SLX SLEEVE ANCHOR

PRODUCT FEATURES

- Quick and easy for through fixing.
- Economical fixing system.
- Fully assembled and ready to use.
- Easy to expand in soft substrates.

MATERIAL SPECIFICATIONS

CARBON STEEL

- Bolt: Cold stamped carbon steel 5.8; zinc galvanised ≥ 5 µm & hot dipped galvanised ≥ 40 µm.
- Flange Nut: DIN 6923; zinc galvanised ≥ 5 µm & hot dipped galvanised ≥ 40 µm.
- Washer: DIN 125 or DIN 9021; zinc galvanised ≥ 5 µm & hot dipped galvanised ≥ 40 µm.
- Sleeve: Cold stamped carbon steel 5.8; zinc galvanised ≥ 5 µm & hot dipped galvanised ≥ 40 µm.

STAINLESS STEEL

- Bolt: Cold stamped stainless steel A2.
- Flange Nut: DIN 6923 stainless steel A2.
- Washer: DIN 125 or DIN 9021 stainless steel A2.
- Sleeve: Cold stamped stainless steel A2.

Z ZINC | G | A2 INOX

SUBSTRATES

- RC concrete C20/25 to C50/60 at maximum according to EN 206-1:2000-12.
- Solid stone, brickwork & other solid masonry.

CONC | STONE | BRICK

BASIC LOADING DATA

- For static and quasi-static loadings.
- For non-cracked concrete only.
- Only a single anchor is considered.
- No anchor spacing and edge distance influences.
- Concrete compressive strength C20/25 ($f_{ck,cube}$ = 25 N/mm²).

CHARACTERISTIC RESISTANCE [F_{Rk}]

Anchor Size		M5	M6	M8	M10	M12	M16
Tensile Load, N_{Rk}	[kN]						
~ Carbon Steel: Class 5.8		2.3	4.5	6.3	10.2	11.1	12.5
~ Stainless Steel: A2		-	3.8	5.3	6.0	-	-
Shear Load, V_{Rk}	[kN]						
~ Carbon Steel: Class 5.8		3.4	6.0	11.0	17.4	25.3	47.1
~ Stainless Steel: A2		-	8.4	15.4	24.4	-	-

DESIGN RESISTANCE [F_{Rd}]

Anchor Size		M5	M6	M8	M10	M12	M16
Tensile Load, N_{Rd}	[kN]						
~ Carbon Steel: Class 5.8		1.5	3.0	4.2	6.8	7.4	8.3
~ Stainless Steel: A2		-	2.5	3.5	4.0	-	-
Shear Load, V_{Rd}	[kN]						
~ Carbon Steel: Class 5.8		2.7	4.8	8.8	13.9	20.2	37.7
~ Stainless Steel: A2		-	5.4	9.9	15.6	-	-

RECOMMENDED LOAD [F_{Rec}]

Anchor Size		M5	M6	M8	M10	M12	M16
Tensile Load, N_{Rec}	[kN]						
~ Carbon Steel: Class 5.8		1.1	2.1	3.0	4.9	5.3	5.9
~ Stainless Steel: A2		-	1.8	2.5	2.9	-	-
Shear Load, V_{Rec}	[kN]						
~ Carbon Steel: Class 5.8		1.9	3.4	6.3	9.9	14.5	26.9
~ Stainless Steel: A2		-	3.9	7.0	11.2	-	-

SETTING DETAILS

SLX SLEEVE ANCHOR - STEEL CLASS 5.8 ZINC GALVANISED (SLX) & HOT DIPPED GALVANISED (SLX-GH)

ANCHOR SIZE		M5	M6	M8	M10	M12	M16
Drilled Hole / Sleeve Diameter, d_0	[mm]	6	8	10	12	16	20
Recommended Torque, T_{inst}	[Nm]	5	10	20	40	70	150
Fixture Hole Diameter, d_{fix}	[mm]	7	9	12	14	18	22
Minimum Hole Depth, h_1	[mm]	35	40	45	55	60	70
Embedment Depth, h_{nom}	[mm]	30	35	40	50	55	60
Standard Effective Anchorage Depth, $h_{ef,std}$	[mm]	25	30	35	45	45	50
Minimum Concrete Thickness, h_{min}	[mm]	55	60	70	85	90	105
Maximum Fixture Thickness, t_{fix}	[mm]	L- 35	L - 35	L - 45	L - 55	L - 60	L - 65
Critical Anchor Spacing, s_{cr}	[mm]	75	90	105	135	135	150
Minimum Anchor Spacing, s_{min}	[mm]	25	30	35	45	45	50
Critical Edge Distance, c_{cr}	[mm]	38	45	53	68	68	75
Minimum Edge Distance, c_{min}	[mm]	25	30	35	45	45	50

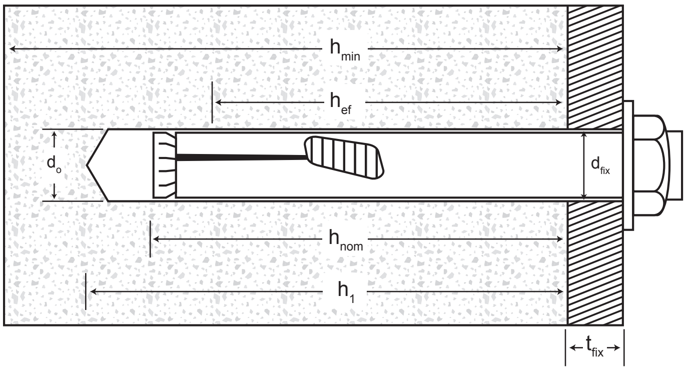
SLX HEX HEAD SLEEVE ANCHOR - STEEL CLASS 5.8 ZINC GALVANISED (SLX-H)

ANCHOR SIZE		M5	M6	M8	M10	M12	M16
Drilled Hole / Sleeve Diameter, d_0	[mm]	-	8	10	12	16	-
Recommended Torque, T_{inst}	[Nm]	-	10	20	40	70	-
Fixture Hole Diameter, d_{fix}	[mm]	-	9	12	14	18	-
Minimum Hole Depth, h_1	[mm]	-	40	45	55	60	-
Embedment Depth, h_{nom}	[mm]	-	35	40	50	55	-
Standard Effective Anchorage Depth, $h_{ef,std}$	[mm]	-	30	35	45	45	-
Minimum Concrete Thickness, h_{min}	[mm]	-	60	70	85	90	-
Maximum Fixture Thickness, t_{fix}	[mm]	-	L - 35	L - 45	L - 55	L - 60	-
Critical Anchor Spacing, s_{cr}	[mm]	-	90	105	135	135	-
Minimum Anchor Spacing, s_{min}	[mm]	-	30	35	45	45	-
Critical Edge Distance, c_{cr}	[mm]	-	45	53	68	68	-
Minimum Edge Distance, c_{min}	[mm]	-	30	35	45	45	-

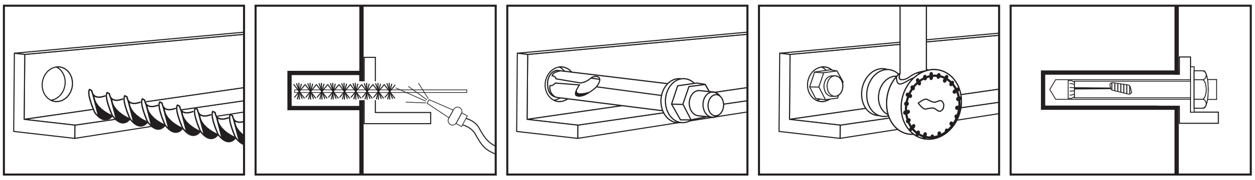
SLX SLEEVE ANCHOR - STAINLESS STEEL CLASS 304 (A2) (SLX-S)

ANCHOR SIZE		M5	M6	M8	M10	M12	M16
Drilled Hole / Sleeve Diameter, d_0	[mm]	-	8	10	12	-	-
Recommended Torque, T_{inst}	[Nm]	-	10	20	40	-	-
Fixture Hole Diameter, d_{fix}	[mm]	-	9	12	14	-	-
Minimum Hole Depth, h_1	[mm]	-	40	45	55	-	-
Embedment Depth, h_{nom}	[mm]	-	35	40	50	-	-
Standard Effective Anchorage Depth, $h_{ef,std}$	[mm]	-	30	35	45	-	-
Minimum Concrete Thickness, h_{min}	[mm]	-	60	70	85	-	-
Maximum Fixture Thickness, t_{fix}	[mm]	-	L - 35	L - 45	L - 55	-	-
Critical Anchor Spacing, s_{cr}	[mm]	-	90	105	135	-	-
Minimum Anchor Spacing, s_{min}	[mm]	-	30	35	45	-	-
Critical Edge Distance, c_{cr}	[mm]	-	45	53	68	-	-
Minimum Edge Distance, c_{min}	[mm]	-	30	35	45	-	-

SETTING DIAGRAM



INSTALLATION PROCEDURES



1. Examine the concrete base is well compact and porosity is insignificant. Drill a hole through the pre-drilled hole fixture into concrete at right angle to the substrate surface, to the specified diameter and depth.
2. Clean the drilled hole by using air pump or brush prior inserting the anchor.
3. Insert the anchor into the drilled hole by tapping lightly with a hammer until the fixing depth is reached. The installation could be done through the fixture hole.
4. Tighten the anchor according to the recommended torque.

MECHANICAL PROPERTIES

ANCHOR SIZE		M5	M6	M8	M10	M12	M16
Cross Sectional Area, A_s	[mm²]	11.3	20.1	36.6	58.0	84.3	157.0
Nominal Tensile Strength, f_{uk}	[N/mm²]						
~ Carbon Steel: Class 5.8		500	500	500	500	500	500
~ Stainless Steel: A2		700	700	700	700	700	700
Elastic Moment Of Resistance, W_{el}	[mm³]	5.4	12.7	31.2	62.3	109.2	277.5
Design Bending Moment, $M_{Rd,s}$	[Nm]						
~ Carbon Steel: Class 5.8		2.6	6.1	15.0	29.9	52.4	133.2
~ Stainless Steel: A2		2.9	6.8	16.8	33.5	58.8	149.4

The design bending moment is derived from $M_{Rd,s} = M_{Rk,s} / \gamma_{Ms,N}$ where the partial of safety factor is 1.25 for carbon steel 5.8 and 1.56 for stainless steel. The recommended bending moment is derived from $M_{Rec,s} = M_{Rd,s} / \gamma_F$ where the partial safety factor is 1.4.

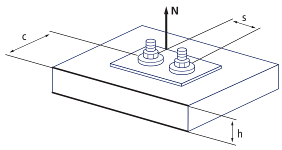
TENSION LOAD [N_{Rd}]

Design Tensile Resistance, N_{Rd}: lower value of [$N_{Rd,s}$; $N_{Rd,p}$; $N_{Rd,c}$]

Design Steel Tensile Resistance: $N_{Rd,s}$

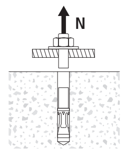
Design Pull-Out Resistance: $N_{Rd,p} = N^0_{Rd,p} \cdot \Psi_{h,N} \cdot \Psi_{\beta,N}$

Design Concrete Cone Resistance: $N_{Rd,c} = N^0_{Rd,c} \cdot \Psi_{h,N} \cdot \Psi_{\beta,N} \cdot \Psi_{s,N} \cdot \Psi_{c,N}$



STEEL TENSILE RESISTANCE [$N_{Rd,s}$]

- For static and quasi-static loadings.
- Only a single anchor is considered.
- For non-cracked concrete only.
- Loading applicable to both carbon steel and stainless steel.

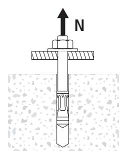


ANCHOR SIZE		M5	M6	M8	M10	M12	M16
$N_{Rd,s}$	[kN]						
~ Carbon Steel: Class 5.8		3.8	6.7	12.2	19.3	28.1	52.3
~ Stainless Steel: A2		-	7.5	13.7	21.7	-	-

The design steel tensile resistance is derived from $N_{Rd,s} = N_{Rk,s} / \gamma_{Ms,N}$ where the partial safety factor is 1.5 for carbon steel 5.8 and 1.87 for stainless steel A2. The recommended load is derived from $N_{Rec,s} = N_{Rd,s} / \gamma_F$ where the partial safety factor is 1.4.

PULL-OUT RESISTANCE [$N_{Rd,p}$]

- For static and quasi-static loadings.
- For non-cracked concrete only.
- Only a single anchor is considered.
- No anchor spacing and edge distance influences.
- Concrete compressive strength C20/25 ($f_{ck,cube}$ = 25 N/mm²).
- Loading applicable to both carbon steel and stainless steel.

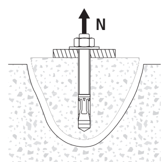


ANCHOR SIZE		M5	M6	M8	M10	M12	M16
$h_{ef,\ std}$	[kN]	25	30	35	45	45	50
$N^0_{Rd,p}$	[kN]						
~ Carbon Steel: Class 5.8		1.5	3.0	4.2	6.8	7.4	8.3
~ Stainless Steel: A2		-	2.5	3.5	4.0	-	-

The design pull-out resistance is derived from $N^0_{Rd,p} = N^0_{Rk,p} / \gamma_{Mc,N}$ where partial of safety factor of 1.5. The recommended load is derived from $N^0_{Rec,p} = N^0_{Rd,p} / \gamma_F$ where the partial safety factor is 1.4.

CONCRETE CONE RESISTANCE [$N_{Rd,c}$]

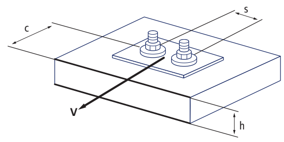
- For static and quasi-static loadings.
- For non-cracked concrete only.
- Only a single anchor is considered.
- No anchor spacing and edge distance influences.
- Concrete compressive strength C20/25 ($f_{ck,cube}$ = 25 N/mm²).
- Loading applicable to both carbon steel and stainless steel.



ANCHOR SIZE		M5	M6	M8	M10	M12	M16
$h_{ef,\ std}$	[mm]	25	30	35	45	45	50
$N^0_{Rd,c}$	[kN]	4.2	5.5	7.0	10.2	10.2	11.9

The design concrete cone resistance is derived from $N^0_{Rd,c} = N^0_{Rk,c} / \gamma_{Mc,N}$ where partial of safety factor of 1.5. The recommended load is derived from $N^0_{Rec,c} = N^0_{Rd,c} / \gamma_F$ where the partial safety factor is 1.4.

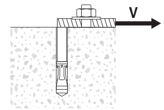
SHEAR LOAD [V_{Rd}]



Design Shear Resistance, V_{Rd}:	lower value of [$V_{Rd,s}$; $V_{Rd,c}$; $V_{Rd,cp}$]
Design Steel Shear Resistance:	$V_{Rd,s}$
Design Concrete Edge Shear Resistance:	$V_{Rd,c} = V^0_{Rd,c} \cdot \Psi_{\beta,V} \cdot \Psi_{\alpha,V} \cdot \Psi_{sc,V}$
Design Concrete Pry-Out Resistance:	$V_{Rd,cp} = V^0_{Rd,cp} \cdot \Psi_{\beta,V} \cdot \Psi_{s,N} \cdot \Psi_{c,N}$

STEEL SHEAR RESISTANCE [$V_{Rd,s}$]

- For static and quasi-static loadings.
- Only a single anchor is considered.
- For non-cracked concrete only.
- Loading applicable to both carbon steel and stainless steel.

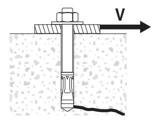


ANCHOR SIZE		M5	M6	M8	M10	M12	M16
$V_{Rd,s}$	[kN]						
~ Carbon Steel: Class 5.8		2.7	4.8	8.8	13.9	20.2	37.7
~ Stainless Steel: A2		-	5.4	9.9	15.6	-	-

The design steel shear resistance is derived from $V_{Rd,s} = V_{Rk,s} / \gamma_{Ms,v}$ where the partial safety factor is 1.25 for carbon steel 5.8 and 1.56 for stainless steel. The recommended load is derived from $V_{Rec,s} = V_{Rd,s} / \gamma_F$ where the partial safety factor is 1.4.

CONCRETE EDGE SHEAR RESISTANCE [$V_{Rd,c}$]

- For non-cracked concrete.
- Only a single anchor is considered.
- No anchor spacing and edge distance influences.
- Single embedded depth is used for loading tabulation.
- Concrete compressive strength C20/25 ($f_{ck,cube}$ = 25 N/mm²).

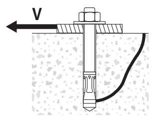


ANCHOR SIZE		M5	M6	M8	M10	M12	M16
$h_{ef,std}$	[mm]	25	30	35	45	45	50
c_{min}	[mm]	25	30	35	45	45	50
$V^0_{Rd,c}$	[kN]	1.4	2.1	3.0	4.7	5.5	7.2

The design concrete edge shear resistance is derived from $V^0_{Rd,c} = V^0_{Rk,c} / \gamma_{Mc,V}$ where the partial safety factor is 1.5. The recommended load is derived from $V^0_{Rec,c} = V^0_{Rd,c} / \gamma_F$ where the partial safety factor is 1.4.

CONCRETE PRY-OUT RESISTANCE [$V_{Rd,cp}$]

- For non-cracked concrete.
- Only a single anchor is considered.
- No anchor spacing and edge distance influences.
- Single embedded depth is used for loading tabulation.
- Concrete compressive strength C20/25 ($f_{ck,cube}$ = 25 N/mm²).



ANCHOR SIZE		M5	M6	M8	M10	M12	M16
$h_{ef,std}$	[mm]	25	30	35	45	45	50
$V^0_{Rd,cp}$	[kN]	1.5	3.0	4.2	6.8	7.4	8.3

The design concrete pry-out resistance is derived from $V^0_{Rd,cp} = V^0_{Rk,cp} / \gamma_{Mp,v}$ where the partial safety factor is 1.5. The recommended load is derived from $V^0_{Rec,cp} = V^0_{Rd,cp} / \gamma_F$ where the partial safety factor is 1.4.

COMBINED TENSION & SHEAR

Combined Tension & Shear: $\frac{N_{Sd}}{N_{Rd}} + \frac{V_{Sd}}{V_{Rd}} \leq 1.2$

The resultant force must be satisfied to the above conditions. The designer must cross check the loading conditions, types of applied loads and substrate to ensure the recommended anchor is applicable to the actual site applications. This would avoid any design faults which commonly caused by inconclusive load requirements with respective to actual site conditions.

INFLUENCING FACTORS - TENSION

INFLUENCE OF ANCHORAGE DEPTH [$\Psi_{h,N}$]

$$\Psi_{h,N} = \left(\frac{h_{act}}{h_{ef,std}}\right)^{1.5}$$

Limits: $0.9 * h_{ef,std} \leq h_{act} \leq 1.2 * h_{ef,std}$

INFLUENCE OF CONCRETE STRENGTH ON PULL-OUT AND CONCRETE CONE RESISTANCE [$\Psi_{\beta,N}$]

$$\Psi_{\beta,N} = \sqrt{\frac{f_{ck,cube}}{25}}$$

Limits: $25\ \text{MPa} \leq f_{ck,cube} \leq 60\ \text{MPa}$

Concrete Strength Designation (ENV 206)		C 20/25	C 25/30	C 30/37	C 35/45	C 40/50	C 50/60
Concrete Cylinder Strength, $f_{ck,cyl}$	[MPa]	20	25	30	35	40	50
Concrete Cube Strength, $f_{ck,cube}$	[MPa]	25	30	37	45	50	60
Concrete Strength Factor, $\psi_{\beta,N}$		1.00	1.10	1.22	1.34	1.41	1.55

INFLUENCE OF ANCHOR SPACING [$\psi_{s,N}$]

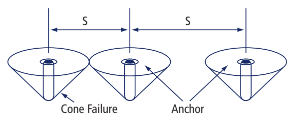
Anchor Spacing 's' [mm]	M5	M6	M8	M10	M12	M16
25	0.67					
30	0.70	0.67				
35	0.73	0.69	0.67			
45	0.80	0.75	0.71	0.67	0.67	
50	0.83	0.78	0.74	0.69	0.69	0.67
75	1.00	0.92	0.86	0.78	0.78	0.75
90		1.00	0.93	0.83	0.83	0.80
105			1.00	0.89	0.89	0.85
135				1.00	1.00	0.95
150						1.00
Critical Spacing 's_{cr}' [mm]	75	90	105	135	135	150
Minimum Spacing 's_{min}' [mm]	25	30	35	45	45	50

$$\Psi_{s,N} = 0.5 + \frac{s}{6 * h_{ef,std}}$$

Limits: $s_{min} \leq s \leq s_{cr}$

$s_{min} = 1.0 * h_{ef,std}$

$s_{cr} = 3.0 * h_{ef,std}$



INFLUENCE OF EDGE DISTANCE [$\psi_{c,N}$]

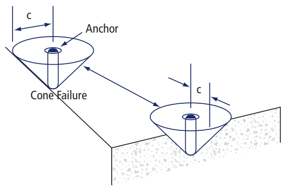
Edge Distance 'c' [mm]	M5	M6	M8	M10	M12	M16
25	0.76					
30	0.85	0.76				
35	0.95	0.84	0.76			
38	1.00	0.89	0.80			
45		1.00	0.89	0.76	0.76	
50			0.96	0.81	0.81	0.76
53			1.00	0.84	0.84	0.79
68				1.00	1.00	0.93
75						1.00
Critical Edge Distance 'c_{cr}' [mm]	38	45	53	68	68	75
Minimum Edge Distance 'c_{min}' [mm]	25	30	35	45	45	50

$$\Psi_{c,N} = 0.29 + 0.47 * \frac{c}{h_{ef,std}}$$

Limits: $c_{min} \leq c \leq c_{cr}$

$c_{min} = 1.0 * h_{ef,std}$

$c_{cr} = 1.5 * h_{ef,std}$



INFLUENCING FACTORS - SHEAR

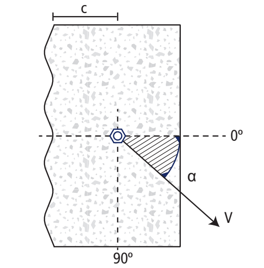
INFLUENCE OF CONCRETE STRENGTH ON CONCRETE EDGE SHEAR AND CONCRETE PRY-OUT RESISTANCE [$\Psi_{\beta,V}$]

$\Psi_{\beta,V} = \sqrt{\frac{f_{ck,cube}}{25}}$ Limits: $25\ \text{MPa} \leq f_{ck,cube} \leq 60\ \text{MPa}$

Concrete Strength Designation (ENV 206)		C 20/25	C 25/30	C 30/37	C 35/45	C 40/50	C 50/60
Concrete Cylinder Strength, $f_{ck,cyl}$	[MPa]	20	25	30	35	40	50
Concrete Cube Strength, $f_{ck,cube}$	[MPa]	25	30	37	45	50	60
Concrete Strength Factor, $\psi_{\beta,V}$		1.00	1.10	1.22	1.34	1.41	1.55

INFLUENCE OF SHEAR LOAD DIRECTION [$\Psi_{\alpha,V}$]

Load Type	Angle, α [°]	$\Psi_{\alpha,V}$
Oblique 0°	$0° < \alpha \leq 15°$	1.00
Oblique 30°	$15° < \alpha \leq 37.5°$	1.14
Oblique 45°	$37.5° < \alpha \leq 52.5°$	1.35
Oblique 60°	$52.5° < \alpha \leq 67.5°$	1.71
Oblique 90°	$67.5° < \alpha \leq 90°$	2.00

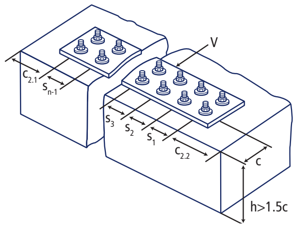


INFLUENCE OF ANCHOR SPACING AND EDGE DISTANCE ON CONCRETE EDGE SHEAR RESISTANCE [$\Psi_{sc,V}$]

$\Psi_{sc,V} = \frac{c}{c_{min}} * \sqrt{\frac{c}{c_{min}}}$ for single anchor towards a concrete edge

$\Psi_{sc,V} = \frac{3c + s}{6c_{min}} * \sqrt{\frac{c}{c_{min}}}$ for two anchors when $s \leq 3c$

$\Psi_{sc,V} = \frac{3c + s_1 + s_2 + s_{n-1}}{3nc_{min}} * \sqrt{\frac{c}{c_{min}}}$ for multiple anchors when s_1 to $s_{n-1} \leq 3c$ and $c_2 \geq 1.5c$



$\Psi_{sc,V}$		c / c_{min}															
		1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0
Edge influence with single anchor		1.00	1.31	1.66	2.02	2.41	2.83	3.26	3.72	4.19	4.69	5.20	5.72	6.27	6.83	7.41	8.00
s / c_{min}	1.0	0.67	0.84	1.03	1.22	1.43	1.65	1.88	2.12	2.36	2.62	2.89	3.16	3.44	3.73	4.03	4.33
	1.5	0.75	0.93	1.12	1.33	1.54	1.77	2.00	2.25	2.50	2.76	3.03	3.31	3.60	3.89	4.19	4.50
	2.0	0.83	1.02	1.22	1.43	1.65	1.89	2.13	2.38	2.63	2.90	3.18	3.46	3.75	4.05	4.35	4.67
	2.5	0.92	1.11	1.32	1.54	1.77	2.00	2.25	2.50	2.77	3.04	3.32	3.61	3.90	4.21	4.52	4.83
	3.0	1.00	1.20	1.42	1.64	1.88	2.12	2.37	2.63	2.90	3.18	3.46	3.76	4.06	4.36	4.68	5.00
	3.5		1.30	1.52	1.75	1.99	2.24	2.50	2.76	3.04	3.32	3.61	3.91	4.21	4.52	4.84	5.17
	4.0			1.62	1.86	2.10	2.36	2.62	2.89	3.17	3.46	3.75	4.05	4.36	4.68	5.00	5.33
	4.5				1.96	2.21	2.47	2.74	3.02	3.31	3.60	3.90	4.20	4.52	4.84	5.17	5.50
	5.0					2.33	2.59	2.87	3.15	3.44	3.74	4.04	4.35	4.67	5.00	5.33	5.67
	5.5						2.71	2.99	3.28	3.57	3.88	4.19	4.50	4.82	5.15	5.49	5.83
	6.0						2.83	3.11	3.41	3.71	4.02	4.33	4.65	4.98	5.31	5.65	6.00
	6.5							3.24	3.53	3.84	4.16	4.47	4.80	5.13	5.47	5.82	6.17
	7.0								3.67	3.98	4.29	4.62	4.95	5.29	5.63	5.98	6.33
	7.5									4.11	4.43	4.76	5.10	5.44	5.79	6.14	6.50
	8.0										4.57	4.91	5.25	5.59	5.95	6.30	6.67
	8.5											5.05	5.40	5.75	6.10	6.47	6.83
	9.0											5.20	5.55	5.90	6.26	6.63	7.00
	9.5												5.69	6.05	6.42	6.79	7.17
	10.0													6.21	6.58	6.95	7.33
	10.5														6.74	7.12	7.50
	11.0															7.28	7.67
	11.5																7.83
	12.0																8.00