under the assumptions of sufficient cleaning of the drill hole and anchoring in non-cracked concrete. For the design the complete assessment ETA-05/0199 from 15 February 2016 has to be considered. Product m2r-C has no technical assessment. In recommended resistance the partial safety factor for material as regulated in the ETA as well as a partial safety factor for load action γ_L = 1.4 are considered. For combination of tensile loads, shear loads, bending moments as well as reduced edge distances or spacing's (anchor groups) see ETA or Mungo design software. The data must be checked by the user under the responsibility of an engineer experienced in anchorage and concrete work. This is to ensure there are no errors and all data is complete and accurate and complies with all rules and regulations for the actual conditions and application. Anchor design is performed according to the ETAG 001, Annex C in combination with assessment ETA-05/0199 from 15 February 2016.