Deutsches Institut für Bautechnik

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Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

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

European Technical Assessment

ETA-23/0211 of 9 June 2023

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	Sympafix SHL-PLUS
Product family to which the construction product belongs	Mechanical fasteners for use in concrete
Manufacturer	Sympafix B.V. Fluorietweg 25E 1812RR ALKMAAR NIEDERLANDE
Manufacturing plant	PLANT 68
This European Technical Assessment contains	15 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 330232-01-0601, Edition 05/2021

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Specific Part

1 Technical description of the product

The Sympafix SHL-PLUS is a fastener made of galvanised steel of sizes M6, M8, M10, M12 and M16 which is placed into a drilled hole and anchored by torque-controlled expansion.

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 fastener 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 fastener of at least 50 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) Method A	See Annex B2 and C1
Characteristic resistance to shear load (static and quasi static loading)	See Annex C2
Displacements	See Annex C5
Characteristic resistance and displacements for seismic performance categories C1 and C2	See Annex C1, C2 and C5

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	See Annex C 3 and C 4

3.3 Aspects of durability

Essential characteristic	Performance
Durability	See Annex B1

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

In accordance with European Assessment Documents EAD No. 330232-01-0601 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.

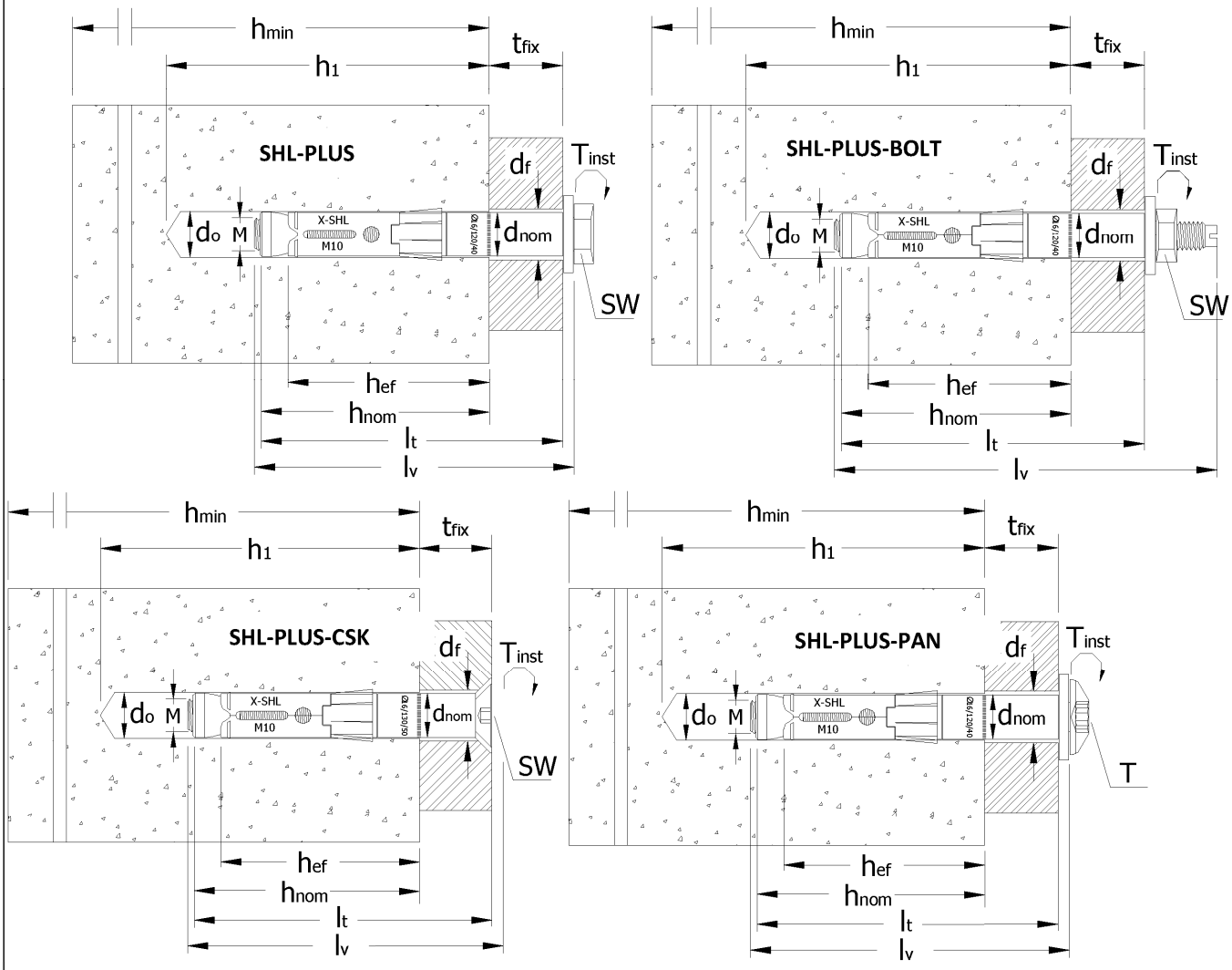
Issued in Berlin on 9 June 2023 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Baderschneider

Deutsches Institut für Bautechnik DIBt

Installed conditions



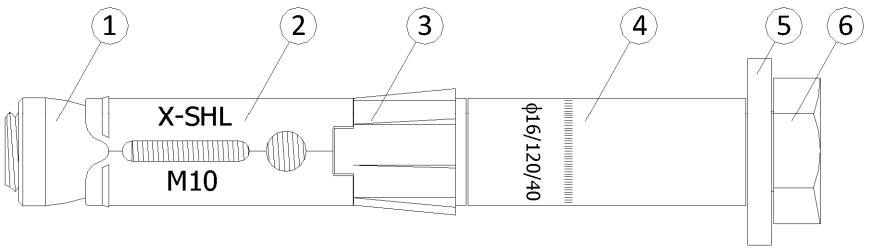
Designation

d_{nom}	Outside diameter of the anchor
T_{inst}	Required torque moment
t_{fix}	Thickness of the fixtures
d_0	Diameter of the drill hole
d_f	Diameter of the clearance hole in the fixture
h_{min}	Minimum thickness of the concrete member
h_{nom}	Overall anchor embedment depth
h_{ef}	Anchorage depth
l_t	Anchor length
l_v	Bolt lenght
T	Hexalobular socket number
SW	Wrench size/Socket size
H	Hexagonal socket

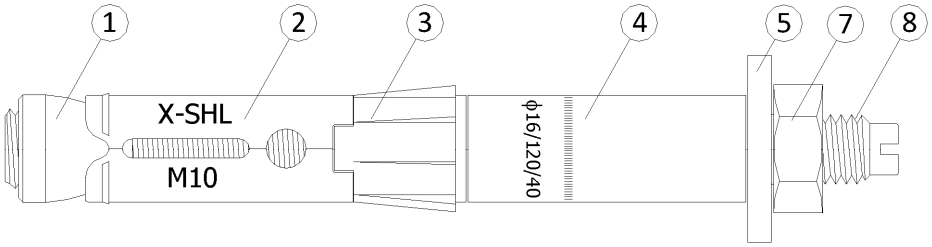
Sympafix SHL-PLUS

Product description
Installed condition

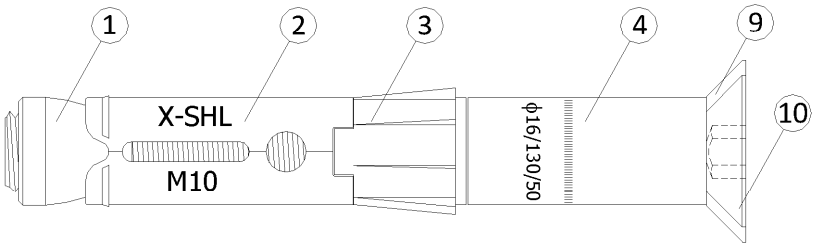
Annex A1



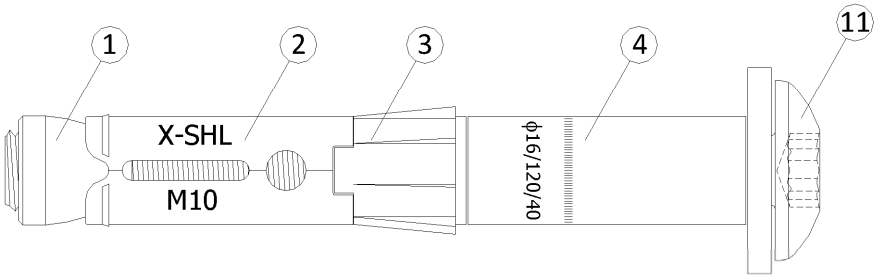
SHL-PLUS
Anchor with hexagon head screw



SHL-PLUS-BOLT
Anchor with threaded stud



SHL-PLUS-CSK
Anchor with flat countersunk head screw



SHL-PLUS-PAN
Anchor with mushroom head screw

Table A1: Materials

ITEM	Description	Finishing
1	Zinc plated conical steel nut	Materials galvanized ≥ 5 [µm] according to EN ISO 4042:2022
2	Zinc plated expansion steel sleeve (marking: X-SHL / bolt size, e.g. M10)	
3	Nylon cylinder with helix, granite grey color	
4	Zinc plated steel extension (marking: $d_{nom}/l_t/t_{fix}$, e.g. Ø16/120/40)	
5	Zinc plated steel washer	
6	Zinc plated steel hexagonal head bolt, class 8.8 according to EN ISO 898-1:2013	
7	Zinc plated steel hexagonal nut, class 8 according to EN ISO 898-2:2022	
8	Zinc plated steel threaded stud, class 8.8 according to EN ISO 898-1:2013	
9	Zinc plated steel countersunk washer, according to EN 683-1:2018	
10	Zinc plated steel flat countersunk head screw, class 8.8 according to EN ISO 898-1:2013	
11	Zinc plated steel mushroom head screw, class 8.8 according to EN ISO 898-1:2013	

Sympafix SHL-PLUS	Annex A2
Product description Anchor types and components	

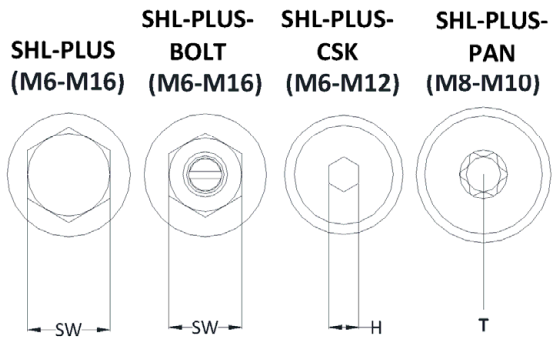


Table A2: SHL-PLUS dimensions

Item	Outside diameter of anchor [mm]	Outside diameter of metric thread [mm]	Length range [mm]	Maximum thickness of fixture range [mm]
SHL-PLUS-M6	10	6	70 - 200	5 - 135
SHL-PLUS-M8	12	8	80 - 200	10 - 130
SHL-PLUS-M10	16	10	90 - 200	10 - 120
SHL-PLUS-M12	18	12	110 – 250	10 - 150
SHL-PLUS-M16	24	16	130 – 300	10 - 180

Table A3: SHL-PLUS-BOLT dimensions

Item	Outside diameter of anchor [mm]	Outside diameter of metric thread [mm]	Length range [mm]	Maximum thickness of fixture range [mm]
SHL-PLUS-BOLT-M6	10	6	70 - 200	5 - 135
SHL-PLUS-BOLT-M8	12	8	80 - 200	10 - 130
SHL-PLUS-BOLT-M10	16	10	90 - 200	10 - 120
SHL-PLUS-BOLT-M12	18	12	110 – 250	10 - 150
SHL-PLUS-BOLT-M16	24	16	130 – 300	10 - 180

Table A4: SHL-PLUS-CSK dimensions

Item	Outside diameter of anchor [mm]	Outside diameter of metric thread [mm]	Length range [mm]	Maximum thickness of fixture range [mm]
SHL-PLUS-CSK-M6	10	6	70 - 205	5 - 140
SHL-PLUS-CSK-M8	12	8	85 - 205	15 - 135
SHL-PLUS-CSK-M10	16	10	100 - 200	20 - 120
SHL-PLUS-CSK-M12	18	12	120 - 200	20 - 100

Table A5: SHL-PLUS-PAN dimensions

Item	Outside diameter of anchor [mm]	Outside diameter of metric thread [mm]	Length range [mm]	Maximum thickness of fixture range [mm]
SHL-PLUS-PAN-M8	12	8	80 - 200	10 - 130
SHL-PLUS-PAN-M10	16	10	100 - 200	20 - 120

Sympafix SHL-PLUS

Product description
Anchor dimensions

Annex A3

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Specifications of intended use

Anchorages subject to:
- Static or quasi-static actions: all sizes
- Seismic action for Performance Category C1: all sizes
- Seismic action for Performance Category C2: all sizes
- Resistance to fire exposure: all sizes

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

Use conditions (Environmental conditions):
- Structures subject to dry internal conditions

Design:
- Fastenings are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored. The position of the anchor is indicated on the design drawings (e.g. position of the anchor relative to reinforcement or to supports, etc.).
- Design of fastenings according to EN 1992-4:2018 and EOTA Technical Report TR 055:2018

Installation:
- Hole drilling by rotary plus hammer mode
- Fastener installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- In case of aborted hole: new drilling at a minimum distance away of twice the depth of the aborted hole or smaller distance if the aborted hole is filled with high strength mortar and if under shear or oblique tension load it is not the direction of the load application.

Sympafix SHL-PLUS	Annex B1
Intended use Specifications	

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Table B1: Installation parameters

Parameter		SHL-PLUS M6	SHL-PLUS M8	SHL-PLUS M10	SHL-PLUS M12	SHL-PLUS M16
Nominal drill hole diameter	d_o = [mm]	10	12	16	18	24
Cutting diameter of drill bit	$d_{cut} \leq$ [mm]	10,45	12,50	16,50	18,50	24,55
Effective embedment depth	h_{ef} = [mm]	55	60	70	90	105
Depth of drill hole	h_1 = [mm]	80	90	100	120	140
Diameter of clearance in the fixture	d_f = [mm]	12	14	18	20	26
Embedment depth	h_{nom} = [mm]	65	70	80	100	120
Installation torque moment	T_{inst} = [Nm]	15	30	50	100	160
Outside diameter of anchor	d_{nom} = [mm]	10	12	16	18	24
Minimum thickness of concrete member	h_{min} = [mm]	110	120	140	180	210
Minimum edge distance	c_{min} = [mm]	70	100	90	175	180
	s ≥ [mm]	110	160	175	255	290
Minimum spacing distance	s_{min} = [mm]	55	110	80	135	130
	c ≥ [mm]	110	145	120	220	240

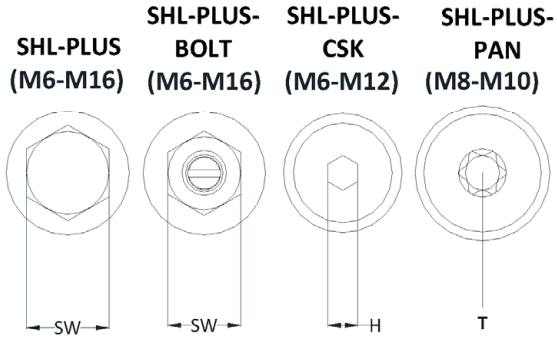


Table B2: Wrenches, sockets and maximum thickness of fixture

Item		M6	M8	M10	M12	M16
SHL-PLUS – Wrench size	SW = [mm]	10	13	17	19	24
Thickness of fixture	$t_{fix,max}$ = [mm]	55	70	80	100	100
	$t_{fix,min}$ = [mm]	5	10	20	20	20
SHL-PLUS-BOLT – Wrench size	SW = [mm]	10	13	17	19	24
Thickness of fixture	$t_{fix,max}$ = [mm]	55	70	80	100	100
	$t_{fix,min}$ = [mm]	5	10	20	20	20
SHL-PLUS-CSK – Hexagonal socket size	H = [mm]	4	5	6	8	-[1]
Thickness of fixture	$t_{fix,max}$ = [mm]	60	55	50	100	-[1]
	$t_{fix,min}$ = [mm]	20	15	30	20	-[1]
SHL-PLUS-PAN – Hexalobular socket number	T = [-]	-[1]	40	40	-[1]	-[1]
Thickness of fixture	$t_{fix,max}$ = [mm]	-[1]	50	40	-[1]	-[1]
	$t_{fix,min}$ = [mm]	-[1]	10	20	-[1]	-[1]

[1] Anchor type not part of the ETA

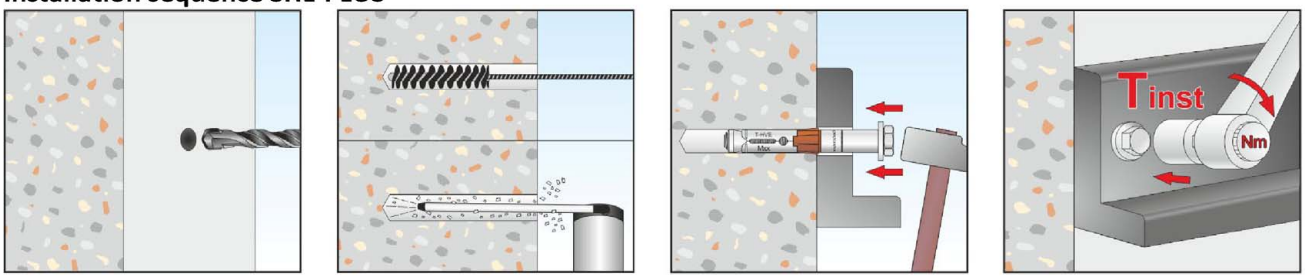
Sympafix SHL-PLUS

Intended use
Installation parameters

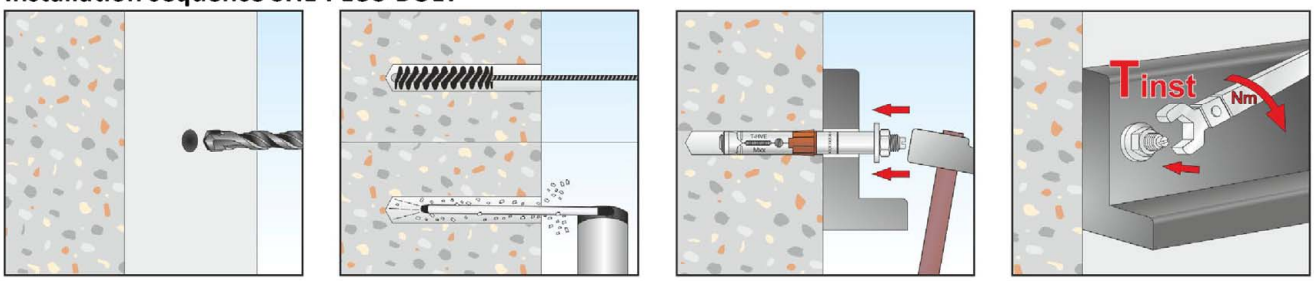
Annex B2

Deutsches Institut für Bautechnik DIBt

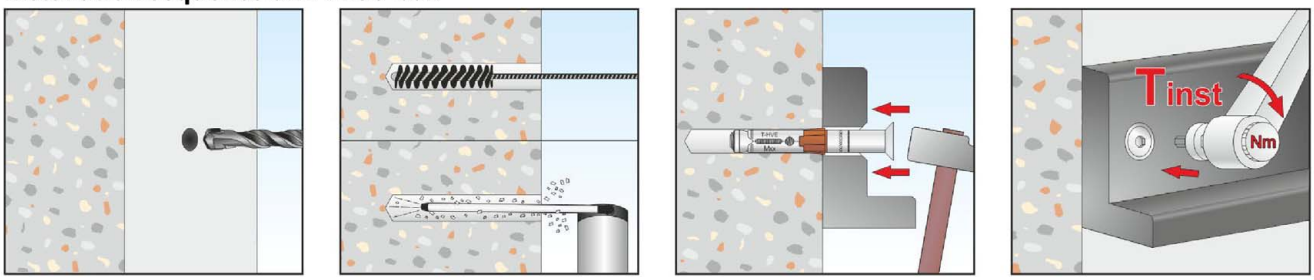
Installation sequence SHL-PLUS



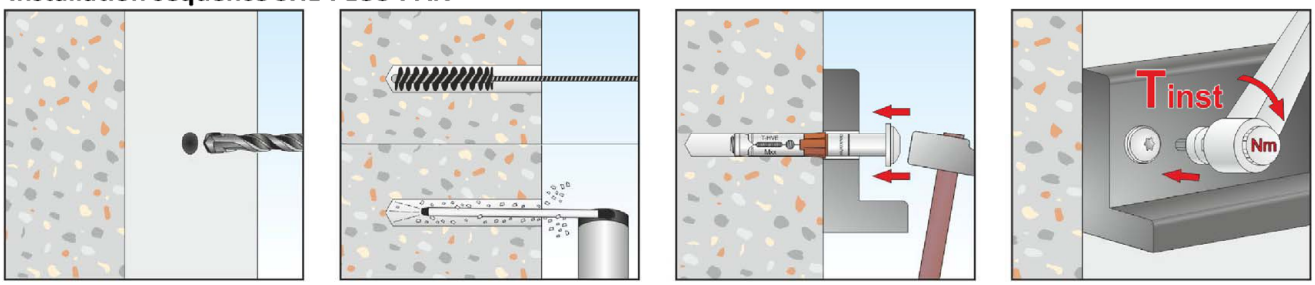
Installation sequence SHL-PLUS-BOLT



Installation sequence SHL-PLUS-CSK



Installation sequence SHL-PLUS-PAN



Step 1	Drill a hole into the concrete in rotary plus hammer mode
Step 2	Remove the dust into the hole using 4 times a brush and 4 times a blowing pump
Step 3	Place the fixture and hammer the anchor in the drill hole
Step 4	Apply the required torque moment

Sympafix SHL-PLUS

Intended use
Installation instructions

Annex B3

Deutsches Institut für Bautechnik DIBt

Table C1: Characteristic values of tension resistance under static and quasi static action and under seismic actions performance category C1 and C2

Type of anchor / Size			**SHL-PLUS M6**	**SHL-PLUS M8**	**SHL-PLUS M10**	**SHL-PLUS M12**	**SHL-PLUS M16**
Steel Failure							
Characteristic resistance	$N_{Rk,s}$ $N_{Rk,s,C1}$ $N_{Rk,s,C2}$	[kN]	16	29	46	67	125
Partial factor	γ_{Ms} [1)]		1,5				
Pull-out failure							
Effective embedment depth	h_{ef}	[mm]	55	60	70	90	105
Characteristic resistance in uncracked concrete C20/25	$N_{Rk,p}$	[kN]	16	16	20	35	45
Characteristic resistance in cracked concrete C20/25			5	6	16	25	35
Characteristic resistance for seismic performance category C1	$N_{Rk,p,,C1}$	[kN]	5	4,2	14,4	25	35
Characteristic resistance for seismic performance category C2	$N_{Rk,p,C2}$	[kN]	3,9	4,2	11,7	18,5	31
Increasing factors for cracked and uncracked concrete $N_{Rk,p} = \Psi_c \bullet N_{Rk,p}$ (C20/25)	Ψ_c	C30/37	1,22				
		C40/50	1,41				
		C50/60	1,55				
Installation sensitivity factor	γ_{inst}		1,0				
Concrete cone failure and splitting failure							
Effective embedment depth	h_{ef}	[mm]	55	60	70	90	105
Factor for uncracked concrete	$k_{ucr,N}$	[-]	11,0				
Factor for cracked concrete	$k_{cr,N}$	[-]	7,7				
Spacing	$s_{cr,N}$	[mm]	165	180	210	270	315
Edge distance	$c_{cr,N}$	[mm]	85	90	105	135	160
Spacing(splitting)	$s_{cr,sp}$	[mm]	220	320	240	370	390
Edge distance (splitting)	$c_{cr,sp}$	[mm]	110	160	120	185	195
Characterstic resistance to splitting	$N^0_{Rk,sp}$	[kN]	min ($N_{Rk,p}$; $N^0_{Rk,c}$ [2)])				
Factor of the annular gap	α_{gap}	[-]	1,0				

[1)] In absence of other national regulations.

[2)] $N^0_{Rk,c}$ according to EN 1992-4:2018

Sympafix SHL-PLUS

Annex C1

Performance
Characteristic values of tension resistance under static and quasi-static actions and seismic actions performance category C1 and C2

Deutsches Institut für Bautechnik DIBt

Table C2: Characteristic values of shear resistance under static and quasi static action and under seismic actions performance category C1 and C2

Type of anchor / Size			SHL-PLUS M6	SHL-PLUS M8	SHL-PLUS M10	SHL-PLUS M12	SHL-PLUS M16
Steel Failure without level arm							
Characteristic resistance	$V^0_{Rk,s}$	[kN]	16	25	43	58	107
Characteristic resistance for seismic performance category C1	$V_{Rk,s,C1}$	[kN]	11,4	17	28	43,5	96,3
Characteristic resistance for seismic performance category C2	$V_{Rk,s,C2}$	[kN]	6,0	10,7	23,2	40,6	74,9
Partial factor	γ_{Ms} [1)]		1,45				
Steel Failure with level arm							
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	12	30	60	105	266
Ductility factor	k_7	[-]	0,8				
Partial factor	γ_{Ms} [1)]		1,45				
Concete pryout failure							
Effective embedmen depth	h_{ef}	[mm]	55	60	70	90	105
Factor for pryout failure	k_8		1	2	2	2	2
Installation sensitivity factor	γ_{inst}		1,0				
Concrete edge failure							
Effective achorage legth	l_{ef}	[mm]	55	60	70	90	105
Effective external diameter anchor	d_{nom}	[mm]	10	12	16	18	24
Installation sensitivity factor	γ_{inst}		1,0				

[1)] In absence of other national regulations.

Sympafix SHL-PLUS

Performance
Characteristic values of shear resistance under static and quasi-static actions and seismic actions performance category C1 and C2

Annex C2

Deutsches Institut für Bautechnik DIBt

Table C3: Characteristic values of tension resistance under fire exposure

Duration of fire resistance = 30min, anchor type SHL-PLUS			**M6**	**M8**	**M10**	**M12**	**M16**
Steel Failure							
Characteristic resistance	$N_{Rk,s,fi,30}$	[kN]	0,2	0,4	0,9	1,7	3,1
Pull-out failure							
Characteristic resistance	$N_{Rk,p,fi,30}$	[kN]	1,3	1,5	4,0	6,3	8,8
Concrete cone failure							
Characteristic resistance	$N_{Rk,c,fi,30}$	[kN]	4,0	5,0	7,4	13,8	20,3
Duration of fire resistance = 60min, anchor type SHL-PLUS			**M6**	**M8**	**M10**	**M12**	**M16**
Steel Failure							
Characteristic resistance	$N_{Rk,s,fi,60}$	[kN]	0,2	0,3	0,8	1,3	2,4
Pull-out failure							
Characteristic resistance	$N_{Rk,p,fi,60}$	[kN]	1,3	1,5	4,0	6,3	8,8
Concrete cone failure							
Characteristic resistance	$N_{Rk,c,fi,60}$	[kN]	4,0	5,0	7,4	13,8	20,3
Duration of fire resistance = 90min, anchor type SHL-PLUS			**M6**	**M8**	**M10**	**M12**	**M16**
Steel Failure							
Characteristic resistance	$N_{Rk,s,fi,90}$	[kN]	0,1	0,3	0,6	1,1	2,0
Pull-out failure							
Characteristic resistance	$N_{Rk,p,fi,90}$	[kN]	1,3	1,5	4,0	6,3	8,8
Concrete cone failure							
Characteristic resistance	$N_{Rk,c,fi,90}$	[kN]	4,0	5,0	7,4	13,8	20,8
Duration of fire resistance = 120min, anchor type SHL-PLUS			**M6**	**M8**	**M10**	**M12**	**M16**
Steel Failure							
Characteristic resistance	$N_{Rk,s,fi,120}$	[kN]	0,1	0,2	0,5	0,8	1,6
Pull-out failure							
Characteristic resistance	$N_{Rk,p,fi,120}$	[kN]	1,0	1,2	3,2	5,0	7,0
Concrete cone failure							
Characteristic resistance	$N_{Rk,c,fi,120}$	[kN]	3,2	4,0	5,9	11,1	16,3

Sympafix SHL-PLUS

Performance
Characteristic values of tension resistance under fire exposure

Annex C3

Deutsches Institut für Bautechnik DIBt

Table C4: Characteristic values of shear resistance under fire exposure

Duration of fire resistance = 30min, anchor type SHL-PLUS			**M6**	**M8**	**M10**	**M12**	**M16**
Shear load without lever arm							
Characteristic resistance	$V_{Rk,s,fi,30}$	[kN]	0,3	0,5	1,2	2,1	3,9
Shear load with lever arm							
Characteristic bending resistance	$M^0_{Rk,s,fi,30}$	[Nm]	0,2	0,4	1,1	2,6	6,7
Duration of fire resistance = 60min, anchor type SHL-PLUS			**M6**	**M8**	**M10**	**M12**	**M16**
Shear load without lever arm							
Characteristic resistance	$V_{Rk,s,fi,60}$	[kN]	0,3	0,4	1,0	1,6	2,9
Shear load with lever arm							
Characteristic bending resistance	$M^0_{Rk,s,fi,60}$	[Nm]	0,1	0,3	1,0	2,0	5,0
Duration of fire resistance = 90min, anchor type SHL-PLUS			**M6**	**M8**	**M10**	**M12**	**M16**
Shear load without lever arm							
Characteristic resistance	$V_{Rk,s,fi,90}$	[kN]	0,2	0,3	0,8	1,4	2,5
Shear load with lever arm							
Characteristic bending resistance	$M^0_{Rk,s,fi,90}$	[Nm]	0,1	0,3	0,8	1,7	4,3
Duration of fire resistance = 120min, anchor type SHL-PLUS			**M6**	**M8**	**M10**	**M12**	**M16**
Shear load without lever arm							
Characteristic resistance	$V_{Rk,s,fi,120}$	[kN]	0,2	0,2	0,6	1,0	1,9
Shear load with lever arm							
Characteristic bending resistance	$M^0_{Rk,s,fi,120}$	[Nm]	0	0,2	0,6	1,3	3,3

Sympafix SHL-PLUS

Performance
Characteristic values of tension resistance under fire exposure

Annex C4

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Table C5: Displacements

Tension loads in cracked and uncracked concrete			**M6**	**M8**	**M10**	**M12**	**M16**
Service tension load in uncracked concrete C20/25	N	[kN]	7,6	7,6	9,5	16,7	21,4
Displacements	δ_{N0}	[mm]	1,3	1,5	1,0	1,3	1,8
	$\delta_{N\infty}$	[mm]	1,3	1,5	1,0	1,3	1,8
Service tension load in cracked concrete C20/25	N	[kN]	2,4	2,9	7,6	11,9	16,7
Displacements	δ_{N0}	[mm]	1,0	0,7	1,0	1,2	1,5
	$\delta_{N\infty}$	[mm]	1,6	1,3	1,6	1,7	1,5
Shear loads in cracked and uncracked concrete			**M6**	**M8**	**M10**	**M12**	**M16**
Service shear load in cracked and uncracked concrete C20/25	V	[kN]	7,7	12,3	21,0	23,3	52,5
Displacements	δ_{V0}	[mm]	2,4	2,6	2,5	3,0	4,0
	$\delta_{V\infty}$	[mm]	3,6	3,9	3,8	4,5	6,0
Displacements for seismic performance category C2							
Damage limit state							
Tension load	$\delta_{N,C2(DLS)}$	[mm]	5,56	5,24	4,23	5,39	6,74
Shear load	$\delta_{V,C2(DLS)}$	[mm]	3,18	5,74	5,12	5,98	6,93
Ultimate limit state							
Tension load	$\delta_{N,C2(ULS)}$	[mm]	22,70	17,65	14,50	16,03	20,59
Shear load	$\delta_{V,C2(ULS)}$	[mm]	4,82	11,02	9,37	9,42	12,96

Sympafix SHL-PLUS

Performance
Displacements

Annex C5