Deutsches Institut für Bautechnik

Public-law institution jointly founded by the federal states and the Federation

European Technical Assessment Body for construction products

Member of EOTA
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Designated according to Article 29 of Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

European Technical Assessment ETA-24/0778 of 4 February 2025

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	Injection system Selkent SEL-V+
Product family to which the construction product belongs	Bonded fasteners and bonded expansion fasteners for use in concrete
Manufacturer	Selkent Fastenings Ltd Riverside House Kangley Bridge Road SE26 5 DA LONDON GROSSBRITANNIEN
Manufacturing plant	Werk Selkent
This European Technical Assessment contains	37 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330499-02-0601, Edition 12/2023

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Specific Part

1 Technical description of the product

The "Injection system Selknet SEL-V+" is a bonded anchor consisting of a cartridge with injection mortar according to Annex A4 and a steel element according to Annex A5.

The steel element is placed into a drilled hole filled with injection mortar and is anchored via the bond between metal part, injection mortar and concrete.

The product description is given in Annex A.

2 Specification of the intended use in accordance with the applicable European Assessment Document

The performances given in Section 3 are only valid if the anchor is used in compliance with the specifications and conditions given in Annex B.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the anchor of at least 50 and/or 100 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and references to the methods used for its assessment

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance to tension load (static and quasi-static loading)	See Annex B3 to B8, C1 to C9
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C1 to C4
Displacements under short-term and long-term loading	See Annex C10 to C11
Characteristic resistance and displacements for seismic performance categories C1 and C2	See Annex C12 to C15

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	No performance assessed

3.3 Hygiene, health and the environment (BWR 3)

Essential characteristic	Performance
Content, emission and/or release of dangerous substances	No performance assessed

4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

In accordance with the European Assessment Document EAD 330499-02-0601 the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at Deutsches Institut für Bautechnik.

Issued in Berlin 4 February 2025 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Head of Section

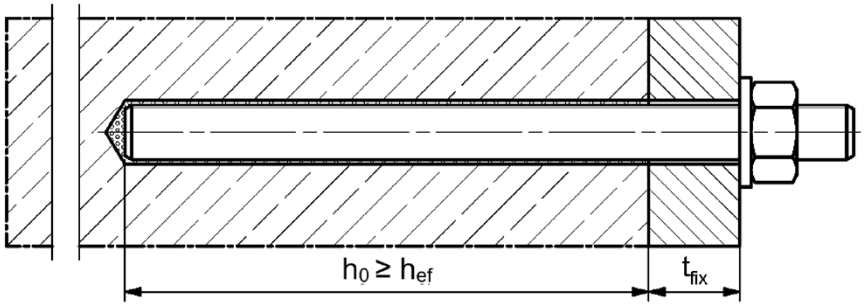
beglaubigt:
Baderschneider

Deutsches Institut für Bautechnik DIBt

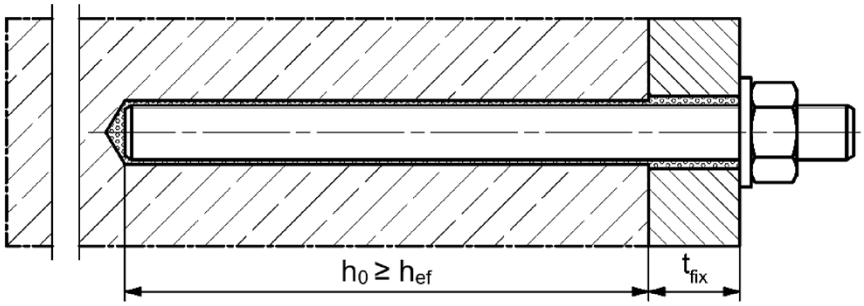
Installation conditions part 1

Selkent Anchor rod or standard Threaded rod (Threaded rod)

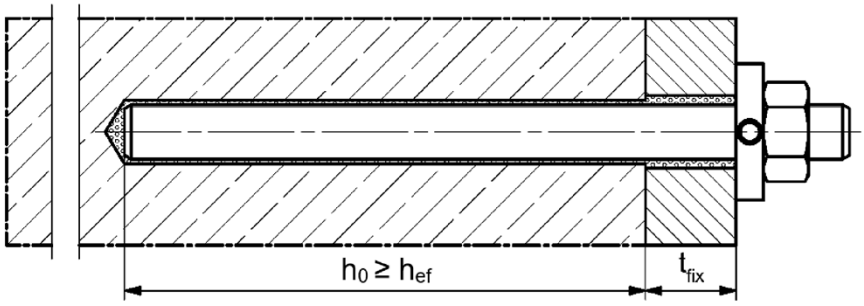
Pre-positioned installation



Push through installation (annular gap filled with mortar)



Pre-positioned or push through installation with subsequently injected Selkent filling disc
(annular gap filled with mortar)



Figures not to scale

h_0 = drill hole depth

h_{ef} = effective embedment depth

t_{fix} = thickness of fixture

Injection system Selkent SEL-V+

Product description
Installation conditions part 1

Annex A1

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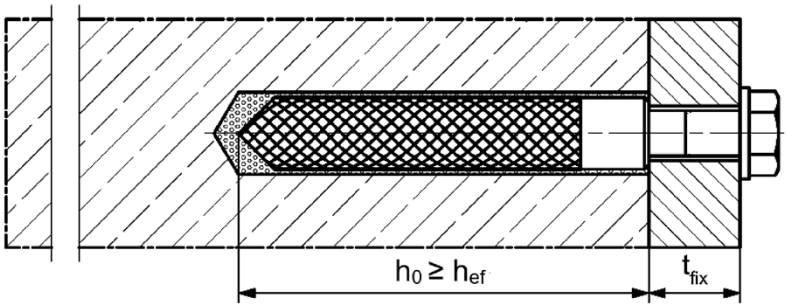
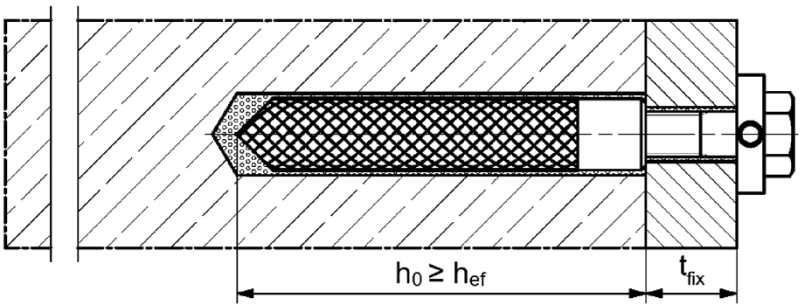
Installation conditions part 2

Selkent internal threaded anchor RG M I (Selkent RG M I)

Pre-positioned installation



Pre-positioned installation with subsequently injected Selkent filling disc (annular gap filled with mortar)



Figures not to scale

h_0 = drill hole depth
h_{ef} = effective embedment depth
t_{fix} = thickness of fixture

Injection system Selkent SEL-V+

Product description
Installation conditions part 2

Annex A2

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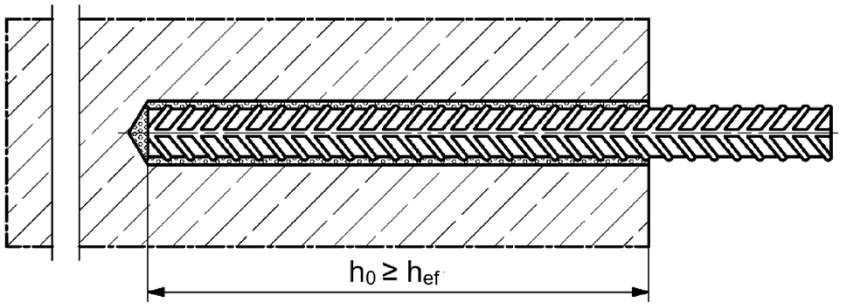
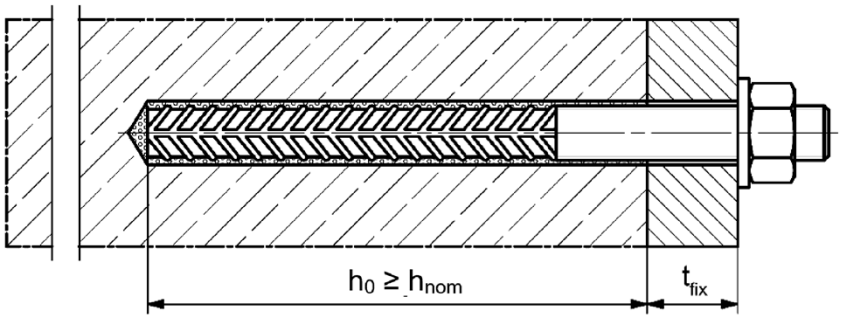
Installation conditions part 3

Reinforcing bar

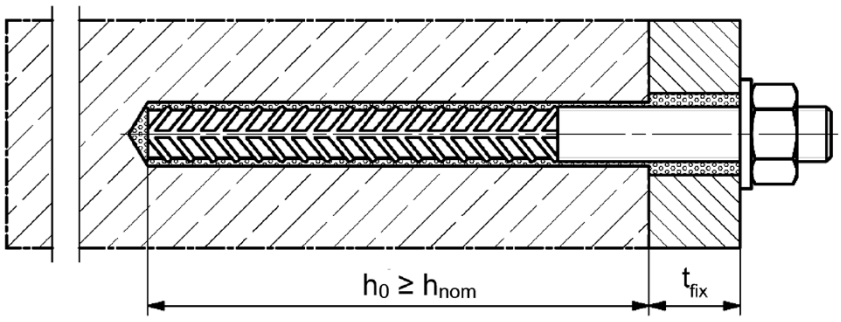


Selkent rebar anchor FRA

Pre-positioned installation



Push through installation (annular gap filled with mortar)



Figures not to scale

h_0 = drill hole depth
h_{ef} = effective embedment depth
t_{fix} = thickness of fixture

Injection system Selkent SEL-V+

Product description
Installation conditions part 3

Annex A3

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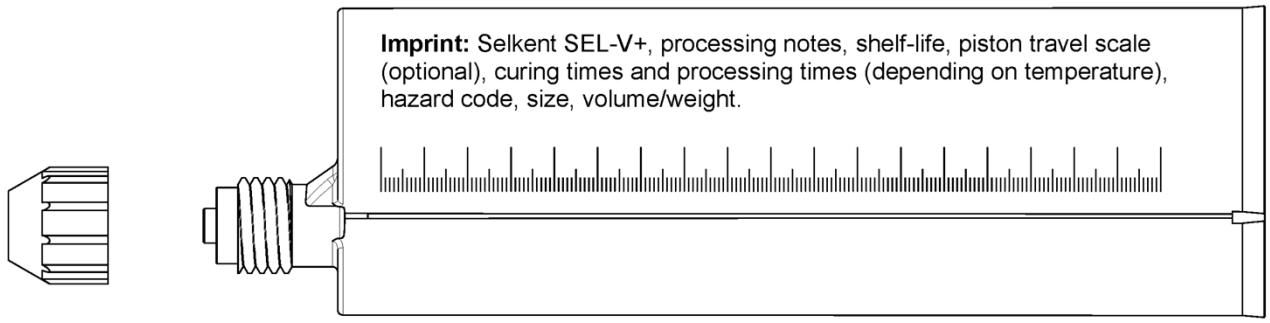
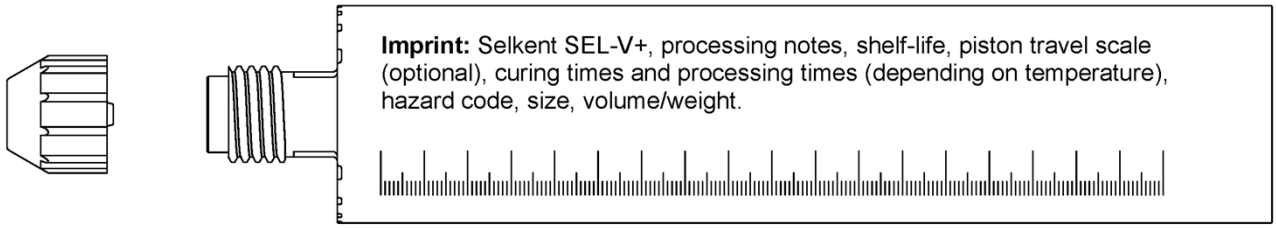
Overview system components part 1

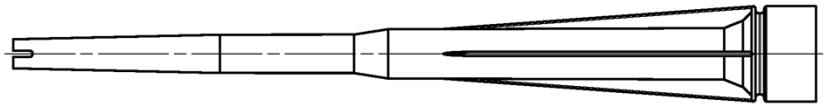
Injection cartridge (shuttle cartridge) with sealing cap; Sizes: 360 ml, 825 ml



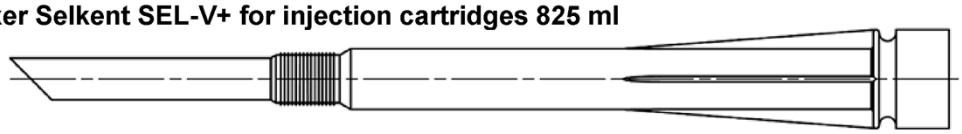
Injection cartridge (coaxial cartridge) with sealing cap; Sizes: 100 ml, 150 ml, 300 ml, 380 ml, 400 ml, 410 ml



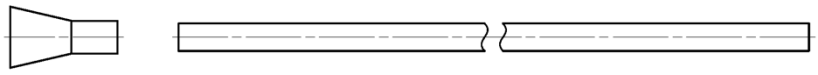
Static mixer Selkent SEL-V+ for injection cartridges up to 410 ml



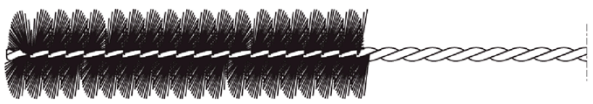
static mixer Selkent SEL-V+ for injection cartridges 825 ml



Injection adapter and extension tube Ø 9 for static mixer Selkent SEL-V+ for injection cartridges up to 410ml
Injection adapter and extension tube Ø 9 or Ø 15 for static mixer Selkent SEL-V+ for injection cartridges 825 ml



Selkent Cleaning brush



Selkent Blow-out pump

Figures not to scale

Injection system Selkent SEL-V+	**Annex A4**
Product description Overview system components part 1; cartridges / static mixer / accessories	

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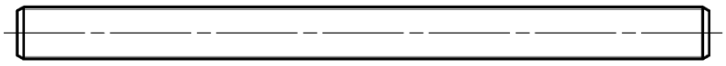
Overview system components part 2

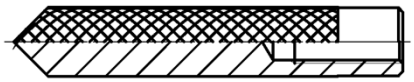
Selkent Anchor rod / Threaded rod

Size: M6, M8, M10, M12, M16, M20, M24, M27, M30

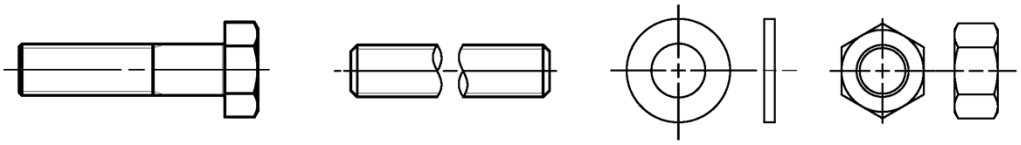


Selkent RG M I

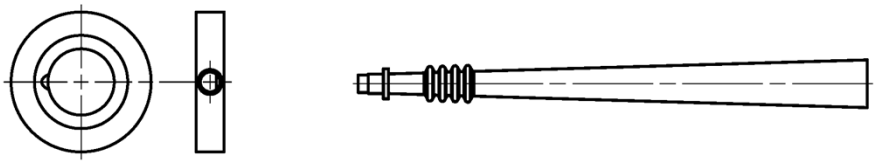
Size: M8, M10, M12, M16, M20



Screw / Threaded rod / washer / hexagon nut



Selkent filling disc with injection adapter



Reinforcing bar

Nominal diameter: ϕ8, ϕ10, ϕ12, ϕ14, ϕ16, ϕ20, ϕ25, ϕ28

Selkent rebar anchor FRA

Size: M12, M16, M20, M24

Figures not to scale

Injection system Selkent SEL-V+	**Annex A5**
Product description Overview system components part 2; metal parts, injection adapter	

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Table A6.1: Materials

Part	Designation	Material		
1	Injection cartridge	Mortar, hardener, filler		
	Steel grade	Steel	Stainless steel R	High corrosion resistant steel HCR
		zinc plated	acc. to EN 10088-1:2023 Corrosion resistance class CRC III acc. to EN 1993-1-4: 2006+A1:2015	acc. to EN 10088-1:2023 Corrosion resistance class CRC V acc. to EN 1993-1-4:2006+A1:2015
2	Selkent Anchor rod / Threaded rod	Property class 4.8, 5.8 or 8.8; EN ISO 898-1:2013 zinc plated ≥ 5 µm, ISO 4042:2022 or hot dip galvanised ≥ 40 µm EN ISO 10684:2004+AC:2009 f_{uk} ≤ 1000 N/mm² A_5 > 12% fracture elongation[1)]	Property class 50, 70 or 80 EN ISO 3506-1:2020 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; 1.4062, 1.4662, 1.4462; EN 10088-1:2023 f_{uk} ≤ 1000 N/mm² A_5 > 12% fracture elongation[1)]	Property class 50, 70 or 80; EN ISO 3506-1:2020 or property class HCR 70 with f_{yk}= 560 N/mm² 1.4565; 1.4529; EN 10088-1:2023 f_{uk} ≤ 1000 N/mm² A_5 > 12% fracture elongation[1)]
3	Washer ISO 7089:2000	zinc plated ≥ 5 µm, ISO 4042:2022 or hot dip galvanised ≥ 40 µm EN ISO 10684:2004+AC:2009	1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2023	1.4565; 1.4529; EN 10088-1:2023
4	Hexagon nut	Property class 5 or 8; EN ISO 898-2:2012 zinc plated ≥ 5 µm, ISO 4042:2022 or hot dip galvanised ≥ 40 µm EN ISO 10684:2004+AC:2009	Property class 50, 70 or 80 EN ISO 3506-2:2020 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2023	Property class 50, 70 or 80 acc. EN ISO 3506-2:2020 1.4565; 1.4529; EN 10088-1:2023
5	Selkent RG M I	Property class 5.8 ISO 898-1:2013 zinc plated ≥ 5 µm, ISO 4042:2022	Property class 70 EN ISO 3506-1:2020 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2023	Property class 70 EN ISO 3506-1:2020 1.4565; 1.4529; EN 10088-1:2023
6	Commercial standard screw or threaded rod for Selkent RG M I	Property class 5.8 or 8.8; EN ISO 898-1:2013 zinc plated ≥ 5 µm, ISO 4042:2022 A_5 > 8 % fracture elongation	Property class 70 EN ISO 3506-1:2020 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2023 A_5 > 8 % fracture elongation	Property class 70 EN ISO 3506-1:2020 1.4565; 1.4529; EN 10088-1:2023 A_5 > 8 % fracture elongation
7	Selkent filling disc similar to DIN 6319-G	zinc plated ≥ 5 µm, ISO 4042:2022 or hot dip galvanised ≥ 40 µm EN ISO 10684:2004+AC:2009	1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2023	1.4565;1.4529; EN 10088-1:2023
8	Reinforcing bar	EN 1992-1-1:2004 and AC:2010, Annex C Bars and de-coiled rods, class B or C with f_{yk} and k according to NDP or NCI of according to EN 1992-1-1:2004/NA $f_{uk} = f_{tk} = k \cdot f_{yk}$ (A_5 > 12 %)[1)]		
9	Selkent rebar anchor FRA	Rebar part: Bars and de-coiled rods class B or C with f_{yk} and k according to NDP or NCI of EN 1992-1-1:2004+AC:2010 $f_{uk} = f_{tk} = k \cdot f_{yk}$ (A_5 > 8 %) Threaded part: Property class 80 EN ISO 3506-1:2020	1.4401, 1.4404, 1.4571, 1.4578, 1.4439, 1.4362, 1.4062 acc. to EN 10088-1:2023 Corrosion resistance class CRC III acc. to EN 1993-1-4: 2006+A1:2015 1.4565; 1.4529 acc. to EN 10088-1:2023 Corrosion resistance class CRC V acc. to EN 1993-1-4: 2006+A1:2015 f_{uk} ≤ 1000 N/mm²; fracture elongation A_5 > 8%	

[1)] Fracture elongation A_5 > 8%, for applications without requirements for seismic performance category C2

Injection system Selkent SEL-V+

Product description
Materials

Annex A6

Deutsches Institut für Bautechnik DIBt

Specifications of intended use part 1

Table B1.1: Overview use and performance categories

			Selkent SEL-V+ with …							
			Anchor rod / Threaded rod		Selkent RG M I 		Reinforcing bar 		Selkent rebar anchor FRA 	
Hammer drilling with standard drill bit			all sizes							
Hammer drilling with hollow drill bit  (fischer „FHD“, Heller „Duster Expert“; Bosch „Speed Clean“; Hilti „TE-CD, TE-YD“, DreBo „D-Plus“, DreBo „D-Max“			Nominal drill bit diameter (d_0) 12 mm to 35 mm							
Static and quasi static load, in		uncracked concrete	all sizes	Tables: C1.1 C4.1 C5.1 C6.1 C10.1	all sizes	Tables: C2.1 C4.1 C7.1 C10.2	all sizes	Tables: C3.1 C4.1 C8.1 C11.1	all sizes	Tables: C3.2 C4.1 C9.1 C11.2
		cracked concrete	M8 to M30		-[1]		ϕ 10 to ϕ 28			
Seismic performance category		C1	M10 to M30	Tables: C12.1 C13.1 C14.1	-[1]		-[1]		-[1]	
		C2	M12 M16 M20	Tables: C12.1 C13.1 C15.1						
Use category	I1	dry or wet concrete	all sizes							
	I2	water filled hole	M12 to M30		all sizes		-[1]		-[1]	
Installation direction			D3 (downward and horizontal and upwards (e.g. overhead) installation)							
Installation temperature			$T_{i,min}$ = -5 °C to $T_{i,max}$ = +40 °C							
In-service temperature		Temperature range I	-40 °C to +80 °C		(max. short term temperature +80 °C; max. long term temperature +50 °C)					
		Temperature range II	-40 °C to +120 °C		(max. short term temperature +120 °C; max. long term temperature +72 °C)					

[1] No performance assessed

Injection system Selkent SEL-V+

Intended use
Specifications part 1

Annex B1

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Specifications of intended use part 2

Base materials:

- Compacted reinforced or unreinforced normal weight concrete without fibres of strength classes C20/25 to C50/60 according to EN 206:2013+A2:2021.

Use conditions (Environmental conditions):

- Fastener intended for use in structures subject to dry, internal conditions (all materials).
- For all other conditions according to EN 1993-1-4: 2006+A1:2015 corresponding to corrosion resistance classes to Annex A6 Table A6.1.

Design:

- The structural design is conducted under responsibility of a designer experienced in the field of anchorages and concrete works.
- Verifiable calculation notes and drawings are to be prepared taking account of the loads to be anchored. The position of the fastener is indicated on the design drawings (e. g. position of the anchor relative to reinforcement or to supports, etc.).
- Fastenings are designed in accordance with:
  EN 1992-4:2018 and EOTA TR 082 from June 2023.

Installation:

- Fastener installation is to be carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- Fastening depth should be marked and adhered to on installation.
- Overhead installation is allowed (necessary equipment see installation instruction).

Injection system Selkent SEL-V+	**Annex B2**
Intended use Specifications part 2	

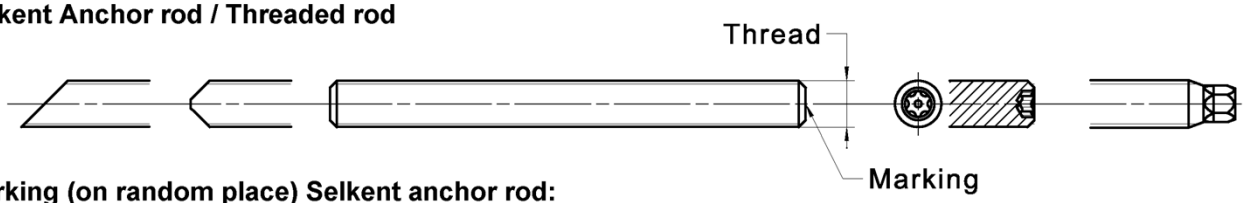
Deutsches Institut für Bautechnik DIBt

Table B3.1: Installation parameters for **Selkent Anchor rods / Threaded rods**[1)]

Selkent Anchor rods / Threaded rods			**Thread**	**M6**	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Nominal drill hole diameter		d_0		8	10	12	14	18	24	28	30	35
Drill hole depth		h_0		$h_0 \geq h_{ef}$								
Effective embedment depth		$h_{ef,\,min}$		50	60	60	70	80	90	96	108	120
		$h_{ef,\,max}$		72	160	200	240	320	400	480	540	600
Minimum spacing and minimum edge distance		s_{min} = c_{min}	[mm]	40	40	45	55	65	85	105	125	140
Diameter of the clearance hole of the fixture	pre-positioned installation	d_f		7	9	12	14	18	22	26	30	33
	push through installation	d_f		9	12	14	16	20	26	30	33	40
Minimum thickness of concrete member		h_{min}		h_{ef} + 30 (≥100)				h_{ef} + 2d_0				
Maximum installation torque		max T_{inst}	[Nm]	5	10	20	40	60	120	150	200	300

[1)] minimum spacing and minimum edge distance see Annex B4.

Selkent Anchor rod / Threaded rod



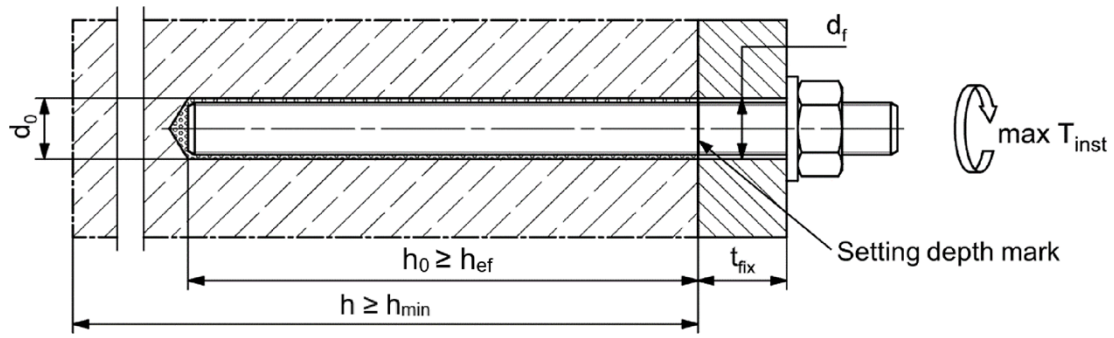
Marking (on random place) Selkent anchor rod:

Steel zinc plated PC[1)] 8.8	• or +	Steel hot-dip PC[1)] 8.8	•
High corrosion resistant steel HCR PC[1)] 50	•	High corrosion resistant steel HCR PC[1)] 70	-
High corrosion resistant steel HCR PC[1)] 80	(	Stainless steel R property class 50	~
Stainless steel R property class 80	*		

Alternatively: Colour coding according to DIN 976-1: 2016

[1)] PC = property class

Installation conditions:



Commercial Threaded rods, washers and hexagon nuts may also be used if the following requirements are fulfilled:

- Materials, dimensions and mechanical properties according to Annex A6, Table A6.1.
- Inspection certificate 3.1 according to EN 10204:2004, the documents have to be stored.
- Setting depth is marked.

Figures not to scale

Injection system Selkent SEL-V+

Intended use
Installation parameters Selkent Anchor rods / Threaded rods

Annex B3

Deutsches Institut für Bautechnik DIBt

Table B4.1: Minimum spacing and minimum edge distance for **Selkent Anchor rods**, **Threaded rods, reinforcing bars** and **Selkent rebar anchor FRA**

Selkent Anchor rods / Threaded rods			**M6**	**M8**	**M10**	**M12**	**-**	**M16**
Reinforcing bars / FRA (nominal diameter)		**ϕ**	**-**	**8**	**10**	**12**	**14**	**16**
Minimum edge distance								
Uncracked / cracked concrete	c_{min}	[mm]	40	40	45	45	45	50
Minimum spacing	s_{min}		according to Annex B5					
Minimum spacing								
Uncracked / cracked concrete	s_{min}	[mm]	40	40	45	55	60	65
Minimum edge distance	c_{min}		according to Annex B5					
Required projecting area								
Uncracked concrete	$A_{sp,req}$	[1000 mm²]	8,0	8,0	13,0	22,0	23,0	24,0
Cracked concrete			6,5	6,5	10	16,5	17,5	18,5

Selkent Anchor rods / Threaded rods			**M20**	**M24**	**-**	**M27**	**-**	**M30**
Reinforcing bars / FRA (nominal diameter)		**ϕ**	**20**	**-**	**25**	**-**	**28**	**-**
Minimum edge distance								
Uncracked / cracked concrete	c_{min}	[mm]	55	60	75	75	80	80
Minimum spacing	s_{min}		according to Annex B5					
Minimum spacing								
Uncracked / cracked concrete	s_{min}	[mm]	85	105	120	120	140	140
Minimum edge distance	c_{min}		according to Annex B5					
Required projecting area								
Uncracked concrete	$A_{sp,req}$	[1000 mm²]	38,5	40,0	47,5	47,5	64,0	64,0
Cracked concrete			29,5	30,5	36,5	36,5	49,0	49,0

Splitting failure for minimum edge distance and spacing in dependence of the effective embedment depth h_{ef}.

For the calculation of minimum spacing and minimum edge distance of anchors in combination with different embedment depths and thicknesses of concrete members the following equation shall be fulfilled:

$$\mathbf{A_{sp,req} < A_{sp,t}}$$

$A_{sp,req}$ = required projecting area.
$A_{sp,t}$ = projecting area (according to Annex B5).

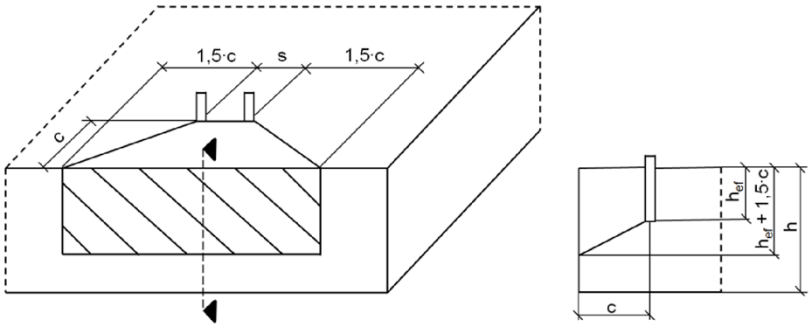
Injection system Selkent SEL-V+

Intended use
Minimum spacing and edge distance for Selkent Anchor rods, Threaded rods, reinforcing bars and Selkent rebar anchor FRA

Annex B4

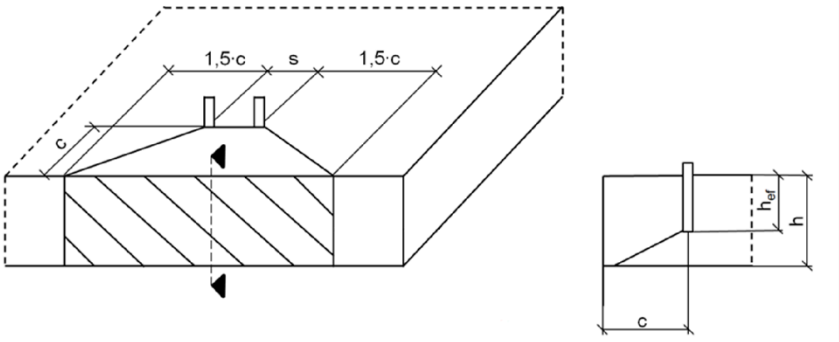
Deutsches Institut für Bautechnik DIBt

Table B5.1: Projecting area $A_{sp,t}$ with concrete member thickness $h > h_{ef} + 1{,}5 \cdot c$ and $h \geq h_{min}$



Single fastener	$A_{sp,t} = (3 \cdot c) \cdot (h_{ef} + 1{,}5 \cdot c)$	[mm²]	with $c \geq c_{min}$
Group of fastener with $s > 3 \cdot c$	$A_{sp,t} = (6 \cdot c) \cdot (h_{ef} + 1{,}5 \cdot c)$	[mm²]	
Group of fastener with $s \leq 3 \cdot c$	$A_{sp,t} = (3 \cdot c + s) \cdot (h_{ef} + 1{,}5 \cdot c)$	[mm²]	with $c \geq c_{min}$ and $s \geq s_{min}$

Table B5.2: Projecting area $A_{sp,t}$ with concrete member thickness $h \leq h_{ef} + 1{,}5 \cdot c$ and $h \geq h_{min}$



Single fastener	$A_{sp,t} = 3 \cdot c \cdot$ existing h	[mm²]	with $c \geq c_{min}$
Group of fastener with $s > 3 \cdot c$	$A_{sp,t} = 6 \cdot c \cdot$ existing h	[mm²]	
Group of fastener with $s \leq 3 \cdot c$	$A_{sp,t} = (3 \cdot c + s) \cdot$ existing h	[mm²]	with $c \geq c_{min}$ and $s \geq s_{min}$

Edge distance and axial spacing shall be rounded up to at least 5 mm.

Figures not to scale

Injection system Selkent SEL-V+

Intended use
Minimum thickness of concrete member for Selkent Anchor rods and reinforcing bars, minimum spacing and edge distance

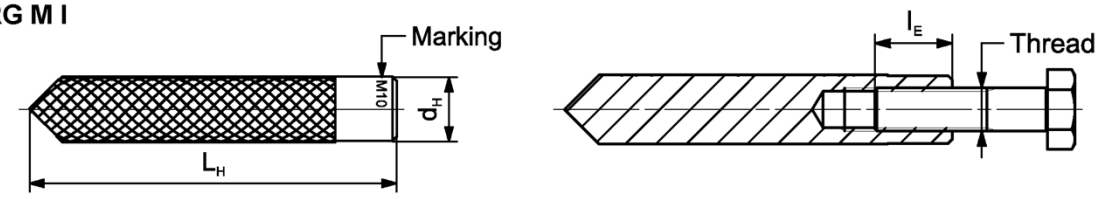
Annex B5

Deutsches Institut für Bautechnik DIBt

Table B6.1: Installation parameters for **Selkent RG M I**

Selkent RG M I		**Thread**	**M8**	**M10**	**M12**	**M16**	**M20**
Diameter of anchor	$d_{nom} = d_H$		12	16	18	22	28
Nominal drill hole diameter	d_0		14	18	20	24	32
Drill hole depth	h_0		$h_0 \geq h_{ef} = L_H$				
Effective embedment depth ($h_{ef} = L_H$)	h_{ef}		90	90	125	160	200
Minimum spacing and minimum edge distance	s_{min} = c_{min}	[mm]	55	65	75	95	125
Diameter of clearance hole in the fixture	d_f		9	12	14	18	22
Minimum thickness of concrete member	h_{min}		120	125	165	205	260
Maximum screw-in depth	$l_{E,max}$		18	23	26	35	45
Minimum screw-in depth	$l_{E,min}$		8	10	12	16	20
Maximum installation torque	max T_{inst}	[Nm]	10	20	40	80	120

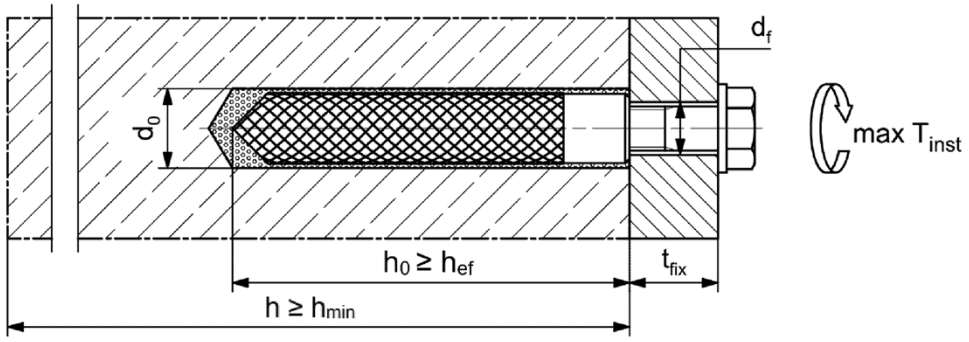
Selkent RG M I



Marking: Anchor size e. g.: **M10**
Stainless steel → additional **R**; e.g.: **M10 R**
High corrosion resistant steel → additional **HCR**; e.g.: **M10 HCR**

Retaining bolt or Selkent Anchor rods / Threaded rods (including nut and washer) must comply with the appropriate material and strength class of Annex A6, Table A6.1.

Installation conditions:



Figures not to scale

Injection system Selkent SEL-V+

Intended use
Installation parameters Selkent RG M I

Annex B6

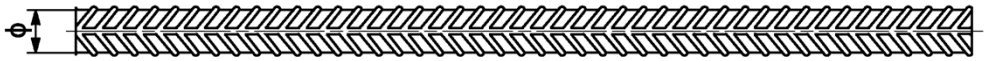
Deutsches Institut für Bautechnik DIBt

Table B7.1: Installation parameters for **reinforcing bars** [1)]

Nominal diameter of the bar		**ϕ**	**8**[2)]		**10**[2)]		**12**[2)]		**14**	**16**	**20**	**25**	**28**
Nominal drill hole diameter	d_0	[mm]	10	12	12	14	14	16	18	20	25	30	35
Drill hole depth	h_0		$h_0 \geq h_{ef}$										
Effective embedment depth	$h_{ef,min}$		60		60		70		75	80	90	100	112
	$h_{ef,max}$		160		200		240		280	320	400	500	560
Minimum spacing and minimum edge distance	s_{min} = c_{min}		40		45		55		60	65	85	110	130
Minimum thickness of concrete member	h_{min}		h_{ef} + 30 (≥ 100)						h_{ef} + $2d_0$				

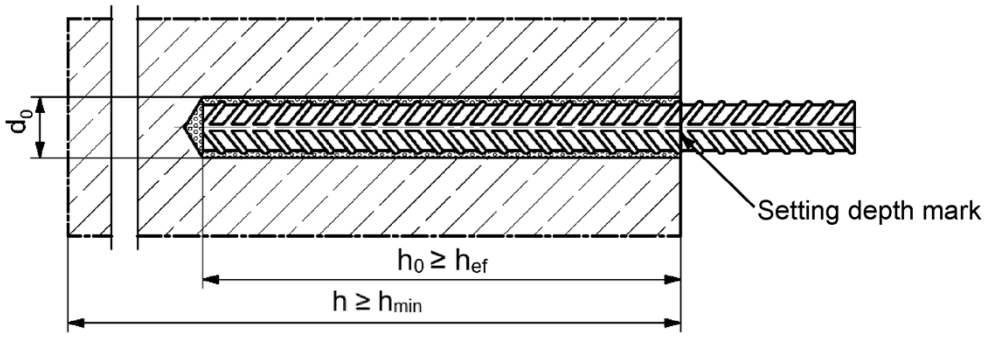
[1)] Minimum spacing and minimum edge distance see Annex B4.
[2)] Both drill hole diameters can be used.

Reinforcing bar



- The minimum value of related rib area $f_{R,min}$ must fulfill the requirements of EN 1992-1-1:2004+AC:2010.
- The rib height must be within the range: $0{,}05 \cdot \phi \leq h_{rib} \leq 0{,}07 \cdot \phi$
  (ϕ = Nominal diameter of the bar, h_{rib} = rib height).

Installation conditions:



Figures not to scale

Injection system Selkent SEL-V+

Intended use
Installation parameters reinforcing bars

Annex B7

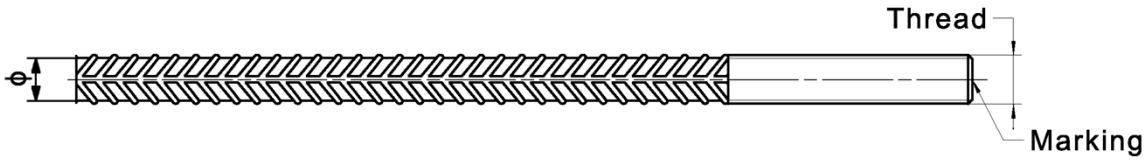
Deutsches Institut für Bautechnik DIBt

Table B8.1: Installation parameters for **Selkent rebar anchor FRA** [1)]

Selkent rebar anchor FRA			**Thread**	**M12**[2)]		**M16**	**M20**	**M24**
Nominal diameter of the bar		ϕ		12		16	20	25
Nominal drill hole diameter		d_0		14	16	20	25	30
Drill hole depth		h_0		$h_{ef} + l_e$				
Effective embedment depth		$h_{ef,min}$		70		80	90	96
		$h_{ef,max}$		140		220	300	380
Distance concrete surface to welded joint		l_e		100				
Minimum spacing and minimum edge distance		s_{min} = c_{min}	[mm]	55		65	85	105
Diameter of clearance hole in the fixture	pre-positioned anchorage	$\leq d_f$		14		18	22	26
	push through anchorage	$\leq d_f$		18		22	26	32
Minimum thickness of concrete member		h_{min}		$h_0 + 30$		$h_0 + 2d_0$		
Maximum installation torque		max T_{inst}	[Nm]	40		60	120	150

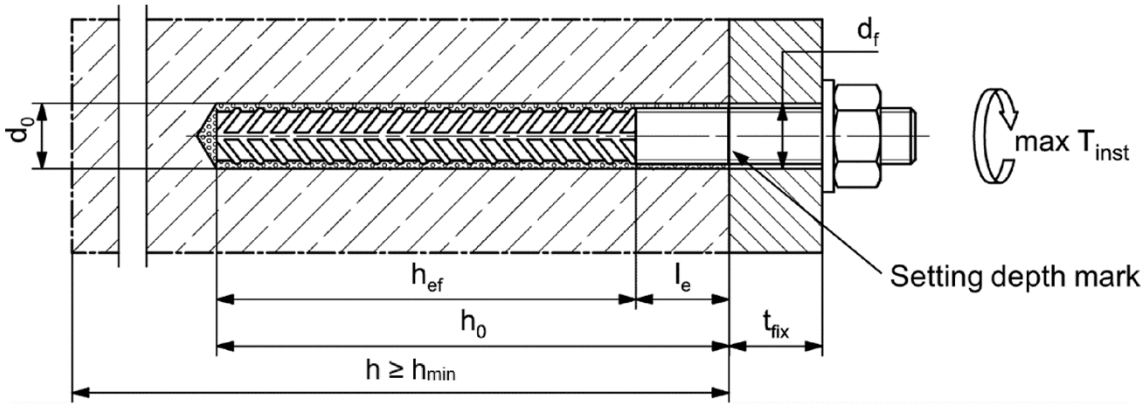
[1)] minimum spacing and minimum edge distance see Annex B5.
[2)] Both drill hole diameters can be used.

Selkent rebar anchor FRA



Marking frontal e.g: FRA (for stainless steel);
FRA HCR (for high corrosion resistant steel).

Installation conditions:



Figures not to scale

Injection system Selkent SEL-V+

Intended use
Installation parameters Selkent rebar anchor FRA

Annex B8

Deutsches Institut für Bautechnik DIBt

Table B9.1: Parameters of the **Selkent cleaning brush** BS (steel brush with steel bristles)

The size of the cleaning brush refers to the drill hole diameter.

Nominal drill hole diameter	d_0	[mm]	8	10	12	14	16	18	20	24	25	28	30	35
Steel brush diameter	d_b		9	11	14	16	20		25	26	27	30	40	

Table B9.2 **Maximum processing** time of the mortar and **minimum curing** time (During the curing time of the mortar the concrete temperature may not fall below the listed minimum temperature)

Temperature at anchoring base [°C]	Maximum processing time t_{work}	Minimum curing time [1] t_{cure}
	Selkent SEL-V+	Selkent SEL-V+
> -5 to 0 [2]	> 13 min	24 h
> 0 to 5 [2]	13 min	3 h
> 5 to 10	9 min	90 min
> 10 to 20	5 min	60 min
> 20 to 30	4 min	45 min
> 30 to 40	2 min	35 min

[1] In wet concrete or water filled holes the curing times must be doubled.
[2] Minimal cartridge temperature +5°C.

Injection system Selkent SEL-V+

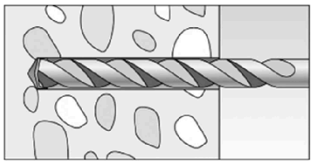
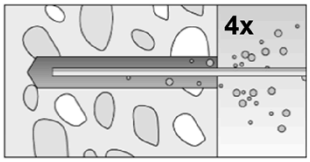
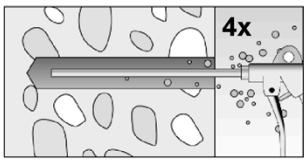
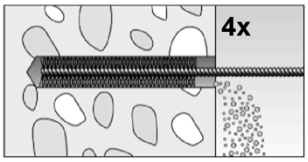
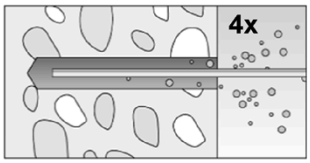
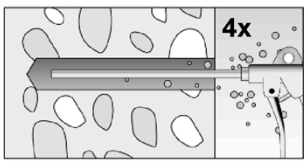
Intended use
Selkent cleaning brush (steel brush)
Processing time and curing time

Annex B9

Deutsches Institut für Bautechnik DIBt

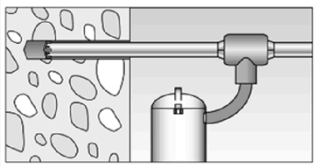
Installation instructions part 1

Drilling and cleaning the hole (hammer drilling with standard drill bit)

1		Drill the hole. Nominal drill hole diameter $\mathbf{d_0}$ and drill hole depth $\mathbf{h_0}$ see **Tables B3.1, B6.1, B7.1, B8.1.**		
2		Clean the drill hole: For $h_{ef} \leq 12d$ and $d_0 < 18$ mm blow out the hole four times by hand.		For $h_{ef} > 12d$ and / or $d_0 \geq 18$ mm blow out the hole four times with oil-free compressed air ($p \geq 6$ bar).
3		Brush the drill hole four times. For drill hole diameter ≥ 30 mm use a power drill. For deep holes use an extension. Corresponding brushes see **Table B9.1.**		
4		Clean the drill hole: For $h_{ef} \leq 12d$ and $d_0 < 18$ mm blow out the hole four times by hand.		For $h_{ef} > 12d$ and / or $d_0 \geq 18$ mm blow out the hole four times with oil-free compressed air ($p \geq 6$ bar).

Go to step 5.

Drilling and cleaning the hole (hammer drilling with hollow drill bit)

1		Check a suitable hollow drill (see **Table B1.1**) for correct operation of the dust extraction.
2		Use a suitable dust extraction system, e.g. fischer FVC 35 M or a comparable dust extraction system with equivalent performance data. Drill the hole with hollow drill bit. The dust extraction system has to extract the drill dust nonstop during the drilling process and must be adjusted to maximum power. Nominal drill hole diameter $\mathbf{d_0}$ and drill hole depth $\mathbf{h_0}$ see **Tables B3.1, B6.1, B7.1, B8.1.**

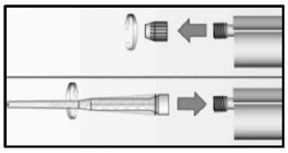
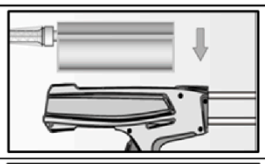
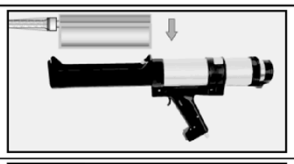
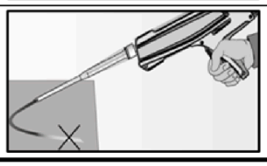
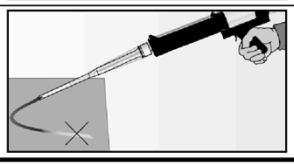
Go to step 5.

Injection system Selkent SEL-V+	**Annex B10**
Intended use Installation instructions part 1	

Deutsches Institut für Bautechnik DIBt

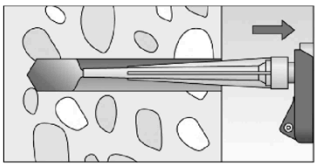
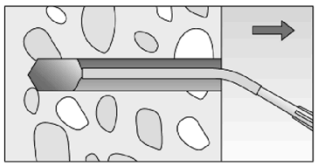
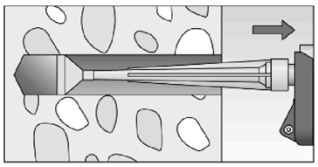
Installation instructions part 2

Preparing the cartridge

5		Remove the sealing cap. Screw on the static mixer (the spiral in the static mixer must be clearly visible).
6	 	Place the cartridge into the dispenser.
7	 	Extrude approximately 10 cm of material out until the resin is evenly grey in colour. Do not use mortar that is not uniformly grey.

Go to step 8.

Injection of the mortar

8	 For $h_0 = h_{ef}$ fill approximately 2/3 of the drill hole with mortar. For $h_0 > h_{ef}$ more mortar is needed. Always begin from the bottom of the hole and avoid bubbles.	 For drill hole depth ≥ 150 mm use an extension tube.	 For overhead installation, deep holes (h_0 > 250 mm) or drill hole diameter (d_0 ≥ 40 mm) use an injection adapter.

Go to step 9.

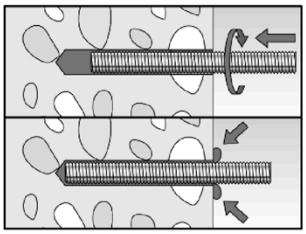
Injection system Selkent SEL-V+	**Annex B11**
Intended use Installation instructions part 2	

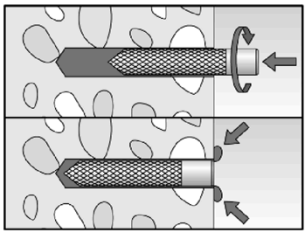
Deutsches Institut für Bautechnik DIBt

Installation instructions part 3

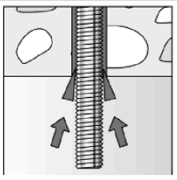
Installation of anchor rods or Selkent internal threaded anchors RG M I

9

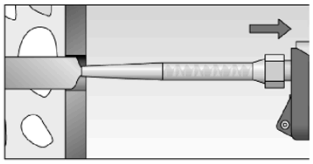




Only use clean and oil-free metal parts.
Mark the setting depth of the metal part. Push the anchor rod or Selkent internal threaded RG M I anchor down to the bottom of the hole, turning it slightly while doing so.
After inserting the metal parts, excess mortar must be emerged around the anchor element. If not, pull out the metal part immediately and reinject mortar.



For overhead installations support the metal part with wedges (e.g. centering wedges or overhead clips).

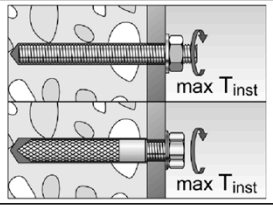


For push through installation fill the annular gap with mortar.

10

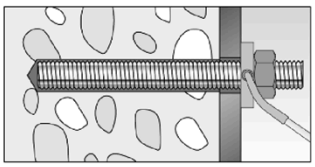
Wait for the specified curing time t_{cure}
see **Table B9.2.**

11



Mounting the fixture
max T_{inst} see **Tables B3.1 and B6.1.**

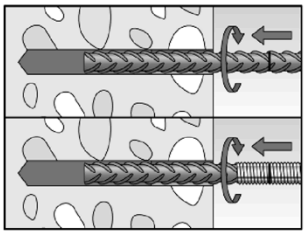
Option



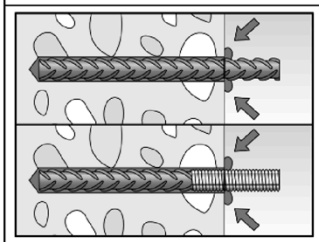
After the minimum curing time is reached, the gap between metal part and fixture (annular clearance) may be filled with mortar via the Selkent filling disc. Compressive strength ≥ 50 N/mm² (e.g Selkent SEL-V+).
ATTENTION: Using Selkent filling disc reduces t_{fix} (usable length of the anchor).

Installation reinforcing bars and Selkent rebar anchor FRA

9

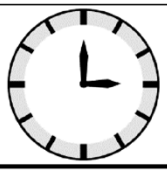


Only use clean and oil-free reinforcing bars or Selkent FRA. Mark the setting depth. Turn while using force to push the reinforcement bar or the Selkent FRA into the filled hole up to the setting depth mark.



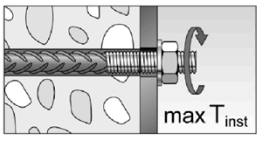
When the setting depth mark is reached, excess mortar must be emerged from the mouth of the drill hole. If not, pull out the anchor element immediately and reinject mortar.

10



Wait for the specified curing time t_{cure} see **Table B9.2.**

11



Mounting the fixture
max T_{inst}
see **Table B8.1.**

Injection system Selkent SEL-V+

Intended use
Installation instructions part 3

Annex B12

Deutsches Institut für Bautechnik DIBt

Table C1.1: Characteristic resistance to steel failure under tension / shear loading of Selkent Anchor rods and Threaded rods

Selkent Anchor rod / Threaded rod				M6	M8	M10	M12	M16	M20	M24	M27	M30
Characteristic resistance to steel failure under tension loading [1)]												
Characteristic resistance $N_{Rk,s}$	Steel zinc plated	Property class	4.8	8,0	14,6(13,2)	23,2(21,4)	33,7	62,8	98,0	141,2	183,6	224,4
			5.8	10,1	18,3(16,6)	29,0(26,8)	42,1	78,5	122,5	176,5	229,5	280,5
			8.8	16,1	29,2(26,5)	46,4(42,8)	67,4	125,6	196,0	282,4	367,2	448,8
	Stainless steel R and high corrosion resistant steel HCR		50	10,1	18,3	29,0	42,1	78,5	122,5	176,5	229,5	280,5
			70	14,1	25,6	40,6	59,0	109,9	171,5	247,1	321,3	392,7
			80	16,1	29,2	46,4	67,4	125,6	196,0	282,4	367,2	448,8
	[kN]											
Partial factors [2)]												
Partial factor $\gamma_{Ms,N}$	Steel zinc plated	Property class	4.8	1,50								
			5.8	1,50								
			8.8	1,50								
	Stainless steel R and high corrosion resistant steel HCR		50	2,86								
			70	1,87 / Selkent Anchor rod HCR: 1,50 [3)]								
			80	1,60								
	[-]											
Characteristic resistance to steel failure under shear loading [1)]												
without lever arm												
Characteristic resistance $V^0_{Rk,s}$	Steel zinc plated	Property class	4.8	4,8	8,7(7,9)	13,9(12,8)	20,2	37,6	58,8	84,7	110,1	134,6
			5.8	6,0	10,9(9,9)	17,4(16,0)	25,2	47,1	73,5	105,9	137,7	168,3
			8.8	8,0	14,6(13,2)	23,2(21,4)	33,7	62,8	98,0	141,2	183,6	224,4
	Stainless steel R and high corrosion resistant steel HCR		50	5,0	9,1	14,5	21,0	39,2	61,2	88,2	114,7	140,2
			70	7,0	12,8	20,3	29,5	54,9	85,7	123,5	160,6	196,3
			80	8,0	14,6	23,2	33,7	62,8	98,0	141,2	183,6	224,4
	[kN]											
Ductility factor		k_7		[-]	1,0							
with lever arm												
Charact. resistance $M^0_{Rk,s}$	Steel zinc plated	Property class	4.8	6,1	14,9(12,9)	29,9(26,5)	52,3	132,9	259,6	448,8	665,7	899,5
			5.8	7,6	18,7(16,1)	37,3(33,2)	65,4	166,2	324,6	561,0	832,2	1124,4
			8.8	12,2	29,9(25,9)	59,8(53,1)	104,6	265,9	519,3	897,6	1331,5	1799,0
	Stainless steel R and high corrosion resistant steel HCR		50	7,6	18,7	37,3	65,4	166,2	324,6	561,0	832,2	1124,4
			70	10,7	26,2	52,3	91,5	232,6	454,4	785,4	1165,0	1574,1
			80	12,2	29,9	59,8	104,6	265,9	519,3	897,6	1331,5	1799,0
	[Nm]											
Partial factors [2)]												
Charact. resistance $M^0_{Rk,s}$	Steel zinc plated	Property class	4.8	1,25								
			5.8	1,25								
			8.8	1,25								
	Stainless steel R and high corrosion resistant steel HCR		50	2,38								
			70	1,56 / Selkent Anchor rod HCR: 1,25 [3)]								
			80	1,33								
	[-]											

[1)] Values in brackets are valid for undersized threaded rods with smaller stress area A_s for hot dip galvanised Threaded rods according to EN ISO 10684:2004+AC:2009.
[2)] In absence of national regulations.
[3)] Only admissible for high corrosion resistant steel HCR, acc. to Table A6.1.

Injection system Selkent SEL-V+

Performances
Characteristic resistance to steel failure under tension / shear loading of Selkent Anchor rods and Threaded rods

Annex C1

Deutsches Institut für Bautechnik DIBt

Table C2.1: Characteristic resistance to steel failure under tension / shear loading of **Selkent RG M I**

Selkent RG M I			**RG M I**	**Screw**		**M8**	**M10**	**M12**	**M16**	**M20**
Characteristic resistance to steel failure under tension loading										
Characteristic resistance with screw	$N_{Rk,s}$	Property class	5.8	5.8	[kN]	18,3	29,0	42,1	78,3	122,4
				8.8		29,2	46,4	67,4	106,7	180,2
		Property class	R-70 / HCR-70	R-70 / commercial standard		25,6	40,6	59,0	109,6	171,3
				HCR-70		25,6	40,6	59,0	109,6	171,3
Partial factors [1]										
Partial factors	$\gamma_{Ms,N}$	Property class	5.8	5.8	[-]	1,50				
				8.8		1,50				
		Property class	R-70 / HCR-70	R-70 / commercial standard		1,87				
				HCR-70		1,50				
Characteristic resistance to steel failure under shear loading										
Without lever arm										
Characteristic resistance with screw	$V^0_{Rk,s}$	Property class	5.8	5.8	[kN]	10,9	17,4	25,2	47,1	73,5
				8.8		14,6	23,2	33,7	62,8	98,0
		Property class	R-70 / HCR-70	R-70 / commercial standard		12,8	20,3	29,5	54,9	85,7
				HCR-70		12,8	20,3	29,5	54,9	85,7
Ductility factor				k_7	[-]	1,0				
With lever arm										
Characteristic resistance with screw	$M^0_{Rk,s}$	Property class	5.8	5.8	[Nm]	18,7	37,3	65,4	166,2	324,6
				8.8		29,9	59,8	104,6	265,9	519,3
		Property class	R-70/ HCR-70	R-70 / commercial standard		26,2	52,3	91,5	232,6	454,4
				HCR-70		26,2	52,3	91,5	232,6	454,4
Partial factors [1]										
Partial factors	$\gamma_{Ms,V}$	Property class	5.8	5.8	[-]	1,25				
				8.8		1,25				
		Property class	R-70 / HCR-70	R-70 / commercial standard		1,56				
				HCR-70		1,25				

[1] In absence of national regulations.

Injection system Selkent SEL-V+

Performances
Characteristic resistance to steel failure under tension / shear loading of Selkent RG M I

Annex C2

Deutsches Institut für Bautechnik DIBt

Table C3.1: Characteristic resistance to steel failure under tension / shear loading of reinforcing bars

Nominal diameter of the bar		**ϕ**	**8**	**10**	**12**	**14**	**16**	**20**	**25**	**28**
Characteristic resistance to steel failure under tension loading										
Characteristic resistance	$N_{Rk,s}$	[kN]	$A_s \cdot f_{uk}$ [1)]							
Characteristic resistance to steel failure under shear loading										
Without lever arm										
Characteristic resistance	$V^0_{Rk,s}$	[kN]	k_6 [2)] $\cdot A_s \cdot f_{uk}$ [1)]							
Ductility factor	k_7	[-]	1,0							
With lever arm										
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	$1{,}2 \cdot W_{el} \cdot f_{uk}$ [1)]							

[1)] f_{uk} or f_{yk} respectively must be taken from the specifications of the reinforcing bar.
[2)] In accordance with EN 1992-4:2018 section 7.2.2.3.1.
k_6 = 0,6 for fasteners made of carbon steel with $f_{uk} \leq 500$ N/mm².
= 0,5 for fasteners made of carbon steel with $500 < f_{uk} \leq 1000$ N/mm².
= 0,5 for fasteners made of stainless steel.

Table C3.2: Characteristic resistance to steel failure under tension / shear loading of Selkent rebar anchors FRA

Selkent rebar anchor FRA			**M12**	**M16**	**M20**	**M24**
Characteristic resistance to steel failure under tension loading						
Characteristic resistance	$N_{Rk,s}$	[kN]	62,0	111,0	173,0	236,5
Partial factor[1)]						
Partial factor	$\gamma_{Ms,N}$	[-]	1,4			
Characteristic resistance to steel failure under shear loading						
Without lever arm						
Characteristic resistance	$V^0_{Rk,s}$	[kN]	34,5	64,3	100,4	144,7
Ductility factor	k_7	[-]	1,0			
With lever arm						
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	107,4	273,0	532,2	920,4
Partial factor[1)]						
Partial factor	$\gamma_{Ms,V}$	[-]	1,5			

[1)] In absence of national regulations.

Injection system Selkent SEL-V+

Performances
Characteristic resistance to steel failure under tension / shear loading of reinforcing bars and Selkent rebar anchors FRA

Annex C3

Deutsches Institut für Bautechnik DIBt

Table C4.1: Characteristic resistance for concrete failure under tension / shear loading

Size				**All sizes**								
Tension loading												
Installation factor	γ_{inst}	[-]		See annex C5 to C12 and C17 to C18								
Factors for the compressive strength of concrete > C20/25												
Increasing factor for τ_{Rk}	C25/30	Ψ_c	[-]	1,05								
	C30/37			1,10								
	C35/45			1,15								
	C40/50			1,19								
	C45/55			1,22								
	C50/60			1,26								
Splitting failure												
Edge distance	$h / h_{ef} \geq 2,0$	$c_{cr,sp}$	[mm]	$1,0\ h_{ef}$								
	$2,0 > h / h_{ef} > 1,3$			$4,6\ h_{ef} - 1,8\ h$								
	$h / h_{ef} \leq 1,3$			$2,26\ h_{ef}$								
Spacing		$s_{cr,sp}$		$2\ c_{cr,sp}$								
Concrete cone failure												
Uncracked concrete		$k_{ucr,N}$	[-]	11,0								
Cracked concrete		$k_{cr,N}$		7,7								
Edge distance		$c_{cr,N}$	[mm]	$1,5\ h_{ef}$								
Spacing		$s_{cr,N}$		$2\ c_{cr,N}$								
Factors for sustained tension loading												
Temperature range			[-]	50 °C / 80 °C					72 °C / 120 °C			
Factor		Ψ^0_{sus}	[-]	0,76					0,78			
Shear loading												
Installation factor		γ_{inst}	[-]	1,0								
Concrete pry-out failure												
Factor for pry-out failure		k_8	[-]	2,0								
Concrete edge failure												
Effective length of fastener for shear loading		l_f	[mm]	for $d_{nom} \leq 24$ mm: min (h_{ef}; 12 d_{nom}) for $d_{nom} > 24$ mm: min (h_{ef}; 8 d_{nom}; 300 mm)								
Effective diameter of the fastener d_{nom}												
Size				M6	M8	M10	M12	M16	M20	M24	M27	M30
Selkent Anchor rods and Threaded rods		d_{nom}	[mm]	6	8	10	12	16	20	24	27	30
Selkent RG M I		d_{nom}		-[1)]	12	16	18	22	28	-[1)]	-[1)]	-[1)]
Selkent rebar anchor FRA		d_{nom}		-[1)]	-[1)]	-[1)]	12	16	20	25	-[1)]	-[1)]
Size (nominal diameter of the bar)			ϕ	8	10	12	14	16	20	25	28	
Reinforcing bar		d_{nom}	[mm]	8	10	12	14	16	20	25	28	

[1)] Size of anchor type not part of the assessment.

Injection system Selkent SEL-V+

Performances
Characteristic resistance for concrete failure under tension / shear loading

Annex C4

Deutsches Institut für Bautechnik DIBt

Table C5.1: Characteristic resistance to combined pull-out and concrete failure for Selkent Anchor rods and Threaded rods in hammer drilled holes; uncracked or cracked concrete; working life 50 years

Selkent Anchor rod / Threaded rod			**M6**	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Combined pullout and concrete cone failure											
Calculation diameter	d	[mm]	6	8	10	12	16	20	24	27	30
Uncracked concrete											
Characteristic bond resistance in uncracked concrete C20/25											
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)											
Temperature range I: 50 °C / 80 °C	$\tau_{Rk,ucr}$	[N/mm²]	9,0	16,0	16,0	15,0	14,0	12,0	11,0	10,0	9,0
Temperature range II: 72 °C / 120 °C	$\tau_{Rk,ucr}$	[N/mm²]	6,5	15,0	14,0	13,0	12,0	11,0	9,0	8,0	8,0
Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)											
Temperature range I: 50 °C / 80 °C	$\tau_{Rk,ucr}$	[N/mm²]	-[1]	-[1]	-[1]	9,5	8,5	8,0	7,5	7,0	7,0
Temperature range II: 72 °C / 120 °C	$\tau_{Rk,ucr}$	[N/mm²]	-[1]	-[1]	-[1]	7,5	7,0	6,5	6,0	6,0	6,0
Installation factors											
Dry or wet concrete	γ_{inst}	[-]	1,0								
Water filled hole	γ_{inst}	[-]	-[1]	-[1]	-[1]	1,2					
Cracked concrete											
Characteristic bond resistance in cracked concrete C20/25											
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)											
Temperature range I: 50 °C / 80 °C	$\tau_{Rk,cr}$	[N/mm²]	-[1]	5,5	6,0	6,5	6,0	5,5	5,0	5,0	4,5
Temperature range II: 72 °C / 120 °C	$\tau_{Rk,cr}$	[N/mm²]	-[1]	4,5	5,0	6,0	5,5	5,0	4,5	4,0	4,0
Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)											
Temperature range I: 50 °C / 80 °C	$\tau_{Rk,cr}$	[N/mm²]	-[1]	-[1]	-[1]	5,0	5,0	4,5	4,0	3,5	3,5
Temperature range II: 72 °C / 120 °C	$\tau_{Rk,cr}$	[N/mm²]	-[1]	-[1]	-[1]	4,0	4,0	4,0	3,5	3,0	3,0
Installation factors											
Dry or wet concrete	γ_{inst}	[-]	1,0								
Water filled hole	γ_{inst}	[-]	-[1]	-[1]	-[1]	1,2					

[1] No performance assessed.

Injection system Selkent SEL-V+

Performances
Characteristic resistance to combined pull-out and concrete failure for Selkent Anchor rods and Threaded rods working life 50 years

Annex C5

Deutsches Institut für Bautechnik DIBt

Table C6.1: Characteristic resistance to combined pull-out and concrete failure for Selkent Anchor rods and Threaded rods in hammer drilled holes; uncracked or cracked concrete; working life 100 years

Selkent Anchor rod / Threaded rod			**M6**	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Combined pullout and concrete cone failure											
Calculation diameter	d	[mm]	6	8	10	12	16	20	24	27	30
Uncracked concrete											
Characteristic bond resistance in uncracked concrete C20/25											
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)											
Temperature range I: 50 °C / 80 °C	$\tau_{Rk,100,ucr}$	[N/mm²]	-[1]	16,0	16,0	15,0	14,0	12,0	11,0	10,0	9,0
Temperature range II: 72 °C / 120 °C	$\tau_{Rk,100,ucr}$	[N/mm²]	-[1]	15,0	14,0	13,0	12,0	11,0	9,0	8,0	8,0
Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)											
Temperature range I: 50 °C / 80 °C	$\tau_{Rk,100,ucr}$	[N/mm²]	-[1]	-[1]	-[1]	9,5	8,5	8,0	7,5	7,0	7,0
Temperature range II: 72 °C / 120 °C	$\tau_{Rk,100,ucr}$	[N/mm²]	-[1]	-[1]	-[1]	7,5	7,0	6,5	6,0	6,0	6,0
Installation factors											
Dry or wet concrete	γ_{inst}	[-]	1,0								
Water filled hole	γ_{inst}	[-]	-[1]	-[1]	-[1]	1,2					
Cracked concrete											
Characteristic bond resistance in cracked concrete C20/25											
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)											
Temperature range I: 50 °C / 80 °C	$\tau_{Rk,100,cr}$	[N/mm²]	-[1]	5,0	5,5	5,5	5,5	5,5	5,0	5,0	4,5
Temperature range II: 72 °C / 120 °C	$\tau_{Rk,100,cr}$	[N/mm²]	-[1]	4,5	5,0	5,0	5,0	5,0	4,0	4,0	4,0
Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)											
Temperature range I: 50 °C / 80 °C	$\tau_{Rk,100,cr}$	[N/mm²]	-[1]	-[1]	-[1]	4,5	4,5	4,5	4,0	3,5	3,5
Temperature range II: 72 °C / 120 °C	$\tau_{Rk,100,cr}$	[N/mm²]	-[1]	-[1]	-[1]	4,0	4,0	4,0	3,5	3,0	3,0
Installation factors											
Dry or wet concrete	γ_{inst}	[-]	1,0								
Water filled hole	γ_{inst}	[-]	-[1]	-[1]	-[1]	1,2					

[1] No performance assessed.

Injection system Selkent SEL-V+

Performances
Characteristic resistance to combined pull-out and concrete failure for Selkent Anchor rod and Threaded rods; working life 100 years

Annex C6

Deutsches Institut für Bautechnik DIBt

Table C7.1: Characteristic resistance to combined pull-out and concrete failure for Selkent RG M I in hammer drilled holes; uncracked concrete; working life 50 years

Selkent RG M I				**M8**	**M10**	**M12**	**M16**	**M20**
Combined pullout and concrete cone failure								
Calculation diameter		d	[mm]	12,0	15,7	18,0	22,0	28,0
Uncracked concrete								
Characteristic bond resistance in uncracked concrete C20/25								
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)								
Temperature range	I: 50 °C / 80 °C	$\tau_{Rk,ucr}$	[N/mm²]	10,5	10,0	9,5	9,0	8,5
	II: 72 °C / 120 °C			9,0	8,0	8,0	7,5	7,0
Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)								
Temperature range	I: 50 °C / 80 °C	$\tau_{Rk,ucr}$	[N/mm²]	10,0	9,0	9,0	8,5	8,0
	II: 72 °C / 120 °C			7,5	6,5	6,5	6,0	6,0
Installation factors								
Dry or wet concrete		γ_{inst}	[-]	1,0				
Water filled hole				1,2				

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Table C8.1: Characteristic resistance to combined pull-out and concrete failure for reinforcing bars in hammer drilled holes; uncracked or cracked concrete; working life 50 years

Nominal diameter of the bar		**ϕ**		**8**	**10**	**12**	**14**	**16**	**20**	**25**	**28**
Combined pullout and concrete cone failure											
Calculation diameter		d	[mm]	8	10	12	14	16	20	25	28
Uncracked concrete											
Characteristic bond resistance in uncracked concrete C20/25											
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)											
Temperature range	I: 50 °C / 80 °C	$\tau_{Rk,ucr}$	[N/mm²]	11,0	11,0	11,0	10,0	10,0	9,5	9,0	8,5
	II: 72 °C / 120 °C			9,5	9,5	9,0	8,5	8,5	8,0	7,5	7,0
Installation factor											
Dry or wet concrete		γ_{inst}	[-]	1,0							
Cracked concrete											
Characteristic bond resistance in cracked concrete C20/25											
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)											
Temperature range	I: 50 °C / 80 °C	$\tau_{Rk,cr}$	[N/mm²]	-[1)]	3,0	5,0	5,0	5,0	4,5	4,0	4,0
	II: 72 °C / 120 °C			-[1)]	3,0	4,5	4,5	4,5	4,0	3,5	3,5
Installation factor											
Dry or wet concrete		γ_{inst}	[-]	1,0							

[1)] No performance assessed.

Injection system Selkent SEL-V+

Performances
Characteristic resistance to combined pull-out and concrete failure for reinforcing bars; working life 50 years

Annex C8

Deutsches Institut für Bautechnik DIBt

Table C9.1: Characteristic resistance to combined pull-out and concrete failure for Selkent rebar anchors FRA in hammer drilled holes; uncracked or cracked concrete; working life 50 years

Selkent rebar anchor FRA				**M12**	**M16**	**M20**	**M24**
Combined pullout and concrete cone failure							
Calculation diameter		d	[mm]	12	16	20	25
Uncracked concrete							
Characteristic bond resistance in uncracked concrete C20/25							
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)							
Temperature range	I: 50 °C / 80 °C	$\tau_{Rk,ucr}$	[N/mm²]	11,0	10,0	9,5	9,5
	II: 72 °C / 120 °C			9,0	8,5	8,0	7,5
Installation factors							
Dry or wet concrete		γ_{inst}	[-]	1,0			
Cracked concrete							
Characteristic bond resistance in cracked concrete C20/25							
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)							
Temperature range	I: 50 °C / 80 °C	$\tau_{Rk,cr}$	[N/mm²]	5,0	5,0	4,5	4,0
	II: 72 °C / 120 °C			4,5	4,5	4,0	3,5
Installation factors							
Dry or wet concrete		γ_{inst}	[-]	1,0			

Injection system Selkent SEL-V+

Performances
Characteristic resistance to combined pull-out and concrete failure for Selkent rebar anchors FRA; working life 50 years

Annex C9

Deutsches Institut für Bautechnik DIBt

Table C10.1: Displacements for Selkent Anchor rods / Threaded rods

Selkent Anchor rod / Threaded rod		M6	M8	M10	M12	M16	M20	M24	M27	M30
Displacement-Factors for tension loading[1)]										
Uncracked concrete; Temperature range I, II										
$\delta_{N0\text{-Factor}}$	[mm/(N/mm²)]	0,09	0,09	0,09	0,10	0,10	0,10	0,10	0,11	0,12
$\delta_{N\infty\text{-Factor}}$		0,10	0,10	0,10	0,12	0,12	0,12	0,13	0,13	0,14
Cracked concrete; Temperature range I, II										
$\delta_{N0\text{-Factor}}$	[mm/(N/mm²)]	-[3)]	0,12	0,12	0,12	0,13	0,13	0,13	0,14	0,15
$\delta_{N0\text{-Factor}}$		-[3)]	0,25	0,27	0,30	0,30	0,30	0,35	0,35	0,40
Displacement-Factors for shear loading[2)]										
Uncracked or cracked concrete; Temperature range I, II										
$\delta_{V0\text{-Factor}}$	[mm/kN]	0,11	0,11	0,11	0,10	0,10	0,09	0,09	0,08	0,07
$\delta_{V\infty\text{-Factor}}$		0,12	0,12	0,12	0,11	0,11	0,10	0,10	0,09	0,09

[1)] Calculation of effective displacement:

$\delta_{N0} = \delta_{N0\text{-Factor}} \cdot \tau$

$\delta_{N\infty} = \delta_{N\infty\text{-Factor}} \cdot \tau$

τ = acting bond strength under tension loading

[2)] Calculation of effective displacement:

$\delta_{V0} = \delta_{V0\text{-Factor}} \cdot V$

$\delta_{V\infty} = \delta_{V\infty\text{-Factor}} \cdot V$

V = acting shear loading

[3)] No performance assessed.

Table C10.2: Displacements for Selkent RG M I

Selkent RG M I		M8	M10	M12	M16	M20
Displacement-Factors for tension loading[1)]						
Uncracked concrete; Temperature range I, II						
$\delta_{N0\text{-Factor}}$	[mm/(N/mm²)]	0,10	0,11	0,12	0,13	0,14
$\delta_{N\infty\text{-Factor}}$		0,13	0,14	0,15	0,16	0,18
Displacement-Factors for shear loading[2)]						
Uncracked concrete; Temperature range I, II						
$\delta_{V0\text{-Factor}}$	[mm/kN]	0,12	0,12	0,12	0,12	0,12
$\delta_{V\infty\text{-Factor}}$		0,14	0,14	0,14	0,14	0,14

[1)] Calculation of effective displacement:

$\delta_{N0} = \delta_{N0\text{-Factor}} \cdot \tau$

$\delta_{N\infty} = \delta_{N\infty\text{-Factor}} \cdot \tau$

τ = acting bond strength under tension loading

[2)] Calculation of effective displacement:

$\delta_{V0} = \delta_{V0\text{-Factor}} \cdot V$

$\delta_{V\infty} = \delta_{V\infty\text{-Factor}} \cdot V$

V = acting shear loading

Injection system Selkent SEL-V+

Performances
Displacements for Selkent Anchor rods / Threaded Rods and Selkent RG MI

Annex C10

Deutsches Institut für Bautechnik DIBt

Table C11.1: Displacements for reinforcing bars

Nominal diameter of the bar ϕ		8	10	12	14	16	20	25	28
Displacement-Factors for tension load[1)]									
Uncracked concrete; Temperature range I, II									
$\delta_{N0\text{-Factor}}$	[mm/(N/mm²)]	0,09	0,09	0,10	0,10	0,10	0,10	0,10	0,11
$\delta_{N\infty\text{-Factor}}$		0,10	0,10	0,12	0,12	0,12	0,12	0,13	0,13
Cracked concrete; Temperature range I, II									
$\delta_{N0\text{-Factor}}$	[mm/(N/mm²)]	-[3)]	0,12	0,13	0,13	0,13	0,13	0,13	0,14
$\delta_{N\infty\text{-Factor}}$		-[3)]	0,27	0,30	0,30	0,30	0,30	0,35	0,37
Displacement-Factors for shear load[2)]									
Uncracked or cracked concrete; Temperature range I, II									
$\delta_{V0\text{-Factor}}$	[mm/kN]	0,11	0,11	0,10	0,10	0,10	0,09	0,09	0,08
$\delta_{V\infty\text{-Factor}}$		0,12	0,12	0,11	0,11	0,11	0,10	0,10	0,09

[1)] Calculation of effective displacement:

$\delta_{N0} = \delta_{N0\text{-Factor}} \cdot \tau$

$\delta_{N\infty} = \delta_{N\infty\text{-Factor}} \cdot \tau$

τ = acting bond strength under tension loading

[2)] Calculation of effective displacement:

$\delta_{V0} = \delta_{V0\text{-Factor}} \cdot V$

$\delta_{V\infty} = \delta_{V\infty\text{-Factor}} \cdot V$

V = acting shear loading

[3)] No performance assessed.

Table C11.2: Displacements for Selkent rebar anchors FRA

Selkent rebar anchor FRA		M12	M16	M20	M24
Displacement-Factors for tension loading[1)]					
Uncracked concrete; Temperature range I, II					
$\delta_{N0\text{-Factor}}$	[mm/(N/mm²)]	0,10	0,10	0,10	0,10
$\delta_{N\infty\text{-Factor}}$		0,12	0,12	0,12	0,13
Cracked concrete; Temperature range I, II					
$\delta_{N0\text{-Factor}}$	[mm/(N/mm²)]	0,12	0,13	0,13	0,13
$\delta_{N\infty\text{-Factor}}$		0,30	0,30	0,30	0,35
Displacement-Factors for shear loading[2)]					
Uncracked or cracked concrete; Temperature range I, II					
$\delta_{V0\text{-Factor}}$	[mm/kN]	0,10	0,10	0,09	0,09
$\delta_{V\infty\text{-Factor}}$		0,11	0,11	0,10	0,10

[1)] Calculation of effective displacement:

$\delta_{N0} = \delta_{N0\text{-Factor}} \cdot \tau$

$\delta_{N\infty} = \delta_{N\infty\text{-Factor}} \cdot \tau$

τ = acting bond strength under tension loading

[2)] Calculation of effective displacement:

$\delta_{V0} = \delta_{V0\text{-Factor}} \cdot V$

$\delta_{V\infty} = \delta_{V\infty\text{-Factor}} \cdot V$

V = acting shear loading

Injection system Selkent SEL-V+

Performances
Displacements for reinforcing bars and Selkent rebar anchors FRA

Annex C11

Deutsches Institut für Bautechnik DIBt

Table C12.1: Characteristic resistance to steel failure under tension / shear loading of Selkent anchor rods and Threaded rods under seismic performance category C1 or C2

Selkent Anchor rod / Threaded rod				M10	M12	M16	M20	M24	M27	M30
Characteristic resistance to steel failure under tension loading[1)]										
Selkent Anchor rods and Threaded rods, performance category C1 [2)]										
Characteristic resistance $N_{Rk,s,C1}$	Steel zinc plated	Property class	5.8	[kN]	29,0(26,8)	42,1	78,5	122,5	176,5	229,5	280,5
			8.8		46,4(42,8)	67,4	125,6	196,0	282,4	367,2	448,8
	Stainless steel R and high corrosion resistant steel HCR		50		29,0	42,1	78,5	122,5	176,5	229,5	280,5
			70		40,6	59,0	109,9	171,5	247,1	321,3	392,7
			80		46,4	67,4	125,6	196,0	282,4	367,2	448,8
Selkent anchor rods, performance category C2 [2)]										
Characteristic resistance $N_{Rk,s,C2}$	Steel zinc plated	Property class	5.8	[kN]	-[4)]	37,9	70,6	110,2	-[4)]	-[4)]	-[4)]
			8.8		-[4)]	60,6	113,0	176,4	-[4)]	-[4)]	-[4)]
	Stainless steel R and high corrosion resistant steel HCR		50		-[4)]	37,9	70,6	110,2	-[4)]	-[4)]	-[4)]
			70		-[4)]	53,1	98,9	154,3	-[4)]	-[4)]	-[4)]
			80		-[4)]	60,6	113,0	176,4	-[4)]	-[4)]	-[4)]
Characteristic resistance to steel failure under shear loading without lever arm[1)]										
Selkent anchor rods, performance category C1 [2)]										
Characteristic resistance $V_{Rk,s,C1}$	Steel zinc plated	Property class	5.8	[kN]	17,4(16,0)	25,2	47,1	73,5	105,9	137,7	168,3
			8.8		23,2(21,4)	33,7	62,8	98,0	141,2	183,6	224,4
	Stainless steel R and high corrosion resistant steel HCR		50		14,5	21,0	39,2	61,2	88,2	114,7	140,2
			70		20,3	29,5	54,9	85,7	123,5	160,6	196,3
			80		23,2	33,7	62,8	98,0	141,2	183,6	224,4
Threaded rods, performance category C1 [2)]										
Characteristic resistance $V_{Rk,s,C1}$	Steel zinc plated	Property class	5.8	[kN]	12,1(11,2)	17,7	32,9	51,4	74,1	96,3	117,8
			8.8		16,2(15,0)	23,6	43,9	68,6	98,8	128,5	157,0
	Stainless steel R and high corrosion resistant steel HCR		50		10,1	14,7	27,4	42,8	61,7	80,3	98,1
			70		14,2	20,6	38,4	60,0	86,4	112,4	137,4
			80		16,2	23,6	43,9	68,6	98,8	128,5	157,0
Selkent Anchor rods, performance category C2										
Characteristic resistance $V_{Rk,s,C2}$	Steel zinc plated	Property class	5.8	[kN]	-[4)]	16,6	35,3	56,5	-[4)]	-[4)]	-[4)]
			8.8		-[4)]	22,2	47,1	75,4	-[4)]	-[4)]	-[4)]
	Stainless steel R and high corrosion resistant steel HCR		50		-[4)]	13,9	29,4	47,1	-[4)]	-[4)]	-[4)]
			70		-[4)]	19,4	41,2	66,0	-[4)]	-[4)]	-[4)]
			80		-[4)]	22,2	47,1	75,4	-[4)]	-[4)]	-[4)]
Factor for the annular gap		α_{gap}		[-]	0,5 (1,0)[3)]						

[1)] Partial factors for performance category C1 or C2 see Table C13.1; for Selkent anchor rods the factor for steel ductility is 1,0.
[2)] Values in brackets are valid for undersized Threaded rods with smaller stress area A_s and for hot dip galvanised Threaded rods according to EN ISO 10684:2004+AC:2009.
[3)] Values in brackets are valid for filled annular gaps between the anchor rod and the through-hole in the attachment. It is necessary to use the Selkent filling disc according to Annex A5.
[4)] No performance assessed.

Injection system Selkent SEL-V+

Performances
Characteristic resistance to steel failure under tension / shear loading under seismic performance category C1 / C2

Annex C12

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Table C13.1: Partial factors for Selkent Anchor rods and Threaded rods under seismic performance category C1 or C2

Selkent Anchor rods / Threaded rods				M10	M12	M16	M20	M24	M27	M30
Tension loading, steel failure[1]										
Partial factor $\gamma_{Ms,N}$	Steel zinc plated	Property class	5.8	[-]	1,50					
			8.8		1,50					
	Stainless steel R and high corrosion resistant steel HCR		50		2,86					
			70		1,87 / Selkent Anchor rods HCR: 1,50[2]					
			80		1,60					
Shear loading, steel failure[1]										
Partial factor $\gamma_{Ms,V}$	Steel zinc plated	Property class	5.8	[-]	1,25					
			8.8		1,25					
	Stainless steel R and high corrosion resistant steel HCR		50		2,38					
			70		1,56 / Selkent Anchor rods HCR: 1,25[2]					
			80		1,33					

[1] In absence of national regulations.
[2] Only admissible for high corrosion resistant steel HCR, with $f_{yk} / f_{uk} \geq 0,8$ and $A_5 > 12$ % (e.g. Selkent Anchor rods).

Injection system Selkent SEL-V+

Performances
Partial factors Selkent Anchor rods and Threaded rods under seismic performance category C1 and C2

Annex C13

Deutsches Institut für Bautechnik DIBt

Table C14.1: Characteristic resistance for combined pull-out and concrete failure for Selkent Anchor rods and Threaded rods in hammer drilled holes under seismic performance category C1, working life 50 and 100 years

Selkent Anchor rod / Threaded rod				M10	M12	M16	M20	M24	M27	M30
Combined pullout and concrete cone failure										
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)										
Temperature range	I:	50 °C / 80 °C	$\tau_{Rk,C1}$ [N/mm²]	4,5	5,5	5,5	5,5	4,5	4,0	4,0
	II:	72 °C / 120 °C		4,0	4,5	4,5	4,5	4,0	3,5	3,5
Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)										
Temperature range	I:	50 °C / 80 °C	$\tau_{Rk,C1}$ [N/mm²]	-[1)]	5,0	5,0	4,5	4,0	3,5	3,5
	II:	72 °C / 120 °C		-[1)]	4,0	4,0	4,0	3,5	3,0	3,0
Installation factors										
Dry or wet concrete			γ_{inst} [-]	1,0						
Water filled hole				-[1)]	1,2					

[1)] No performance assessed.

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Table C15.1: Characteristic resistance for combined pull-out and concrete failure for Selkent Anchor rods in hammer drilled holes under seismic performance category C2, working life 50 and 100 years

Selkent Anchor rod			**M12**	**M16**	**M20**
Combined pullout and concrete cone failure					
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)					
Temperature range I: 50 °C / 80 °C	$\tau_{Rk,C2}$	[N/mm²]	1,5	1,3	2,1
Temperature range II: 72 °C / 120 °C	$\tau_{Rk,C2}$	[N/mm²]	1,3	1,2	1,9
Hammer-drilling with standard drill bit or hollow drill bit (water filled hole)					
Temperature range I: 50 °C / 80 °C	$\tau_{Rk,C2}$	[N/mm²]	1,3	1,1	1,8
Temperature range II: 72 °C / 120 °C	$\tau_{Rk,C2}$	[N/mm²]	1,1	1,0	1,6
Displacement-Factors for tension loading[1)]					
$\delta_{N,C2\ (50\%)}$-Factor		[mm/(N/mm²)]	0,20	0,13	0,21
$\delta_{N,C2\ (100\%)}$-Factor		[mm/(N/mm²)]	0,38	0,18	0,24
Displacement-Factors for shear loading[2)]					
$\delta_{V,C2\ (50\%)}$-Factor		[mm/kN]	0,18	0,10	0,07
$\delta_{V,C2\ (100\%)}$-Factor		[mm/kN]	0,25	0,14	0,11

[1)] Calculation of effective displacement:

$\delta_{N,C2\ (50\%)} = \delta_{N,C2\ (50\%)\text{-Factor}} \cdot \tau$

$\delta_{N,C2\ (100\%)} = \delta_{N,C2\ (100\%)\text{-Factor}} \cdot \tau$

τ = acting bond strength under tension loading

[2)] Calculation of effective displacement:

$\delta_{V,C2\ (50\%)} = \delta_{V,C2\ (50\%)\text{-Factor}} \cdot V$

$\delta_{V,C2\ (100\%)} = \delta_{V,C2\ (100\%)\text{-Factor}} \cdot V$

V = acting shear loading

[3)] No performance assessed.

Injection system Selkent SEL-V+

Performances
Characteristic resistance under seismic performance category C2; working life 50 and 100 years

Annex C15