R-XPTIIA4 Stainless Steel Throughbolt

Stainless steel throughbolt for non-cracked concrete

Approvals and Reports

- ETA-12/0384; ETAG 001-2, Option 7
  A1 (96/603/EC)

Product information

Features and benefits

- Stainless steel 1.4578 anchor for the highest corrosion resistance
- High performance in non-cracked concrete confirmed by ETA Option 7 in C1, C2, C3 and C4 environments (accordingly to PN-EN ISO 12944-2:2001)
- Highest quality to receive optimal load capability
- Fire resistant
- Suitable for reduced embedment to avoid contact with reinforcement
- Embedment depth markings help to ensure precise installation of the anchor
- Design of R-HPTII allows drilling and installing directly through the fixture and helps to reduce installation time

Applications

- Cladding restraint
- Curtain wall
- Balustrading
- Barriers
- Handrails
- Racking
- Structural steel
- Bollards

Base materials

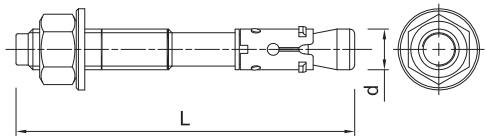
Approved for use in:

- Non-cracked concrete C20/25-C50/60

Installation guide

1. Drill a hole of required diameter and depth
2. Clear the hole of drilling dust and debris (using blow pump and brush or equivalent method)
3. Lightly tap the throughbolt through the fixture into hole with a hammer, until fixing depth is reached
4. Tighten to the recommended torque

Product information



Size	Product Code	Anchor		Fixture		
		Diameter	Length	Max. thickness		Hole diameter
		d	L	$t_{fix,r}$	$t_{fix,s}$	d_f
		[mm]	[mm]	[mm]	[mm]	[mm]
M6	R-XPTA4-06050/10*	6	50	10	-	7
	R-XPTA4-06085/25*	6	85	45	25	7
M8	R-XPTIIA4-08075/10	8	75	25	10	9
	R-XPTIIA4-08085/20	8	85	35	20	9
	R-XPTIIA4-08095/30	8	95	45	30	9
	R-XPTIIA4-08105/40	8	105	55	40	9
	R-XPTIIA4-08115/50	8	115	65	50	9
M10	R-XPTIIA4-10065/5	10	65	5	-	11
	R-XPTIIA4-10080/20	10	80	20	-	11
	R-XPTIIA4-10095/15	10	95	35	15	11
	R-XPTIIA4-10115/35	10	115	55	35	11
	R-XPTIIA4-10130/50	10	130	70	50	11
	R-XPTIIA4-10140/60	10	140	80	60	11
M12	R-XPTIIA4-12080/5	12	80	5	-	13
	R-XPTIIA4-12100/5	12	100	25	5	13
	R-XPTIIA4-12125/30	12	125	50	30	13
	R-XPTIIA4-12150/55	12	150	75	55	13
	R-XPTIIA4-12180/85	12	180	105	85	13

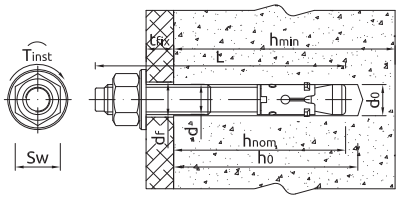
* Not confirmed by ETA approval

Product information (cont.)

Size	Product Code	Anchor		Fixture		
		Diameter	Length	Max. thickness		Hole diameter
		d	L	$t_{Fix,r}$	$t_{Fix,s}$	d_f
		[mm]	[mm]	[mm]	[mm]	[mm]
M16	R-XPTII-A4-16125/5	16	125	25	5	18
	R-XPTII-A4-16140/20	16	140	40	20	18
	R-XPTII-A4-16150/30	16	150	50	30	18
	R-XPTII-A4-16180/60	16	180	80	60	18
	R-XPTII-A4-16220/100	16	220	120	100	18
M20	R-XPT-A4-20125/5*	20	125	5	0	22
	R-XPT-A4-20160/20*	20	160	40	20	22
	R-XPT-A4-20200/60*	20	200	80	60	22
	R-XPT-A4-20300/160*	20	300	180	160	22
M24	R-XPT-A4-24260/100*	24	260	115	100	26

* Not confirmed by ETA approval

Installation data



Size			M6*	M8	M10	M12	M16	M20*	M24*
Thread diameter	d	[mm]	6	8	10	12	16	20	24
Hole diameter in substrate	d_0	[mm]	6	8	10	12	16	20	24
Installation torque	T_{inst}	[Nm]	5	15	30	50	100	180	320
Wrench size	s_w	[mm]	10	13	17	19	24	30	36
STANDARD EMBEDMENT DEPTH									
Min. hole depth in substrate	$h_{0,s}$	[mm]	55	60	75	85	105	125	140
Installation depth	$h_{nom,s}$	[mm]	50	55	69	80	100	120	135
Min. substrate thickness	$h_{min,s}$	[mm]	84	100	120	140	170	200	224
Min. spacing	$s_{min,r}$	[mm]	45	65	90	110	170	140	180
Min. edge distance	$c_{min,r}$	[mm]	50	50	60	85	90	100	200
REDUCED EMBEDMENT DEPTH									
Min. hole depth in substrate	$h_{0,r}$	[mm]	35	45	55	65	85	105	125
Installation depth	$h_{nom,r}$	[mm]	30	40	49	60	80	100	120
Min. substrate thickness	$h_{min,r}$	[mm]	80	100	100	100	130	158	194
Min. spacing	$s_{min,r}$	[mm]	40	65	115	150	190	125	160
Min. edge distance	$c_{min,r}$	[mm]	45	50	80	100	120	125	160

* Not covered by approval

Mechanical properties

Size			M6*	M8	M10	M12	M16	M20*	M24*
Nominal ultimate tensile strength	f_{uk}	[N/mm²]	600	600	600	550	550	700	700
Nominal yield strength	f_{yk}	[N/mm²]	450	450	450	413	413	525	525
Cross sectional area	A_s	[mm²]	20.1	36.6	58.0	84.3	157.0	245.0	353.0
Elastic section modulus	W_{el}	[mm³]	21.21	50.27	98.17	169.65	402.12	785.40	1357.17
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	15.27	36.19	70.69	111.97	265.40	659.73	1140.02
Design bending resistance	M	[Nm]	10.	24.13	47.12	74.64	176.93	439.82	760.01

Design performance data

Data for anchor calculation acc. to ETAG 001 p. 5.2 - Method A

Size			M8	M10	M12	M16	M8	M10	M12	M16
			STANDARD ANCHORAGE				REDUCED ANCHORAGE			
Embedment depth	h_{ef}	[mm]	47	59	68	85	32	39	48	65
TENSION LOAD										
STEEL FAILURE (ETAG 001, zał. C, p.5.2.2.2.)										
Characteristic resistance	$N_{Rk,s}$	[kN]	21.20	33.60	44.80	82.60	21.20	33.60	44.80	82.60
Design resistance γ_{Ms}= 1.4	γ_{Ms}	-	1.5				1.5			
PULL-OUT FAILURE; CONCRETE C20/25 (ETAG 001, zał. C, p.5.2.2.3.)										
Characteristic resistance - non-cracked concrete	$N_{Rk,p}$	[kN]	9.00	16.00	25.00	1)	7.50	12.00	1)	1)
Partial safety factor	γ_{Mp}	-	1.8	1.5	1.5	1.5	1.8	1.8	1.5	1.5
Increasing factor	ψ_c C30/37	-	1.46	1.37	1.20	1.18	1.07	1.11	1.16	1.18
	ψ_c C40/50	-	1.91	1.73	1.40	1.37	1.13	1.22	1.32	1.37
	ψ_c C50/60	-	2.36	2.10	1.60	1.55	1.20	1.33	1.49	1.55

Design performance data

Data for anchor calculation acc. to ETAG 001 p. 5.2 - Method A

Size			M8	M10	M12	M16	M8	M10	M12	M16
CONCRETE CONE FAILURE (ETAG 001, zał. C, p.5.2.2.4.)										
Spacing	$s_{cr,N}$	[mm]	141	177	204	255	96	117	144	195
Edge distance	$c_{cr,N}$	[mm]	71	89	102	128	48	59	72	98
Partial safety factor	γ_{Mc}	-	1.8	1.5	1.5	1.5	1.8	1.8	1.5	1.5
CONCRETE SPLITTING FAILURE (ETAG 001, zał. C, p.5.2.2.6.)										
Spacing	$s_{cr,sp}$	[mm]	240	300	340	430	160	200	250	320
Edge distance	$c_{cr,sp}$	[mm]	120	150	170	215	80	100	125	160
Partial safety factor	γ_{Msp}	-	1.8	1.5	1.5	1.5	1.8	1.8	1.5	1.5
SHEAR LOAD										
STEEL FAILURE (ETAG 001, zał. C, p.5.2.3.2.)										
Characteristic resistance without lever arm	$V_{Rk,s}$	[kN]	11.7	18.5	24.6	45.4	11.7	18.5	24.6	45.4
Characteristic resistance with lever arm	$M^0_{Rk,s}$	[Nm]	22	45	72	180	22	45	72	180
Partial safety factor	γ_{Ms}	-	1.25				1.25			
CONCRETE PRY-OUT FAILURE (ETAG 001, zał. C, p.5.2.3.3.)										
Factor	k	-	1)	1)	1)	1)	1)	1.2	1)	1)
Partial safety factor	γ_{Mc}	-	1.8	1.5	1.5	1.5	1.8	1.8	1.5	1.5
CONCRETE EDGE FAILURE (ETAG 001, zał. C, p.5.2.3.4.)										
	d_{nom}	[mm]	8	10	12	16	8	10	12	16
Effective anchor length	l_f	[mm]	47	59	68	85	32	39	48	65
Partial safety factor	γ_{Mc}	-	1.8	1.5	1.5	1.5	1.8	1.8	1.5	1.5

1) Failure is not decisive

Basic performance data

STANDARD EMBEDMENT DEPTH
NON-CRACKED CONCRETE

Performance data for single anchor without influence of edge distance and spacing

Size		M6*	M8	M10	M12	M16	M20*	M24*
Standard embedment depth h_{ef}	[mm]	42	47	59	68	85	99	112
MEAN ULTIMATE LOAD								
TENSION LOAD $N_{Ru,m}$	[kN]	9.80	15.39	22.77	30.39	55.78	68.50	82.80
SHEAR LOAD $V_{Ru,m}$	[kN]	9.00	14.00	22.20	29.60	54.50	73.00	103.50
CHARACTERISTIC LOAD								
TENSION LOAD N_{Rk}	[kN]	7.60	9.00	16.00	25.00	39.50	54.30	64.70
SHEAR LOAD V_{Rk}	[kN]	5.50	11.70	18.50	24.60	45.40	67.40	97.10
DESIGN LOAD								
TENSION LOAD N_{Rd}	[kN]	3.52	5.00	10.67	16.67	26.33	25.14	29.95
SHEAR LOAD V_{Rd}	[kN]	4.40	9.36	14.80	19.68	36.32	53.92	77.68
RECOMMENDED LOAD**								
TENSION LOAD N_{Rec}	[kN]	2.51	3.57	7.62	11.90	18.81	17.96	21.40
SHEAR LOAD V_{Rec}	[kN]	3.14	6.69	10.57	14.06	25.94	38.51	55.49

* Not convered by ETA approval; ** Partial safety factor 1.4

steel failure concrete cone failure

EDGE DISTANCE AND SPACING

Reduction resistance factors for edge distance and spacing

EDGE DISTANCE IN TENSION

Reduction factors for edge distance $<c_{cr,N}$ applicable to N_{Rd} or N_{rec} for non-cracked concrete.
Table only valid for one edge distance $<c_{cr,N}$ and $s \geq s_{cr,N}$. For other cases use the Rawlplug EasyFix - Anchor Calculator.

c_N [mm]	M6		M8		M10		M12		M16		M20		M24	
	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}
50	1.00	1.00	1.00	1.00										
60					0.86	0.86								
70					0.95	0.95								
75					1.00	1.00								
90							0.86	0.86	0.72	0.72				
100							0.94	0.94	0.77	0.77				
120							1.00	1.00	0.88	0.88				
140									0.97	0.97				
160									1.00	1.00	0.95	0.95		
180											1.00	1.00		
200													1.00	1.00

Basic performance data (cont.)

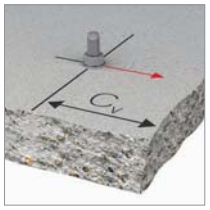
EDGE DISTANCE AND SPACING

Reduction resistance factors for edge distance and spacing

SPACING IN TENSION

Reduction factors for spacing $<s_{cr,N}$ applicable to N_{Rd} or N_{rec} for non-cracked concrete.
Table only valid for one spacing $<s_{cr,N}$ and $c \geq c_{cr,N}$. For other cases use the Rawlplug EasyFix - Anchor Calculator.

S_N [mm]	M6		M8		M10		M12		M16		M20		M24	
	$h>1.84h_{min}$	h_{min}	$h>1.84h_{min}$	h_{min}	$h>1.84h_{min}$	h_{min}	$h>1.84h_{min}$	h_{min}	$h>1.84h_{min}$	h_{min}	$h>1.84h_{min}$	h_{min}	$h>1.84h_{min}$	h_{min}
45	0.87	0.87												
55	0.92	0.92												
60	0.95	0.95												
70	1.00	1.00	0.99	0.99										
75			1.00	1.00										
90					0.86	0.86								
100					0.89	0.89								
120					0.95	0.95	0.76	0.76						
140					1.00	1.00	0.80	0.80			0.67	0.67		
160							0.85	0.85			0.70	0.70		
180							0.90	0.90	0.79	0.79	0.73	0.73	0.71	0.71
200							0.94	0.94	0.83	0.83	0.76	076	0.74	0.74
250							1.00	1.00	0.92	0.92	0.84	0.84	0.81	0.81
300									1.00	1.00	0.92	0.92	0.88	0.88
320											0.95	0.95	0.90	0.90
340											0.98	0.98	0.93	0.93
360											1.00	1.00	0.96	0.96
380													0.99	0.99
400													1.00	1.00



EDGE DISTANCE IN SHEAR

Reduction factors for edge distance $<c_{min}$ applicable to V_{Rd} or V_{rec} for non-cracked concrete.
Table only valid for one edge distance $<c_{min}$ and $s \geq 3c_V$. For other cases use the Rawlplug EasyFix - Anchor Calculator.

C_V [mm]	M6		M8		M10		M12		M16		M20		M24	
	$h>1.5c_v$	h_{min}	$h>1.5c_v$	h_{min}	$h>1.5c_v$	h_{min}	$h>1.5c_v$	h_{min}	$h>1.5c_v$	h_{min}	$h>1.5c_v$	h_{min}	$h>1.5c_v$	h_{min}
50	1.00	1.00	0.58	0.58										
55			0.66	0.66										
60			0.74	0.74	0.50	0.50								
70			0.91	0.89	0.62	0.62								
75			1.00	0.95	0.68	0.68								
90				1.00	0.87	0.82	0.69	0.69	0.40	0.40				
100					1.00	0.90	0.79	0.76	0.46	0.46				
120						1.00	1.00	0.89	0.59	0.57				
140								1.00	0.72	0.65				
160									0.87	0.73	0.62	056		
180									1.00	0.81	0.72	.62		
200										0.88	0.83	0.68	0.60	0.54
250										1.00	1.00	0.82	0.81	0.65
280												0.90	0.94	0.71
300												0.96	1.00	0.76
350												1.00		0.86
380														0.93
400														0.97
415														1.00

Basic performance data (cont.)

EDGE DISTANCE AND SPACING

Reduction resistance factors for edge distance and spacing

SPACING IN SHEAR

Reduction factors for edge distance >s_{min} applicable to V_{Rd} and V_{rec} for non-cracked concrete.
Table only valid for one spacing <$s_{cr,N}$ and c ≥ $c_{cr,N}$. For other cases use the Rawlplug EasyFix - Anchor Calculator.

s_v [mm]	M6		M8		M10		M12		M16		M20		M24	
	h>1.5c_v	h_{min}	h>1.5c_v	h_{min}	h>1.5c_v	h_{min}	h>1.5c_v	h_{min}	h>1.5c_v	h_{min}	h>1.5c_v	h_{min}	h>1.5c_v	h_{min}
50	1.00	1.00												
70			1.00	1.00										
90					1.00	1.00								
120							1.00	1.00						
140											0.74	0.70		
160											0.76	0.72		
180									0.94	0.89	0.79	0.74	0.65	0.64
200									0.97	0.92	0.81	0.77	0.67	0.65
220											0.84	0.79	0.69	0.67
250									1.00	1.00	0.87	0.83	0.72	0.70
300											0.94	0.89	0.77	0.75
340											0.99	0.94	0.80	0.78
380											1.00	0.98	0.84	0.82
420												1.00	0.88	0.86
460													0.92	0.90
500													0.96	0.93
540													0.99	0.97
560													1.00	0.99
580														1.00

REDUCED EMBEDMENT DEPTH NON-CRACKED CONCRETE

Performance data for single anchor without influence of edge distance and spacing

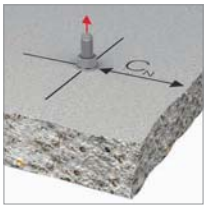
Size		M6*	M8	M10	M12	M16	M20*	M24*
Standard embedment depth h_{ef}	[mm]	22	32	39	48	65	79	97
MEAN ULTIMATE LOAD								
TENSION LOAD $N_{Ru,m}$	[kN]	5.70	10.39	16.01	22.09	37.90	44.60	62.70
SHEAR LOAD $V_{Ru,m}$	[kN]	9.00	14.00	22.20	29.60	54.50	73.00	103.50
CHARACTERISTIC LOAD								
TENSION LOAD N_{Rk}	[kN]	4.50	7.50	12.00	16.80	26.40	35.00	48.90
SHEAR LOAD V_{Rk}	[kN]	5.50	11.70	14.70	24.60	45.40	67.40	97.10
DESIGN LOAD								
TENSION LOAD N_{Rd}	[kN]	2.08	4.17	6.67	11.20	17.60	16.20	22.64
SHEAR LOAD V_{Rd}	[kN]	4.40	9.36	8.17	19.68	36.32	53.92	77.68
RECOMMENDED LOAD*								
TENSION LOAD N_{Rec}	[kN]	1.49	2.98	4.76	8.00	12.57	11.57	16.17
SHEAR LOAD V_{Rec}	[kN]	3.14	6.69	5.83	14.06	25.94	38.51	55.49

* Not convered by ETA approval; ** Partial safety factor 1.4

steel failure | concrete cone failure | concrete pry-out failure

EDGE DISTANCE AND SPACING

Reduction resistance factors for edge distance and spacing



EDGE DISTANCE IN TENSION

Reduction factors for edge distance <$c_{cr,N}$ applicable to N_{Rd} or N_{rec} for non-cracked concrete.
Table only valid for one edge distance <$c_{cr,N}$ and s ≥ $s_{cr,N}$. For other cases use the Rawlplug EasyFix - Anchor Calculator.

c_N [mm]	M6		M8		M10		M12		M16		M20		M24	
	h>1.84h_{min}	h_{min}	h>1.84h_{min}	h_{min}	h>1.84h_{min}	h_{min}	h>1.84h_{min}	h_{min}	h>1.84h_{min}	h_{min}	h>1.84h_{min}	h_{min}	h>1.84h_{min}	h_{min}
45	0.83	0.83												
50	0.89	0.89	0.82	0.82										
55	0.94	0.94	0.86	0.86										
60	1.00	1.00	0.91	0.91										
70			0.99	0.99										
75			1.00	1.00										
90					0.90	0.90								
100					0.97	0.97	0.88	0.88						
120					1.00	1.00	0.99	0.99	0.92	0.92				
140							1.00	1.00	1.00	1.00	0.99	0.99		
160											1.00	1.00	1.00	1.00

Basic performance data (cont.)

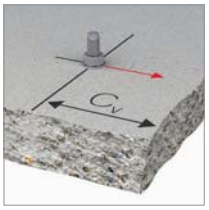
EDGE DISTANCE AND SPACING

Reduction resistance factors for edge distance and spacing

SPACING IN TENSION

Reduction factors for spacing $<s_{cr,N}$ applicable to N_{Rd} or N_{rec} for non-cracked concrete.
Table only valid for one spacing $<s_{cr,N}$ and $c \geq c_{cr,N}$. For other cases use the Rawlplug EasyFix - Anchor Calculator.

S_N [mm]	M6		M8		M10		M12		M16		M20		M24	
	$h>1.84h_{min}$	h_{min}	$h>1.84h_{min}$	h_{min}	$h>1.84h_{min}$	h_{min}	$h>1.84h_{min}$	h_{min}	$h>1.84h_{min}$	h_{min}	$h>1.84h_{min}$	h_{min}	$h>1.84h_{min}$	h_{min}
40	0.57	0.57												
50	0.62	0.62												
60	0.67	0.67												
70	0.73	0.73	0.70	0.70										
75	0.75	0.75	0.72	0.72										
90	0.83	0.83	0.78	0.78										
100	0.89	0.89	0.82	0.82										
120	1.00	1.00	0.91	0.91	0.72	0.72								
140			0.99	0.99	0.78	0.78					0.72	0.72		
160			1.00	1.00	0.84	0.84	0.78	0.78			0.76	0.76	0.75	0.75
180					0.90	0.90	0.83	0.83			0.80	0.80	0.79	0.79
200					0.97	0.97	0.88	0.88	0.84	0.84	0.84	0.84	0.82	0.82
250					1.00	1.00	1.00	1.00	0.94	0.94	0.93	0.93	0.90	0.90
300									1.00	1.00	1.00	1.00	0.99	0.99
305													1.00	1.00



EDGE DISTANCE IN SHEAR

Reduction factors for edge distance $<c_{min}$ applicable to V_{Rd} or V_{rec} for non-cracked concrete.
Table only valid for one edge distance $<c_{min}$ and $s \geq 3c_V$. For other cases use the Rawlplug EasyFix - Anchor Calculator.

C_V [mm]	M6		M8		M10		M12		M16		M20		M24	
	$h>1.5c_V$	h_{min}	$h>1.5c_V$	h_{min}	$h>1.5c_V$	h_{min}	$h>1.5c_V$	h_{min}	$h>1.5c_V$	h_{min}	$h>1.5c_V$	h_{min}	$h>1.5c_V$	h_{min}
45	0.68	0.68												
50	0.73	0.73	0.54	0.54										
55	0.77	0.77	0.62	0.62										
60	0.81	0.81	0.70	0.70										
70	0.90	0.90	0.87	0.84										
75	0.95	0.95	0.95	0.90										
90	1.00	1.00	1.00	1.00	0.90	0.90								
100					0.97	0.97	0.75	0.61						
120					1.09	1.09	0.96	0.71	0.56	0.48				
140					1.21	1.21	1.00	0.82	0.69	0.55	0.50	0.43		
160					1.28	1.28		0.92	0.83	0.61	0.59	048	0.44	0.40
180								1.00	0.98	0.68	0.69	0.53	0.51	0.44
200									1.00	0.74	0.80	0.58	0.59	0.46
250										0.90	1.00	0.71	0.79	0.58
300										1.00		0.83	1.00	0.68
350												0.95		0.77
400												1.00		0.87
430														0.92
470														1.00

Basic performance data (cont.)

EDGE DISTANCE AND SPACING

Reduction resistance factors for edge distance and spacing

SPACING IN SHEAR

Reduction factors for edge distance >s_{min} applicable to V_{Rd} and V_{rec} for non-cracked concrete.
Table only valid for one spacing <$s_{cr,N}$ and c ≥ $c_{cr,N}$. For other cases use the Rawlplug EasyFix - Anchor Calculator.

s_v [mm]	M6		M8		M10		M12		M16		M20		M24	
	h>1.5c_v	h_{min}	h>1.5c_v	h_{min}	h>1.5c_v	h_{min}	h>1.5c_v	h_{min}	h>1.5c_v	h_{min}	h>1.5c_v	h_{min}	h>1.5c_v	h_{min}
40	0.46	0.46												
50	0.51	0.51												
60	0.55	0.55												
70	0.60	0.60	0.77	0.77										
75	0.62	0.62	0.78	0.78										
90	0.66	0.66	0.84	0.84										
100	0.73	0.73	0.87	0.87										
120	0.81	0.81	0.94	0.94	0.72	0.72								
140	0.90	0.90	1.00	1.00	0.78	0.78					0.56	0.53		
160	0.99	0.99			0.84	0.84	0.83	0.80			0.58	0.55	0.53	0.51
180	1.00	1.00			0.90	0.90	0.88	0.84			0.60	0.57	0.55	0.52
200					0.97	0.97	0.92	0.89	0.72	0.68	0.62	0.59	0.56	0.54
250					1.12	1.12	1.00	0.99	0.79	0.75	0.68	0.64	0.61	0.58
300					1.27	1.27		1.00	0.86	0.82	0.73	0.70	0.65	0.62
350					1.28	1.28			0.94	0.88	0.79	0.75	0.70	0.67
400									1.00	0.95	0.85	0.80	0.74	0.71
450										1.00	0.90	0.86	0.79	0.75
500											0.96	0.91	0.83	0.79
550											1.00	0.96	0.87	0.84
600											1.00	1.00	0.92	0.88
650											1.00	1.00	0.96	0.92
700											1.00	1.00	1.00	0.96
740											1.00	1.00	1.00	1.00