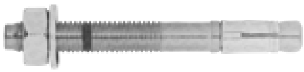
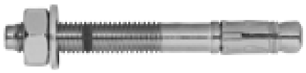
SORMAT

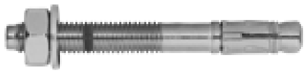
S-KA+



S-KAK+



S-KAH+ A4



S-KAH+ HCR

PRODUCT DATA SHEET

HIGH PERFORMANCE THROUGH BOLTS

S-KA+, S-KAK+, S-KAH+, S-KAH+ HCR THROUGH BOLT

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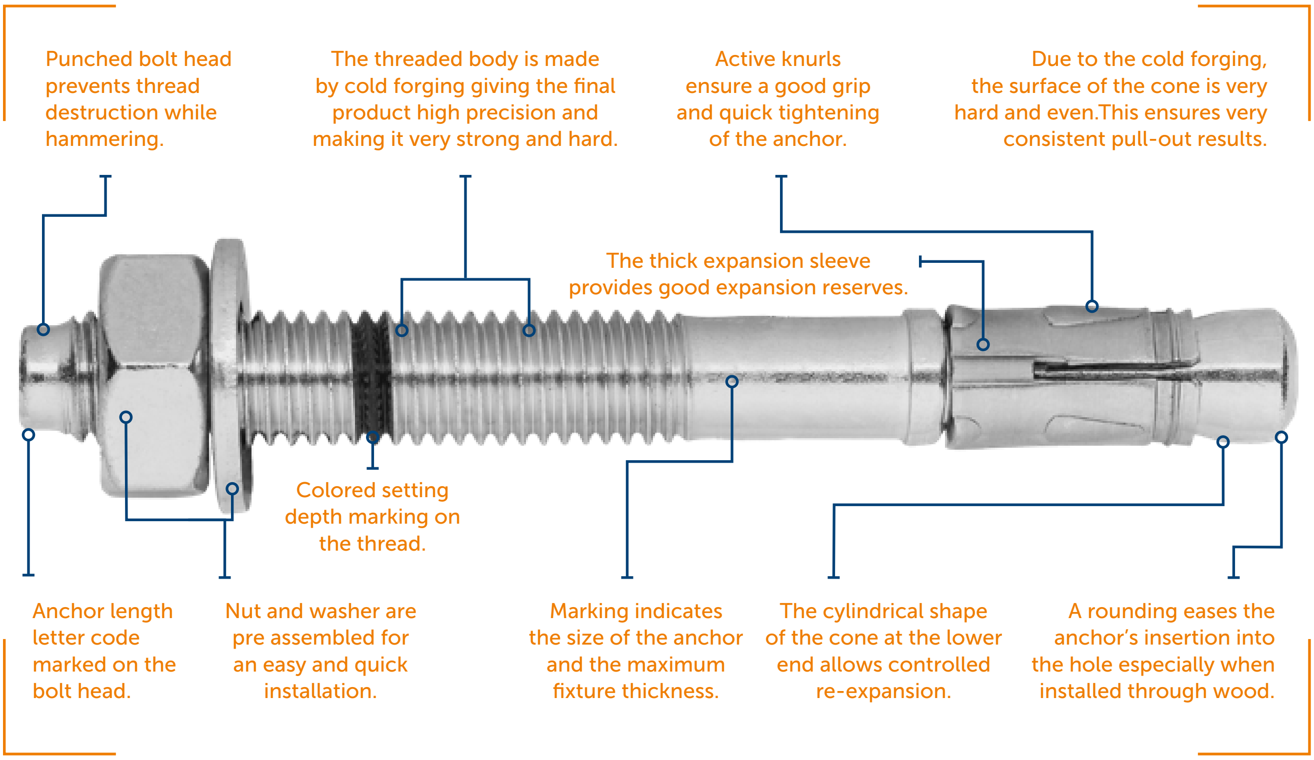
High performance through bolts for fixing in cracked and non-cracked concrete



THROUGH BOLT

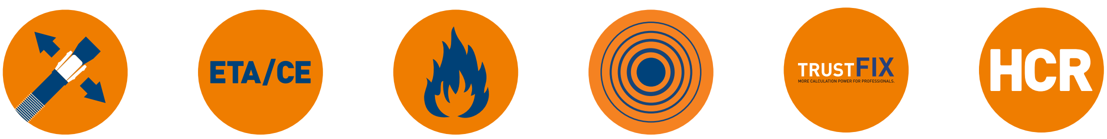
The through bolt is a torque-controlled expansion anchor for use in cracked and non-cracked concrete. The anchor is preassembled and can be installed directly through the fixture.

Available in

- Zinc electroplated steel for indoor and dry applications.
- Hot dip galvanized steel for damp interiors with occasional exposure to condensation and in non-safety-relevant slightly corrosive outside environments, when corrosion is inspected regurarly.
- Stainless steel for outdoor applications subject to humidity, as well as installation in industrial and maritime environments.
- HCR stainless steel for aggressive conditions, chloride atmosphere and atmosphere with chemical pollution such as tunnels, swimming pools etc.

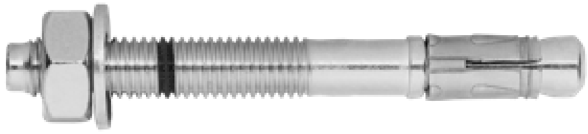
Benefits

- Fixing in cracked and non-cracked concrete, also suitable for natural stone
- Torque-controlled expansion anchors for pre-, push-through and distance installations
- When torque is applied the expansion clip expands developing frictional grip into the hole.
- Anchor diameter and max. fixture thickness marked on the body.
- Anchor length letter code marked on the bolt head.
- Colored setting depth marking for the deeper anchorage depth on the thread.
- Variable range of coatings and materials such a ZP, HDG, A4 and HCR 1.4529 which supports for anchor selecting in different applications
- Sormat Through bolts are manufactured reliably in Finland since 1970s



S-KA+ carbon steel

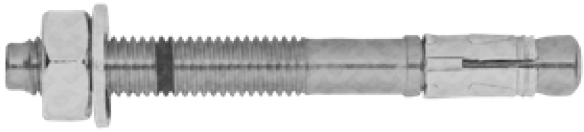
Zinc electroplated acc. EN ISO 4042, t ≥ 5 µm



Dry indoor conditions, indoor with temporary condensation.

S-KAK+ carbon steel

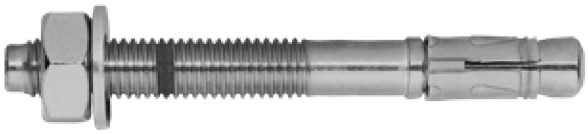
Hot dip galvanized acc. EN ISO 10684, t ≥ 50 µm



Humid indoor use, outdoor inland rural areas only in not safety relevant applications.

S-KAH+ A4 stainless steel

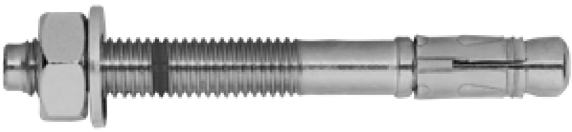
A4 for indoor, outdoor, industrial use and maritime climate



S-KAH A4 recommended when fire or corrosion resistance is required.

S-KAH+ HCR

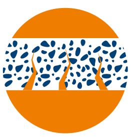
HCR for extremely corrosive conditions,



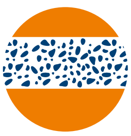
such as high chlorine concentrations (swimming halls), road tunnels and desulphurization plants.

Base materials

Approved for



Cracked concrete



Non-cracked concrete

Also suitable for

Natural stone

APPROVALS / CERFICATIONS / APPLICATIONS

Description of document		Authority/ Laboratory	ID	Additional info
European Technical Assessment		ZAG -National Building and Civil Engineering Institute, Slovenia	ETA-16/0934	EAD 330232-01-0601
Fire resistance		ZAG -National Building and Civil Engineering Institute, Slovenia	ETA-16/0934	EOTA TR 020 / EN 1992-4:2008
Seismic resistance		ZAG -National Building and Civil Engineering Institute, Slovenia	ETA-16/0934	EOTA TR 045
Sormat Trustfix anchor calculation software		EJOT Sormat Oy / S&P Software Consulting		TrustFIX anchor calculation
Through bolts CAD-blocks for AutoCAD		EJOT Sormat Oy		Blocks installation instructions for AutoCAD
YouTube installation videos		EJOT Sormat Oy	Pending	

Additional information concerning all given data in the product data sheet

1. Load figures include the partial safety factors as per approvals and a partial safety factor on the action of $\gamma_F = 1.4$. Load figures apply for a rebar spacing $s \geq 15$ cm or alternatively for a rebar spacing $s \geq 10$ cm in combination with a rebar diameter of $d_s \leq 10$ mm.

2. If spacings or edge distances become smaller than the characteristic figures ($s_{cr,N}$ / $c_{cr,N}$) a calculation as per EOTA TR 055 needs to be carried out. For more details, see ETA-16/0934.

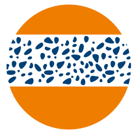
3. Concrete is considered non-cracked when the value of tension within the concrete is $\sigma_L + \sigma_R \leq 0$. In the absence of detailed verification $\sigma_R = 3$ N/mm^2 can be assumed (σ_L equals the tension within the concrete as a result of external loads, forces on anchor included; σ_R equals the tension coming from shrinkage or creep of the concrete, as well as displacements of supports or temperature variations).

4. Shear load figures apply for an anchor without influence of a concrete edge. For shear loads close to an edge ($c \leq 10 \times h_{ef}$), concrete edge failure has to be checked as per EOTA TR 055.

STATIC AND QUASI-STATIC LOADS

The data of these tables is based on:

- ETA-16/0934
- Concrete C20/25, $f_{ck,cube}$ = 25 N/mm².
- Installation has been done correctly (see page 10).
- No influence of edge distances and spacings.
- Respect of minimum base material thickness (see page 11).



Characteristic resistances

Anchor size			M8		M10		M12		M16
Effective anchorage depth h_{ef}		[mm]	35	48	40	60	50	70	85
Non-cracked concrete									
Tensile N_{Rk}	S-KA+/S-KAK+	[kN]	8,0	11,0	12,0	19,0	17,4	25,0	36,0
	S-KAH+/S-KAH+ HCR	[kN]	8,0	11,0	12,0	19,0	17,4	25,0	36,0
Shear V_{Rk}	S-KA+/S-KAK+	[kN]	12,6*	12,6*	20,4*	20,4*	30,0*	30,0*	54,1*
	S-KAH+/S-KAH+ HCR	[kN]	15,8*	15,8*	20,4*	20,4*	34,4*	34,4*	68,6*
Cracked concrete									
Tensile N_{Rk}	S-KA+/S-KAK+	[kN]	5,0	8,5	8,7	12,0	12,2	16,0	24,0
	S-KAH+/S-KAH+ HCR	[kN]	5,0	8,5	8,7	12,0	12,2	16,0	24,0
Shear V_{Rk}	S-KA+/S-KAK+	[kN]	12,6*	12,6*	20,4*	20,4*	34,6	30,0*	54,1*
	S-KAH+/S-KAH+ HCR	[kN]	15,8*	15,8*	20,4*	20,4*	34,6	34,4*	73,1

* Failure mode = steel

Design resistances

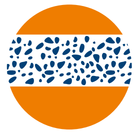
Anchor size			M8		M10		M12		M16
Effective anchorage depth h_{ef}		[mm]	35	48	40	60	50	70	85
Non-cracked concrete									
Tensile N_{Rd}	S-KA+/S-KAK+	[kN]	5,3	7,3	8,0	12,7	11,6	16,7	24,0
	S-KAH+/S-KAH+ HCR	[kN]	5,3	7,3	8,0	12,7	11,6	16,7	24,0
Shear V_{Rd}	S-KA+/S-KAK+	[kN]	10,1*	10,1*	16,3*	16,3*	24,0*	24,0*	43,3*
	S-KAH+/S-KAH+ HCR	[kN]	12,6*	12,6*	16,3*	16,3*	27,5*	27,5*	54,9*
Cracked concrete									
Tensile N_{Rd}	S-KA+/S-KAK+	[kN]	3,3	5,7	5,8	8,0	8,1	10,7	16,0
	S-KAH+/S-KAH+ HCR	[kN]	3,3	5,7	5,8	8,0	8,1	10,7	16,0
Shear V_{Rd}	S-KA+/S-KAK+	[kN]	10,1*	10,1*	16,3*	16,3*	23,1	24,0*	43,3*
	S-KAH+/S-KAH+ HCR	[kN]	10,5	12,6*	16,3*	16,3*	23,1	27,5*	48,7

* Failure mode = steel

STATIC AND QUASI-STATIC LOADS

The data of these tables is based on:

- ETA-16/0934
- Concrete C20/25, $f_{ck,cube}$ = 25 N/mm².
- Installation has been done correctly (see page 10).
- No influence of edge distances and spacings.
- Respect of minimum base material thickness (see page 11).



Recommended loads

Anchor size			M8		M10		M12		M16
Effective anchorage depth h_{ef}		[mm]	**35**	**48**	**40**	**60**	**50**	**70**	**85**
Non-cracked concrete									
Tensile N_{Rec}	S-KA+/S-KAK+	[kN]	**3,8**	**5,2**	**5,7**	**9,0**	**8,3**	**11,9**	**17,1**
	S-KAH+/S-KAH+ HCR	[kN]	**3,8**	**5,2**	**5,7**	**9,0**	**8,3**	**11,9**	**17,1**
Shear V_{Rec}	S-KA+/S-KAK+	[kN]	**7,2***	**7,2***	**11,7***	**11,7***	**17,1***	**17,1***	**30,9***
	S-KAH+/S-KAH+ HCR	[kN]	**9,0***	**9,0***	**11,7***	**11,7***	**19,7***	**19,7***	**39,2***
Cracked concrete									
Tensile N_{Rec}	S-KA+/S-KAK+	[kN]	**2,4**	**4,0**	**4,1**	**5,7**	**5,8**	**7,6**	**11,4**
	S-KAH+/S-KAH+ HCR	[kN]	**2,4**	**4,0**	**4,1**	**5,7**	**5,8**	**7,6**	**11,4**
Shear V_{Rec}	S-KA+/S-KAK+	[kN]	**7,2***	**7,2***	**11,7***	**11,7***	**16,5**	**17,1***	**30,9***
	S-KAH+/S-KAH+ HCR	[kN]	**7,5**	**9,0***	**11,7***	**11,7***	**16,5**	**19,7***	**34,8**

* Failure mode = steel

SEISMIC RESISTANCE

Design acc. EOTA TR 045: Performance category C2

The data of these tables is based on:

- Concrete C20/25, $f_{ck,cube}$ = 25 N/mm².
- Installation has been done correctly (see page 10).
- No influence of edge distances and spacings.
- Respect of minimum base material thickness (see page 11).

Characteristic resistances

Anchor size			M8	M10	M12	M16
Effective anchorage depth h_{ef}		[mm]	**48**	**60**	**70**	**85**
Cracked concrete						
Tensile $N_{Rk, seis}$	S-KA+	[kN]	**1,7**	**2,7**	**2,8**	**10,2**
	S-KAH+	[kN]	**3,6**	**3,2**	**3,3**	**11,1**
Shear $V_{Rk, seis}$	S-KA+	[kN]	**4,8***	**4,3***	**6,9***	**15,4***
	S-KAH+	[kN]	**4,2***	**4,7***	**7,2***	**15,4***

Design resistances

Anchor size			M8	M10	M12	M16
Effective anchorage depth h_{ef}		[mm]	**48**	**60**	**70**	**85**
Cracked concrete						
Tensile $N_{Rd, seis}$	S-KA+	[kN]	**1,1**	**1,8**	**1,9**	**6,8**
	S-KAH+	[kN]	**2,4**	**2,1**	**2,2**	**7,4**
Shear $V_{Rd, seis}$	S-KA+	[kN]	**3,8***	**3,4***	**5,5***	**12,3***
	S-KAH+	[kN]	**3,4***	**3,8***	**5,8***	**12,3***

Recommended loads

Anchor size			M8	M10	M12	M16
Effective anchorage depth h_{ef}		[mm]	**48**	**60**	**70**	**85**
Cracked concrete						
Tensile $N_{Rec, seis}$	S-KA+	[kN]	**0,8**	**1,3**	**1,3**	**4,9**
	S-KAH+	[kN]	**1,7**	**1,5**	**1,6**	**5,3**
Shear $V_{Rec, seis}$	S-KA+	[kN]	**2,7***	**2,4***	**3,9***	**8,8***
	S-KAH+	[kN]	**2,4***	**2,7***	**4,1***	**8,8***

α_{seis} and α_{gap} included as per EOTA TR 045. The values don't consider any filling of the annular gap between the anchor and the fixture.
* Failure mode = steel

FIRE RESISTANCE

The data of these tables is based on:

- ETA-16/0934
- In the absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M'fi}$ = 1,0 is recommended
- Concrete C20/25, $f_{ck,cube}$ = 25 N/mm^2
- Installation has been done correctly (see page 10).
- No influence of edge distances and spacings.
- Respect of minimum base material thickness (see page 11).

Characteristic resistances

Anchor size			M8		M10		M12		M16
Effective anchorage depth h_{ef}		[mm]	**35**	**48**	**40**	**60**	**50**	**70**	**85**
R30									
Tensile $N_{Rk,fi}$	S-KA+/S-KAK+	[kN]	1,25	1,31	1,82	2,09	3,05	3,05	5,69
	S-KAH+/S-KAH+ HCR	[kN]	1,25	2,13	1,82	3,00	3,18	4,00	6,00
Shear $V_{Rk,fi}$	S-KA+/S-KAK+	[kN]	1,31	1,31	2,09	2,09	3,05	3,05	5,69
	S-KAH+/S-KAH+ HCR	[kN]	2,76	3,92	6,02	6,66	9,03	10,25	19,09
R60									
Tensile $N_{Rk,fi}$	S-KA+/S-KAK+	[kN]	1,05	1,05	1,66	1,66	2,40	2,40	4,47
	S-KAH+/S-KAH+ HCR	[kN]	1,25	2,13	1,82	3,00	3,18	4,00	6,00
Shear $V_{Rk,fi}$	S-KA+/S-KAK+	[kN]	1,05	1,05	1,66	1,66	2,40	2,40	4,47
	S-KAH+/S-KAH+ HCR	[kN]	2,70	2,70	4,59	4,59	7,07	7,07	13,16
R90									
Tensile $N_{Rk,fi}$	S-KA+/S-KAK+	[kN]	0,80	0,80	1,24	1,24	1,74	1,74	3,25
	S-KAH+/S-KAH+ HCR	[kN]	1,25	1,48	1,82	2,52	3,18	3,88	6,00
Shear $V_{Rk,fi}$	S-KA+/S-KAK+	[kN]	0,80	0,80	1,24	1,24	1,74	1,74	3,25
	S-KAH+/S-KAH+ HCR	[kN]	1,48	1,48	2,52	2,52	3,88	3,88	7,23
R120									
Tensile $N_{Rk,fi}$	S-KA+/S-KAK+	[kN]	0,67	0,67	1,02	1,02	1,41	1,41	2,64
	S-KAH+/S-KAH+ HCR	[kN]	0,87	0,87	1,46	1,48	2,29	2,29	4,26
Shear $V_{Rk,fi}$	S-KA+/S-KAK+	[kN]	0,67	0,67	1,02	1,02	1,41	1,41	2,64
	S-KAH+/S-KAH+ HCR	[kN]	0,87	0,87	1,48	1,48	2,29	2,29	4,26

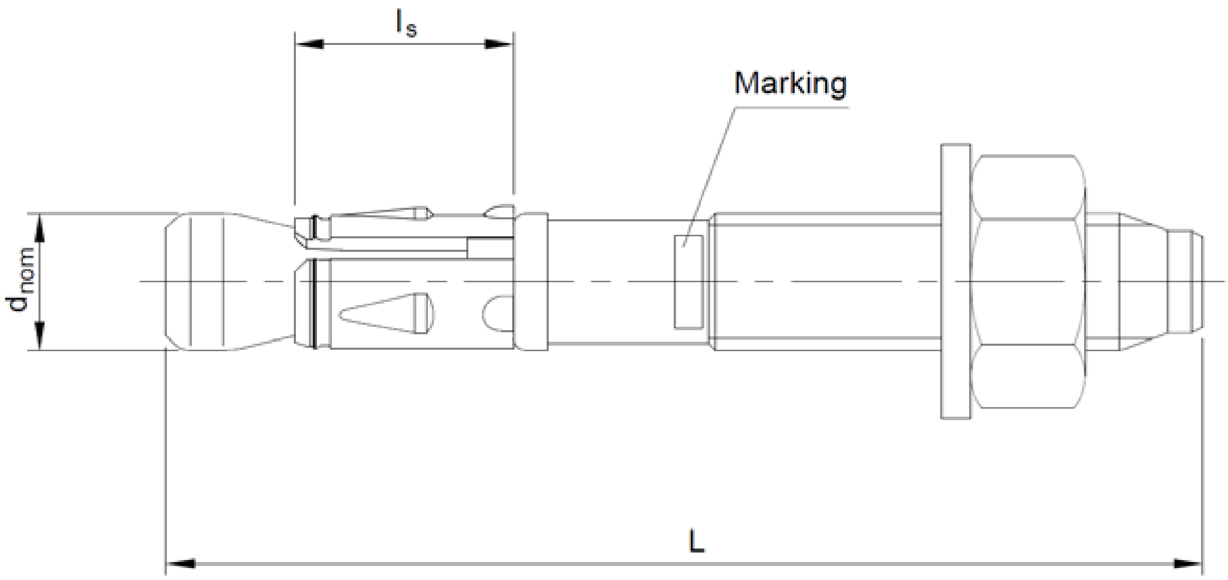
Recommended loads

Anchor size			M8		M10		M12		M16
Effective anchorage depth h_{ef}		[mm]	**35**	**48**	**40**	**60**	**50**	**70**	**85**
R30									
Tensile $N_{Rec,fi}$	S-KA+/S-KAK+	[kN]	1,25	1,31	1,82	2,09	3,05	3,05	5,69
	S-KAH+/S-KAH+ HCR	[kN]	1,25	2,13	1,82	3,00	3,18	4,00	6,00
Shear $V_{Rec,fi}$	S-KA+/S-KAK+	[kN]	1,31	1,31	2,09	2,09	3,05	3,05	5,69
	S-KAH+/S-KAH+ HCR	[kN]	2,76	3,92	6,02	6,66	9,03	10,25	19,09
R60									
Tensile $N_{Rec,fi}$	S-KA+/S-KAK+	[kN]	1,05	1,05	1,66	1,66	2,40	2,40	4,47
	S-KAH+/S-KAH+ HCR	[kN]	1,25	2,13	1,82	3,00	3,18	4,00	6,00
Shear $V_{Rec,fi}$	S-KA+/S-KAK+	[kN]	1,05	1,05	1,66	1,66	2,40	2,40	4,47
	S-KAH+/S-KAH+ HCR	[kN]	2,70	2,70	4,59	4,59	7,07	7,07	13,16
R90									
Tensile $N_{Rec,fi}$	S-KA+/S-KAK+	[kN]	0,80	0,80	1,24	1,24	1,74	1,74	3,25
	S-KAH+/S-KAH+ HCR	[kN]	1,25	1,48	1,82	2,52	3,18	3,88	6,00
Shear $V_{Rec,fi}$	S-KA+/S-KAK+	[kN]	0,80	0,80	1,24	1,24	1,74	1,74	3,25
	S-KAH+/S-KAH+ HCR	[kN]	1,48	1,48	2,52	2,52	3,88	3,88	7,23
R120									
Tensile $N_{Rec,fi}$	S-KA+/S-KAK+	[kN]	0,67	0,67	1,02	1,02	1,41	1,41	2,64
	S-KAH+/S-KAH+ HCR	[kN]	0,87	0,87	1,46	1,48	2,29	2,29	4,26
Shear $V_{Rec,fi}$	S-KA+/S-KAK+	[kN]	0,67	0,67	1,02	1,02	1,41	1,41	2,64
	S-KAH+/S-KAH+ HCR	[kN]	0,87	0,87	1,48	1,48	2,29	2,29	4,26

MATERIALS AND DIMENSIONS

Anchor dimensions

Anchor size		M8	M10	M12	M16
Total length	L [mm]	**57...420**	**62...420**	**78...420**	**118...420**
Sleeve length	l_s [mm]	**14,8**	**17,9**	**19,1**	**26,0**
Bolt body	d_{nom} [mm]	**8**	**10**	**12**	**16**
Hexagonal nut	SW [mm]	**13**	**17**	**19**	**24**
	m	**≥ 6,5**	**≥ 8,0**	**≥ 10,0**	**≥ 13,0**



Mechanical properties

Specification	Anchor/size		M8	M10	M12	M16
Nominal tensile strength $F_{uk,thread}$	S-KA+ / S-KAK+	[N/mm²]	**700**	**690**	**690**	**660**
	S-KAH+ / S-KAH+ HCR	[N/mm²]	**670**	**690**	**690**	**645**
Char. bending resistance $M^0_{Rk,s}$	S-KA+ / S-KAK+	[Nm]	**26,3**	**51**	**90**	**219,8**
	S-KAH+ / S-KAH+ HCR	[Nm]	**25,1**	**51**	**90**	**214,8**
Design bending resistance $M_{Rd,s}$	S-KA+ / S-KAK+	[Nm]	**21,0**	**40,8**	**72,0**	**175,8**
	S-KAH+ / S-KAH+ HCR	[Nm]	**20,1**	**40,8**	**72,0**	**171,8**
Recommended bending moment M_{Rec}	S-KA+ / S-KAK+	[Nm]	**15,0**	**29,1**	**51,4**	**125,6**
	S-KAH+ / S-KAH+ HCR	[Nm]	**14,3**	**29,1**	**51,4**	**122,7**

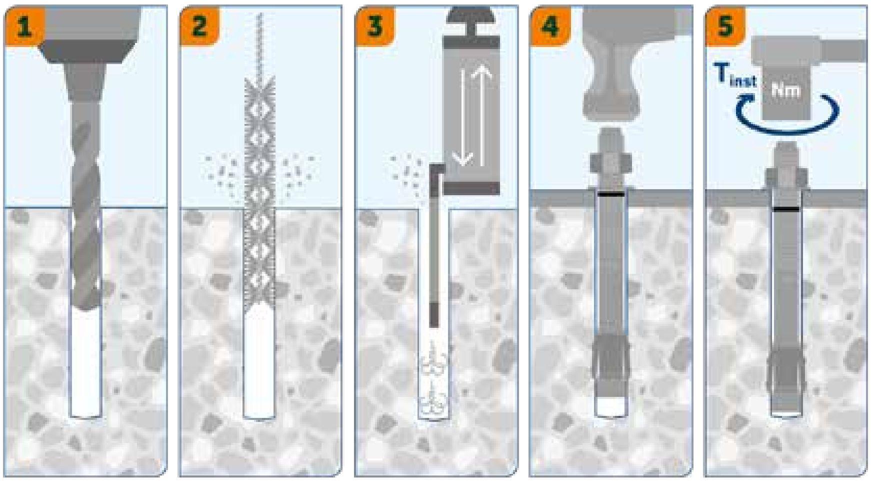
Material quality

Part of anchor		Material
Bolt	S-KA+	Carbon steel, zinc electroplated EN ISO 4042, min. 5 µm
	S-KAK+	Carbon steel, hot dip galvanized EN ISO 10684, min. 50 µm
	S-KAH+	Stainless steel A4
	S-KAH+ HCR	Stainless steel HCR 1.4529

SETTING INSTRUCTIONS

Installation equipment

Specification	M8	M10	M12	M16
Rotary hammer (recommendation)	**750...1200 r.p.m / 1.8...3.3 J**			
				360...550 r.p.m / 4.9...11.5 J
Setting tool (optional)	**S-KA 6-10 SDS+**		**S-KA 12-20 SDS+**	
Drill bit	**SDS+ 2-CUT/4-CUT 8 mm...16 mm**			
Additional tools	**brush, air pump/compressor, hammer, torque wrench**			



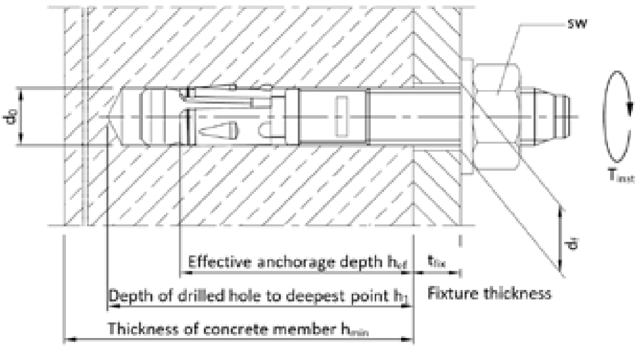
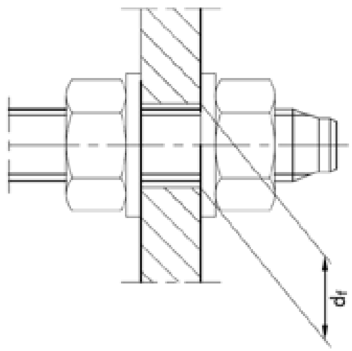
INSTALLATION

1. Drill a hole according to the product data.
2.-3. Clean the hole using a metal brush and a blow-out pump.
4. Install anchor with a hammer or a setting tool.
5. Tighten the anchor to the specified installation torque.

Installation data

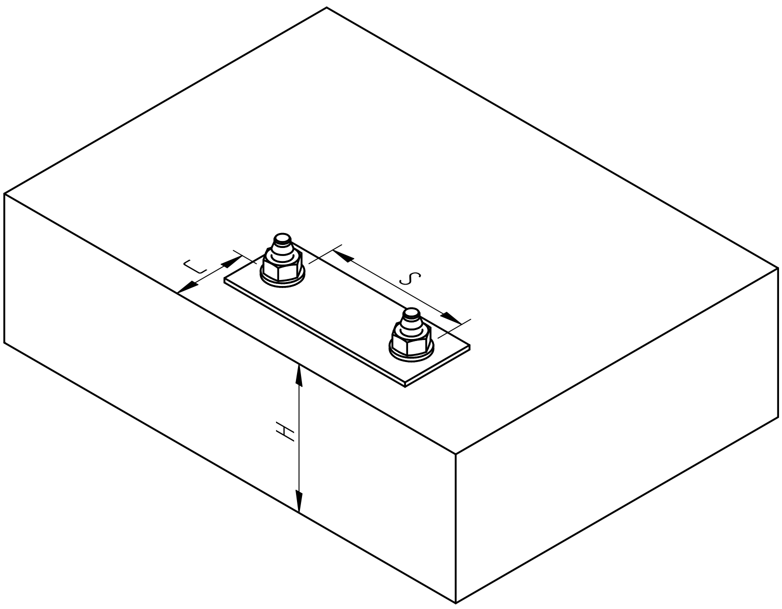
Parameters and anchor sizes				M8		M10		M12		M16
Drill hole diameter		d_0	[mm]	**8**		**10**		**12**		**16**
Diameter of the drill bit at the upper tolerance limit		$d_{cut,max} \leq$	[mm]	**8,45**		**10,45**		**12,50**		**16,50**
Depth of drilled hole to deepest point		$h_1 \geq$	[mm]	**47**	**60**	**55**	**75**	**70**	**90**	**110**
Effective anchorage depth		h_{ef}	[mm]	**35**	**48**	**40**	**60**	**50**	**70**	**85**
Nominal anchorage depth		h_{nom}	[mm]	**40**	**53**	**48**	**68**	**61**	**81**	**97**
Diameter of clearance hole in the fixture		$d_f \leq$	[mm]	**9**		**12**		**14**		**18**
Width across flats		SW	[mm]	**13**		**17**		**19**		**24**
Required torque	S-KA+ / S-KAK+	T_{inst}	[Nm]	**15**		**30**		**60**		**110**
	S-KAH+ / S-KAH+ HCR			**20**		**45**		**60**		**110**

Installation methods

Push-through installation	Distance installation
	

Minimum thickness of concrete member, spacing and edge distance

Cracked and non-cracked concrete			M8		M10		M12		M16
Effective anchorage depth	h_{ef}	[mm]	**35**	**48**	**40**	**60**	**50**	**70**	**85**
Minimum thickness of base material	h_{min}	[mm]	80	100	100	120	100	140	170
	$h_{min\text{-}red}$	[mm]	-	80	-	100	-	-	-
Minimum spacing for h_{min}	s_{min}	[mm]	55	35	50	40	55	60	65
	$c \geq$	[mm]	75	50	95	60	110	70	95
Minimum edge distance for h_{min}	c_{min}	[mm]	40		50		60	55	65
	$s \geq$	[mm]	140	55	190	100	215	110	150
Minimum spacing for $h_{min\text{-}red}$	s_{min}	[mm]	-	35	-	40	-	-	-
	$c \geq$	[mm]	-	55	-	100	-	-	-
Minimum edge distance for $h_{min\text{-}red}$	c_{min}	[mm]	-	40	-	60	-	-	-
	$s \geq$		-	60	-	90	-	-	-
Critical spacing for splitting failure and concrete cone failure (in case characteristic loading affects)	$s_{cr,sp}$	[mm]	170	192	160	240	200	280	340
	$s_{cr,N}$	[mm]	106	144	120	180	150	210	254
Critical edge distance for splitting failure and concrete cone failure (in case characteristic loading affects)	$c_{cr,sp}$	[mm]	85	96	80	120	100	140	170
	$c_{cr,N}$	[mm]	53	72	60	90	75	105	127

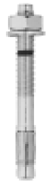
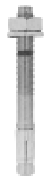
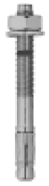
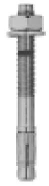


Setting tool S-KA SDS+

Hammering tool to make through bolt installation quicker and smoother

- Original Sormat through bolts setting tool with designed head that does not damage the head of the anchor and keep the head from slipping.
- Besides ensuring most efficient and safe through bolt installation in general, the setting tool also significantly saves time and energy in serial installation.
- Compatible with all rotary hammer machines with SDS+ chuck.

DELIVERY PROGRAM

				S-KA+	S-KAK+	S-KAH+ A4	S-KAH+ HCR
							
Thread size	**Type**	**t_{fix}**	**Length**	**Zinc**	**Hot dip**	**Stainless A4**	**HCR**
M8	M8/5/-	5	57	●	●	●	●
	M8/23/10	23/10	75	●	●	●	●
	M8/43/30	43/30	95	●	●	●	●
	M8/63/50	63/50	115	●	●	●	●
	M8/98/85	98/85	150	●	●	●	●
M10	M10/10/-	10/-	72	●	●	●	●
	M10/30/10	30/10	92	●	●	●	●
	M10/40/20	40/20	102	●	●	●	●
	M10/50/30	50/30	112	●	●	●	●
	M10/70/50	70/50	132	●	●	●	●
	M10/100/80	100/80	162	●	●	●	●
M12	M12/10/-	10/-	88	●	●	●	●
	M12/25/5	25/5	103	●	●	●	●
	M12/40/20	40/20	118	●	●	●	●
	M12/50/30	50/30	128	●	●	●	●
	M12/70/50	70/50	148	●	●	●	●
	M12/85/65	85/65	163	●	●	●	●
	M12/100/80	100/80	178	●	●	●	●
M16	M16/5	5	123	●	●	●	●
	M16/20	20	138	●	●	●	●
	M16/50	50	168	●	●	●	●
	M16/60	60	178	●	●	●	●

• On request