Hilti HSA Submission Folder

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Customer Hotline

Hong Kong 8228 8118

Macau (Toll free) 00800- 8228 8118

SAMPLE SUBMISSION AND APPROVAL FORM

Contract Title:	_____	Ref. No.:	_____
	_____	Date:	_____
		Ref. No. of Previous Submission:	_____
Contract No:	_____	(1)	_____
File Reference:	_____	(2)	_____

DETAILS OF SUBMISSION

To: Contract Manager's Representative Attention: _____

From: _____

The enclosed sample and catalogue* / certificate of origin* / technical data* / test report* / job reference* as described below have been checked for compliance with the Specifications and Drawings, and are submitted for approval.

1. General Information

a. Material Description HSA / HSA-F / HSA-R / HST / HST-R / HST-HCR stud anchor

b. Location: _____

c. Specification Ref. Page: _____ Item: _____

d. Drawing Ref. No. _____

e. B.Q. Ref.No.: _____

f. Anticipated date of approval: _____

2. Technical Information

The submitted sample has been checked against the specification and drawings as listed below:-

Specification Requirements	**Submitted Sample** (State details against each item)
a. **Brand** Not specified	Hilti
b. **Country of Origin** Not specified	Liechtenstein
c. **Manufacturer's Name & Address** Not specified	Hilti Corporation, FL-9494 Principality of Liechtenstein
d. **Factory's Name & Address(es)** Not specified	Hilti Aktiengesellschaft, Hilti AG, Feldkircherstrasse, FL-9494 Schaan, Liechtenstein
e. **Supplier (with Applicator, if any)** Not specified	Hilti (Hong Kong) Ltd

f. **Appearance** Not specified	According to the sample submitted
g. **Color +** Not specified	NIL
h. **Specification** Not specified	Attached
i. **Manufacturer's Catalogue** Not specified	Attached
j. **Test Report** (Original/Certificated True Copy) Not specified	Attached
k. **Previous Job Reference** Not specified	Attached
l. **Supplementary Information** Not specified	NIL

For and on behalf of the Contractor

_____
(Quality Control Manager)

CONTRACT MANAGER'S COMMENTS

To:
From: Contract Manager's Representative: _____

On the basis of the sample and information given, the above sample submitted is:

(1) * **Approved.**
(2) * **Not approved** because _____
_____
_____
Remarks: _____
_____
_____

Approval does not alter the requirements of the Contract

Contract Manager's Representative: _____

_____
Date:

cc. _____
_____
_____
_____

(* Delete if appropriate)
(+ For glass or vitreous mosaic tiles, the contractor is required to confirm the colour range(s) of the submitted sample, i.e. a) light and or medium; or b) dark)

Stud anchor
HSA

Applications

- For fastening cladding works and facades, shopfronts and balustrades, window wall and steel works
- For fastening aluminum windows and Louvres
- For fastening marble granite and architectural features

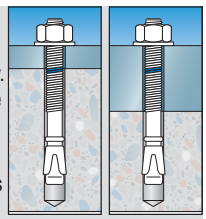
Base material

- Non-cracked concrete

Material

- Steel, galvanized at least 5µm (M6-M20)
- Hot dip galvanized at least 45µm (M6-M20)
- A4 stainless steel (M6-M20)

Advantages



- Two anchorage depth for optimize use and high efficiency. And two defined and marked embedment depths for ease in inspection
- Due to the cold-forming technology manufacturing process, the anchor material remains ductile. The result is an anchor which allows alignment without breaking
- Head mark with letter code for accurate identification when in place

Approvals

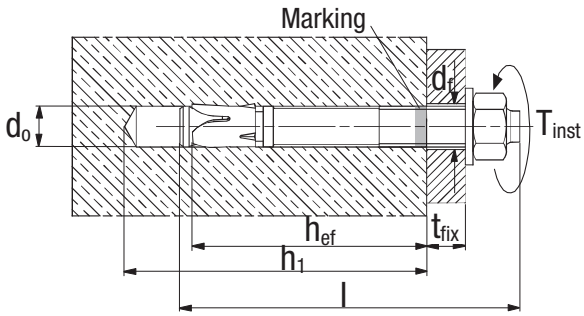
ETA Tested as per BS5080

Technical data

Recommended load (kN), non-cracked concrete at 25N/mm², safety factor(ϒ)=3

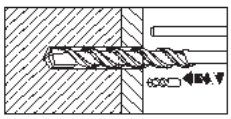
Model	Size	M6	M8	M10	M12	M16	M20
HSA (standard embedment)	Tensile Load, N_{rec}	2.0	4.0	5.3	8.3	12.9	17.6
	Shear Load, V_{rec}	2.2	4.0	6.5	10.2	18.3	28.3
HSA-F (standard embedment)	Tensile Load, N_{rec}	2.0	4.0	5.3	8.3	11.6	16.7
	Shear Load, V_{rec}	2.2	4.0	6.5	10.2	18.3	28.3
HSA-R (standard embedment)	Tensile Load, N_{rec}	2.0	4.0	4.0	8.3	12.9	14.7
	Shear Load, V_{rec}	2.0	3.7	5.7	8.3	11.7	16.7

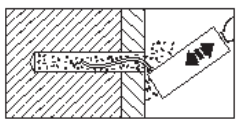
Remarks:
1) All the data applies to no edge distance, spacing and other influences
2) For detail design method, please refer to Fastening Technology Manual

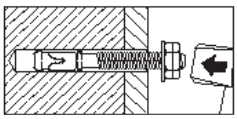


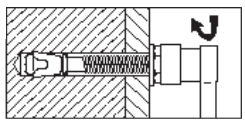
7

Installation procedures

1

Drill hole with drill bit.

2

Blow out dust and fragments.

3

Install anchor.

4

Apply tightening torque.

HSA programme

HSA: stud head (galv. to min. 5µm)

Drill bit nom. dia., d_o (mm)	Anchor length, l (mm)	Head mark	Min. hole depth, h_1 Standard (mm)	Min. hole depth, h_1 Reduced (mm)	Max. fasten thk. t_{fix} Standard (mm)	Max. fasten thk. t_{fix} Reduced (mm)	Tighten. torque T_{inst} (Nm)	Clear-ance hole, d_f (mm)	Width across flats, S_w	Package (pcs)	Order designation	Item no.
6	50	A	-	45	-	5	5	7	10	200	**HSA M6x50/-/5**	00255830
6	65	C	55	45	10	20	5	7	10	200	**HSA M6x65/10/20**	00255831
6	85	D	55	45	30	40	5	7	10	100	**HSA M6x85/30/40**	00255832
6	100	E	55	45	45	55	5	7	10	100	**HSA M6x100/45/55**	00255833
8	57	B	-	50	-	5	15	9	13	100	**HSA M8x57/-/5**	00255834
8	75	C	65	50	10	23	15	9	13	100	**HSA M8x75/10/23**	00255835
8	92	E	65	50	27	40	15	9	13	80	**HSA M8x92/27/40**	00295377
8	115	G	65	50	50	63	15	9	13	50	**HSA M8x115/50/63**	00255837
8	137	H	65	50	72	85	15	9	13	50	**HSA M8x137/72/85**	00255838 ★

★ Special Request

HSA: stud head (galv. to min. 5µm)

Drill bit nom. dia., d_0 (mm)	Anchor length, l (mm)	Head mark	Min. hole depth, h_1 Standard (mm)	Min. hole depth, h_1 Reduced (mm)	Max. fasten thk. t_{fix} Standard (mm)	Max. fasten thk. t_{fix} Reduced (mm)	Tighten. torque T_{inst} (Nm)	Clear-ance hole, d_f (mm)	Width across flats, S_w	Package (pcs)	Order designation	Item no.
10	68	C	-	60	-	5	30	12	17	50	**HSA M10x68/-/5**	00255839
10	90	E	70	60	20	25	30	12	17	50	**HSA M10x90/20/25**	00255840
10	108	F	70	60	37	45	30	12	17	40	**HSA M10x108/37/45**	00295350
10	120	G	70	60	50	57	30	12	17	40	**HSA M10x120/50/57**	00295352
10	140	I	70	60	70	77	30	12	17	25	**HSA M10x140/70/77**	00255843 ★
10	160	J	70	60	90	97	30	12	17	25	**HSA M10x160/90/97**	00384614 ★
10	180	L	70	60	110	117	30	12	17	25	**HSA M10x180/110/117**	00384615 ★
12	80	D	-	70	-	5	50	14	19	25	**HSA M12x80/-/5**	00255844
12	100	E	95	70	5	25	50	14	19	25	**HSA M12x100/5/25**	00255845
12	120	G	95	70	25	45	50	14	19	25	**HSA M12x120/25/45**	00255846
12	150	I	95	70	55	75	50	14	19	25	**HSA M12x150/55/75**	00255847
12	180	L	95	70	85	105	50	14	19	25	**HSA M12x180/85/105**	00255848
12	220	O	95	70	125	145	50	14	19	25	**HSA M12x220/125/145**	00255849 ★
12	240	P	95	70	145	165	50	14	19	25	**HSA M12x240/145/165**	00255850 ★
12	300	S	95	70	205	225	50	14	19	25	**HSA M12x300/205/225**	00255851 ★
16	100	E	-	90	-	5	100	18	24	16	**HSA M16x100/-/5**	00255852
16	120	G	115	90	5	25	100	18	24	16	**HSA M16x120/5/25**	00255853
16	140	I	115	90	25	45	100	18	24	16	**HSA M16x140/25/45**	00255854
16	190	L	115	90	75	95	100	18	24	16	**HSA M16x190/75/95**	00255855
16	240	P	115	90	125	145	100	18	24	16	**HSA M16x240/125/145**	00255856 ★
20	125	G	-	105	-	10	200	22	30	10	**HSA M20x125/-/10**	00255857 ★
20	170	K	130	105	30	55	200	22	30	10	**HSA M20x170/30/55**	00255858

HSA-F: stud head (hot dip galv. to min. 45µm)

6	50	A	-	45	-	5	5	7	10	200	**HSA-F M6x50/-/5**	00338260 ★
6	65	C	55	45	10	20	5	7	10	200	**HSA-F M6x65/10/20**	00337121
8	57	B	-	50	-	5	15	9	13	100	**HSA-F M8x57/-/5**	00337122
8	75	C	65	50	10	23	15	9	13	100	**HSA-F M8x75/10/23**	00337123
8	92	E	65	50	27	40	15	9	13	80	**HSA-F M8x92/27/40**	00295371
8	137	H	65	50	72	85	15	9	13	50	**HSA-F M8x137/72/85**	00337125 ★
10	68	C	-	60	-	5	30	12	17	50	**HSA-F M10x68/-/5**	00337126 ★
10	90	E	70	60	20	25	30	12	17	50	**HSA-F M10x90/20/25**	00337127
10	108	F	70	60	37	45	30	12	17	40	**HSA-F M10x108/37/45**	00295353 ★
10	120	G	70	60	50	57	30	12	17	40	**HSA-F M10x120/50/57**	00295354
12	80	D	-	70	-	5	50	14	19	25	**HSA-F M12x80/-/5**	00337130 ★
12	100	E	95	70	5	25	50	14	19	25	**HSA-F M12x100/5/25**	00337131
12	120	G	95	70	25	45	50	14	19	25	**HSA-F M12x120/25/45**	00337132
12	150	I	95	70	55	75	50	14	19	25	**HSA-F M12x150/55/75**	00337133
12	240	P	95	70	145	165	50	14	19	25	**HSA-F M12x240/145/165**	00338261 ★
16	100	E	-	90	-	5	100	18	24	16	**HSA-F M16x100/-/5**	00337134 ★
16	140	I	115	90	25	45	100	18	24	16	**HSA-F M16x140/25/45**	00337135
16	190	L	115	90	75	95	100	18	24	16	**HSA-F M16x190/75/95**	00337136 ★
20	125	G	-	105	-	10	200	22	30	10	**HAS-F M20x125/-/10**	00274696 ★
20	170	K	130	105	30	55	200	22	30	10	**HSA-F M20x170/30/55**	00337137

HSA-R: stud head (A4 stainless steel)

6	50	A	-	45	-	5	5	7	10	200	**HSA-R M6x50/-/5**	00332183
6	65	C	55	45	10	20	5	7	10	200	**HSA-R M6x65/10/20**	00332184
6	85	D	55	45	30	40	5	7	10	100	**HSA-R M6x85/30/40**	00332185
8	57	B	-	50	-	5	15	9	13	100	**HSA-R M8x57/-/5**	00332186
8	75	C	65	50	10	23	15	9	13	100	**HSA-R M8x75/10/23**	00332187
8	92	E	65	50	27	40	15	9	13	80	**HSA-R M8x92/27/40**	00295370
8	115	G	65	50	50	63	15	9	13	50	**HSA-R M8x115/50/63**	00332189
10	68	C	-	60	-	5	30	12	17	50	**HSA-R M10x68/-/5**	00332190
10	90	E	70	60	20	25	30	12	17	50	**HSA-R M10x90/20/25**	00332191
10	120	G	70	60	50	57	30	12	17	40	**HSA-R M10x120/50/57**	00295355
12	80	D	-	70	-	5	50	14	19	25	**HSA-R M12x80/-/5**	00332193
12	100	E	95	70	5	25	50	14	19	25	**HSA-R M12x100/5/25**	00332194
12	120	G	95	70	25	45	50	14	19	25	**HSA-R M12x120/25/45**	00332195
16	100	E	-	90	-	5	100	18	24	16	**HSA-R M16x100/-/5**	00337116
16	140	I	115	90	25	45	100	18	24	16	**HSA-R M16x140/25/45**	00337117
16	190	L	115	90	75	95	100	18	24	16	**HSA-R M16x190/75/95**	00337118 ★
20	125	G	-	105	-	10	200	22	30	10	**HSA-R M20x125/-/10**	00337119
20	170	K	130	105	30	55	200	22	30	10	**HSA-R M20x170/30/55**	00337120

★ Special Request

Characteristic resistance

		Standard embedment depth						Reduced embedment depth					
Anchor size		**M6**	**M8**	**M10**	**M12**	**M16**	**M20**	**M6**	**M8**	**M10**	**M12**	**M16**	**M20**
Tensile N_{Rk}													
HSA	[kN]	6	12	16	25	38,8	52,7	5	9	12	17,8	25,8	34,7
HSA-R	[kN]	6	12	12	25	38,7	44,1	-	7,5	12	17,8	23,0	33,0
HSA-F	[kN]	6	12	16	25	35	50	4	9	12	16	20	30
Shear V_{Rk}													
HSA	[kN]	6,5	12	19,5	30,5	55,0	85,0	6,5	12,0	19,5	30,5	55,0	85,0
HSA-R	[kN]	6,0	11,0	17,0	25,0	35,0	50,0	-	10,4	13,7	17,8	35,0	50,0
HSA-F	[kN]	6,5	12	19,5	30,5	55,0	85,0	6,5	12,0	19,5	30,5	55,0	85,0

Design resistance

		Standard embedment depth						Reduced embedment depth					
Anchor size		**M6**	**M8**	**M10**	**M12**	**M16**	**M20**	**M6**	**M8**	**M10**	**M12**	**M16**	**M20**
Tensile N_{Rd}													
HSA	[kN]	3,3	8,0	10,7	16,7	25,9	35,1	2,8	6,0	8,0	11,9	17,2	23,1
HSA-R	[kN]	3,3	6,7	6,7	11,9	18,1	20,6	-	4,2	5,7	8,5	10,8	15,4
HSA-F	[kN]	3,3	6,7	7,6	11,9	23,3	33,3	1,9	6	6,7	7,6	13,3	20
Shear V_{Rd}													
HSA	[kN]	5,2	9,6	15,6	24,4	44,0	68,0	5,2	9,6	15,6	23,8	44,0	68,0
HSA-R	[kN]	4,0	7,3	11,3	16,7	38,5	41,7	-	7,0	9,1	11,9	38,5	41,7
HSA-F	[kN]	5,2	9,6	15,6	24,4	44,0	68,0	5,2	9,6	15,6	23,8	44,0	68,0

Recommended loads

		Standard embedment depth						Reduced embedment depth					
Anchor size		**M6**	**M8**	**M10**	**M12**	**M16**	**M20**	**M6**	**M8**	**M10**	**M12**	**M16**	**M20**
Tensile N_{rec} a)													
HSA	[kN]	2,0	4,0	5,3	8,3	12,9	17,6	1,7	3	4,0	5,9	8,6	11,6
HSA-R	[kN]	2,0	4,0	4,0	8,3	12,9	14,7	-	2,5	4,0	5,9	7,0	11,0
HSA-F	[kN]	2,0	4,0	5,3	8,3	11,6	16,7	1,3	3,0	4,0	5,3	6,6	10
Shear V_{rec} a)													
HSA	[kN]	2,2	4,0	6,5	10,2	18,3	28,3	2,2	4,0	6,5	10,2	6,6	28,3
HSA-R		2,0	3,7	5,7	8,3	11,7	16,7	-	3,5	4,6	5,9	11,7	16,7
HSA-F	[kN]	2,2	4,0	6,5	10,2	18,3	28,3	2,2	4,0	6,5	10,2	18,3	28,3

a) With overall global safety factor γ = 3. The recommended loads vary according to the safety factor requirement from national regulations.

Materials

Mechanical properties of HSA, HSA-R, HSA-F

Anchor size			M6	M8	M10	M12	M16	M20
Nominal tensile strength f_{uk}	HSA	[N/mm²]	720	720	720	720	670	720
	HSA-R	[N/mm²]	600	600	600	600	450	400
	HSA-F	[N/mm²]	720	720	720	720	670	720
Yield strength f_{yk}	HSA	[N/mm²]	576	576	576	576	536	576
	HSA-R	[N/mm²]	400	400	400	400	-	-
	HSA-F	[N/mm²]	576	576	576	576	536	576
Stressed cross-section A_s		[mm²]	20,1	36,6	58,0	84,3	157	245
Moment of resistance W		[mm³]	12,7	31,2	62,3	109,2	277,5	540,9
Char. bending resistance $M^0_{Rk,s}$	HSA	[Nm]	11	27	54	94	223	454
	HSA-R	[Nm]	9	22	45	79	150	252
	HSA-F	[Nm]	11	27	54	94	223	454

HSA Stud anchor

Anchor version	Benefits
HSA Carbon steel HSA-R Stainless steel HSA-F Carbon steel, hot-dip galvanised	- two setting depths - setting mark

Concrete | Fire resistance | Corrosion resistance | European Technical Approval | CE conformity | Hilti anchor design software

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European technical approval a)	CSTB, Paris	ETA-99/0001 / 2008-03-13
Fire test report	IBMB, Braunschweig	UB 3049/8151 / 2006-05-03
Assessment report (fire)	warringtonfire	WF 166404/ 2007-10-26

a) All data given in this section for HSA and HSA-R M6 to M12 according ETA-99/0001, issue 2008-03-13. HSA-F and HAS-R M16 + M20 have no approval.

Basic loading data (for a single anchor)

All data in this section applies to For details see Simplified design method

- Correct setting (See setting instruction)
- No edge distance and spacing influence
- *Steel* failure
- Minimum base material thickness
- Non-cracked Concrete C 20/25, $f_{ck,cube}$ = 25 N/mm²

Mean ultimate resistance

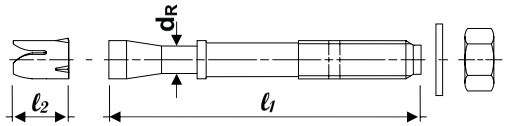
		Standard embedment depth						Reduced embedment depth					
Anchor size		**M6**	**M8**	**M10**	**M12**	**M16**	**M20**	**M6**	**M8**	**M10**	**M12**	**M16**	**M20**
Tensile $N_{Ru,m}$													
HSA	[kN]	12,5	20,1	20,6	39,7	62,5	100,1	9,2	12,8	18,3	19,8	38,3	44,4
HSA-R	[kN]	11,2	17,2	20,1	33,6	52,3	69,0	9,2	12,8	18,3	19,8	30,0	43,0
HSA-F	[kN]	11,1	18,3	25,3	38,3	45,6	64,4	10,4	14,2	20,8	26,8	39,8	54,1
Shear $V_{Ru,m}$													
HSA	[kN]	8,7	15,8	25,1	36,4	63,1	105,8	8,7	15,8	25,1	36,4	63,1	105,8
HSA-R	[kN]	7,2	13,2	20,9	30,3	61,2	95,6	-	-	-	-	-	--
HSA-F	[kN]	8,7	15,8	25,1	36,4	63,1	105,8	8,7	15,8	25,1	36,4	63,1	105,8

Material quality

Part		Material
Bolt	HSA	Carbon steel, galvanised to min. 5 µm
	HSA-R	Stainless steel A4 (316)
	HSA-F	Carbon steel, hot-dip galvanised to average min. 45 µm

Anchor dimensions

			Standard embedment depth						Reduced embedment depth					
Anchor size			**M6**	**M8**	**M10**	**M12**	**M16**	**M20**	**M6**	**M8**	**M10**	**M12**	**M16**	**M20**
Minimum thickness of fixture	$t_{fix,min}$	[mm]	-	-	-	-	-	-	5	5	5	5	5	10
Maximum thickness of fixture	$t_{fix,max}$	[mm]	45	72	70	205	125	30	55	85	77	225	145	55
Shaft diameter at the cone	d_R	[mm]	4,2	5,8	7,6	9	12,2	15,4	4,2	5,8	7,6	9	12,2	15,4
Maximum length of the anchor	$\ell_{1,max}$	[mm]	100	137	140	300	240	170	100	137	140	300	240	170
Length of expansion sleeve	ℓ_2	[mm]	8,2	11,5	15,4	19,1	24,8	29	8,2	11,5	15,4	19,1	24,8	29

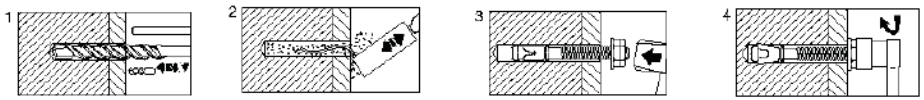


Setting

Installation equipment

Anchor size	M6	M8	M10	M12	M16	M20
Rotary hammer	TE2 – TE16					TE40 – TE70
Other tools	hammer, torque wrench, blow out pump					

Setting instruction

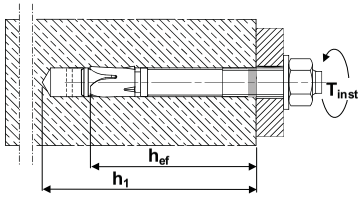


1 Drill hole with drill bit. 2 Blow out dust and fragments. 3 Install anchor. 4 Apply tightening torque.

For detailed information on installation see instruction for use given with the package of the product.

For technical data for anchors in diamond drilled holes please contact the Hilti Technical advisory service.

Setting details: depth of drill hole h_1 and effective anchorage depth h_{ef}



		M6X50	M6X65	M6X85	M8X57	M8X75	M8X92	M8x115	M10X68	M10X90	M10X108	M10X120	M10X140
	Nominal diameter of drill bit d_o [mm]	6			8				10				
	Anchor length l [mm]	50	65	85	57	75	92	115	68	90	108	120	140
	Head Marking (letter code)	A	C	D	B	C	E	G	C	E	F	G	I
	Torque moment T_{inst} [Nm]	5			15				30				
	Width across nut flats SW [mm]	10			13				17				
	Clearance hole diameter d_1 [mm]	7			9				12				
Standard embedment	Min. depth of drill hole h_1 [mm]	-	55		-	65			-	70			
Standard embedment	**Effective embed. depth h_{ef} [mm]**	**-**	**40**		**-**	**45**			**-**	**50**			
Standard embedment	Max. fastenable thickness t_{fix} [mm]	-	10	30	-	10	27	50	-	20	37	50	70
Reduced embedment	Min. depth of drill hole h_1 [mm]	45			50				60				
Reduced embedment	**Effective embed. depth h_{ef} [mm]**	**30**			**35**				**42**				
Reduced embedment	Max. fastenable thickness t_{fix} [mm]	5	20	40	5	23	40	63	5	25	45	57	77

		M12X80	M12X100	M12X120	M12X150	M12X180	M16X100	M16X120	M16X140	M16X190	M16X240	M20X125	M20X170
	Nominal diameter of drill bit d_o [mm]	12					16					20	
	Anchor length l [mm]	80	100	120	150	180	100	120	140	190	240	125	170
	Head Marking (letter code)	D	E	G	I	L	E	G	I	L	P	G	K
	Torque moment T_{inst} [Nm]	50					100					200	
	Width across nut flats SW [mm]	19					24					30	
	Clearance hole diameter d_1 [mm]	14					18					22	
Standard embedment	Min. depth of drill hole h_1 [mm]	-	95				-	115				-	130
Standard embedment	**Effective embed. depth h_{ef} [mm]**	**-**	**70**				**-**	**84**				**-**	**103**
Standard embedment	Max. fastenable thickness t_{fix} [mm]	-	5	25	55	85	-	5	25	75	125	-	30
Reduced embedment	Min. depth of drill hole h_1 [mm]	70					90					105	
Reduced embedment	**Effective embed. depth h_{ef} [mm]**	**50**					**64**					**78**	
Reduced embedment	Min. embedment depth h_{norm} [mm]	60					75					90	
Reduced embedment	Max. fastenable thickness t_{fix} [mm]	5	20	40	5	23	40	63	5	25	45	57	77

Simplified design method

Simplified version of the design method according ETAG 001, Annex C. Design resistance for HSA and HSA-R according data given in ETA-99/0001, issue 2008-03-13.

- Influence of concrete strength
- Influence of edge distance
- Influence of spacing
- Valid for a group of two anchors. (The method may also be applied for anchor groups with more than two anchors or more than one edge. The influencing factors must then be considered for each edge distance and spacing. The calculated design loads are then on the save side: They will be lower than the exact values according ETAG 001, Annex C. To avoid this, it is recommended to use the anchor design software PROFIS anchor)

The design method is based on the following simplification:

- No different loads are acting on individual anchors (no eccentricity)

The values are valid for one anchor.

Design data for HAS-R M16 and M20 are additional Hilti technical data

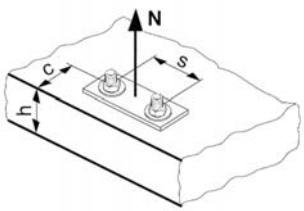
For more complex fastening applications please use the anchor design software PROFIS Anchor.

Tension loading

The design tensile resistance is the lower value of

- Steel resistance: $N_{Rd,s}$
- Concrete pull-out resistance: $N_{Rd,p} = N^0_{Rd,p} \cdot f_B$
- Concrete cone resistance: $N_{Rd,c} = N^0_{Rd,c} \cdot f_B \cdot f_{1,N} \cdot f_{2,N} \cdot f_{3,N} \cdot f_{re,N}$
- Concrete splitting resistance (only non-cracked concrete):

$$N_{Rd,sp} = N^0_{Rd,c} \cdot f_B \cdot f_{1,sp} \cdot f_{2,sp} \cdot f_{3,sp} \cdot f_{h,sp} \cdot f_{re,N}$$



Basic design tensile resistance

Design steel resistance $N_{Rd,s}$ $\gamma_{Ms} \geq 1.5$

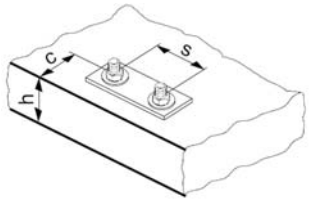
Anchor size			M6	M8	M10	M12	M16	M20
$N_{Rd,s}$	HSA	[kN]	6,3	12,0	21,0	29,7	50,7	89,3
	HSA-R	[kN]	6,9	12,5	21,9	30,6	43,8	62,8

Design pull-out resistance $N_{Rd,p} = N^0_{Rd,p} \cdot f_B$ $\gamma_{Mp} \geq 1.5$

			Standard embedment depth						Reduced embedment depth					
Anchor size			M6	M8	M10	M12	M16	M20	M6	M8	M10	M12	M16	M20
$N^0_{Rd,p}$	HSA	[kN]	3,3	8	10,7	16,7	No pull-out		2,8	6,0	8,0	No pull-out		
	HSA-R	[kN]	3,3	6,7	6,7	11,9	21,5	24,5	-	4,2	5,7	no p/o	12,8	18,5

Setting parameters

		Standard embedment depth						Reduced embedment depth					
Anchor size		M6	M8	M10	M12	M16	M20	M6	M8	M10	M12	M16	M20
Minimum base material thickness h_{min}	[mm]	100	100	100	140	170	210	100	100	100	100	130	160
Minimum spacing s_{min}													
HSA	[mm]	40	50	55	75	90	105	35	35	55	100	100	100
HSA-R	[mm]	40	50	65	100	100	105	-	35	55	100	100	100
Minimum edge distance c_{min}													
HSA	[mm]	50	60	65	90	105	125	40	45	65	100	100	115
HSA-R	[mm]	50	60	75	100	125	155	-	45	65	100	100	115
Critical spacing for splitting failure $s_{cr,sp}$													
HSA	[mm]	200	240	270	378	454	556	150	176	226	270	346	422
HSA-R	[mm]	200	240	270	380	500	620	-	180	230	270	380	470
Critical edge distance for splitting failure $c_{cr,sp}$													
HSA	[mm]	100	120	135	189	227	278	75	88	113	135	173	211
HSA-R	[mm]	100	120	135	190	250	310	-	90	115	135	190	235
Critical spacing for concrete cone failure $s_{cr,N}$													
HSA	[mm]	120	144	150	210	252	309	90	105	126	150	192	234
HSA-R	[mm]	120	150	150	210	250	310	-	110	130	150	190	235
Critical edge distance for concrete cone failure $c_{cr,N}$													
HSA	[mm]	60	72	75	105	126	155	45	53	63	75	96	117
HSA-R	[mm]	60	75	75	105	126	155	-	55	65	100	96	117

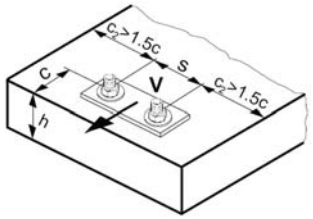


For spacing (edge distance) smaller than critical spacing (critical edge distance) the design loads have to be reduced.

Shear loading

The design shear resistance is the lower value of

- Steel resistance: $V_{Rd,s}$
- Concrete pryout resistance: $V_{Rd,cp} = V^0_{Rd,cp} \cdot f_B \cdot f_{1,N} \cdot f_{2,N} \cdot f_{3,N} \cdot f_{re,N}$
- Concrete edge resistance: $V_{Rd,c} = V^0_{Rd,c} \cdot f_B \cdot f_{ß} \cdot f_h \cdot f_4$



Basic design shear resistance

Design steel resistance $V_{Rd,s}$ γ_{Ms} = 1.25 (HSA) 1.5 (HSA-R)

Anchor size			M6	M8	M10	M12	M16	M20
$V_{Rd,s}$	HSA	[kN]	5,2	9,6	15,6	24,4	44	68
	HSA-R	[kN]	4	7,3	11,3	16,7	43,8	62,8

Design concrete pryout resistance $V_{Rd,cp} = V^0_{Rd,cp} \cdot f_B \cdot f_{1,N} \cdot f_{2,N} \cdot f_{3,N} \cdot f_{re,N}$ γ_{Mc} = 1.5

			Standard embedment depth						Reduced embedment depth					
Anchor size			M6	M8	M10	M12	M16	M20	M6	M8	M10	M12	M16	M20
$V^0_{Rd,cp}$	HSA	[kN]	8,5	11,2	23,8	39,4	51,7	70,2	5,5	10,4	18,3	23,8	49,9	81,0
	HSA-R	[kN]	8,5	11,2	11,9	39,4	51.7	70.2	-	7,0	9,1	11,9	49.9	81.0

Design concrete edge resistance [a] $V_{Rd,c} = V^0_{Rd,c} \cdot f_B \cdot f_{ß} \cdot f_4$ γ_{Mc} = 1.5

			Standard embedment depth						Reduced embedment depth					
Anchor size			M6	M8	M10	M12	M16	M20	M6	M8	M10	M12	M16	M20
$V^0_{Rd,c}$	HSA	[kN]	2,7	4,0	4,8	8,8	12,6	18,2	1,8	2,4	4,6	9,7	11,1	15,2
	HSA-R	[kN]	2,7	4,0	6,0	10,4	12,6	18,2	-	2,4	4,6	9,7	11,1	15,2

a) For anchor groups only the anchors close to the edge must be considered.

Influencing factors

Influence of concrete strength

Concrete strength designation (ENV 206)	C 20/25	C 25/30	C 30/37	C 35/45	C 40/50	C 45/55	C 50/60
$f_B = (f_{ck,cube}/25N/mm^2)^{1/2}$ [a) b)]	1	1,1	1,22	1,34	1,41	1,48	1,55

a) $f_{ck,cube}$ = concrete compressive strength, measured on cubes with 150 mm side length
b) For design data of $f_{ck,cube}$ = 15 and 20, please contact Hilti technical advisory service

Influence of edge distance [a]

$c/c_{cr,N}$	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1
$f_{1,N} = 0,7 + 0,3 \cdot c/c_{cr,N} \leq 1$	0,73	0,76	0,79	0,82	0,85	0,88	0,91	0,94	0,97	1
$f_{2,N} = 0,5 \cdot (1 + c/c_{cr,N}) \leq 1$	0,55	0,60	0,65	0,70	0,75	0,80	0,85	0,90	0,95	1

a) The edge distance shall not be smaller than the minimum edge distance c_{min} given in the table with the setting details. These influencing factors must be considered for every edge distance.

Design concrete cone resistance $N_{Rd,c} = N^0_{Rd,c} \cdot f_B \cdot f_{1,N} \cdot f_{2,N} \cdot f_{3,N} \cdot f_{re,N}$

Design splitting resistance [a] $N_{Rd,sp} = N^0_{Rd,c} \cdot f_B \cdot f_{1,sp} \cdot f_{2,sp} \cdot f_{3,sp} \cdot f_{h,sp} \cdot f_{re,N}$ $\gamma_{Mc} \geq 1.5$

			Standard embedment depth						Reduced embedment depth					
Anchor size			M6	M8	M10	M12	M16	M20	M6	M8	M10	M12	M16	M20
$N^0_{Rd,c}$	HSA	[kN]	7,1	11,2	11,9	19,7	25,9	35,1	4,6	7,0	9,1	11,9	17,2	23,1
	HSA-R	[kN]	7,1	9,3	9,9	14,1	25,9	35,1	-	5,8	6,5	8,5	17,2	23,1

a) Splitting resistance must only be considered for non-cracked concrete

Influencing factors

Influence of concrete strength

Concrete strength designation (ENV 206)	C 20/25	C 25/30	C 30/37	C 35/45	C 40/50	C 45/55	C 50/60
$f_B = (f_{ck,cube}/25N/mm^2)^{1/2}$ [a) b)]	1	1,1	1,22	1,34	1,41	1,48	1,55

a) $f_{ck,cube}$ = concrete compressive strength, measured on cubes with 150 mm side length
b) For design data of $f_{ck,cube}$ = 15 and 20, please contact Hilti technical advisory service

Influence of edge distance [a]

$c/c_{cr,N}$ / $c/c_{cr,sp}$	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1
$f_{1,N} = 0,7 + 0,3 \cdot c/c_{cr,N} \leq 1$ / $f_{1,sp} = 0,7 + 0,3 \cdot c/c_{cr,sp} \leq 1$	0,73	0,76	0,79	0,82	0,85	0,88	0,91	0,94	0,97	1
$f_{2,N} = 0,5 \cdot (1 + c/c_{cr,N}) \leq 1$ / $f_{2,sp} = 0,5 \cdot (1 + c/c_{cr,sp}) \leq 1$	0,55	0,60	0,65	0,70	0,75	0,80	0,85	0,90	0,95	1

a) The edge distance shall not be smaller than the minimum edge distance c_{min} given in the table with the setting details. These influencing factors must be considered for every edge distance.

Influence of anchor spacing [a]

$s/s_{cr,N}$ / $s/s_{cr,sp}$	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1
$f_{3,N} = 0,5 \cdot (1 + s/s_{cr,N}) \leq 1$ / $f_{3,sp} = 0,5 \cdot (1 + s/s_{cr,sp}) \leq 1$	0,55	0,60	0,65	0,70	0,75	0,80	0,85	0,90	0,95	1

a) The anchor spacing shall not be smaller than the minimum anchor spacing s_{min} given in the table with the setting details. This influencing factor must be considered for every anchor spacing.

Influence of base material thickness

h/h_{ef}	2,0	2,2	2,4	2,6	2,8	3,0	3,2	3,4	3,6	≥ 3,68
$f_{h,sp} = [h/(2 \cdot h_{ef})]^{2/3}$	1	1,07	1,13	1,19	1,25	1,31	1,37	1,42	1,48	1,5

Influence of reinforcement

Anchor size		M6	M8	M10	M12	M16	M20
$f_{re,N} = 0.5 + h_{ef}/200mm \leq 1$							
	Standard embedment depth	0,70 [a)]	0,74 [a)]	0,75 [a)]	0,85 [a)]	0,92 [a)]	1
	Reduced embedment depth	0,65 [a)]	0,68 [a)]	0,71 [a)]	0,75 [a)]	0,82 [a)]	0,89 [a)]

a) This factor applies only for dense reinforcement. If in the area of anchorage there is reinforcement with a spacing ≥ 150 mm (any diameter) or with a diameter ≤ 10 mm and a spacing ≥ 100 mm, then a factor $f_{re,N}$ = 1 may be applied.

Influence of anchor spacing and edge distance [a)] for concrete edge resistance: f_4

$f_4 = (c/h_{ef})^{1,5} \cdot (1 + s / [3 \cdot c]) \cdot 0,5$

c/h_{ef}	Single anchor	Group of two anchors s/h_{ef}														
		0,75	1,50	2,25	3,00	3,75	4,50	5,25	6,00	6,75	7,50	8,25	9,00	9,75	10,50	11,25
0,50	0,35	0,27	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35
0,75	0,65	0,43	0,54	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65
1,00	1,00	0,63	0,75	0,88	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
1,25	1,40	0,84	0,98	1,12	1,26	1,40	1,40	1,40	1,40	1,40	1,40	1,40	1,40	1,40	1,40	1,40
1,50	1,84	1,07	1,22	1,38	1,53	1,68	1,84	1,84	1,84	1,84	1,84	1,84	1,84	1,84	1,84	1,84
1,75	2,32	1,32	1,49	1,65	1,82	1,98	2,15	2,32	2,32	2,32	2,32	2,32	2,32	2,32	2,32	2,32
2,00	2,83	1,59	1,77	1,94	2,12	2,30	2,47	2,65	2,83	2,83	2,83	2,83	2,83	2,83	2,83	2,83
2,25	3,38	1,88	2,06	2,25	2,44	2,63	2,81	3,00	3,19	3,38	3,38	3,38	3,38	3,38	3,38	3,38
2,50	3,95	2,17	2,37	2,57	2,77	2,96	3,16	3,36	3,56	3,76	3,95	3,95	3,95	3,95	3,95	3,95
2,75	4,56	2,49	2,69	2,90	3,11	3,32	3,52	3,73	3,94	4,15	4,35	4,56	4,56	4,56	4,56	4,56
3,00	5,20	2,81	3,03	3,25	3,46	3,68	3,90	4,11	4,33	4,55	4,76	4,98	5,20	5,20	5,20	5,20
3,25	5,86	3,15	3,38	3,61	3,83	4,06	4,28	4,51	4,73	4,96	5,18	5,41	5,63	5,86	5,86	5,86
3,50	6,55	3,51	3,74	3,98	4,21	4,44	4,68	4,91	5,14	5,38	5,61	5,85	6,08	6,31	6,55	6,55
3,75	7,26	3,87	4,12	4,36	4,60	4,84	5,08	5,33	5,57	5,81	6,05	6,29	6,54	6,78	7,02	7,26
4,00	8,00	4,25	4,50	4,75	5,00	5,25	5,50	5,75	6,00	6,25	6,50	6,75	7,00	7,25	7,50	7,75
4,25	8,76	4,64	4,90	5,15	5,41	5,67	5,93	6,18	6,44	6,70	6,96	7,22	7,47	7,73	7,99	8,25
4,50	9,55	5,04	5,30	5,57	5,83	6,10	6,36	6,63	6,89	7,16	7,42	7,69	7,95	8,22	8,49	8,75
4,75	10,35	5,45	5,72	5,99	6,27	6,54	6,81	7,08	7,36	7,63	7,90	8,17	8,45	8,72	8,99	9,26
5,00	11,18	5,87	6,15	6,43	6,71	6,99	7,27	7,55	7,83	8,11	8,39	8,66	8,94	9,22	9,50	9,78
5,25	12,03	6,30	6,59	6,87	7,16	7,45	7,73	8,02	8,31	8,59	8,88	9,17	9,45	9,74	10,02	10,31
5,50	12,90	6,74	7,04	7,33	7,62	7,92	8,21	8,50	8,79	9,09	9,38	9,67	9,97	10,26	10,55	10,85

a) The anchor spacing and the edge distance shall not be smaller than the minimum anchor spacing s_{min} and the minimum edge distance c_{min}.

Combined tension and shear loading

For combined tension and shear loading see section “Anchor Design”.

Influence of anchor spacing [a)]

$s/s_{cr,N}$	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1
$f_{3,N} = 0,5 \cdot (1 + s/s_{cr,N}) \leq 1$	0,55	0,60	0,65	0,70	0,75	0,80	0,85	0,90	0,95	1

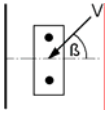
a) The anchor spacing shall not be smaller than the minimum anchor spacing s_{min} given in the table with the setting details. This influencing factor must be considered for every anchor spacing.

Influence of reinforcement

Anchor size		M6	M8	M10	M12	M16	M20
$f_{re,N} = 0,5 + h_{ef}/200mm \leq 1$							
	Standard embedment depth	0,70 [a)]	0,74 [a)]	0,75 [a)]	0,85 [a)]	0,92 [a)]	1
	Reduced embedment depth	0,65 [a)]	0,68 [a)]	0,71 [a)]	0,75 [a)]	0,82 [a)]	0,89 [a)]

a) This factor applies only for dense reinforcement. If in the area of anchorage there is reinforcement with a spacing ≥ 150 mm (any diameter) or with a diameter ≤ 10 mm and a spacing ≥ 100 mm, then a factor $f_{re,N} = 1$ may be applied.

Influence of angle between load applied and the direction perpendicular to the free edge

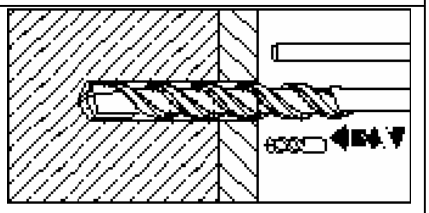
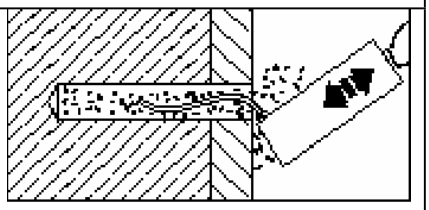
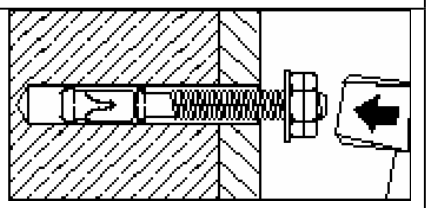
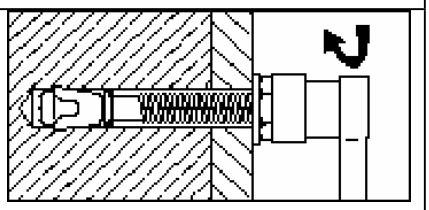
Angle ß	0° - 55°	60°	65°	70°	75°	80°	85°	90° - 180°
$f_ß$ 	1	1,07	1,14	1,23	1,35	1,50	1,71	2

Influence of base material thickness

h/c	0,15	0,3	0,45	0,6	0,75	0,9	1,05	1,2	1,35	≥ 1,5
$f_h = \{h/(1,5 \cdot c)\}^{2/3} \leq 1$	0,22	0,34	0,45	0,54	0,63	0,71	0,79	0,86	0,93	1,00

SETTING OPERATION

Hilti HSA Stud Anchor
Versions : HSA / HSA-F / HSA-R
Accessories : NIL
Reference : Product Information / Fastening Technology Manual

Setting Operation:	
1. Drill the hole with drill bit	
2. Blow out dust and fragments	
3. Install anchor	
4. Apply appropriate tightening torque	

Summary of Test result of Hilti HSA Stud Anchor

Sample Description: [supplied by Hilti (Hong Kong) Ltd.]

Product: HSA

Size: M6 - M20

Material: Galvanized steel

Coating: min. 5 microns meter thick of zinc plating

Concrete Description: [supplied and tested by ETS Testconsult Ltd]

Concrete Strength: 30MPa at 26days

Mix Proportion: Grade 30/20

Laboratory Information:

Name of Laboratory: ETS-Testconsult Ltd (HOKLAS No. 022)

Test Method: BS 5080: Part 1: 1993
BS 5080: Part 2: 1986

Date Tested: July-05

Test Result:

Size	Type	Result 1 [kN]	Result 2 [kN]	Result 3 [kN]	Result 4 [kN]	Result 5 [kN]	Avg. Value [kN]	Std. Dev.	Charact. Load [kN]
HSA M6	Tensile	12.30	13.20	13.04	11.04	12.13	12.34	0.86	9.41
	Shear	9.71	8.89	8.74	8.66	8.52	8.90	0.47	7.30
HSA M8	Tensile	21.24	25.04	23.82	24.68	21.44	23.24	1.80	17.12
	Shear	16.20	17.20	16.40	16.30	16.30	16.48	0.41	15.09
HSA M10	Tensile	25.11	25.01	28.51	27.11	29.04	26.96	1.87	20.58
	Shear	28.60	26.90	28.60	28.10	28.20	28.08	0.70	25.70
HSA M12	Tensile	40.22	42.41	40.73	48.66	45.82	43.57	3.59	31.32
	Shear	46.30	44.70	43.30	43.60	47.70	45.12	1.86	38.78
HSA M16	Tensile	67.83	64.61	70.32	63.54	69.08	67.08	2.90	57.18
	Shear	76.80	72.30	71.10	79.20	71.70	74.22	3.58	62.02
HSA M20	Tensile	104.30	107.20	106.60	105.70	107.20	106.20	1.23	102.02
	Shear	102.70	99.50	106.80	110.40	107.10	105.30	4.24	90.84

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TEST REPORT

Tensile Load Test on Anchor Bolt

Client	Hilti (Hong Kong) Ltd	Report No.	: FDA50580
Address	17/F, Tower 6, China HK City, 33 Canton Road, TST	Test Date	: 15-Jul-05
Project	-	Report Date	: 25-Jul-05
Test Location	ETL's Laboratory	Page No.	: 2 of 3
Anchor Type	M6, HSA Stud Anchor-Galv. Steel	Test Method	: BS 5080:Part 1:1993 Cl. 7.1
Amb.Temperature	23°C		

Load (kN)	*Dial Gauge Reading (mm)*				
	Sample 1	*Sample 2*	*Sample 3*	*Sample 4*	*Sample 5*
0.00	0.00	0.00	0.00	0.00	0.00
1.25	0.00	0.00	0.00	0.00	0.00
2.50	0.00	0.00	0.01	0.03	0.00
3.75	0.02	0.01	0.05	0.05	0.01
5.00	0.10	0.03	0.11	0.05	0.04
6.25	0.23	0.07	0.21	0.08	0.06
7.50	0.41	0.17	0.49	0.59	0.14
8.75	0.87	0.39	0.98	2.70	0.15
10.00	1.43	1.37	1.67	3.77	0.57
11.25	2.44	2.26	2.06	-	1.21
12.50	-	3.40	2.89	-	-
13.75	-	-	-	-	-
15.00	-	-	-	-	-
16.25					
17.50					
Failure Load (kN)	12.30	13.20	13.04	11.40	12.13
Failure Mode	F7	F7	F7	F7	F7
Average Failure Load (kN)	12.41				
Standard Deviation (kN)	0.73				

A) Test Appratus

Load Cell :	Maywood C3000 (ET/930/07/01) (200kN)	S/N : 1000136752
Load Cell Indicator :	AD813 (ET/930/07/02)	S/N : -
Cylinder :	Enerpac RCH121 (ET/903/14)	S/N : -
Digital Dail Gauge :	ET/430/02	

B) Structural member Grade 35/20D

C) Anchor installed date -

D) Failure Modes

P = No sign of failure in anchor and/or structural member
F1 = Failure of anchor or its accessories
F2 = Failure in structural member
F3 = Pull out of anchor
F4 = Failure of structural member in a shear cone
F5 = Failure by continuous displacement or decreasing load
F6 = Failure in structural member with crack radiates outward from anchor
F7 = Other failure mode(s) : Anchor Breaking

E) Span width(mm) 280

F) Edge distance(mm) 140

G) Drill hole size(mm) 6

H) Drill hole depth (mm) 55

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TEST REPORT

Shear Load Test on Anchor Bolt

Client	Hilti (Hong Kong) Ltd	Report No.	: FDA50676
Address	17/F, Tower 6, China HK City, 33 Canton Road, TST	Test Date	: 03-Aug-05
Project	-	Report Date	: 11-Aug-05
Test Location	ETL's Laboratory	Page No.	: 2 of 3
Anchor Type	M6 HSA Stud Anchor Galv. Steel	Test Method	: BS 5080:Part 2:1986 Cl 7.2
Amb.Temperature	24°C		

Load (kN)	Dial Gauge Reading (mm)				
	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
0.00	0.00	0.00	0.00	0.00	0.00
0.84	0.00	0.00	0.00	0.00	0.01
1.68	0.00	0.00	0.00	0.00	0.03
2.52	0.00	0.01	0.02	0.06	0.11
3.36	0.15	0.21	0.20	0.32	0.24
4.20	0.53	0.47	0.33	0.52	0.46
5.04	0.79	0.88	0.48	0.66	0.65
5.88	1.06	1.12	0.63	1.24	1.13
6.72	1.26	1.37	1.00	1.62	1.72
7.56	1.58	1.68	1.35	1.88	1.98
8.40	2.01	2.21	2.77	2.79	2.99
9.24	2.85	-	-	-	-
10.08	-	-	-	-	-
10.92	-	-	-	-	-
11.76	-	-	-	-	-
12.60	-	-	-	-	-
Failure Load (kN)	9.71	8.89	8.74	8.66	8.52
Failure Mode	F7	F7	F7	F7	F7
Average Failure Load (kN)	8.90				
Standard Deviation (kN)	0.47				

A) Test Appratus	Load Cell :	Maywood C3000 (ET/930/06/01) (500kN)	S/N : 174529
	Load Cell Indicator :	AD813 (ET/930/06/02)	S/N : -
	Cylinder :	Enerpac RCH302 (ET/903/07)	S/N : C3691C
	Digital Dail Gauge :	ET/915/35	
B) Structural member	Grade 35/20D		
C) Anchor installed date	-		
D) Failure Modes	P = No sign of failure in anchor and/or structural member		F1 = Failure of anchor or its accessories
	F2 = Failure in structural member		F3 = Pull out of anchor
	F4 = Failure of structural member in a shear cone		F5 = Failure by continuous displacement or decreasing load
	F6 = Failure in structural member with crack radiates outward from anchor		
	F7 = Other failure mode(s) : Anchor Breaking		
E) Span width(mm)	110		
F) Edge distance(mm)	110		
G) Drill hole size(mm)	6		
H) Drill hole depth (mm)	55		

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TEST REPORT

Tensile Load Test on Anchor Bolt

Client	Hilti (Hong Kong) Ltd	Report No.	: FDA50581
Address	17/F, Tower 6, China HK City, 33 Canton Road, TST	Test Date	: 15-Jul-05
Project	-	Report Date	: 29-Jul-05
Test Location	ETL's Laboratory	Page No.	: 2 of 3
Anchor Type	M8, HSA Stud Anchor-Galv. Steel	Test Method	: BS 5080:Part 1:1993 Cl. 7.1
Amb.Temperature	23°C		

Load (kN)	*Dial Gauge Reading (mm)*				
	Sample 1	*Sample 2*	*Sample 3*	*Sample 4*	*Sample 5*
0.00	0.00	0.00	0.00	0.00	0.00
2.01	0.00	0.00	0.00	0.01	0.00
4.02	0.00	0.00	0.01	0.03	0.01
6.03	0.00	0.00	0.03	0.06	0.02
8.04	0.01	0.00	0.25	0.10	0.04
10.05	0.06	0.05	0.96	0.15	0.08
12.06	0.13	0.16	1.74	0.28	0.19
14.07	0.32	0.39	2.78	0.41	0.46
16.08	0.70	0.78	3.62	1.62	0.87
18.09	1.53	1.68	4.79	2.24	1.96
20.10	3.94	2.45	5.98	3.04	3.58
22.11	-	3.58	7.84	4.26	-
24.12	-	5.45	-	6.18	-
26.13	-	-	-	-	-
28.14	-	-	-	-	-
Failure Load (kN)	21.24	25.04	23.82	24.68	21.44
Failure Mode	F5	F7	F5	F7	F5
Average Failure Load (kN)	23.24				
Standard Deviation (kN)	1.80				

A) Test Appratus

Load Cell :	Maywood C3000 (ET/930/07/01) (200kN)	S/N : 1000136752
Load Cell Indicator :	AD813 (ET/930/07/02)	S/N : -
Cylinder :	Enerpac RCH121 (ET/903/14)	S/N : -
Digital Dail Gauge :	ET/430/02	

B) Structural member Grade 35/20D

C) Anchor installed date -

D) Failure Modes

P = No sign of failure in anchor and/or structural member
F1 = Failure of anchor or its accessories
F2 = Failure in structural member
F3 = Pull out of anchor
F4 = Failure of structural member in a shear cone
F5 = Failure by continuous displacement or decreasing load
F6 = Failure in structural member with crack radiates outward from anchor
F7 = Other failure mode(s) : Anchor Breaking

E) Span width(mm) 330

F) Edge distance(mm) 165

G) Drill hole size(mm) 8

H) Drill hole depth (mm) 65

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TEST REPORT

Shear Load Test on Anchor Bolt

Client	Hilti (Hong Kong) Ltd	Report No.	: FDA50678
Address	17/F, Tower 6, China HK City, 33 Canton Road, TST	Test Date	: 03-Aug-05
Project	-	Report Date	: 11-Aug-05
Test Location	ETL's Laboratory	Page No.	: 2 of 3
Anchor Type	M8 HSA Stud Anchor Galv. Steel	Test Method	: BS 5080:Part 2:1986 Cl 7.2
Amb.Temperature	24°C		

Load (kN)	Dial Gauge Reading (mm)				
	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
0.00	0.00	0.00	0.00	0.00	0.00
1.55	0.03	0.01	0.00	0.00	0.00
3.10	0.08	0.05	0.00	0.00	0.00
4.65	0.22	0.07	0.02	0.14	0.03
6.20	0.51	0.22	0.44	0.31	0.43
7.75	0.73	0.57	0.71	0.54	0.69
9.30	1.00	0.91	1.05	0.95	0.94
10.85	1.34	1.26	1.40	1.70	1.32
12.40	1.96	1.73	1.69	2.54	1.95
13.95	2.97	2.62	2.10	4.02	2.89
15.50	4.10	4.12	3.55	8.63	4.97
17.05	-	5.82	-	-	-
18.60	-	-	-	-	-
20.15	-	-	-	-	-
21.70	-	-	-	-	-
23.25	-	-	-	-	-
Failure Load (kN)	16.20	17.20	16.40	16.30	16.30
Failure Mode	F7	F7	F7	F7	F7
Average Failure Load (kN)	16.48				
Standard Deviation (kN)	0.41				

A) Test Appratus	Load Cell :	Maywood C3000 (ET/930/06/01) (500kN)	S/N : 174529
	Load Cell Indicator :	AD813 (ET/930/06/02)	S/N : -
	Cylinder :	Enerpac RCH302 (ET/903/07)	S/N : C3691C
	Digital Dail Gauge :	ET/915/35	
B) Structural member	Grade 35/20D		
C) Anchor Installed date	-		
D) Failure Modes	P = No sign of failure in anchor and/or structural member		F1 = Failure of anchor or its accessories
	F2 = Failure in structural member		F3 = Pull out of anchor
	F4 = Failure of structural member in a shear cone		F5 = Failure by continuous displacement or decreasing load
	F6 = Failure in structural member with crack radiates outward from anchor		
	F7 = Other failure mode(s) : Anchor Breaking		
E) Span width(mm)	130		
F) Edge distance(mm)	130		
G) Drill hole size(mm)	8		
H) Drill hole depth (mm)	65		

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TEST REPORT

Tensile Load Test on Anchor Bolt

Client	Hilti (Hong Kong) Ltd	Report No.	: FDA50582
Address	17/F, Tower 6, China HK City, 33 Canton Road, TST	Test Date	: 15-Jul-05
Project	-	Report Date	: 29-Jul-05
Test Location	ETL's Laboratory	Page No.	: 2 of 3
Anchor Type	M10, HSA Stud Anchor-Galv. Steel	Test Method	: BS 5080:Part 1:1993 Cl. 7.1
Amb.Temperature	23°C		

Load (kN)	*Dial Gauge Reading (mm)*				
	Sample 1	*Sample 2*	*Sample 3*	*Sample 4*	*Sample 5*
0.00	0.00	0.00	0.00	0.00	0.00
2.06	0.00	0.02	0.00	0.00	0.00
4.12	0.00	0.03	0.00	0.00	0.03
6.18	0.00	0.06	0.02	0.00	0.06
8.24	0.00	0.08	0.04	0.00	0.11
10.30	0.00	0.10	0.07	0.04	0.16
12.36	0.06	0.15	0.09	0.25	0.18
14.42	0.06	0.24	0.17	0.37	0.29
16.48	0.28	0.33	0.21	0.83	0.39
18.54	0.46	0.77	0.27	1.78	0.49
20.60	0.70	1.55	0.41	2.89	0.71
22.66	1.73	2.67	0.72	3.91	1.23
24.72	3.14	6.98	1.73	4.74	2.18
26.78	-	-	2.54	6.33	3.42
28.84	-	-	-	-	7.11
Failure Load (kN)	25.11	25.01	28.51	27.11	29.04
Failure Mode	F4	F4	F5	F5	F5
Average Failure Load (kN)	26.96				
Standard Deviation (kN)	1.87				

A) Test Appratus	Load Cell :	Maywood C3000 (ET/930/07/01) (200kN)	S/N : 1000136752
	Load Cell Indicator :	AD813 (ET/930/07/02)	S/N : -
	Cylinder :	Enerpac RCH121 (ET/903/14)	S/N : -
	Digital Dail Gauge :	ET/430/02	
B) Structural member	Grade 35/20D		
C) Anchor installed date	-		
D) Failure Modes	P = No sign of failure in anchor and/or structural member		F1 = Failure of anchor or its accessories
	F2 = Failure in structural member		F3 = Pull out of anchor
	F4 = Failure of structural member in a shear cone		F5 = Failure by continuous displacement or decreasing load
	F6 = Failure in structural member with crack radiates outward from anchor		
	F7 = Other failure mode(s) : Anchor Breaking		
E) Span width(mm)	350		
F) Edge distance(mm)	175		
G) Drill hole size(mm)	10		
H) Drill hole depth (mm)	70		

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TEST REPORT

Shear Load Test on Anchor Bolt

Client	Hilti (Hong Kong) Ltd	Report No.	: FDA50682
Address	17/F, Tower 6, China HK City, 33 Canton Road, TST	Test Date	: 03-Aug-05
Project	-	Report Date	: 11-Aug-05
Test Location	ETL's Laboratory	Page No.	: 2 of 3
Anchor Type	M10 HSA Stud Anchor Galv. Steel	Test Method	: BS 5080:Part 2:1986 Cl 7.2
Amb.Temperature	24°C		

Load (kN)	Dial Gauge Reading (mm)				
	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
0.00	0.00	0.00	0.00	0.00	0.00
2.24	0.00	0.00	0.00	0.00	0.00
4.48	0.00	0.00	0.00	0.01	0.00
6.72	0.02	0.03	0.00	0.07	0.03
8.96	0.29	0.11	0.05	0.24	0.21
11.20	0.51	0.27	0.19	0.42	0.39
13.44	0.77	0.46	0.41	0.68	0.60
15.68	0.97	0.73	0.61	0.84	0.84
17.92	1.34	1.11	0.79	0.99	1.15
20.16	1.88	1.68	1.01	1.25	1.64
22.40	2.61	2.18	1.21	1.50	2.48
24.64	3.72	3.58	1.79	2.11	3.47
26.88	5.67	5.82	2.82	3.66	5.05
29.12	-	-	-	-	-
31.36	-	-	-	-	-
33.60	-	-	-	-	-
Failure Load (kN)	28.60	26.90	28.60	28.10	28.20
Failure Mode	F5	F7	F7	F7	F7
Average Failure Load (kN)	28.08				
Standard Deviation (kN)	0.70				

A) Test Appratus	Load Cell :	Maywood C3000 (ET/930/06/01) (500kN)	S/N : 174529
	Load Cell Indicator :	AD813 (ET/930/06/02)	S/N : -
	Cylinder :	Enerpac RCH302 (ET/903/07)	S/N : C3691C
	Digital Dail Gauge :	ET/915/35	
B) Structural member	Grade 35/20D		
C) Anchor installed date	-		
D) Failure Modes	P = No sign of failure in anchor and/or structural member		F1 = Failure of anchor or its accessories
	F2 = Failure in structural member		F3 = Pull out of anchor
	F4 = Failure of structural member in a shear cone		F5 = Failure by continuous displacement or decreasing load
	F6 = Failure in structural member with crack radiates outward from anchor		
	F7 = Other failure mode(s) : Anchor Breaking		
E) Span width(mm)	140		
F) Edge distance(mm)	140		
G) Drill hole size(mm)	10		
H) Drill hole depth (mm)	70		

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TEST REPORT

Tensile Load Test on Anchor Bolt

Client	Hilti (Hong Kong) Ltd	Report No.	: FDA50583
Address	17/F, Tower 6, China HK City, 33 Canton Road, TST	Test Date	: 15-Jul-05
Project	-	Report Date	: 29-Jul-05
Test Location	ETL's Laboratory	Page No.	: 2 of 3
Anchor Type	M12, HSA Stud Anchor-Galv. Steel	Test Method	: BS 5080:Part 1:1993 Cl. 7.1
Amb.Temperature	23°C		

Load (kN)	*Dial Gauge Reading (mm)*				
	Sample 1	*Sample 2*	*Sample 3*	*Sample 4*	*Sample 5*
0.00	0.00	0.00	0.00	0.00	0.00
3.97	0.00	0.00	0.00	0.00	0.00
7.94	0.01	0.00	0.00	0.00	0.00
11.91	0.01	0.01	0.09	0.00	0.00
15.88	0.02	0.06	0.39	0.00	0.00
19.85	0.08	0.14	0.63	0.06	0.03
23.82	0.34	0.22	0.90	0.10	0.41
27.79	0.94	0.46	1.07	0.43	0.93
31.76	2.59	0.97	1.12	1.04	1.17
35.73	4.21	3.62	2.19	1.78	1.67
39.70	6.64	8.86	4.58	2.55	2.94
43.67	-	-	-	3.63	4.22
47.64	-	-	-	5.86	-
51.61	-	-	-	-	-
55.58	-	-	-	-	-
Failure Load (kN)	40.22	42.41	40.73	48.66	45.82
Failure Mode	F5	F5	F5	F5	F5
Average Failure Load (kN)	43.57				
Standard Deviation (kN)	3.59				

A) Test Appratus	Load Cell :	Maywood C3000 (ET/930/07/01) (200kN)	S/N : 1000136752
	Load Cell Indicator :	AD813 (ET/930/07/02)	S/N : -
	Cylinder :	Enerpac RCH121 (ET/903/14)	S/N : -
	Digital Dail Gauge :	ET/430/02	
B) Structural member	Grade 35/20D		
C) Anchor installed date	-		
D) Failure Modes	P = No sign of failure in anchor and/or structural member		F1 = Failure of anchor or its accessories
	F2 = Failure in structural member		F3 = Pull out of anchor
	F4 = Failure of structural member in a shear cone		F5 = Failure by continuous displacement or decreasing load
	F6 = Failure in structural member with crack radiates outward from anchor		
	F7 = Other failure mode(s) : Anchor Breaking		
E) Span width(mm)	480		
F) Edge distance(mm)	240		
G) Drill hole size(mm)	12		
H) Drill hole depth (mm)	95		

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TEST REPORT

Shear Load Test on Anchor Bolt

Client	Hilti (Hong Kong) Ltd	Report No.	: FDA50684
Address	17/F, Tower 6, China HK City, 33 Canton Road, TST	Test Date	: 02-Aug-05
Project	-	Report Date	: 11-Aug-05
Test Location	ETL's Laboratory	Page No.	: 2 of 3
Anchor Type	M12 HSA Stud Anchor Galv. Steel	Test Method	: BS 5080:Part 2:1986 Cl 7.2
Amb.Temperature	24°C		

Load (kN)	*Dial Gauge Reading (mm)*				
	Sample 1	*Sample 2*	*Sample 3*	*Sample 4*	*Sample 5*
0.00	0.00	0.00	0.00	0.00	0.00
3.51	0.00	0.00	0.00	0.02	0.02
7.02	0.05	0.02	0.02	0.05	0.04
10.53	0.10	0.07	0.15	0.09	0.16
14.04	0.27	0.48	0.77	0.17	0.38
17.55	0.64	0.77	1.32	0.34	0.42
21.06	1.04	0.98	1.63	0.51	1.54
24.57	1.26	1.30	2.10	0.86	2.02
28.08	1.52	1.52	2.56	1.27	2.75
31.59	2.03	1.79	3.10	1.71	3.51
35.10	2.69	2.21	3.81	2.17	4.25
38.61	3.31	2.93	4.45	2.88	5.22
42.12	4.31	3.72	5.89	3.82	6.32
45.63	6.77	-	-	-	8.31
49.14	-	-	-	-	-
52.65	-	-	-	-	-
Failure Load (kN)	46.30	44.70	43.30	43.60	47.70
Failure Mode	F5	F7	F7	F7	F7
Average Failure Load (kN)	45.12				
Standard Deviation (kN)	1.86				

A) Test Appratus	Load Cell :	Maywood C3000 (ET/930/06/01) (500kN)	S/N : 174529
	Load Cell Indicator :	AD813 (ET/930/06/02)	S/N : -
	Cylinder :	Enerpac RCH302 (ET/903/07)	S/N : C3691C
	Digital Dail Gauge :	ET/915/35	
B) Structural member	Grade 35/20D		
C) Anchor installed date	-		
D) Failure Modes	P = No sign of failure in anchor and/or structural member		F1 = Failure of anchor or its accessories
	F2 = Failure in structural member		F3 = Pull out of anchor
	F4 = Failure of structural member in a shear cone		F5 = Failure by continuous displacement or decreasing load
	F6 = Failure in structural member with crack radiates outward from anchor		
	F7 = Other failure mode(s) : Anchor Breaking		
E) Span width(mm)	190		
F) Edge distance(mm)	190		
G) Drill hole size(mm)	12		
H) Drill hole depth (mm)	95		

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TEST REPORT

Tensile Load Test on Anchor Bolt

Client	Hilti (Hong Kong) Ltd	Report No.	: FDA50584
Address	17/F, Tower 6, China HK City, 33 Canton Road, TST	Test Date	: 15-Jul-05
Project	-	Report Date	: 29-Jul-05
Test Location	ETL's Laboratory	Page No.	: 2 of 3
Anchor Type	M16, HSA Stud Anchor-Galv. Steel	Test Method	: BS 5080:Part 1:1993 Cl. 7.1
Amb.Temperature	23°C		

Load (kN)	*Dial Gauge Reading (mm)*				
	Sample 1	*Sample 2*	*Sample 3*	*Sample 4*	*Sample 5*
0.00	0.00	0.00	0.00	0.00	0.00
6.25	0.01	0.00	0.00	0.00	0.01
12.50	0.03	0.00	0.00	0.00	0.01
18.75	0.09	0.06	0.00	0.10	0.04
25.00	1.49	0.82	0.00	0.22	0.20
31.25	3.05	1.58	0.09	0.79	0.83
37.50	4.59	3.08	0.66	1.76	1.78
43.75	6.73	4.89	2.35	2.96	3.08
50.00	9.39	6.01	4.39	4.45	4.49
56.25	12.43	10.13	5.87	6.86	5.72
62.50	17.50	14.29	7.96	11.54	7.67
68.75	-	-	11.42	-	11.23
75.00	-	-	-	-	-
81.25	-	-	-	-	-
87.50	-	-	-	-	-
Failure Load (kN)	67.83	64.61	70.32	63.54	69.08
Failure Mode	F5	F5	F5	F5	F5
Average Failure Load (kN)	67.08				
Standard Deviation (kN)	2.90				

A) Test Appratus	Load Cell :	Maywood C3000 (ET/930/07/01) (200kN)	S/N : 1000136752
	Load Cell Indicator :	AD813 (ET/930/07/02)	S/N : -
	Cylinder :	Enerpac RCH121 (ET/903/14)	S/N : -
	Digital Dail Gauge :	ET/430/02	
B) Structural member	Grade 35/20D		
C) Anchor installed date	-		
D) Failure Modes	P = No sign of failure in anchor and/or structural member		F1 = Failure of anchor or its accessories
	F2 = Failure in structural member		F3 = Pull out of anchor
	F4 = Failure of structural member in a shear cone		F5 = Failure by continuous displacement or decreasing load
	F6 = Failure in structural member with crack radiates outward from anchor		
	F7 = Other failure mode(s) : Anchor Breaking		
E) Span width(mm)	480		
F) Edge distance(mm)	240		
G) Drill hole size(mm)	12		
H) Drill hole depth (mm)	95		

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TEST REPORT

Shear Load Test on Anchor Bolt

Client	Hilti (Hong Kong) Ltd	Report No.	: FDA50686
Address	17/F, Tower 6, China HK City, 33 Canton Road, TST	Test Date	: 02-Aug-05
Project	-	Report Date	: 11-Aug-05
Test Location	ETL's Laboratory	Page No.	: 2 of 3
Anchor Type	M16 HSA Stud Anchor Galv. Steel	Test Method	: BS 5080:Part 2:1986 Cl 7.2
Amb.Temperature	24°C		

Load (kN)	*Dial Gauge Reading (mm)*				
	Sample 1	*Sample 2*	*Sample 3*	*Sample 4*	*Sample 5*
0.00	0.00	0.00	0.00	0.00	0.00
6.33	0.00	0.00	0.05	0.02	0.05
12.66	0.02	0.11	0.22	0.06	0.19
18.99	1.37	0.59	0.87	0.36	0.80
25.32	2.07	1.11	1.56	0.64	1.57
31.65	2.70	1.81	2.24	1.05	2.52
37.98	3.36	3.20	2.95	1.50	3.50
44.31	4.21	4.03	3.73	1.93	4.60
50.64	4.71	5.68	4.72	2.46	6.36
56.97	5.43	6.91	6.43	3.15	7.60
63.30	6.34	8.99	8.03	4.22	8.90
69.63	7.87	-	10.70	5.43	11.01
75.96	10.52	-	-	8.13	-
82.29	-	-	-	-	-
88.62	-	-	-	-	-
94.45	-	-	-	-	-
Failure Load (kN)	76.80	72.30	71.10	79.20	71.70
Failure Mode	F5	F7	F7	F5	F7
Average Failure Load (kN)	74.22				
Standard Deviation (kN)	3.58				

A) Test Appratus	Load Cell :	Maywood C3000 (ET/930/06/01) (500kN)	S/N : 174529
	Load Cell Indicator :	AD813 (ET/930/06/02)	S/N : -
	Cylinder :	Enerpac RCH302 (ET/903/07)	S/N : C3691C
	Digital Dail Gauge :	ET/915/35	
B) Structural member	Grade 35/20D		
C) Anchor installed date	-		
D) Failure Modes	P = No sign of failure in anchor and/or structural member		F1 = Failure of anchor or its accessories
	F2 = Failure in structural member		F3 = Pull out of anchor
	F4 = Failure of structural member in a shear cone		F5 = Failure by continuous displacement or decreasing load
	F6 = Failure in structural member with crack radiates outward from anchor		
	F7 = Other failure mode(s) : Anchor Breaking		
E) Span width(mm)	230		
F) Edge distance(mm)	230		
G) Drill hole size(mm)	16		
H) Drill hole depth (mm)	115		

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TEST REPORT

Tensile Load Test on Anchor Bolt

Client	Hilti (Hong Kong) Ltd	Report No.	: FDA50585
Address	17/F, Tower 6, China HK City, 33 Canton Road, TST	Test Date	: 15-Jul-05
Project	-	Report Date	: 29-Jul-05
Test Location	ETL's Laboratory	Page No.	: 2 of 3
Anchor Type	M20, HSA Stud Anchor-Galv. Steel	Test Method	: BS 5080:Part 1:1993 Cl. 7.1
Amb.Temperature	23°C		

Load (kN)	*Dial Gauge Reading (mm)*				
	Sample 1	*Sample 2*	*Sample 3*	*Sample 4*	*Sample 5*
0.00	0.00	0.00	0.00	0.00	0.00
10.01	0.00	0.00	0.00	0.00	0.00
20.02	0.00	0.00	0.00	0.00	0.00
30.03	0.00	0.20	0.07	0.00	0.17
40.04	0.54	1.08	0.82	0.81	0.98
50.05	2.01	1.81	1.73	1.73	1.62
60.06	4.07	3.43	3.24	4.01	3.92
70.07	6.02	4.60	5.21	5.82	5.78
80.08	8.39	6.63	6.80	6.25	6.37
90.09	10.89	8.24	8.44	8.03	8.41
100.10	13.02	10.91	11.26	11.05	10.80
110.11	-	-	-	-	-
120.12	-	-	-	-	-
130.13	-	-	-	-	-
140.14	-	-	-	-	-
Failure Load (kN)	104.30	107.20	106.60	105.70	107.20
Failure Mode	F5	F5	F5	F5	F5
Average Failure Load (kN)	106.20				
Standard Deviation (kN)	1.23				

A) Test Appratus

Load Cell :	Maywood C3000 (ET/930/07/01) (200kN)	S/N : 1000136752
Load Cell Indicator :	AD813 (ET/930/07/02)	S/N : -
Cylinder :	Enerpac RCH121 (ET/903/14)	S/N : -
Digital Dail Gauge :	ET/430/02	

B) Structural member Grade 35/20D

C) Anchor installed date -

D) Failure Modes

P = No sign of failure in anchor and/or structural member
F1 = Failure of anchor or its accessories
F2 = Failure in structural member
F3 = Pull out of anchor
F4 = Failure of structural member in a shear cone
F5 = Failure by continuous displacement or decreasing load
F6 = Failure in structural member with crack radiates outward from anchor
F7 = Other failure mode(s) : Anchor Breaking

E) Span width(mm) 650

F) Edge distance(mm) 325

G) Drill hole size(mm) 20

H) Drill hole depth (mm) 130

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TEST REPORT

Shear Load Test on Anchor Bolt

Client	Hilti (Hong Kong) Ltd	Report No.	: FDA50688
Address	17/F, Tower 6, China HK City, 33 Canton Road, TST	Test Date	: 02-Aug-05
Project	-	Report Date	: 11-Aug-05
Test Location	ETL's Laboratory	Page No.	: 2 of 3
Anchor Type	M20 HSA Stud Anchor Galv. Steel	Test Method	: BS 5080:Part 2:1986 Cl 7.2
Amb.Temperature	24°C		

Load (kN)	*Dial Gauge Reading (mm)*				
	Sample 1	*Sample 2*	*Sample 3*	*Sample 4*	*Sample 5*
0.00	0.00	0.00	0.00	0.00	0.00
8.42	0.00	0.00	0.00	0.00	0.00
16.84	0.00	0.05	0.00	0.00	0.05
25.26	0.00	0.45	0.00	0.00	0.48
33.68	0.00	0.83	0.01	0.00	0.82
42.10	0.09	1.17	0.05	0.00	1.15
50.52	0.44	1.51	0.53	0.02	1.44
58.94	0.83	1.86	0.95	0.35	1.99
67.36	1.29	2.04	1.70	0.90	2.37
75.78	2.10	2.84	2.26	1.47	2.96
84.20	3.89	3.48	3.09	2.25	3.71
92.62	3.91	4.45	4.01	3.37	4.63
101.04	5.72	-	5.53	4.79	5.72
109.46	-	-	-	7.49	-
117.88	-	-	-	-	-
126.30	-	-	-	-	-
Failure Load (kN)	102.70	99.50	106.80	110.40	107.10
Failure Mode	F5, F6	F5, F6	F5	F5	F5
Average Failure Load (kN)	105.30				
Standard Deviation (kN)	4.24				

A) Test Appratus	Load Cell :	Maywood C3000 (ET/930/06/01) (500kN)	S/N : 174529
	Load Cell Indicator :	AD813 (ET/930/06/02)	S/N : -
	Cylinder :	Enerpac RCH302 (ET/903/07)	S/N : C3691C
	Digital Dail Gauge :	ET/915/35	
B) Structural member	Grade 35/20D		
C) Anchor installed date	-		
D) Failure Modes	P = No sign of failure in anchor and/or structural member		F1 = Failure of anchor or its accessories
	F2 = Failure in structural member		F3 = Pull out of anchor
	F4 = Failure of structural member in a shear cone		F5 = Failure by continuous displacement or decreasing load
	F6 = Failure in structural member with crack radiates outward from anchor		
	F7 = Other failure mode(s) : Anchor Breaking		
E) Span width(mm)	260		
F) Edge distance(mm)	260		
G) Drill hole size(mm)	20		
H) Drill hole depth (mm)	130		

Summary of Test result of Hilti HSA-R Stud Anchor

Sample Description: [supplied by Hilti (Hong Kong) Ltd.]

Product: HSA-R

Size: M6 - M20

Material: A4 stainless steel

Coating: N/A

Concrete Description: [supplied and tested by ETS Testconsult Ltd]

Concrete Strength: 30MPa at 26days

Mix Proportion: Grade 30/20

Laboratory Information:

Name of Laboratory: ETS-Testconsult Ltd (HOKLAS No. 022)

Test Method: BS 5080: Part 1: 1993
BS 5080: Part 2: 1986

Date Tested: July-05

Test Result:

Size	Type	Result 1 [kN]	Result 2 [kN]	Result 3 [kN]	Result 4 [kN]	Result 5 [kN]	Avg. Value [kN]	Std. Dev.	Charact. Load [kN]
HSA M6	Tensile	11.80	11.70	11.70	12.60	15.30	12.62	1.54	7.35
	Shear	7.02	6.43	6.70	7.08	6.56	6.76	0.28	5.79
HSA M8	Tensile	26.80	23.80	25.00	28.40	27.00	26.20	1.81	20.04
	Shear	15.60	15.20	16.40	15.00	14.90	15.42	0.61	13.34
HSA M10	Tensile	29.50	30.40	32.00	32.10	29.80	30.76	1.22	26.59
	Shear	40.10	36.70	45.20	45.30	43.90	42.24	3.75	29.46
HSA M12	Tensile	40.00	42.10	40.20	41.70	42.40	41.28	1.11	37.50
	Shear	48.60	40.40	41.20	43.60	44.00	43.56	3.21	32.62
HSA M16	Tensile	63.10	68.80	63.40	64.20	63.10	64.52	2.43	56.22
	Shear	62.90	63.40	63.90	65.10	63.00	63.66	0.90	60.60
HSA M20	Tensile	70.40	71.40	72.20	79.70	74.60	73.66	3.72	60.99
	Shear	104.90	104.70	105.30	109.70	104.20	105.76	2.24	98.13

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TEST REPORT

Tensile Load Test on Anchor Bolt

Client	Hilti (Hong Kong) Ltd	Report No.	: FDA50782
Address	17/F, Tower 6, China HK City, 33 Canton Road, TST	Test Date	: 27-Jul-05
Project	-	Report Date	: 06-Sep-05
Test Location	ETL's Laboratory	Page No.	: 2 of 3
Anchor Type	M6 HSA-R Stud Anchor A4 Stainless Steel	Test Method	: BS 5080:Part 1:1993 Cl. 7.1
Amb.Temperature	24°C		

Load (kN)	*Dial Gauge Reading (mm)*				
	Sample 1	*Sample 2*	*Sample 3*	*Sample 4*	*Sample 5*
0.00	0.00	0.00	0.00	0.00	0.00
1.12	0.00	0.00	0.00	0.00	0.00
2.24	0.01	0.03	0.06	0.12	0.00
3.36	0.02	0.17	0.16	1.30	0.00
4.48	0.18	0.67	0.72	2.65	0.00
5.60	0.46	1.33	1.28	3.14	0.00
6.72	0.79	1.91	1.63	3.46	0.10
7.84	1.17	2.56	2.14	3.93	0.34
8.96	1.63	3.01	2.72	4.37	0.78
10.08	2.17	3.66	3.14	4.57	1.53
11.20	3.72	4.22	3.70	5.01	1.88
12.32	-	-	-	6.20	2.43
13.44	-	-	-	-	3.41
14.56	-	-	-	-	4.25
15.68	-	-	-	-	-
Failure Load (kN)	11.8	11.7	11.7	12.6	15.3
Failure Mode	F4, F5	F5	F4, F5	F5	anchor breaking
Average Failure Load (kN)	12.62				
Standard Deviation (kN)	1.54				

A) Test Appratus	Load Cell :	Maywood C3000 (ET/930/07/01) (200kN)	S/N : 1000136752
	Load Cell Indicator :	AD813 (ET/930/07/02)	S/N : -
	Cylinder :	Enerpac RCH121 (ET/903/14)	S/N : -
	Digital Dail Gauge :	ET/430/02	
B) Structural member	Grade 35/20D		
C) Anchor installed date	-		
D) Failure Modes	P = No sign of failure in anchor and/or structural member		F1 = Failure of anchor or its accessories
	F2 = Failure in structural member		F3 = Pull out of anchor
	F4 = Failure of structural member in a shear cone		F5 = Failure by continuous displacement or decreasing load
	F6 = Failure in structural member with crack radiates outward from anchor		
	F7 = Other failure mode(s) : Anchor Breaking		
E) Span width(mm)	280		
F) Edge distance(mm)	140		
G) Drill hole size(mm)	6		
H) Drill hole depth (mm)	55		

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TEST REPORT

Shear Load Test on Anchor Bolt

Client	Hilti (Hong Kong) Ltd	Report No.	: FDA50726A
Address	17/F, Tower 6, China HK City, 33 Canton Road, TST	Test Date	: 08-Aug-05
Project	-	Report Date	: 28-Oct-05
Test Location	ETL's Laboratory	Page No.	: 2 of 3
Anchor Type	M6 HSA-R Stud Anchor A4 Stainless Steel	Test Method	: BS 5080:Part 2:1986 Cl 7.2
Amb.Temperature	24°C		

Load (kN)	Dial Gauge Reading (mm)				
	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
0.00	0.00	0.00	0.00	0.00	0.00
0.87	0.00	0.00	0.00	0.00	0.00
1.74	0.15	0.02	0.03	0.00	0.00
2.61	0.24	0.14	0.07	0.01	0.02
3.48	0.40	0.39	0.18	0.09	0.08
4.35	0.73	0.86	0.41	0.35	0.34
5.22	1.00	1.38	0.97	0.79	0.55
6.09	1.58	2.48	2.08	1.45	1.15
6.96	2.64	-	-	2.55	-
7.83	-	-	-	-	-
8.70	-	-	-	-	-
9.57	-	-	-	-	-
10.44	-	-	-	-	-
11.31	-	-	-	-	-
12.18	-	-	-	-	-
13.05	-	-	-	-	-
13.92	-	-	-	-	-
14.79	-	-	-	-	-
15.66	-	-	-	-	-
16.53	-	-	-	-	-
Failure Load (kN)	7.02	6.43	6.70	7.08	6.56
Failure Mode	F5	F5	F5	F5	F5
Average Failure Load (kN)	6.76				
Standard Deviation (kN)	0.28				

A) Test Appratus

Load Cell :	Maywood C3000 (ET/930/06/01) (500kN)	S/N : 174529
Load Cell Indicator :	AD813 (ET/930/06/02)	S/N : -
Cylinder :	Enerpac RCH302 (ET/903/07)	S/N : C3691C
Digital Dail Gauge :	ET/915/35	

B) Structural member Grade 45/20D

C) Anchor installed date -

D) Failure Modes

P = No sign of failure in anchor and/or structural member
F1 = Failure of anchor or its accessories
F2 = Failure in structural member
F3 = Pull out of anchor
F4 = Failure of structural member in a shear cone
F5 = Failure by continuous displacement or decreasing load
F6 = Failure in structural member with crack radiates outward from anchor
F7 = Other failure mode(s) : Anchor Breaking

E) Span width(mm) 110

F) Edge distance(mm) 110

G) Drill hole size(mm) 6

H) Drill hole depth (mm) 55

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TEST REPORT

Tensile Load Test on Anchor Bolt

Client	Hilti (Hong Kong) Ltd	Report No.	: FDA50776
Address	17/F, Tower 6, China HK City, 33 Canton Road, TST	Test Date	: 27-Jul-05
Project	-	Report Date	: 06-Sep-05
Test Location	ETL's Laboratory	Page No.	: 2 of 3
Anchor Type	M8 HSA-R Stud Anchor A4 Stainless Steel	Test Method	: BS 5080:Part 1:1993 Cl. 7.1
Amb.Temperature	24°C		

Load (kN)	*Dial Gauge Reading (mm)*				
	Sample 1	*Sample 2*	*Sample 3*	*Sample 4*	*Sample 5*
0.00	0.00	0.00	0.00	0.00	0.00
1.72	0.00	0.00	0.00	0.00	0.01
3.44	0.00	0.00	0.03	0.01	0.02
5.16	0.01	0.01	0.10	0.06	0.05
6.88	0.03	0.07	0.12	0.11	0.10
8.60	0.22	0.19	0.15	0.31	0.20
10.32	0.57	0.44	0.19	0.70	0.46
12.04	1.04	0.80	0.32	1.14	0.75
13.76	1.48	1.21	0.48	1.50	0.90
15.48	1.91	1.66	0.65	1.93	1.01
17.20	2.30	2.20	0.97	2.50	1.40
18.92	2.71	2.85	1.99	2.94	1.95
20.64	3.10	3.27	2.45	3.41	2.31
22.36	3.84	3.85	2.96	4.18	2.52
24.08	4.61	-	4.17	4.87	3.76
Failure Load (kN)	26.8	23.8	25.0	28.4	27.0
Failure Mode	F5	F4, F5	F5	F5	F5
Average Failure Load (kN)	26.20				
Standard Deviation (kN)	1.81				

A) Test Appratus	Load Cell :	Maywood C3000 (ET/930/07/01) (200kN)	S/N : 1000136752
	Load Cell Indicator :	AD813 (ET/930/07/02)	S/N : -
	Cylinder :	Enerpac RCH121 (ET/903/14)	S/N : -
	Digital Dail Gauge :	ET/430/02	
B) Structural member	Grade 35/20D		
C) Anchor installed date	-		
D) Failure Modes	P = No sign of failure in anchor and/or structural member		F1 = Failure of anchor or its accessories
	F2 = Failure in structural member		F3 = Pull out of anchor
	F4 = Failure of structural member in a shear cone		F5 = Failure by continuous displacement or decreasing load
	F6 = Failure in structural member with crack radiates outward from anchor		
	F7 = Other failure mode(s) : Anchor Breaking		
E) Span width(mm)	330		
F) Edge distance(mm)	165		
G) Drill hole size(mm)	8		
H) Drill hole depth (mm)	65		

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TEST REPORT

Shear Load Test on Anchor Bolt

Client	Hilti (Hong Kong) Ltd	Report No.	: FDA50728
Address	17/F, Tower 6, China HK City, 33 Canton Road, TST	Test Date	: 08-Aug-05
Project	-	Report Date	: 30-Aug-05
Test Location	ETL's Laboratory	Page No.	: 2 of 3
Anchor Type	M8 HSA-R Stud Anchor A4 Stainless Steel	Test Method	: BS 5080:Part 2:1986 Cl 7.2
Amb.Temperature	24°C		

Load (kN)	Dial Gauge Reading (mm)				
	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
0.00	0.00	0.00	0.00	0.00	0.00
2.00	0.00	0.00	0.00	0.08	0.01
4.00	0.02	0.01	0.00	0.20	0.02
6.00	0.40	0.22	0.47	0.38	0.50
8.00	0.71	0.44	0.80	0.60	0.92
10.00	0.92	0.61	1.08	1.11	1.28
12.00	1.30	1.21	1.37	1.83	1.73
14.00	2.61	2.56	1.90	2.99	2.60
16.00	-	-	3.05	-	-
18.00	-	-	-	-	-
20.00	-	-	-	-	-
22.00	-	-	-	-	-
24.00	-	-	-	-	-
26.00	-	-	-	-	-
28.00	-	-	-	-	-
30.00	-	-	-	-	-
32.00	-	-	-	-	-
34.00	-	-	-	-	-
36.00	-	-	-	-	-
38.00	-	-	-	-	-
Failure Load (kN)	15.60	15.20	16.40	15.00	14.90
Failure Mode	F5	F5	F5	F5	F5
Average Failure Load (kN)	15.42				
Standard Deviation (kN)	0.61				

A) Test Appratus	Load Cell :	Maywood C3000 (ET/930/06/01) (500kN)	S/N : 174529
	Load Cell Indicator :	AD813 (ET/930/06/02)	S/N : -
	Cylinder :	Enerpac RCH302 (ET/903/07)	S/N : C3691C
	Digital Dall Gauge :	ET/915/35	
B) Structural member	Grade 45/20D		
C) Anchor installed date	-		
D) Failure Modes	P = No sign of failure in anchor and/or structural member		F1 = Failure of anchor or its accessories
	F2 = Failure in structural member		F3 = Pull out of anchor
	F4 = Failure of structural member in a shear cone		F5 = Failure by continuous displacement or decreasing load
	F6 = Failure in structural member with crack radiates outward from anchor		
	F7 = Other failure mode(s) : Anchor Breaking		
E) Span width(mm)	130		
F) Edge distance(mm)	130		
G) Drill hole size(mm)	8		
H) Drill hole depth (mm)	65		

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TEST REPORT

Tensile Load Test on Anchor Bolt

Client	Hilti (Hong Kong) Ltd	Report No.	: FDA50772
Address	17/F, Tower 6, China HK City, 33 Canton Road, TST	Test Date	: 27-Jul-05
Project	-	Report Date	: 06-Sep-05
Test Location	ETL's Laboratory	Page No.	: 2 of 3
Anchor Type	M10 HSA-R Stud Anchor A4 Stainless Steel	Test Method	: BS 5080:Part 1:1993 Cl. 7.1
Amb.Temperature	24°C		

Load (kN)	*Dial Gauge Reading (mm)*				
	Sample 1	*Sample 2*	*Sample 3*	*Sample 4*	*Sample 5*
0.00	0.00	0.00	0.00	0.00	0.00
2.01	0.00	0.00	0.00	0.00	0.00
4.02	0.00	0.02	0.00	0.00	0.00
6.03	0.02	0.07	0.00	0.00	0.00
8.04	0.06	0.12	0.02	0.01	0.02
10.05	0.20	0.34	0.09	0.24	0.10
12.06	0.56	0.47	0.25	0.70	0.60
14.07	1.00	0.70	0.55	1.22	1.50
16.08	1.61	1.38	1.00	2.00	1.97
18.09	2.09	1.77	1.17	2.65	2.49
20.10	3.00	2.07	1.47	3.12	3.60
22.11	3.48	2.83	2.17	3.59	4.06
24.12	4.00	3.31	2.70	4.35	4.76
26.13	4.68	3.75	3.08	5.37	5.61
28.14	6.39	5.01	4.23	5.87	7.97
30.15	-	5.89	6.03	7.42	-
32.16	-	-	-	-	-
34.17	-	-	-	-	-
Failure Load (kN)	29.5	30.4	32.0	32.1	29.8
Failure Mode	F5	F4, F5	F4, F5	F5	F5
Average Failure Load (kN)	30.76				
Standard Deviation (kN)	1.22				

A) Test Appratus	Load Cell :	Maywood C3000 (ET/930/07/01) (200kN)	S/N : 1000136752
	Load Cell Indicator :	AD813 (ET/930/07/02)	S/N : -
	Cylinder :	Enerpac RCH121 (ET/903/14)	S/N : -
	Digital Dail Gauge :	ET/430/02	
B) Structural member	Grade 35/20D		
C) Anchor installed date	-		
D) Failure Modes	P = No sign of failure in anchor and/or structural member		F1 = Failure of anchor or its accessories
	F2 = Failure in structural member		F3 = Pull out of anchor
	F4 = Failure of structural member in a shear cone		F5 = Failure by continuous displacement or decreasing load
	F6 = Failure in structural member with crack radiates outward from anchor		
	F7 = Other failure mode(s) : Anchor Breaking		
E) Span width(mm)	350		
F) Edge distance(mm)	175		
G) Drill hole size(mm)	10		
H) Drill hole depth (mm)	70		

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TEST REPORT

Shear Load Test on Anchor Bolt

Client	Hilti (Hong Kong) Ltd	Report No.	: FDA50730
Address	17/F, Tower 6, China HK City, 33 Canton Road, TST	Test Date	: 08-Aug-05
Project	-	Report Date	: 30-Aug-05
Test Location	ETL's Laboratory	Page No.	: 2 of 3
Anchor Type	M10 HSA-R Stud Anchor A4 Stainless Steel	Test Method	: BS 5080:Part 2:1986 Cl 7.2
Amb.Temperature	24°C		

Load (kN)	Dial Gauge Reading (mm)				
	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
0.00	0.00	0.00	0.00	0.00	0.00
2.40	0.00	0.00	0.00	0.00	0.00
4.80	0.00	0.00	0.00	0.01	0.00
7.20	0.01	0.33	0.00	0.01	0.00
9.60	0.01	0.81	0.04	0.01	0.00
12.00	0.04	1.16	0.11	0.26	0.00
14.40	0.06	1.56	0.24	0.84	0.36
16.80	0.10	1.97	0.37	1.23	0.64
19.20	0.13	2.75	0.72	1.77	1.37
21.60	2.48	3.16	1.05	2.47	1.82
24.00	3.44	4.25	1.35	3.44	2.13
26.40	4.90	4.90	2.27	4.21	2.68
28.80	5.23	6.87	3.56	4.98	3.27
31.20	6.33	8.41	3.84	5.74	4.36
33.60	7.15	9.43	4.07	6.99	7.56
36.00	8.40	10.92	5.73	7.54	8.40
38.40	10.16	-	6.88	8.39	9.16
40.80	-	-	8.74	10.18	10.71
43.20	-	-	10.75	12.72	-
45.60	-	-	-	-	-
Failure Load (kN)	40.10	36.70	45.20	45.30	43.90
Failure Mode	F7	F7	F7	F7	F7
Average Failure Load (kN)	42.24				
Standard Deviation (kN)	3.75				

A) Test Appratus

Load Cell :	Maywood C3000 (ET/930/06/01) (500kN)	S/N : 174529
Load Cell Indicator :	AD813 (ET/930/06/02)	S/N : -
Cylinder :	Enerpac RCH302 (ET/903/07)	S/N : C3691C
Digital Dail Gauge :	ET/915/35	

B) Structural member Grade 45/20D

C) Anchor installed date -

D) Failure Modes

P = No sign of failure in anchor and/or structural member
F1 = Failure of anchor or its accessories
F2 = Failure in structural member
F3 = Pull out of anchor
F4 = Failure of structural member in a shear cone
F5 = Failure by continuous displacement or decreasing load
F6 = Failure in structural member with crack radiates outward from anchor
F7 = Other failure mode(s) : Anchor Breaking

E) Span width(mm) 140

F) Edge distance(mm) 140

G) Drill hole size(mm) 10

H) Drill hole depth (mm) 70

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TEST REPORT

Tensile Load Test on Anchor Bolt

Client	Hilti (Hong Kong) Ltd	Report No.	: FDA50774
Address	17/F, Tower 6, China HK City, 33 Canton Road, TST	Test Date	: 27-Jul-05
Project	-	Report Date	: 06-Sep-05
Test Location	ETL's Laboratory	Page No.	: 2 of 3
Anchor Type	M12 HSA-R Stud Anchor A4 Stainless Steel	Test Method	: BS 5080:Part 1:1993 Cl. 7.1
Amb.Temperature	24°C		

Load (kN)	*Dial Gauge Reading (mm)*				
	Sample 1	*Sample 2*	*Sample 3*	*Sample 4*	*Sample 5*
0.00	0.00	0.00	0.00	0.00	0.00
3.36	0.01	0.00	0.00	0.00	0.00
6.72	0.03	0.02	0.00	0.00	0.00
10.08	0.12	0.16	0.01	0.06	0.01
13.44	0.16	0.82	0.24	0.59	0.03
16.80	0.67	1.86	1.03	1.30	0.48
20.16	1.42	3.01	2.02	1.82	1.09
23.52	2.46	4.09	3.20	2.47	2.13
26.88	4.04	4.68	4.21	3.05	2.80
30.24	5.42	5.45	5.67	3.61	3.73
33.60	7.22	7.59	7.46	4.09	4.56
36.96	9.57	8.92	9.76	4.72	5.95
40.32	-	10.14	-	5.27	7.02
43.68	-	-	-	-	-
47.04	-	-	-	-	-
Failure Load (kN)	40.0	42.1	40.2	41.7	42.4
Failure Mode	F4, F5	F5	F4, F5	F5	F5
Average Failure Load (kN)	41.28				
Standard Deviation (kN)	1.11				

A) Test Appratus	Load Cell :	Maywood C3000 (ET/930/07/01) (200kN)	S/N : 1000136752
	Load Cell Indicator :	AD813 (ET/930/07/02)	S/N : -
	Cylinder :	Enerpac RCH121 (ET/903/14)	S/N : -
	Digital Dail Gauge :	ET/430/02	
B) Structural member	Grade 35/20D		
C) Anchor installed date	-		
D) Failure Modes	P = No sign of failure in anchor and/or structural member		F1 = Failure of anchor or its accessories
	F2 = Failure in structural member		F3 = Pull out of anchor
	F4 = Failure of structural member in a shear cone		F5 = Failure by continuous displacement or decreasing load
	F6 = Failure in structural member with crack radiates outward from anchor		
	F7 = Other failure mode(s) : Anchor Breaking		
E) Span width(mm)	480		
F) Edge distance(mm)	240		
G) Drill hole size(mm)	12		
H) Drill hole depth (mm)	95		

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TEST REPORT

Shear Load Test on Anchor Bolt

Client	Hilti (Hong Kong) Ltd	Report No.	: FDA50732
Address	17/F, Tower 6, China HK City, 33 Canton Road, TST	Test Date	: 08-Aug-05
Project	-	Report Date	: 30-Aug-05
Test Location	ETL's Laboratory	Page No.	: 2 of 3
Anchor Type	M12 HSA-R Stud Anchor A4 Stainless Steel	Test Method	: BS 5080:Part 2:1986 Cl 7.2
Amb.Temperature	23°C		

Load (kN)	Dial Gauge Reading (mm)				
	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
0.00	0.00	0.00	0.00	0.00	0.00
3.54	0.00	0.00	0.00	0.00	0.00
7.08	0.02	0.00	0.01	0.00	0.11
10.62	0.14	0.12	0.23	0.99	0.19
14.16	0.29	0.42	0.65	1.41	0.45
17.70	0.70	0.78	0.90	1.70	0.80
21.24	1.29	1.22	1.24	1.92	0.98
24.78	1.81	1.73	1.55	2.30	1.41
28.32	2.24	2.51	1.85	2.64	1.86
31.86	2.99	3.87	2.80	3.09	2.40
35.40	4.29	5.46	3.68	3.79	3.28
38.94	5.92	7.71	5.15	4.79	4.23
42.48	7.99	-	-	6.26	5.46
46.02	9.55	-	-	-	-
49.56	-	-	-	-	-
53.10	-	-	-	-	-
56.64	-	-	-	-	-
60.18	-	-	-	-	-
63.72	-	-	-	-	-
67.26	-	-	-	-	-
Failure Load (kN)	48.60	40.40	41.20	43.60	44.00
Failure Mode	F7	F5	F5	F5	F5
Average Failure Load (kN)	43.56				
Standard Deviation (kN)	3.21				

A) Test Appratus	Load Cell :	Maywood C3000 (ET/930/06/01) (500kN)	S/N : 174529
	Load Cell Indicator :	AD813 (ET/930/06/02)	S/N : -
	Cylinder :	Enerpac RCH302 (ET/903/07)	S/N : C3691C
	Digital Dail Gauge :	ET/915/35	
B) Structural member	Grade 45/20D		
C) Anchor installed date	-		
D) Failure Modes	P = No sign of failure in anchor and/or structural member		F1 = Failure of anchor or its accessories
	F2 = Failure in structural member		F3 = Pull out of anchor
	F4 = Failure of structural member in a shear cone		F5 = Failure by continuous displacement or decreasing load
	F6 = Failure in structural member with crack radiates outward from anchor		
	F7 = Other failure mode(s) : Anchor Breaking		
E) Span width(mm)	190		
F) Edge distance(mm)	190		
G) Drill hole size(mm)	12		
H) Drill hole depth (mm)	95		

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TEST REPORT

Tensile Load Test on Anchor Bolt

Client	Hilti (Hong Kong) Ltd	Report No.	: FDA50780
Address	17/F, Tower 6, China HK City, 33 Canton Road, TST	Test Date	: 27-Jul-05
Project	-	Report Date	: 06-Sep-05
Test Location	ETL's Laboratory	Page No.	: 2 of 3
Anchor Type	M16 HSA-R Stud Anchor A4 Stainless Steel	Test Method	: BS 5080:Part 1:1993 Cl. 7.1
Amb.Temperature	24°C		

Load (kN)	*Dial Gauge Reading (mm)*				
	Sample 1	*Sample 2*	*Sample 3*	*Sample 4*	*Sample 5*
0.00	0.00	0.00	0.00	0.00	0.00
5.23	0.00	0.00	0.00	0.00	0.04
10.46	0.00	0.01	0.27	0.35	0.36
15.69	0.12	0.11	1.01	1.89	1.93
20.92	0.47	1.14	2.19	3.58	3.15
26.15	1.64	2.12	3.75	5.18	4.56
31.38	3.02	3.21	5.53	6.70	6.11
36.61	3.62	4.37	7.55	8.18	7.80
41.84	4.82	5.36	8.00	9.78	9.92
47.07	6.06	6.76	9.29	11.84	12.86
52.30	8.21	8.89	11.94	13.64	-
57.53	10.24	11.84	-	-	-
62.76	13.15	-	-	-	-
67.99	-	-	-	-	-
73.22	-	-	-	-	-
Failure Load (kN)	63.1	68.8	63.4	64.2	63.1
Failure Mode	F5	F5	F4	F5	F5
Average Failure Load (kN)	64.52				
Standard Deviation (kN)	2.43				

A) Test Appratus

Load Cell :	Maywood C3000 (ET/930/07/01) (200kN)	S/N : 1000136752
Load Cell Indicator :	AD813 (ET/930/07/02)	S/N : -
Cylinder :	Enerpac RCH121 (ET/903/14)	S/N : -
Digital Dail Gauge :	ET/430/02	

B) Structural member Grade 35/20D

C) Anchor installed date -

D) Failure Modes

P = No sign of failure in anchor and/or structural member
F1 = Failure of anchor or its accessories
F2 = Failure in structural member
F3 = Pull out of anchor
F4 = Failure of structural member in a shear cone
F5 = Failure by continuous displacement or decreasing load
F6 = Failure in structural member with crack radiates outward from anchor
F7 = Other failure mode(s) : Anchor Breaking

E) Span width(mm) 580

F) Edge distance(mm) 290

G) Drill hole size(mm) 16

H) Drill hole depth (mm) 115

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TEST REPORT

Shear Load Test on Anchor Bolt

Client	Hilti (Hong Kong) Ltd	Report No.	: FDA50734
Address	17/F, Tower 6, China HK City, 33 Canton Road, TST	Test Date	: 08-Aug-05
Project	-	Report Date	: 30-Aug-05
Test Location	ETL's Laboratory	Page No.	: 2 of 3
Anchor Type	M16 HSA-R Stud Anchor A4 Stainless Steel	Test Method	: BS 5080:Part 2:1986 Cl 7.2
Amb.Temperature	23°C		

Load (kN)	Dial Gauge Reading (mm)				
	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
0.00	0.00	0.00	0.00	0.00	0.00
6.22	0.02	0.00	0.03	0.01	0.02
12.44	0.10	0.16	0.11	0.19	0.20
18.66	0.30	0.57	0.31	0.68	0.68
24.88	0.70	0.85	0.56	0.98	1.12
31.10	1.20	1.28	0.94	1.48	1.76
37.32	1.63	1.72	1.37	2.18	2.32
43.54	2.25	2.23	1.89	2.80	2.98
49.76	2.96	3.19	2.68	3.62	3.85
55.98	4.26	5.13	4.01	5.07	5.76
62.20	6.36	7.73	7.11	7.60	7.91
68.42	-	-	-	-	-
74.64	-	-	-	-	-
80.86	-	-	-	-	-
87.08	-	-	-	-	-
93.30	-	-	-	-	-
99.52	-	-	-	-	-
105.74	-	-	-	-	-
111.96	-	-	-	-	-
118.18	-	-	-	-	-
Failure Load (kN)	62.90	63.40	63.90	65.10	63.00
Failure Mode	F5	F5	F5	F5	F5
Average Failure Load (kN)	63.66				
Standard Deviation (kN)	0.90				

A) Test Appratus	Load Cell :	Maywood C3000 (ET/930/06/01) (500kN)	S/N : 174529
	Load Cell Indicator :	AD813 (ET/930/06/02)	S/N : -
	Cylinder :	Enerpac RCH302 (ET/903/07)	S/N : C3691C
	Digital Dail Gauge :	ET/915/35	
B) Structural member	Grade 45/20D		
C) Anchor installed date	-		
D) Failure Modes	P = No sign of failure in anchor and/or structural member		F1 = Failure of anchor or its accessories
	F2 = Failure in structural member		F3 = Pull out of anchor
	F4 = Failure of structural member in a shear cone		F5 = Failure by continuous displacement or decreasing load
	F6 = Failure in structural member with crack radiates outward from anchor		
	F7 = Other failure mode(s) : Anchor Breaking		
E) Span width(mm)	230		
F) Edge distance(mm)	230		
G) Drill hole size(mm)	16		
H) Drill hole depth (mm)	115		

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ETS-TESTCONSULT LIMITED
8/F., Block B, Veristrong Industrial Centre, 34-36 Au Pui Wan Street, Fotan, Hong Kong
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Fax : 2695 3944 Web site : www.ets-testconsult.com

TEST REPORT

Tensile Load Test on Anchor Bolt

Client	Hilti (Hong Kong) Ltd	Report No.	: FDA50778
Address	17/F, Tower 6, China HK City, 33 Canton Road, TST	Test Date	: 27-Jul-05
Project	-	Report Date	: 06-Sep-05
Test Location	ETL's Laboratory	Page No.	: 2 of 3
Anchor Type	M20 HSA-R Stud Anchor A4 Stainless Steel	Test Method	: BS 5080:Part 1:1993 Cl. 7.1
Amb.Temperature	24°C		

Load (kN)	*Dial Gauge Reading (mm)*				
	Sample 1	*Sample 2*	*Sample 3*	*Sample 4*	*Sample 5*
0.00	0.00	0.00	0.00	0.00	0.00
6.90	0.00	0.00	0.00	0.00	0.00
13.80	0.00	0.00	0.00	0.00	0.00
20.70	0.00	0.00	0.00	0.00	0.00
27.60	0.14	0.12	0.10	0.10	0.08
34.50	0.31	0.22	0.19	0.41	0.24
41.40	0.64	0.59	0.52	1.09	0.64
48.30	1.41	1.33	1.36	1.94	1.54
55.20	2.11	1.87	1.98	2.90	2.59
62.10	3.95	3.35	3.29	4.00	3.53
69.00	7.46	6.84	7.11	5.28	4.74
75.90	-	-	-	6.98	-
82.80	-	-	-	-	-
89.70	-	-	-	-	-
96.60	-	-	-	-	-
Failure Load (kN)	70.4	71.4	72.2	79.7	74.6
Failure Mode	F4	F4	F4	F4	F4
Average Failure Load (kN)	73.66				
Standard Deviation (kN)	3.72				

A) Test Appratus	Load Cell :	Maywood C3000 (ET/930/07/01) (200kN)	S/N : 1000136752
	Load Cell Indicator :	AD813 (ET/930/07/02)	S/N : -
	Cylinder :	Enerpac RCH121 (ET/903/14)	S/N : -
	Digital Dail Gauge :	ET/430/02	
B) Structural member	Grade 35/20D		
C) Anchor installed date	-		
D) Failure Modes	P = No sign of failure in anchor and/or structural member		F1 = Failure of anchor or its accessories
	F2 = Failure in structural member		F3 = Pull out of anchor
	F4 = Failure of structural member in a shear cone		F5 = Failure by continuous displacement or decreasing load
	F6 = Failure in structural member with crack radiates outward from anchor		
	F7 = Other failure mode(s) : Anchor Breaking		
E) Span width(mm)	650		
F) Edge distance(mm)	325		
G) Drill hole size(mm)	20		
H) Drill hole depth (mm)	130		

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Fax : 2695 3944 Web site : www.ets-testconsult.com

TEST REPORT
Shear Load Test on Anchor Bolt

Client	Hilti (Hong Kong) Ltd	Report No.	: FDA50736
Address	17/F, Tower 6, China HK City, 33 Canton Road, TST	Test Date	: 08-Aug-05
Project	-	Report Date	: 30-Aug-05
Test Location	ETL's Laboratory	Page No.	: 2 of 3
Anchor Type	M20 HSA-R Stud Anchor A4 Stainless Steel	Test Method	: BS 5080:Part 2:1986 Cl 7.2
Amb.Temperature	23°C		

Load (kN)	Dial Gauge Reading (mm)				
	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
0.00	0.00	0.00	0.00	0.00	0.00
9.70	0.84	1.17	0.84	0.20	0.95
19.40	1.34	2.09	2.39	0.82	1.70
29.10	1.99	2.84	3.35	1.76	2.87
38.80	2.64	3.53	3.97	2.24	3.83
48.50	3.17	4.18	4.45	2.73	5.02
58.20	3.96	4.93	5.20	3.36	5.67
67.90	4.55	5.53	5.80	3.95	6.49
77.60	5.41	6.31	6.71	4.56	7.67
87.30	6.50	7.33	7.50	5.61	8.94
97.00	8.01	8.56	8.54	6.61	9.73
106.70	-	-	-	8.43	-
116.40	-	-	-	-	-
126.10	-	-	-	-	-
135.80	-	-	-	-	-
145.80	-	-	-	-	-
155.20	-	-	-	-	-
164.90	-	-	-	-	-
174.60	-	-	-	-	-
184.30	-	-	-	-	-
Failure Load (kN)	104.90	104.70	105.30	109.70	104.20
Failure Mode	F5	F5	F5	F5	F5
Average Failure Load (kN)	105.76				
Standard Deviation (kN)	2.24				

A) Test Appratus	Load Cell :	Maywood C3000 (ET/930/06/01) (500kN)	S/N : 174529
	Load Cell Indicator :	AD813 (ET/930/06/02)	S/N : -
	Cylinder :	Enerpac RCH302 (ET/903/07)	S/N : C3691C
	Digital Dail Gauge :	ET/915/35	
B) Structural member	Grade 45/20D		
C) Anchor installed date	-		
D) Failure Modes	P = No sign of failure in anchor and/or structural member		F1 = Failure of anchor or its accessories
	F2 = Failure in structural member		F3 = Pull out of anchor
	F4 = Failure of structural member in a shear cone		F5 = Failure by continuous displacement or decreasing load
	F6 = Failure in structural member with crack radiates outward from anchor		
	F7 = Other failure mode(s) : Anchor Breaking		
E) Span width(mm)	260		
F) Edge distance(mm)	260		
G) Drill hole size(mm)	20		
H) Drill hole depth (mm)	130		

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Autorisé et notifié conformément à l'article 10 de la directive 89/106/EEC du Conseil, du 21 décembre 1988, relative au rapprochement des dispositions législatives, réglementaires et administratives des Etats membres concernant les produits de construction.

CSTB
le futur en construction
MEMBRE DE L'EOTA

European Technical Approval ETA-99/0001

(English language translation, the original version is in French language)

Nom commercial : **Trade name:**	**HILTI HSA**
Titulaire : **Holder of approval:**	**Hilti AG, Business Unit Anchors FL-9494 SCHAAN Principality of Liechtenstein**
Type générique et utilisation prévue du produit de construction : **Generic type and use of construction product:**	Cheville métallique en acier galvanisé, à expansion par vissage à couple contrôlé, de fixation dans le béton non fissuré : diamètres M6, M8, M10, M12, M16 et M20. **Torque-controlled expansion anchor, made of galvanised steel, for use in non cracked concrete: sizes M6, M8, M10, M12, M16 and M20.**
Validité du : au : **Validity from / to:**	**08/03/2005 08/03/2010**
Usine de fabrication : **Manufacturing plant:**	**Hilti AG, usine 1 (plant 1), Principality of Liechtenstein**
Le présent Agrément technique européen contient : **This European Technical Approval contains:**	12 pages incluant 5 annexes faisant partie intégrante du document. **12 pages including 5 annexes which form an integral part of the document.**

This European Technical Approval cancels and replaces ETA-99/0001 with validity from 28/09/2000 to 28/09/2005.

Cet Agrément Technique Européen annule et remplace l'ETA-99/0001 valide du 28/09/2000 au 28/09/2005

EOTA
Organisation pour l'Agrément Technique Européen
European Organisation for Technical Approvals

I LEGAL BASES AND GENERAL CONDITIONS

1. This European Technical Approval is issued by the Centre Scientifique et Technique du Bâtiment in accordance with:

   - Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products[1], modified by the Council Directive 93/68/EEC of 22 July 1993[2];
   - Décret n° 92-647 du 8 juillet 1992[3] concernant l'aptitude à l'usage des produits de construction;
   - Common Procedural Rules for Requesting, Preparing and the Granting of European Technical Approvals set out in the Annex of Commission Decision 94/23/EC[4];
   - Guideline for European Technical Approval of « Metal Anchors for use in Concrete » ETAG 001, edition 1997, Part 1 « Anchors in general » and Part 2 « Torque-controlled expansion anchors ».

2. The Centre Scientifique et Technique du Bâtiment is authorised to check whether the provisions of this European Technical Approval are met. Checking may take place in the manufacturing plant (for example concerning the fulfilment of assumptions made in this European Technical Approval with regard to manufacturing). Nevertheless, the responsibility for the conformity of the products with the European Technical Approval and for their fitness for the intended use remains with the holder of the European Technical Approval.

3. This European Technical Approval is not to be transferred to manufacturers or agents of manufacturer other than those indicated on page 1; or manufacturing plants other than those indicated on page 1 of this European Technical Approval.

4. This European Technical Approval may be withdrawn by the Centre Scientifique et Technique du Bâtiment pursuant to Article 5 (1) of the Council Directive 89/106/EEC.

5. Reproduction of this European Technical Approval including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of the Centre Scientifique et Technique du Bâtiment. In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European Technical Approval.

6. The European Technical Approval is issued by the approval body in its official language. This version corresponds to the version circulated within EOTA. Translations into other languages have to be designated as such.

1 Official Journal of the European Communities n° L 40, 11.2.1989, p. 12
2 Official Journal of the European Communities n° L 220, 30.8.1993, p. 1
3 Journal officiel de la République française du 14 juillet 1992
4 Official Journal of the European Communities n° L 17, 20.1.1994, p. 34

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of product and intended use

1.1. Definition of product

The HILTI HSA anchor in the range of M6 to M20 is an anchor made of galvanised steel, which is placed into a drilled hole and anchored by torque-controlled expansion.
For the installed anchor see Figure given in Annex 1.

1.2. Intended use

The anchor is intended to be used for anchorages for which requirements for mechanical resistance and stability and safety in use in the sense of the Essential Requirements 1 and 4 of Council Directive 89/106/EEC shall be fulfilled and failure of anchorages made with these products would compromise the stability of the works, cause risk to human life and/or lead to considerable economic consequences. The anchor is to be used only for anchorages subject to static or quasi-static loading in reinforced or unreinforced normal weight concrete of strength classes C 20/25 minimum to C50/60 maximum according to ENV 206: 2000-12. It may be anchored in non-cracked concrete only.

The anchor may only be used in concrete subject to dry internal conditions.

The provisions made in this European Technical Approval are based on an assumed intended working life of the anchor of 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.

2 Characteristics of product and methods of verification

2.1. Characteristics of product

The anchor in the range of M6 to M20 corresponds to the drawings and provisions given in Annexes 1 to 3. The characteristic material values, dimensions and tolerances of the anchor not indicated in Annexes 2 and 3 shall correspond to the respective values laid down in the technical documentation[5] of this European Technical Approval. The characteristic anchor values for the design of anchorages are given in Annexes 3 to 5.

Each anchor is marked with the commercial name, the nominal diameter of the anchor and the two maximum thickness of the fixture according to Annex 1. A blue colour ring marking identifies the standard embedment depth and the reduced embedment depth corresponds to the end of the threaded part to the concrete surface. A letter code corresponding to the total length of the bolt is punched on the head of the bolt.

The anchor shall only be packaged and supplied as a complete unit.

[5] The technical documentation of this European Technical Approval is deposited at the Centre Scientifique et Technique du Bâtiment and, as far as relevant for the tasks of the approved bodies involved in the attestation of conformity procedure, is handed over to the approved bodies.

2.2. Methods of verification

The assessment of fitness of the anchor for the intended use in relation to the requirements for mechanical resistance and stability and safety in use in the sense of the Essential Requirements 1 and 4 has been made in accordance with the « Guideline for European Technical Approval of Metal Anchors for use in Concrete », Part 1 « Anchors in general » and Part 2 « Torque-controlled expansion anchors », on the basis of Option 7.

3 Evaluation of Conformity and CE marking

3.1. Attestation of conformity system

The system of attestation of conformity 2 (I) (referred to as system 1) according to Council Directive 89/106/EEC Annex III laid down by the European Commission provides:

a) tasks for the manufacturer:

1. factory production control,
2. further testing of samples taken at the factory by the manufacturer in accordance with a prescribed test plan.

b) tasks for the approved body:

3. initial type-testing of the product,
4. initial inspection of factory and of factory production control,
5. continuous surveillance, assessment and approval of factory production control.

3.2. Responsibilities

3.2.1. Tasks of the manufacturer, factory production control

The manufacturer has a factory production control system in the plant and exercises permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer are documented in a systematic manner in the form of written policies and procedures. This production control system ensures that the product is in conformity with the European Technical Approval.

The manufacturer shall only use raw materials supplied with the relevant inspection documents as laid down in the prescribed test plan[6]. The incoming raw materials shall be subject to controls and tests by the manufacturer before acceptance. Check of incoming materials such as nuts, washers, wire for bolts and metal band for expansion sleeves shall include control of the inspection documents presented by suppliers (comparison with nominal values) by verifying dimension and determining material properties, e.g. tensile strength, hardness, surface finish.

The manufactured components of the anchor shall be subjected to the following tests:

- Dimensions of component parts:
  bolt (diameters, lengths, thread, geometry of the cone, marking);
  sleeve (length, thickness, catch sizes);
  hexagonal nut (proper running, wrench size across flats);

[6] The prescribed test plan has been deposited at the Centre Scientifique et Technique du Bâtiment and is only made available to the approved bodies involved in the conformity attestation procedure.

washer (diameters, thickness).
- Material properties: bolt (yielding and ultimate tensile strengths), sleeve (ultimate tensile strength), hexagonal nut (proof load), washer (hardness).
- Thickness of the galvanised treatment of the elements.
- Visual control of correct assembly and of completeness of the anchor.

The frequency of controls and tests conducted during production and on the assembled anchor is laid down in the prescribed test plan taking account of the automated manufacturing process of the anchor.

The results of factory production control are recorded and evaluated. The records include at least the following information:

- designation of the product, basic material and components;
- type of control or testing;
- date of manufacture of the product and date of testing of the product or basic material and components;
- result of control and testing and, if appropriate, comparison with requirements;
- signature of person responsible for factory production control.

The records shall be presented to the inspection body during the continuous surveillance. On request, they shall be presented to the Centre Scientifique et Technique du Bâtiment.

Details of the extent, nature and frequency of testing and controls to be performed within the factory production control shall correspond to the prescribed test plan which is part of the technical documentation of this European Technical Approval.

3.2.2. Tasks of approved bodies

3.2.2.1. Initial type-testing of the product

For initial type-testing the results of the tests performed as part of the assessment for the European Technical Approval shall be used unless there are changes in the production line or plant. In such cases the necessary initial type-testing has to be agreed between the Centre Scientifique et Technique du Bâtiment and the approved bodies involved.

3.2.2.2. Initial inspection of factory and of factory production control

The approved body shall ascertain that, in accordance with the prescribed test plan, the factory and the factory production control are suitable to ensure continuous and orderly manufacturing of the anchor according to the specifications mentioned in 2.1. as well as to the Annexes to the European Technical Approval.

3.2.2.3. Continuous surveillance

The approved body shall visit the factory at least once a year for regular inspection. It has to be verified that the system of factory production control and the specified automated manufacturing process are maintained taking account of the prescribed test plan.

Continuous surveillance and assessment of factory production control have to be performed according to the prescribed test plan.

The results of product certification and continuous surveillance shall be made available on demand by the certification body or inspection body, respectively, to the Centre Scientifique et

Technique du Bâtiment. In cases where the provisions of the European Technical Approval and the prescribed test plan are no longer fulfilled the conformity certificate shall be withdrawn.

3.3. CE-Marking

The CE marking shall be affixed on each packaging of anchors. The symbol « CE » shall be accompanied by the following information:

- identification number of the certification body;
- name or identifying mark of the producer and manufacturing plant;
- the last two digits of the year in which the CE-marking was affixed;
- number of the EC certificate of conformity;
- number of the European Technical Approval;
- use category (ETAG 001-1 Option 7);
- size.

4 Assumptions under which the fitness of the product for the intended use was favourably assessed

4.1. Manufacturing

The anchor is manufactured in accordance with the provisions of the European Technical Approval using the automated manufacturing process as identified during inspection of the plant by the Centre Scientifique et Technique du Bâtiment and the approved body and laid down in the technical documentation.

4.2. Installation

4.2.1. Design of anchorages

The fitness of the anchors for the intended use is given under the following conditions:

The anchorages are designed in accordance with the « Guideline for European Technical Approval of Metal Anchors for Use in Concrete », Annex C, Method A, for torque-controlled expansion anchors 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 support, etc.).

4.2.2. Installation of anchors

The fitness for use of the anchor can only be assumed if the anchor is installed as follows:

- anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters on the site;
- use of the anchor only as supplied by the manufacturer without exchanging the components of an anchor;

- anchor installation in accordance with the manufacturer's specifications and drawings prepared for that purpose and using the appropriate special tools;
- thickness of the fixture corresponding to the range of required thickness values for the type of anchor;
- checks before placing the anchor to ensure that the strength class of the concrete in which the anchor is to be placed is in the range given and is not lower than that of the concrete to which the characteristic loads apply;
- check of concrete being well compacted, e.g. without significant voids;
- clearing the hole of drilling dust;
- anchor installation ensuring the specified embedment depth, that is the appropriate depth marking of the anchor not exceeding the concrete surface or embedment depth control;
- keeping of the edge distance and spacing to the specified values without minus tolerances;
- positioning of the drill holes without damaging the reinforcement;
- 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 drill hole is filled with high strength mortar and if under shear or oblique tension load it is not to the anchor in the direction of load application;
- application of the torque moment given in Annex 3 using a calibrated torque wrench.

4.2.3. Responsibility of the manufacturer

It is the manufacturer's responsibility to ensure that the information on the specific conditions according to 1 and 2 including Annexes referred to in 4.2.1. and 4.2.2. is given to those who are concerned. This information may be made by reproduction of the respective parts of the European Technical Approval. In addition all installation data shall be shown clearly on the package and/or on an enclosed instruction sheet, preferably using illustration(s).

The minimum data required are:

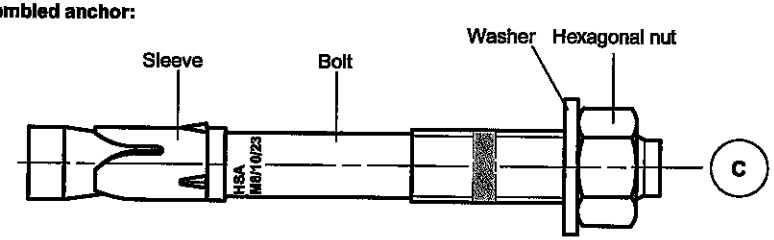
- drill bit diameter,
- thread diameter,
- maximum thickness of the fixture,
- minimum installation depth,
- minimum hole depth,
- required torque moment,
- information on the installation procedure, including cleaning of the hole, preferably by means of an illustration,
- reference to any special installation equipment needed,
- identification of the manufacturing batch.

All data shall be presented in a clear and explicit form.

The original French version is signed by

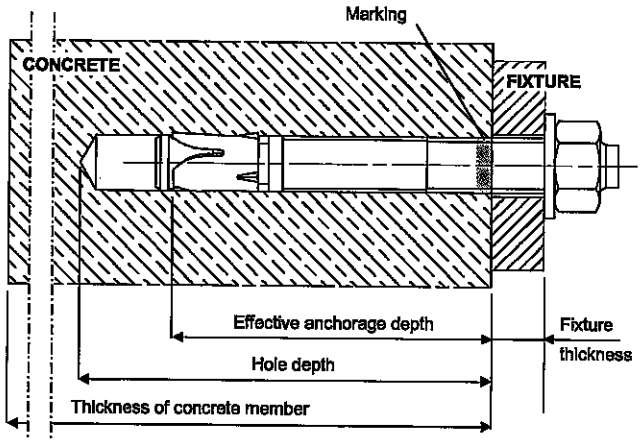
Le Directeur Technique
H. BERRIER

Assembled anchor:



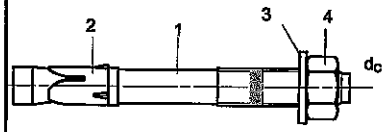
Marking: on the bolt, HSA commercial name,
M8/10/23 nominal diameter, maximum fixture thickness $t_{fix,max}$ corresponding to respective standard / reduced embedment depth.
on the thread, a blue colour ring identifies the standard embedment depth. (the end of the threaded part corresponds to the reduced embedment)
on the head, letter code C referring to the total length of the bolt.

Illustration of the anchor in use:



Hilti HSA torque-controlled expansion anchor	**Annex 1**
Product and intended use	of European Technical Approval **ETA-99/0001**

Assembled anchor:



Different parts of the anchor:

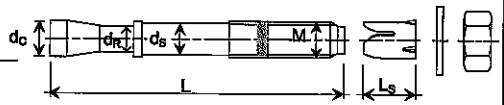


Table 1: Materials

Part	Designation	Material	Protection
1	Bolt	M6, M8, M10, M12, M16 and M20: cold-formed, DIN 59115 (in future DIN EN 10108) and HN-490 M16: cold-formed, DIN 59115 (in future DIN EN 10108) and HN-450	DIN 50961, galvanised (≥5 µm)
2	Sleeve	M6: DIN EN 10088, stainless steel M8, M10, M12: DIN EN 10139, DC03 C590 steel (coldformed) M16, M20: DIN EN 10139, DC03 C490 steel (coldformed)	DIN 50961, galvanised ≥5 µm
3	Washer	DIN 125 (in future EN 7089) or DIN 9021 (in future EN 7093), steel	ISO 4042, Zinc electroplated and bichromated A2k (≥5 µm)
4	Hexagonal nut	DIN 934 (in future ISO 4032) steel strength grade 8 acc. EN 20898-2	

Table 2: Dimensions

Anchor type	L (mm) from	L (mm) to	M	d_s (mm)	d_R (mm)	d_C (mm)	L_S (mm)
HSA M6/$t_{fix,max,stand}$/$t_{fix,max,red}$	50	100	M6	5,3	4,2	6	8,2
HSA M8/$t_{fix,max,stand}$/$t_{fix,max,red}$	57	137	M8	7,1	5,8	8	11,5
HSA M10/$t_{fix,max,stand}$/$t_{fix,max,red}$	68	140	M10	9	7,6	9,9	15,4
HSA M12/$t_{fix,max,stand}$/$t_{fix,max,red}$	80	300	M12	10,8	9	11,9	19,1
HSA M16/$t_{fix,max,stand}$/$t_{fix,max,red}$	100	240	M16	14,6	12,2	15,9	24,8
HSA M20/$t_{fix,max,stand}$/$t_{fix,max,red}$	125	170	M20	18,3	15,4	19,85	29

Hilti HSA torque-controlled expansion anchor	**Annex 2**
Materials and dimensions of anchors	of European Technical Approval **ETA-99/0001**

Illustration of the anchor in use:

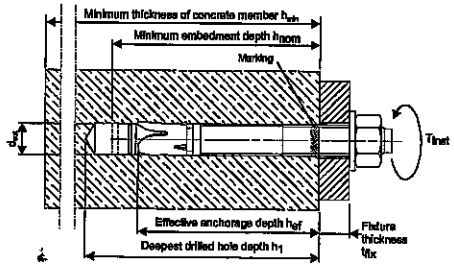


Table 3: Installation data

Anchor type	L min (mm) (0)	Lmax (mm) (0)	d_{cut} (mm) (1)	d_f (mm) (2)	T_{inst} (Nm) (3)	Standard embedment: h_{min} (mm) (4)	h_1 (mm) (5)	h_{nom} (mm) (6)	$h_{ef,sta}$ (mm) (7)	$t_{fix,max}$ (mm) (8)	Reduced embedment: h_{min} (mm) (4)	h_1 (mm) (5)	h_{nom} (mm) (6)	$h_{ef,red}$ (mm) (7)	$t_{fix,max}$ (mm) (8)
M6 $t_{fix,max,sta}$/$t_{fix,max,red}$	50	100	6	7	5	100	55	47	40	0 - 45	100	45	37	30*	5 - 55
M8 $t_{fix,max,sta}$/$t_{fix,max,red}$	57	137	8	9	15	100	65	55	48	0 - 72	100	50	42	35*	5 - 85
M10 $t_{fix,max,sta}$/$t_{fix,max,red}$	68	140	10	12	30	100	70	59	50	0 - 70	100	60	51	42	5 - 77
M12 $t_{fix,max,sta}$/$t_{fix,max,red}$	80	300	12	14	50	140	95	80	70	0 - 205	100	70	60	50	5 - 225
M16 $t_{fix,max,sta}$/$t_{fix,max,red}$	100	240	16	18	100	170	115	95	84	0 - 125	130	90	75	64	5 - 145
M20 $t_{fix,max,sta}$/$t_{fix,max,red}$	125	170	20	22	200	210	130	115	103	0 - 30	160	105	90	78	10 - 55

* use restricted to anchoring of structural components which are statically indeterminate.

(0) Total length of the bolt (mm; min – max)
(1) Nominal diameter of drill bit, d_{cut} (mm)
(2) Diameter of clearance hole in the fixture, d_f (mm)
(3) Required torque moment, T_{inst} (Nm)
(4) Minimum thickness of concrete member, h_{min} (mm)
(5) Depth of drilled hole to deepest point, h_1 (mm)
(6) Minimum installation depth, h_{nom} (mm)
(7) Effective anchorage depth, h_{ef} (mm)
(8) Maximum thickness of the fixture, $t_{fix,max}$ (mm; from – to)

Non-cracked concrete only				M6	M8	M10	M12	M16	M20
Standard effective Anchorage depth $h_{ef,sta}$	Minimum spacing	S_{min}	(mm)	40	50	55	75	90	105
	Minimum edge distance	C_{min}	(mm)	50	60	65	90	105	125
Reduced effective Anchorage depth $h_{ef,red}$	Minimum spacing	S_{min}	(mm)	35	35	55	100	100	100
	Minimum edge distance	C_{min}	(mm)	40	45	65	100	100	115

Hilti HSA torque-controlled expansion anchor	**Annex 3**
Installation data	of European Technical Approval **ETA-99/0001**

Table 4: Characteristic values of resistance to tension loads of design method A

			M6	M8	M10	M12	M16	M20
Steel failure								
Characteristic resistance (reduced part)	$N_{Rk,s}$	(kN)	9,45	16,58	28,73	40,43	66,12	108,05
Partial safety factor	γ_{Ms}	-	1,68	1,73	1,63	1,63	1,51	1,51
Pull-out failure								
Standard embedment depth	$h_{ef,sta}$							
Characteristic resistance in non-cracked concrete C20/25	$N_{Rk,p}$	(kN)	6	12	16	25	-**	-**
Partial safety factor	γ_2	-	1,2	1,0	1,0	1,0		
in non-cracked concrete	γ_{Mp}	-	1,80	1,50	1,50	1,50		
Reduced embedment depth	$h_{ef,red}$							
Characteristic resistance in non-cracked concrete C20/25	$N_{Rk,p}$	(kN)	5*	9*	12	-**	-**	-**
Partial safety factor	γ_2	-	1,2	1,0	1,0			
in non-cracked concrete	γ_{Mp}	-	1,80*	1,50*	1,50			
Increasing factors for $N_{Rk,p}$ C30/37	ψ_c	-	1,17					
C40/50			1,32					
C50/60			1,42					
Concrete cone failure and splitting failure								
Standard embedment depth	$h_{ef,sta}$							
Effective anchorage depth	$h_{ef,sta}$	(mm)	40	48	50	70	84	103
Partial safety factor	γ_2	-	1,2	1,0	1,0	1,0	1,0	1,0
in non-cracked concrete	$\gamma_{Mc} = \gamma_{M,sp}$	-	1,80	1,50	1,50	1,50	1,50	1,50
Spacing	$s_{cr,N}$	(mm)	120	144	150	210	252	309
	$s_{cr,sp}$	(mm)	200	240	270	378	454	556
Edge distance	$c_{cr,N}$	(mm)	60	72	75	105	126	155
	$c_{cr,sp}$	(mm)	100	120	135	189	227	278
Reduced embedment depth	$h_{ef,red}$							
Effective anchorage depth	$h_{ef,red}$	(mm)	30*	35*	42	50	64	78
Partial safety factor	γ_2	-	1,2	1,0	1,0	1,0	1,0	1,0
in non-cracked concrete	$\gamma_{Mc} = \gamma_{M,sp}$	-	1,80*	1,50*	1,50	1,50	1,50	1,50
Spacing	$s_{cr,N}$	(mm)	90*	105*	126	150	192	234
	$s_{cr,sp}$	(mm)	150*	176*	226	270	346	422
Edge distance	$c_{cr,N}$	(mm)	45*	53*	63	75	96	117
	$c_{cr,sp}$	(mm)	75*	88*	113	135	173	211

* use restricted to anchoring of structural components which are statically indeterminate.
** pull-out not decisive for design

Table 5: Displacements under tension loads

		M6	M8	M10	M12	M16	M20	M6	M8	M10	M12	M16	M20
		Standard embedment depth $h_{ef,sta}$						Reduced embedment depth $h_{ef,red}$					
Tension load in non-cracked concrete C20/25 to C50/60 (kN)		2,0	4,0	4,0	7,1	11,6	19,9	1,1	3,6	4,0	4,5	8,3	13,9
Displacement	δ_{N0} (mm)	0,2	0,2	0,2	0,2	0,2	0,1	0,1	0,1	0,1	0,1	0,1	0,1
	$\delta_{N\infty}$ (mm)	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8

Hilti HSA torque-controlled expansion anchor	**Annex 4**
Design method A, characteristic values of resistance to tension loads; displacements	of European Technical Approval **ETA-99/0001**

Table 6: Characteristic values of resistance to shear loads of design method A

			M6	M8	M10	M12	M16	M20
Steel failure without lever arm								
Characteristic resistance	$V_{Rk,s}$	(kN)	5,5	9,5	16,0	23,2	39,3	61,3
Partial safety factor	γ_{Ms}	-	1,38	1,53	1,62	1,62	1,47	1,47
Steel failure with lever arm								
Characteristic resistance	$M_{Rk,s}$	(Nm)	8	19	41	72	166	325
Partial safety factor	γ_{Ms}	-	1,38	1,53	1,62	1,62	1,47	1,47
Concrete pryout failure								
Factor in equation (5.6) of for $h_{ef,sta}$	k	-	1	1	1	2	2	2
ETAG Annex C, § 5.2.3.3 for $h_{ef,red}$	k	-	1*	1*	1	1	2	2
Partial safety factor	γ_2	-	1,00					
	γ_{Mc}	-	1,50					
Concrete edge failure								
Effective length of anchor for $h_{ef,sta}$	l_f	(mm)	40	48	50	70	84	103
under shear loading for $h_{ef,red}$	l_f	(mm)	30*	35*	42	50	64	78
Outside diameter of anchor	d_{nom}	(mm)	6	8	10	12	16	20
Partial safety factor	γ_2	-	1,00					
	γ_{Mc}	-	1,50					

* use restricted to anchoring of structural components which are statically indeterminate.

Table 7: Displacements under shear loads

		M6	M8	M10	M12	M16	M20	M6	M8	M10	M12	M16	M20
		Standard embedment depth $h_{ef,sta}$						Reduced embedment depth $h_{ef,red}$					
Shear load in non- cracked concrete C20/25 to C50/60 (kN)		2,9	4,4	7,1	10,2	19,0	29,6	2,9	4,4	7,1	10,2	19,0	29,6
Displacement	δ_{V0} (mm)	1,5 (+0,7)	1,6 (+0,7)	1,7 (+1,2)	1,8 (+1,2)	1,9 (+1,2)	2,1 (+1,3)	1,5 (+0,7)	1,6 (+0,7)	1,7 (+1,2)	1,8 (+1,2)	1,9 (+1,2)	2,1 (+1,3)
	$\delta_{V\infty}$ (mm)	2,3 (+0,7)	2,4 (+0,7)	2,5 (+1,2)	2,7 (+1,2)	2,9 (+1,2)	3,1 (+1,3)	2,3 (+0,7)	2,4 (+0,7)	2,5 (+1,2)	2,7 (+1,2)	2,9 (+1,2)	3,1 (+1,3)

Displacement: the table shows the deformation to be expected from the anchor itself, whilst the bracket value indicates the movement between the anchor body and the hole drilled in the concrete member or the hole in the fixture.

Hilti HSA torque-controlled expansion anchor	**Annex 5**
Design method A, characteristic values of resistance to shear loads; displacements	of European Technical Approval **ETA-99/0001**

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Autorisé et notifié conformément à l'article 10 de la directive 89/106/EEC du Conseil, du 21 décembre 1988, relative au rapprochement des dispositions législatives, réglementaires et administratives des Etats membres concernant les produits de construction.

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European Technical Approval ETA-99/0008

(English language translation, the original version is in French language)

Nom commercial : **Trade name:**	**HILTI HSA-R**
Titulaire : **Holder of approval:**	**Hilti AG, Business Unit Anchors FL-9494 SCHAAN Principality of Liechtenstein**
Type générique et utilisation prévue du produit de construction : **Generic type and use of construction product:**	Cheville métallique en acier inoxydable, à expansion par vissage à couple contrôlé, de fixation dans le béton non fissuré : diamètres M6, M8, M10 et M12. **Torque-controlled expansion anchor, made of stainless steel, for use in non cracked concrete: sizes M6, M8, M10, and M12.**
Validité du : au : **Validity from / to:**	**08/03/2005 08/03/2010**
Usine de fabrication : **Manufacturing plant:**	**Hilti AG, usine 1 (plant 1), Principality of Liechtenstein**
Le présent Agrément technique européen contient : **This European Technical Approval contains:**	12 pages incluant 5 annexes faisant partie intégrante du document. **12 pages including 5 annexes which form an integral part of the document.**

This European Technical Approval cancels and replaces ETA-99/0008 with validity from 01/08/2000 to 01/08/2005.

Cet Agrément Technique Européen annule et remplace l'ETA-99/0008 valide du 01/08/2000 au 01/08/2005

EOTA
Organisation pour l'Agrément Technique Européen
European Organisation for Technical Approvals

I LEGAL BASES AND GENERAL CONDITIONS

1. This European Technical Approval is issued by the Centre Scientifique et Technique du Bâtiment in accordance with:

   - Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products[1], modified by the Council Directive 93/68/EEC of 22 July 1993[2];
   - Décret n° 92-647 du 8 juillet 1992[3] concernant l'aptitude à l'usage des produits de construction;
   - Common Procedural Rules for Requesting, Preparing and the Granting of European Technical Approvals set out in the Annex of Commission Decision 94/23/EC[4];
   - Guideline for European Technical Approval of « Metal Anchors for use in Concrete » ETAG 001, edition 1997, Part 1 « Anchors in general » and Part 2 « Torque-controlled expansion anchors ».

2. The Centre Scientifique et Technique du Bâtiment is authorised to check whether the provisions of this European Technical Approval are met. Checking may take place in the manufacturing plant (for example concerning the fulfilment of assumptions made in this European Technical Approval with regard to manufacturing). Nevertheless, the responsibility for the conformity of the products with the European Technical Approval and for their fitness for the intended use remains with the holder of the European Technical Approval.

3. This European Technical Approval is not to be transferred to manufacturers or agents of manufacturer other than those indicated on page 1; or manufacturing plants other than those indicated on page 1 of this European Technical Approval.

4. This European Technical Approval may be withdrawn by the Centre Scientifique et Technique du Bâtiment pursuant to Article 5 (1) of the Council Directive 89/106/EEC.

5. Reproduction of this European Technical Approval including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of the Centre Scientifique et Technique du Bâtiment. In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European Technical Approval.

6. The European Technical Approval is issued by the approval body in its official language. This version corresponds to the version circulated within EOTA. Translations into other languages have to be designated as such.

1 Official Journal of the European Communities n° L 40, 11.2.1989, p. 12
2 Official Journal of the European Communities n° L 220, 30.8.1993, p. 1
3 Journal officiel de la République française du 14 juillet 1992
4 Official Journal of the European Communities n° L 17, 20.1.1994, p. 34

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of product and intended use

1.1. Definition of product

The HILTI HSA-R anchor in the range of M6 to M12 is an anchor made of stainless steel, which is placed into a drilled hole and anchored by torque-controlled expansion.
For the installed anchor see Figure given in Annex 1.

1.2. Intended use

The anchor is intended to be used for anchorages for which requirements for mechanical resistance and stability and safety in use in the sense of the Essential Requirements 1 and 4 of Council Directive 89/106/EEC shall be fulfilled and failure of anchorages made with these products would compromise the stability of the works, cause risk to human life and/or lead to considerable economic consequences. The anchor is to be used only for anchorages subject to static or quasi-static loading in reinforced or unreinforced normal weight concrete of strength classes C 20/25 minimum to C50/60 maximum according to ENV 206: 2000-12. It may be anchored in non-cracked concrete only.

The anchor may be used in concrete subject to dry internal conditions and also in concrete subject to external atmospheric exposure (including industrial and marine environment), or exposure in permanently damp internal conditions, if no particular aggressive conditions exist. Such particular aggressive conditions are e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with extreme chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used).

The provisions made in this European Technical Approval are based on an assumed intended working life of the anchor of 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.

2 Characteristics of product and methods of verification

2.1. Characteristics of product

The anchor in the range of M6 to M12 corresponds to the drawings and provisions given in Annexes 1 to 3. The characteristic material values, dimensions and tolerances of the anchor not indicated in Annexes 2 and 3 shall correspond to the respective values laid down in the technical documentation[5] of this European Technical Approval. The characteristic anchor values for the design of anchorages are given in Annexes 3 to 5.

Each anchor is marked with the commercial name, the nominal diameter of the anchor and the two maximum thickness of the fixture according to Annex 1. A blue colour ring marking identifies the standard embedment depth and the reduced embedment depth corresponds to

[5] The technical documentation of this European Technical Approval is deposited at the Centre Scientifique et Technique du Bâtiment and, as far as relevant for the tasks of the approved bodies involved in the attestation of conformity procedure, is handed over to the approved bodies.

the end of the threaded part to the concrete surface. A letter code corresponding to the total length of the bolt is punched on the head of the bolt.

The anchor shall only be packaged and supplied as a complete unit.

2.2. Methods of verification

The assessment of fitness of the anchor for the intended use in relation to the requirements for mechanical resistance and stability and safety in use in the sense of the Essential Requirements 1 and 4 has been made in accordance with the « Guideline for European Technical Approval of Metal Anchors for use in Concrete », Part 1 « Anchors in general » and Part 2 « Torque-controlled expansion anchors », on the basis of Option 8.

3 Evaluation of Conformity and CE marking

3.1. Attestation of conformity system

The system of attestation of conformity 2 (I) (referred to as system 1) according to Council Directive 89/106/EEC Annex III laid down by the European Commission provides:

a) tasks for the manufacturer:

1. factory production control,
2. further testing of samples taken at the factory by the manufacturer in accordance with a prescribed test plan.

b) tasks for the approved body:

3. initial type-testing of the product,
4. initial inspection of factory and of factory production control,
5. continuous surveillance, assessment and approval of factory production control.

3.2. Responsibilities

3.2.1. Tasks of the manufacturer, factory production control

The manufacturer has a factory production control system in the plant and exercises permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer are documented in a systematic manner in the form of written policies and procedures. This production control system ensures that the product is in conformity with the European Technical Approval.

The manufacturer shall only use raw materials supplied with the relevant inspection documents as laid down in the prescribed test plan[6]. The incoming raw materials shall be subject to controls and tests by the manufacturer before acceptance. Check of incoming materials such as nuts, washers, wire for bolts and metal band for expansion sleeves shall include control of the inspection documents presented by suppliers (comparison with nominal values) by verifying dimension and determining material properties, e.g. tensile strength, hardness, surface finish.

[6] The prescribed test plan has been deposited at the Centre Scientifique et Technique du Bâtiment and is only made available to the approved bodies involved in the conformity attestation procedure.

The manufactured components of the anchor shall be subjected to the following tests:

- Dimensions of component parts:
  bolt (diameters, lengths, thread, geometry of the cone, marking);
  sleeve (length, thickness, catch sizes);
  hexagonal nut (proper running, wrench size across flats);
  washer (diameters, thickness).
- Material properties: bolt (yielding and ultimate tensile strengths), sleeve (ultimate tensile strength), hexagonal nut (proof load), washer (hardness).
- Coating of the cone.
- Visual control of correct assembly and of completeness of the anchor.

The frequency of controls and tests conducted during production and on the assembled anchor is laid down in the prescribed test plan taking account of the automated manufacturing process of the anchor.

The results of factory production control are recorded and evaluated. The records include at least the following information:

- designation of the product, basic material and components;
- type of control or testing;
- date of manufacture of the product and date of testing of the product or basic material and components;
- result of control and testing and, if appropriate, comparison with requirements;
- signature of person responsible for factory production control.

The records shall be presented to the inspection body during the continuous surveillance. On request, they shall be presented to the Centre Scientifique et Technique du Bâtiment.

Details of the extent, nature and frequency of testing and controls to be performed within the factory production control shall correspond to the prescribed test plan which is part of the technical documentation of this European Technical Approval.

3.2.2. Tasks of approved bodies

3.2.2.1. Initial type-testing of the product

For initial type-testing the results of the tests performed as part of the assessment for the European Technical Approval shall be used unless there are changes in the production line or plant. In such cases the necessary initial type-testing has to be agreed between the Centre Scientifique et Technique du Bâtiment and the approved bodies involved.

3.2.2.2. Initial inspection of factory and of factory production control

The approved body shall ascertain that, in accordance with the prescribed test plan, the factory and the factory production control are suitable to ensure continuous and orderly manufacturing of the anchor according to the specifications mentioned in 2.1. as well as to the Annexes to the European Technical Approval.

3.2.2.3. Continuous surveillance

The approved body shall visit the factory at least once a year for regular inspection. It has to be verified that the system of factory production control and the specified automated manufacturing process are maintained taking account of the prescribed test plan.

Continuous surveillance and assessment of factory production control have to be performed according to the prescribed test plan.

The results of product certification and continuous surveillance shall be made available on demand by the certification body or inspection body, respectively, to the Centre Scientifique et Technique du Bâtiment. In cases where the provisions of the European Technical Approval and the prescribed test plan are no longer fulfilled the conformity certificate shall be withdrawn.

3.3. CE-Marking

The CE marking shall be affixed on each packaging of anchors. The symbol « CE » shall be accompanied by the following information:

- identification number of the certification body;
- name or identifying mark of the producer and manufacturing plant;
- the last two digits of the year in which the CE-marking was affixed;
- number of the EC certificate of conformity;
- number of the European Technical Approval;
- use category (ETAG 001-1 Option 8);
- size.

4 Assumptions under which the fitness of the product for the intended use was favourably assessed

4.1. Manufacturing

The anchor is manufactured in accordance with the provisions of the European Technical Approval using the automated manufacturing process as identified during inspection of the plant by the Centre Scientifique et Technique du Bâtiment and the approved body and laid down in the technical documentation.

4.2. Installation

4.2.1. Design of anchorages

The fitness of the anchors for the intended use is given under the following conditions:

The anchorages are designed in accordance with the « Guideline for European Technical Approval of Metal Anchors for Use in Concrete », Annex C, Method A, for torque-controlled expansion anchors 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 support, etc.).

4.2.2. Installation of anchors

The fitness for use of the anchor can only be assumed if the anchor is installed as follows:

- anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters on the site;
- use of the anchor only as supplied by the manufacturer without exchanging the components of an anchor;
- anchor installation in accordance with the manufacturer's specifications and drawings prepared for that purpose and using the appropriate tools;
- thickness of the fixture corresponding to the range of required thickness values for the type of anchor;
- checks before placing the anchor to ensure that the strength class of the concrete in which the anchor is to be placed is in the range given and is not lower than that of the concrete to which the characteristic loads apply;
- check of concrete being well compacted, e.g. without significant voids;
- clearing the hole of drilling dust;
- anchor installation ensuring the specified embedment depth, that is the appropriate depth marking of the anchor not exceeding the concrete surface or embedment depth control;
- keeping of the edge distance and spacing to the specified values without minus tolerances;
- positioning of the drill holes without damaging the reinforcement;
- 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 drill hole is filled with high strength mortar and if under shear or oblique tension load it is not to the anchor in the direction of load application;
- application of the torque moment given in Annex 3 using a calibrated torque wrench.

4.2.3. Responsibility of the manufacturer

It is the manufacturer's responsibility to ensure that the information on the specific conditions according to 1 and 2 including Annexes referred to in 4.2.1. and 4.2.2. is given to those who are concerned. This information may be made by reproduction of the respective parts of the European Technical Approval. In addition all installation data shall be shown clearly on the package and/or on an enclosed instruction sheet, preferably using illustration(s).

The minimum data required are:

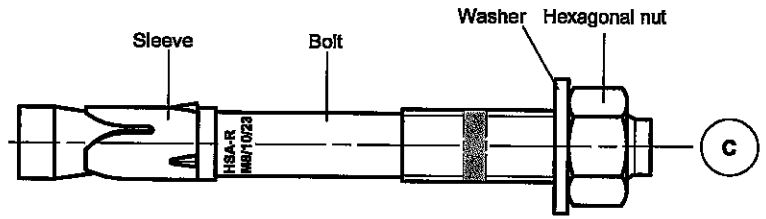
- drill bit diameter,
- thread diameter,
- maximum thickness of the fixture,
- minimum installation depth,
- minimum hole depth,
- required torque moment,
- information on the installation procedure, including cleaning of the hole, preferably by means of an illustration,
- reference to any special installation equipment needed,
- identification of the manufacturing batch.

All data shall be presented in a clear and explicit form.

The original French version is signed by

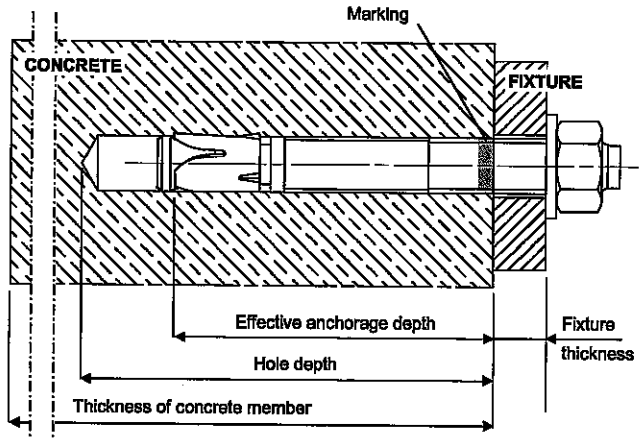
Le Directeur Technique
H. BERRIER

Assembled anchor:



Marking: on the bolt, HSA-R commercial name,
M8/10/23 nominal diameter, maximum fixture thickness $t_{fix,max}$ corresponding to respective standard / reduced embedment depth.
on the thread, a blue colour ring identifies the standard embedment depth. (the end of the threaded part corresponds to the reduced embedment)
on the head, letter code C referring to the total length of the bolt.

Illustration of the anchor in use:



Hilti HSA-R torque-controlled expansion anchor	Annex 1
Product and intended use	of European Technical Approval ETA-99/0008

Assembled anchor: **Different parts of the anchor:**

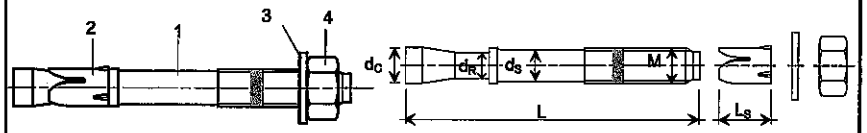


Table 1: Materials

Part	Designation	Material
1	Bolt	M6, M8, M10 and M12: cold-formed, EN 10088 stainless steel 1.4401 coating of cone with acrylic resin
2	Sleeve	cold-formed, EN 10088 stainless steel 1.4401
3	Washer	EN 10088 stainless steel A4
4	Hexagonal nut, EN 24032	EN 20898-2, stainless steel A4-70 strength grade 8

Table 2: Dimensions

Anchor type	L (mm) from	L (mm) to	M	d_s (mm)	d_R (mm)	d_C (mm)	L_s (mm)
HSA-R M6/$t_{fix,max,stand}$/$t_{fix,max,red}$	65	85	M6	5,3	4,35	6	8,2
HSA-R M8/$t_{fix,max,stand}$/$t_{fix,max,red}$	57	115	M8	7,1	5,8	8	11,2
HSA-R M10/$t_{fix,max,stand}$/$t_{fix,max,red}$	68	120	M10	9	7,6	9,9	15,6
HSA-R M12/$t_{fix,max,stand}$/$t_{fix,max,red}$	80	120	M12	10,8	9	11,9	19

Hilti HSA-R torque-controlled expansion anchor	Annex 2
Materials and dimensions of anchors	of European Technical Approval ETA-99/0008

Illustration of the anchor in use:

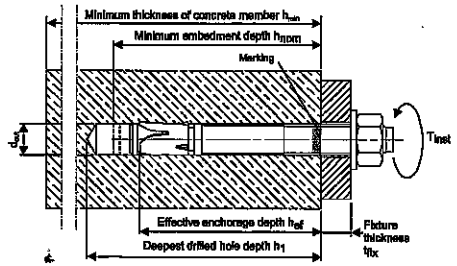


Table 3: Installation data

Anchor type	L min (mm) (0)	Lmax (mm) (0)	d_{out} (mm) (1)	d_f (mm) (2)	T_{inst} (Nm) (3)	Standard embedment h_{min} (mm) (4)	Standard embedment h_1 (mm) (5)	Standard embedment h_{nom} (mm) (6)	Standard embedment $h_{ef,sta}$ (mm) (7)	Standard embedment $t_{fix,max}$ (mm) (8)	Reduced embedment h_{min} (mm) (4)	Reduced embedment h_1 (mm) (5)	Reduced embedment h_{nom} (mm) (6)	Reduced embedment $h_{ef,red}$ (mm) (7)	Reduced embedment $t_{fix,max}$ (mm) (8)
M6 $t_{fix,max,sta}$/$t_{fix,max,red}$	65	85	6	7	5	100	55	47	40	10 - 30	-	-	-	-	-
M8 $t_{fix,max,sta}$/$t_{fix,max,red}$	57	115	8	9	15	100	65	55	48	10 -50	100	50	42	35*	5 – 63
M10 $t_{fix,max,sta}$/$t_{fix,max,red}$	68	120	10	12	30	100	70	59	50	20–50	100	60	51	42	5 - 57
M12 $t_{fix,max,sta}$/$t_{fix,max,red}$	80	120	12	14	50	140	95	80	70	5-25	100	70	60	50	5 - 45

* use restricted to anchoring of structural components which are statically indeterminate.
(0) Total length of the bolt (mm; min – max))
(1) Nominal diameter of drill bit, d_{out} (mm)
(2) Diameter of clearance hole in the fixture, d_f (mm)
(3) Required torque moment, T_{inst} (Nm)
(4) Minimum thickness of concrete member, h_{min} (mm)
(5) Depth of drilled hole to deepest point, h_1 (mm)
(6) Minimum installation depth, h_{nom} (mm)
(7) Effective anchorage depth, h_{ef} (mm)
(8) Maximum thickness of the fixture, $t_{fix,max}$ (mm; from – to)

Non-cracked concrete only				M6	M8	M10	M12
Standard effective anchorage depth $h_{ef,sta}$	Minimum spacing	S_{min}	(mm)	40	50	65	100
	Minimum edge distance	C_{min}	(mm)	50	60	75	100
Reduced effective anchorage depth $h_{ef,red}$	Minimum spacing	S_{min}	(mm)	-	35	55	100
	Minimum edge distance	C_{min}	(mm)	-	45	65	100

Hilti HSA-R torque-controlled expansion anchor	Annex 3
Installation data	of European Technical Approval ETA-99/0008

Table 4: Characteristic values of resistance to tension loads of design method A

			M6	M8	M10	M12
Steel failure						
Characteristic resistance (reduced part)	$N_{Rk,s}$	(kN)	11	20	35	49
Partial safety factor	γ_{Ms}	-	1,60	1,60	1,60	1,60
Pull-out failure						
Standard embedment depth	$h_{ef,sta}$					
Characteristic resistance in non-cracked concrete C20/25 to C50/60	$N_{Rk,p}$	(kN)	6	12	12	25
Partial safety factor	γ_2	-	1,2	1,2	1,2	1,4
in non cracked concrete	γ_{Mp}	-	1,8	1,8	1,8	2,1
Reduced embedment depth	$h_{ef,red}$					
Characteristic resistance in non-cracked concrete C20/25 to C50/60	$N_{Rk,p}$	(kN)	-	7,5*	12	**
Partial safety factor	γ_2	-	-	1,2*	1,4	1,4
in non cracked concrete	γ_{Mp}	-	-	1,8*	2,1	2,1
Concrete cone failure and splitting failure						
Standard embedment depth	$h_{ef,sta}$					
Effective anchorage depth	$h_{ef,sta}$	(mm)	40	48	50	70
Partial safety factor	γ_2	-	1,2	1,2	1,2	1,4
in non cracked concrete	$\gamma_{Mc} = \gamma_{M,sp}$	-	1,8	1,8	1,8	2,1
Spacing	$s_{cr,N}$	(mm)	120	150	150	210
	$s_{cr,sp}$	(mm)	200	240	270	380
Edge distance	$c_{cr,N}$	(mm)	60	75	75	105
	$c_{cr,sp}$	(mm)	100	120	135	190
Reduced embedment depth	$h_{ef,red}$					
Effective anchorage depth	$h_{ef,red}$	(mm)	-	35*	42	50
Partial safety factor	γ_2	-	-	1,2*	1,4	1,4
in non cracked concrete	$\gamma_{Mc} = \gamma_{M,sp}$	-	-	1,8*	2,1	2,1
Spacing	$s_{cr,N}$	(mm)	-	110*	130	150
	$s_{cr,sp}$	(mm)	-	180*	230	270
Edge distance	$c_{cr,N}$	(mm)	-	55*	65	100
	$c_{cr,sp}$	(mm)	-	90*	115	135

* use restricted to anchoring of structural components which are statically indeterminate.
** pull-out failure not decisive for design

Table 5: Displacements under tension loads

			M6	M8	M10	M12	M6	M8	M10	M12
			Standard embedment depth $h_{ef,sta}$				Reduced embedment depth $h_{ef,red}$			
Tension load in non-cracked concrete C20/25 to C50/60 (kN)			2,5	4,0	4,0	7,1	-	3,6	4,0	4,5
Displacement	δ_{N0}	(mm)	0,3	0,3	0,3	0,2	-	0,1	0,1	0,1
	$\delta_{N\infty}$	(mm)	0,8	0,8	0,8	0,8	-	0,8	0,8	0,8

Hilti HSA-R torque-controlled expansion anchor	**Annex 4**
Design method A, characteristic values of resistance to tension loads; displacements	of European Technical Approval **ETA-99/0008**

Table 6: Characteristic values of resistance to shear loads of design method A

			M6	M8	M10	M12
Steel failure without lever arm						
Characteristic resistance	$V_{Rk,s}$	(kN)	6	11	17	25
Partial safety factor	γ_{Ms}	-	1,50	1,50	1,50	1,50
Steel failure with lever arm						
Characteristic resistance	$M_{Rk,s}$	(Nm)	9	22	45	79
Partial safety factor	γ_{Ms}	-	1,50	1,50	1,50	1,50
Concrete pryout failure						
Factor in equation (5.6) of for $h_{ef,sta}$	k	-	1	1	1	2
ETAG Annex C, § 5.2.3.3 for $h_{ef,red}$	k	-	-	1*	1	1
Partial safety factor	γ_2	-	1,00			
	γ_{Mc}	-	1,50			

* use restricted to anchoring of structural components which are statically indeterminate.

Concrete edge failure						
Effective length of anchor for $h_{ef,sta}$	l_f	(mm)	40	48	50	70
under shear loading for $h_{ef,red}$	l_f	(mm)	-	35*	42	50
Outside diameter of anchor	d_{nom}	(mm)	6	8	10	12
Partial safety factor	γ_2	-	1,00			
	γ_{Mc}	-	1,50			

* use restricted to anchoring of structural components which are statically indeterminate.

Table 7: Displacements under shear loads

			M6	M8	M10	M12	M6	M8	M10	M12
			Standard embedment depth $h_{ef,sta}$				Reduced embedment depth $h_{ef,red}$			
Shear load in non- cracked concrete C20/25 to C50/60 (kN)			2,9	4,4	7,1	10,2	-	4,4	7,1	10,2
Displacement	δ_{V0}	(mm)	1,2 (+0,7)	1,4 (+0,7)	1,3 (+1,2)	1,9 (+1,2)	-	1,4 (+0,7)	1,3 (+1,2)	1,9 (+1,2)
	$\delta_{V\infty}$	(mm)	1,9 (+0,7)	2,1 (+0,7)	1,9 (+1,2)	2,8 (+1,2)	-	2,1 (+0,7)	1,9 (+1,2)	2,8 (+1,2)

Displacement: the table shows the deformation to be expected from the anchor itself, whilst the bracket value indicates the movement between the anchor body and the hole drilled in the concrete member or the hole in the fixture.

Hilti HSA-R torque-controlled expansion anchor	**Annex 5**
Design method A, characteristic values of resistance to shear loads; displacements	of European Technical Approval **ETA-99/0008**

Buildings Department
屋宇署

YOUR REF 來函檔號: 729-519
OUR REF 本署檔號: (3) in BD/GR/SEG/PPA(G)
FAX 圖文傳真: 2626 1762
TEL 電話: 2626 1583

Hilti (Hong Kong) Limited
17/F, Tower 6,
China Hong Kong City,
33 Canton Road,
Tsimshatsui,
Kowloon.

4 June, 1997

Attention: Mr. Denny Wu

Dear Sir,

Procedures for building materials submission

I refer to your letter dated 19 May, 1997 concerning the above.

2. Please be advised that there is no provision under the Buildings Ordinance for the Building Authority to approve any proprietary building products. Under the Buildings Ordinance, authorized persons and/or registered structural engineers are required to supervise building works including the selection and installation of proprietary building products and to certify compliance with the Buildings Ordinance upon completion of works. They are therefore responsible for ensuring the health and structural safety requirements, inter alia, of these building products in the building projects which they have been appointed by the developer to co-ordinate and supervise. It is also their responsibility to ensure these products have been installed in accordance with the manufacturers' specifications and complied with the Buildings Ordinance and Regulations.

3. In establishing the acceptability of the proprietary products in building works, reference may be made to the performance standards laid down in Building (Construction) Regulations 1990 and the current Practice Note for Authorized Persons and Registered Structural Engineers 140 in which performance requirements for compliance are given. Reliance may also be placed on the test/assessment report prepared by a recognized laboratory or an equivalent establishment.

4. Before the proprietary products are installed in a building project, the authorized person and/or registered structural engineer appointed for the project should be approached by the manufacturers or their agents for advice and guidance. **Prior approval/acceptance from the Buildings Department is not required.**

5. Generally, all relevant information supporting the use of the proprietary products in building works under the Buildings Ordinance should be submitted associated with the prescribed plans for approval on project basis.

/ Notwithstanding....

Buildings Department
屋宇署

YOUR REF 來函編號: 729-519
OUR REF 本署編號: (43) in BD/GR/SEG/PPA(G)
FAX 圖文傳真: 2626 1762
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6. Notwithstanding the above, the proprietary building products to which 'No objection' letters have been given are still recognized as accepted constructional materials to be used in building works under the Buildings Ordinance provided that all conditions specified in the letters are satisfied. You are informed that the procedures currently adopted by the Building Authority for processing statutory approval of plans which involve the use of these proprietary building products remain unchanged.

7. It is a fact that the 'No objection' letter giving general acceptance to a proprietary building product is based on the technical information submitted to this Department at the time of its application. Should there be any significant modification to these technical information, the product will certainly be considered as 'new' product. The acceptability of such proprietary product in building works should be evaluated by the authorized person and/or registered structural engineer appointed for the project as mentioned above.

8. Should you have any further queries to the above, please feel free to contact the undersigned or Mr. T.C. Kan of this office at phone no. 2626 1583.

Yours faithfully,

(K.S. Chang)
Technical Secretary/Structural
for Building Authority

tck/

Attn. : To whom it may concern

Date : 27 July 2011
Ref. : LE/333/TC/09

Subject : Hilti HSA and HST Stud Anchor

Dear Sirs / Madams,

Enclosed please find the information of Hilti HSA and HST Stud Anchor.

Brand Name	: Hilti
Model Name	: Hilti HSA / HSA-F / HSA-R / HST / HST-R / HST-HCR
Manufacturer	: Hilti Corporation
Address of Manufacturer	: FL-9494, Principality of Liechtenstein
Supplier	: Hilti (Hong Kong) Limited
Address of Supplier	: 701-704, 7/F, Tower A, Manulife Financial Centre, 223 Wai Yip Street, Kwun Tong, Kowloon, Hong Kong
Country of Origin	: Liechtenstein
Name of Factory	: Hilti Aktiengesellschaft
Address of Factory	: Hilti AG, Feldkircherstrasse, FL-9494 Schaan, Liechtenstein.

Should you have further questions, please do not hesitate to contact our Technical Representatives or Customer Service Hotline at 8228-8118.

Yours sincerely,
Hilti (Hong Kong) Limited

Alan Lee
Marketing Manager

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Job/Application Reference

07-Apr-11

Ref No	Date	Project	Contractor	Consulting Engineer	Product	Application
40318	09-10	Tamar Development	GAMMON CONSTRUCTION LTD		Std stud anchor HSA M16X120/5/25	steel bracket fixing
40349	09-10	Hennessy Center Redevelopment	GAMMON CONSTRUCTION LTD		Std stud anchor HSA M12X120/25/45	safety system fixing
40895	09-10	SHK Development, Tseung Kwan O (Area 56)	HUNG WAN ENGINEERING CO.		Std stud anchor HSA-R M12X80/-/5	steel bracket fixing
40893	09-10	Pak Shek Kok Development	HACELY FACADE ENGINEERING LTD		Std stud anchor HSA-R M10X90/20/25	steel bracket fixing
40891	09-10	Ocean Park Master Development	KADEN CONSTRUCTION LTD		Std stud anchor HSA M12X120/25/45	steel bracket fixing
40890	09-10	Ocean Park Master Development	KADEN CONSTRUCTION LTD		Std stud anchor HSA M12X100/5/25	steel bracket fixing
40889	09-10	Ocean Park Master Development	KADEN CONSTRUCTION LTD		Std stud anchor HSA M10X90/20/25	steel bracket fixing
40887	09-10	Kai Tak Development	CHINA STATE CONST ENG COR		Std stud anchor HSA M16X100/-/5	steel bracket fixing
40885	09-10	Airport	PAUL Y CONST CO LTD		Std stud anchor HSA M12X180/85/105	steel bracket fixing
40872	09-10	Shangri-la and Traders HotelsSheraton and St. Regis Hotels (Parcel 5&6)	PICO SANDERSON JV PTE LTD		Std stud anchor HSA-R M8x92/27/40	marble / granite fixing
40901	09-10	SHK, Tuen Mun Station (TMTL 447)	TAI WAH ALUMINIUM ENGRG LTD		Std stud anchor HSA M12X80/-/5	window fixing
40317	09-10	Tamar Development	GAMMON CONSTRUCTION LTD		Std stud anchor HSA M16X100/-/5	steel bracket fixing
40527	09-10	Galaxy Mega Resort	SON SENG CONSTRUCTION CO		Std stud anchor HSA M16X120/5/25	cladding / pre-cast panel fixing
40319	09-10	Tamar Development	GAMMON CONSTRUCTION LTD		Std stud anchor HSA M16X140/25/45	steel bracket fixing
40320	09-10	Tamar Development	GAMMON CONSTRUCTION LTD		Std stud anchor HSA M20X170/30/55	steel bracket fixing

Job/Application Reference

07-Apr-11

Ref No	Date	Project	Contractor	Consulting Engineer	Product	Application
40325	09-10	Tamar Development	LEIGHTON-CHINA STATE-VAN OORD J.V.		Std stud anchor HSA-R M8X57/-/5	steel bracket fixing
40326	09-10	Tamar Development	LEIGHTON-CHINA STATE-VAN OORD J.V.		Std stud anchor HSA-R M8X75/10/23	steel bracket fixing
40337	09-10	Airport	GAMMON - HIP HING JOINT VENTURE		Std stud anchor HSA M12X80/-/5	safety system fixing
40338	09-10	Airport	GAMMON - HIP HING JOINT VENTURE		Std stud anchor HSA M16X120/5/25	steel bracket fixing
40339	09-10	Airport	GAMMON - HIP HING JOINT VENTURE		Std stud anchor HSA M20X170/30/55	steel bracket fixing
40340	09-10	Airport	GAMMON CONSTRUCTION LTD		Std stud anchor HSA M12X100/5/25	safety system fixing
40667	09-10	MTR West Island Line	COMMANDING VIEW ENG CO LTD		Std stud anchor HSA-R M8x92/27/40	hoarding fixing
40864	09-10	Shangri-la and Traders HotelsSheraton and St. Regis Hotels (Parcel 5&6)	MERCURIO SERVICOS DE ENGENHARIA		Std stud anchor HSA M8X57/-/5	hanger fixing
40620	09-10	Shangri-la and Traders HotelsSheraton and St. Regis Hotels (Parcel 5&6)	REX ENGINEERING (MACAU) LTD		Std stud anchor HSA M16X100/-/5	hand rail fixing
40666	09-10	MTR West Island Line	COMMANDING VIEW ENG CO LTD		Std stud anchor HSA M16X120/5/25	hoarding fixing
40665	09-10	MTR West Island Line	COMMANDING VIEW ENG CO LTD		Std stud anchor HSA M12X120/25/45	hoarding fixing
40647	09-10	Shangri-la and Traders HotelsSheraton and St. Regis Hotels (Parcel 5&6)	TOP BUILDERS GROUP LTD		Std stud anchor HSA M16X100/-/5	steel bracket fixing
40497	09-10	Galaxy Mega Resort	ENGENHARIA DE ARTE CTR WEN XING		Std stud anchor HSA M12X100/5/25	cladding / pre-cast panel fixing
40645	09-10	Shangri-la and Traders HotelsSheraton and St. Regis Hotels (Parcel 5&6)	TOP BUILDERS GROUP LTD		Std stud anchor HSA M12X180/85/105	steel bracket fixing

Job/Application Reference

07-Apr-11

Ref No	Date	Project	Contractor	Consulting Engineer	Product	Application
40644	09-10	Shangri-la and Traders HotelsSheraton and St. Regis Hotels (Parcel 5&6)	TOP BUILDERS GROUP LTD		Std stud anchor HSA M10x108/37/45	steel bracket fixing
40635	09-10	Shangri-la and Traders HotelsSheraton and St. Regis Hotels (Parcel 5&6)	SUN KOU NGAI CONST. MATERIAL & ENG.		Std stud anchor HSA M16X120/5/25	steel hanger fixing
40634	09-10	Shangri-la and Traders HotelsSheraton and St. Regis Hotels (Parcel 5&6)	SUN KOU NGAI CONST. MATERIAL & ENG.		Std stud anchor HSA M12X120/25/45	steel hanger fixing
40625	09-10	Shangri-la and Traders HotelsSheraton and St. Regis Hotels (Parcel 5&6)	REX ENGINEERING (MACAU) LTD		Std stud anchor HSA M8X57/-/5	hand rail fixing
40896	09-10	Lohas Park Phase 1 & Phase 2	CHINA STATE CONST ENG COR		Std stud anchor HSA-R M8X57/-/5	steel bracket fixing
40621	09-10	Shangri-la and Traders HotelsSheraton and St. Regis Hotels (Parcel 5&6)	REX ENGINEERING (MACAU) LTD		Std stud anchor HSA M8X57/-/5	hand rail fixing
40350	09-10	Hennessy Center Redevelopment	GAMMON CONSTRUCTION LTD		Std stud anchor HSA M8X57/-/5	safety system fixing
40586	09-10	Shangri-la and Traders HotelsSheraton and St. Regis Hotels (Parcel 5&6)	FULL WIN INTERNATIONAL ENG LTD		Std stud anchor HSA-R M16X140/25/45	curtain wall fixing
40585	09-10	Shangri-la and Traders HotelsSheraton and St. Regis Hotels (Parcel 5&6)	FULL WIN INTERNATIONAL ENG LTD		Std stud anchor HSA-R M12X120/25/45	curtain wall fixing
40545	09-10	Galaxy Mega Resort	WAI HING STEEL & ALUMINIUM		Std stud anchor HSA-F M20X170/30/55	steel bracket fixing
40544	09-10	Galaxy Mega Resort	WAI HING STEEL & ALUMINIUM		Std stud anchor HSA-F M12X150/55/75	steel bracket fixing
40543	09-10	Galaxy Mega Resort	WAI HING STEEL & ALUMINIUM		Std stud anchor HSA-F M12X100/5/25	steel bracket fixing
40542	09-10	Galaxy Mega Resort	WAI HING STEEL & ALUMINIUM		Std stud anchor HSA M10X68/-/5	steel bracket fixing

Job/Application Reference

07-Apr-11

Ref No	Date	Project	Contractor	Consulting Engineer	Product	Application
40538	09-10	Galaxy Mega Resort	WAI HING STEEL & ALUMINIUM		Std stud anchor HSA-F M20X170/30/55	steel bracket fixing
40537	09-10	Galaxy Mega Resort	WAI HING STEEL & ALUMINIUM		Std stud anchor HSA-F M12X150/55/75	steel bracket fixing
40536	09-10	Galaxy Mega Resort	WAI HING STEEL & ALUMINIUM		Std stud anchor HSA M10X68/-/5	steel bracket fixing
40624	09-10	Shangri-la and Traders HotelsSheraton and St. Regis Hotels (Parcel 5&6)	REX ENGINEERING (MACAU) LTD		Std stud anchor HSA M16X100/-/5	hand rail fixing
40517	09-10	Galaxy Mega Resort	L & L DIGITAL TECHNOLOGY CO. LTD		Std stud anchor HSA-R M12X100/5/25	cladding / pre-cast panel fixing
40348	09-10	Hennessy Center Redevelopment	GAMMON CONSTRUCTION LTD		Std stud anchor HSA M10X68/-/5	safety system fixing
40493	09-10	City of Dreams Resort	OFIC FERRAGENS OU SON		Std stud anchor HSA M12X120/25/45	hand rail fixing
40495	09-10	Galaxy Mega Resort	ENGENHARIA DE ARTE CTR WEN XING		Std stud anchor HSA M12X100/5/25	cladding / pre-cast panel fixing
40496	09-10	Galaxy Mega Resort	ENGENHARIA DE ARTE CTR WEN XING		Std stud anchor HSA-R M10X90/20/25	cladding / pre-cast panel fixing
40526	09-10	Galaxy Mega Resort	SON SENG CONSTRUCTION CO		Std stud anchor HSA M12X120/25/45	cladding / pre-cast panel fixing
40525	09-10	Galaxy Mega Resort	SON SENG CONSTRUCTION CO		Std stud anchor HSA M10X90/20/25	cladding / pre-cast panel fixing
40522	09-10	Galaxy Mega Resort	L & L DIGITAL TECHNOLOGY CO. LTD		Std stud anchor HSA-R M8x92/27/40	cladding / pre-cast panel fixing
40521	09-10	Galaxy Mega Resort	L & L DIGITAL TECHNOLOGY CO. LTD		Std stud anchor HSA-R M8X75/10/23	cladding / pre-cast panel fixing
40520	09-10	Galaxy Mega Resort	L & L DIGITAL TECHNOLOGY CO. LTD		Std stud anchor HSA-R M6X65/10/-	cladding / pre-cast panel fixing
40476	09-10	Pak Shek Kok Development	FLOURISHING ENGINEERING CO LTD		Std stud anchor HSA M8X75/10/23	MVAC fixing

Job/Application Reference

07-Apr-11

Ref No	Date	Project	Contractor	Consulting Engineer	Product	Application
40518	09-10	Galaxy Mega Resort	L & L DIGITAL TECHNOLOGY CO. LTD		Std stud anchor HSA-R M12X120/25/45	cladding / pre-cast panel fixing
40432	09-10	Tamar Development	NEWALL SIGMA LIMITED		Std stud anchor HSA-R M8X75/10/23	curtain wall fixing
40516	09-10	Galaxy Mega Resort	L & L DIGITAL TECHNOLOGY CO. LTD		Std stud anchor HSA-R M10X90/20/25	cladding / pre-cast panel fixing
40515	09-10	Galaxy Mega Resort	L & L DIGITAL TECHNOLOGY CO. LTD		Std stud anchor HSA-R M10x120/50/57	cladding / pre-cast panel fixing
40514	09-10	Galaxy Mega Resort	L & L DIGITAL TECHNOLOGY CO. LTD		Std stud anchor HSA-F M16X140/25/45	cladding / pre-cast panel fixing
40513	09-10	Galaxy Mega Resort	L & L DIGITAL TECHNOLOGY CO. LTD		Std stud anchor HSA-F M12X120/25/45	cladding / pre-cast panel fixing
40512	09-10	Galaxy Mega Resort	L & L DIGITAL TECHNOLOGY CO. LTD		Std stud anchor HSA M12X120/25/45	cladding / pre-cast panel fixing
40505	09-10	Galaxy Mega Resort	JUN LEI CONST & ENG CO LTD		Std stud anchor HSA M16X100/-/5	staircase fencing fixing
40502	09-10	Galaxy Mega Resort	GENYIELD CONSTRUCTION CO LTD		Std stud anchor HSA-R M16X100/-/5	steel bracket fixing
40501	09-10	Galaxy Mega Resort	GENYIELD CONSTRUCTION CO LTD		Std stud anchor HSA M12X80/-/5	steel bracket fixing
40498	09-10	Galaxy Mega Resort	ENGENHARIA DE ARTE CTR WEN XING		Std stud anchor HSA-R M10X90/20/25	cladding / pre-cast panel fixing
40519	09-10	Galaxy Mega Resort	L & L DIGITAL TECHNOLOGY CO. LTD		Std stud anchor HSA-R M16X140/25/45	cladding / pre-cast panel fixing
40560	09-10	One Grantai	SON SENG CONSTRUCTION CO		Std stud anchor HSA M10x120/50/57	cladding / pre-cast panel fixing
40360	09-10	Hong Kong University Re-development	GAMMON CONSTRUCTION LTD		Std stud anchor HSA M10X68/-/5	safety system fixing
40371	09-10	MTR West Island Line	GAMMON CONSTRUCTION LTD		Std stud anchor HSA M10X68/-/5	safety system fixing

Job/Application Reference

07-Apr-11

Ref No	Date	Project	Contractor	Consulting Engineer	Product	Application
40372	09-10	MTR West Island Line	GAMMON CONSTRUCTION LTD		Std stud anchor HSA M10X90/20/25	safety system fixing
40373	09-10	MTR West Island Line	GAMMON CONSTRUCTION LTD		Std stud anchor HSA M12X100/5/25	safety system fixing
40374	09-10	MTR West Island Line	GAMMON CONSTRUCTION LTD		Std stud anchor HSA M12X120/25/45	safety system fixing
40375	09-10	MTR West Island Line	GAMMON CONSTRUCTION LTD		Std stud anchor HSA M16X140/25/45	steel bracket fixing
40376	09-10	MTR West Island Line	GAMMON CONSTRUCTION LTD		Std stud anchor HSA M20X170/30/55	steel bracket fixing
40377	09-10	MTR West Island Line	GAMMON CONSTRUCTION LTD		Std stud anchor HSA-R M20X170/30/55	steel bracket fixing
40379	09-10	MTR West Island Line	LEIGHTON-LNS JOINT VENTURE		Std stud anchor HSA M12X80/-/5	steel bracket fixing
40492	09-10	City of Dreams Resort	OFIC FERRAGENS OU SON		Std stud anchor HSA M12X100/5/25	hand rail fixing
40561	09-10	Development of Ponte 16	CHIT SENG METAL ENGINEERING		Std stud anchor HSA M12X120/25/45	hand rail fixing
40648	09-10	Shangri-la and Traders HotelsSheraton and St. Regis Hotels (Parcel 5&6)	TOP BUILDERS GROUP LTD		Std stud anchor HSA M16X190/75/95	steel bracket fixing
40380	09-10	MTR West Island Line	LEIGHTON-LNS JOINT VENTURE		Std stud anchor HSA M16X100/-/5	steel bracket fixing
40391	09-10	MTR West Island Line	MILLION HOPE INDUSTRIES LTD		Std stud anchor HSA M8X75/10/23	steel bracket fixing
40392	09-10	MTR West Island Line	MILLION HOPE INDUSTRIES LTD		Std stud anchor HSA-F M8X57/-/5	steel bracket fixing
40403	09-10	Ocean Park Master Development	YKK AP FACADE HONG KONG LTD		Std stud anchor HSA M16X190/75/95	steel bracket fixing
40404	09-10	Ocean Park Master Development	YKK AP FACADE HONG KONG LTD		Std stud anchor HSA-R M8X115/50/63	steel bracket fixing

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Ref No	Date	Project	Contractor	Consulting Engineer	Product	Application
40420	09-10	Lohas Park Phase 1 & Phase 2	SHUN WING ALUMINIUM WORKS CO., LTD		Std stud anchor HSA M12X150/55/75	steel bracket fixing
40424	09-10	SHK, Tuen Mun Station (TMTL 447)	GAMMON CONSTRUCTION LTD		Std stud anchor HSA-R M10x120/50/57	safety system fixing
40425	09-10	SHK, Tuen Mun Station (TMTL 447)	MAEDA-CREC-SELI-JOINT VENTURE		Std stud anchor HSA M16X140/25/45	metal gate fixing
40431	09-10	Tamar Development	NEWALL SIGMA LIMITED		Std stud anchor HSA-R M6X65/10/-	curtain wall fixing
40562	09-10	The Venetian Casino Resort (Parcel 1)	FULL WIN INTERNATIONAL ENG LTD		Std stud anchor HSA-R M16X190/75/95	curtain wall fixing
40646	09-10	Shangri-la and Traders HotelsSheraton and St. Regis Hotels (Parcel 5&6)	TOP BUILDERS GROUP LTD		Std stud anchor HSA M12X80/-/5	steel bracket fixing
40290	09-10	KCRC Tai Wai Depot	GOLDEN RESOURCES ENG. LTD.		Std stud anchor HSA-F M8x92/27/40	steel bracket fixing
40291	09-10	KCRC Tai Wai Depot	ICGL TECHNICAL WORKS LIMITED		Std stud anchor HSA M10x120/50/57	steel bracket fixing
40292	09-10	KCRC Tai Wai Depot	ICGL TECHNICAL WORKS LIMITED		Std stud anchor HSA M16X140/25/45	steel bracket fixing
40293	09-10	Tamar Development	HINRICH INTERNATIONAL LTD		Std stud anchor HSA M10X90/20/25	door frame fixing
40309	09-10	Union Square 7, Kowloon Station	DURACLAD ENGINEERING LTD		Std stud anchor HSA M10X68/-/5	door frame fixing
40314	09-10	Tamar Development	GAMMON - HIP HING JOINT VENTURE		Std stud anchor HSA M6X50/-/5	safety system fixing
40859	09-10	Shangri-la and Traders HotelsSheraton and St. Regis Hotels (Parcel 5&6)	HUNG FAI DECORATION (MACAU) LTD		Std stud anchor HSA M8X57/-/5	overhead line fixing
40763	09-10	Galaxy Mega Resort	MERCURIO SERVICOS DE ENGENHARIA		Std stud anchor HSA-R M10x120/50/57	suspension ceiling fixing

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Ref No	Date	Project	Contractor	Consulting Engineer	Product	Application
40847	09-10	Shangri-la and Traders HotelsSheraton and St. Regis Hotels (Parcel 5&6)	GREATECH ENGINEERING LIMITED		Std stud anchor HSA-R2 M8x75	marble / granite fixing
40287	09-10	KCRC Tai Wai Depot	GOLDEN RESOURCES ENG. LTD.		Std stud anchor HSA-F M10X90/20/25	steel bracket fixing
40845	09-10	Shangri-la and Traders HotelsSheraton and St. Regis Hotels (Parcel 5&6)	DECORACAO CHEONG KONG		Std stud anchor HSA M16X140/25/45	cladding / pre-cast panel fixing
40669	09-10	Ocean Park Master Development	MAN KIT CONST CO LTD		Std stud anchor HSA-R M20X170/30/55	structural steel / I-beam fixing
40838	09-10	Shangri-la and Traders HotelsSheraton and St. Regis Hotels (Parcel 5&6)	COMPANHIA PIU HENG LONG (MACAU) LTD		Std stud anchor HSA-R2 M8x75	marble / granite fixing
40815	09-10	Shangri-la and Traders HotelsSheraton and St. Regis Hotels (Parcel 5&6)	BEST JOINT (MACAU) ENGINEERING		Std stud anchor HSA M12X100/5/25	electrical services fixing
40777	09-10	Galaxy Mega Resort	SPACE CONSTRUCTION & ENGINEERING CO		Std stud anchor HSA M10X90/20/25	block work fixing
40771	09-10	Galaxy Mega Resort	SHENZHEN BLDG DECORATION GROUP		Std stud anchor HSA M12X100/5/25	steel hanger fixing
40770	09-10	Galaxy Mega Resort	SHENZHEN BLDG DECORATION GROUP		Std stud anchor HSA M10X90/20/25	steel hanger fixing
40764	09-10	Galaxy Mega Resort	MERCURIO SERVICOS DE ENGENHARIA		Std stud anchor HSA-R M10X90/20/25	suspension ceiling fixing
40854	09-10	Shangri-la and Traders HotelsSheraton and St. Regis Hotels (Parcel 5&6)	HUNG FAI DECORATION (MACAU) LTD		Std stud anchor HSA M8X57/-/5	decoration fixing
40275	09-10	MTR West Island Line	REX DECORATION LTD		Std stud anchor HSA M10X90/20/25	steel bracket fixing
40261	09-10	Tamar Development	SKY FOUNDATION ENG CO LTD		Std stud anchor HSA M6X50/-/5	roofing fixing
40265	09-10	Hennessy Center Redevelopment	REX DECORATION LTD		Std stud anchor HSA M10X90/20/25	catch fence fixing

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Ref No	Date	Project	Contractor	Consulting Engineer	Product	Application
40266	09-10	Hennessy Center Redevelopment	REX DECORATION LTD		Std stud anchor HSA M12X120/25/45	catch fence fixing
40267	09-10	Kai Tak Development	HO WAH STEEL ENG CO LTD		Std stud anchor HSA M12X100/5/25	catch fence fixing
40268	09-10	Kai Tak Development	WANG HIP IRON WKS CO LTD		Std stud anchor HSA-R M6X65/10/-	steel bracket fixing
40269	09-10	MTR West Island Line	GOLDEN RESOURCES ENG. LTD.		Std stud anchor HSA M10X90/20/25	steel bracket fixing
40270	09-10	MTR West Island Line	GOLDEN RESOURCES ENG. LTD.		Std stud anchor HSA-F M16X140/25/45	steel bracket fixing
40271	09-10	MTR West Island Line	GOLDEN RESOURCES ENG. LTD.		Std stud anchor HSA-F M20X170/30/55	steel bracket fixing
40289	09-10	KCRC Tai Wai Depot	GOLDEN RESOURCES ENG. LTD.		Std stud anchor HSA-F M16X140/25/45	steel bracket fixing
40273	09-10	MTR West Island Line	GOLDEN RESOURCES ENG. LTD.		Std stud anchor HSA-R M8X75/10/23	steel bracket fixing
40288	09-10	KCRC Tai Wai Depot	GOLDEN RESOURCES ENG. LTD.		Std stud anchor HSA-F M12X100/5/25	steel bracket fixing
40277	09-10	Ocean Park Master Development	HONG KI ENG LTD		Std stud anchor HSA M16X140/25/45	steel bracket fixing
40278	09-10	SHK, Tuen Mun Station (TMTL 447)	TEAMBO METAL ENGINEERING LIMITED		Std stud anchor HSA M12X100/5/25	steel bracket fixing
40279	09-10	SHK, Tuen Mun Station (TMTL 447)	TEAMBO METAL ENGINEERING LIMITED		Std stud anchor HSA M8X75/10/23	steel bracket fixing
40280	09-10	Tung Ying Re-development, Nathan Road	REX DECORATION LTD		Std stud anchor HSA-R M16X140/25/45	steel bracket fixing
40284	09-10	KCRC Tai Wai Depot	GOLDEN RESOURCES ENG. LTD.		Std stud anchor HSA M10x108/37/45	steel bracket fixing
40285	09-10	KCRC Tai Wai Depot	GOLDEN RESOURCES ENG. LTD.		Std stud anchor HSA M8X75/10/23	steel bracket fixing
40286	09-10	KCRC Tai Wai Depot	GOLDEN RESOURCES ENG. LTD.		Std stud anchor HSA-F M10x120/50/57	steel bracket fixing

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Ref No	Date	Project	Contractor	Consulting Engineer	Product	Application
40844	09-10	Shangri-la and Traders HotelsSheraton and St. Regis Hotels (Parcel 5&6)	DECORACAO CHEONG KONG		Std stud anchor HSA M10X90/20/25	cladding / pre-cast panel fixing
40272	09-10	MTR West Island Line	GOLDEN RESOURCES ENG. LTD.		Std stud anchor HSA-R M16X140/25/45	steel bracket fixing
40846	09-10	Shangri-la and Traders HotelsSheraton and St. Regis Hotels (Parcel 5&6)	GREATECH ENGINEERING LIMITED		Std stud anchor HSA-R M10X68/-/5	marble / granite fixing
40705	09-10	SHK Development, Tseung Kwan O (Area 56)	KAM KEE STEEL WORKS LTD		Std stud anchor HSA M10x120/50/57	steel bracket fixing
40704	09-10	SHK Development, Tseung Kwan O (Area 56)	KAM KEE STEEL WORKS LTD		Std stud anchor HSA M10x108/37/45	steel bracket fixing
40703	09-10	SHK Development, Tseung Kwan O (Area 56)	JUMBO ORIENT CONTRACTING LTD		Std stud anchor HSA M16X120/5/25	steel bracket fixing
40702	09-10	SHK Development, Tseung Kwan O (Area 56)	JUMBO ORIENT CONTRACTING LTD		Std stud anchor HSA M10X90/20/25	steel bracket fixing
40696	09-10	MTR West Island Line	MING KEE CONSTRUCTION ENG LTD		Std stud anchor HSA M8X75/10/23	steel bracket fixing
40695	09-10	MTR West Island Line	GOLDENWALL ENGINEERING LTD		Std stud anchor HSA M10X90/20/25	cladding / pre-cast panel fixing
40694	09-10	MTR West Island Line	GOLDENWALL CURTAIN WALL LTD		Std stud anchor HSA M10X90/20/25	cladding / pre-cast panel fixing
40706	09-10	SHK Development, Tseung Kwan O (Area 56)	KAM KEE STEEL WORKS LTD		Std stud anchor HSA M10X68/-/5	steel bracket fixing
40689	09-10	MTR West Island Line	G & M ENG CO LTD		Std stud anchor HSA-R M6X50/-/5	cladding / pre-cast panel fixing
40690	09-10	MTR West Island Line	G & M ENG CO LTD		Std stud anchor HSA-R M8X75/10/23	cladding / pre-cast panel fixing
40687	09-10	MTR West Island Line	G & M ENG CO LTD		Std stud anchor HSA-R M10X90/20/25	cladding / pre-cast panel fixing
40686	09-10	MTR West Island Line	G & M ENG CO LTD		Std stud anchor HSA-R M10X68/-/5	cladding / pre-cast panel fixing

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Ref No	Date	Project	Contractor	Consulting Engineer	Product	Application
40683	09-10	Hong Kong University Re-development	MING KEE CONSTRUCTION ENG LTD		Std stud anchor HSA M16X190/75/95	structural steel / I-beam fixing
40682	09-10	Hong Kong University Re-development	MING KEE CONSTRUCTION ENG LTD		Std stud anchor HSA M16X140/25/45	structural steel / I-beam fixing
40681	09-10	Tamar Development	CREATOR'S METAL & GLASS ENG LTD		Std stud anchor HSA M8X75/10/23	cladding / pre-cast panel fixing
40680	09-10	Tamar Development	CREATOR'S METAL & GLASS ENG LTD		Std stud anchor HSA M10X90/20/25	cladding / pre-cast panel fixing
40674	09-10	Tamar Development	HANG CHEONG ENGINEERING CO		Std stud anchor HSA-R M10X90/20/25	metal fixing
40672	09-10	SHK, Tuen Mun Station (TMTL 447)	FULL KEY ENGINEERING COMPANY		Std stud anchor HSA-F M12X120/25/45	water tank fixing
40691	09-10	MTR West Island Line	G & M ENG CO LTD		Std stud anchor HSA-R M8x92/27/40	cladding / pre-cast panel fixing
40724	09-10	Galaxy Mega Resort	BOYA DECORATION AND ENGINEERING		Std stud anchor HSA M12X80/-/5	structural steel / I-beam fixing
40688	09-10	MTR West Island Line	G & M ENG CO LTD		Std stud anchor HSA-R M12X120/25/45	cladding / pre-cast panel fixing
40707	09-10	SHK Development, Tseung Kwan O (Area 56)	YEE WO ENG CO		Std stud anchor HSA-R M8X75/10/23	steel bracket fixing
40759	09-10	Galaxy Mega Resort	MAN SHING ENGINEERING (MACAO) LTD		Std stud anchor HSA M8X75/10/23	block work fixing
40758	09-10	Galaxy Mega Resort	MAN SHING ENGINEERING (MACAO) LTD		Std stud anchor HSA M16X120/5/25	structural steel / I-beam fixing
40751	09-10	Galaxy Mega Resort	CREATOR'S METAL & GLASS ENG (MACAU)		Std stud anchor HSA M12X80/-/5	water pipe / pipe duct fixing
40725	09-10	Galaxy Mega Resort	BOYA DECORATION AND ENGINEERING		Std stud anchor HSA M16X190/75/95	structural steel / I-beam fixing
40723	09-10	Galaxy Mega Resort	BOYA DECORATION AND ENGINEERING		Std stud anchor HSA M12X120/25/45	structural steel / I-beam fixing

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Ref No	Date	Project	Contractor	Consulting Engineer	Product	Application
40715	09-10	KCRC Tai Wai Depot	OPAL STONE LIMITED		Std stud anchor HSA-R M8X75/10/23	cladding / pre-cast panel fixing
40711	09-10	Union Square 7, Kowloon Station	KAM KEE STEEL WORKS LTD		Std stud anchor HSA M12X120/25/45	steel bracket fixing
40710	09-10	Union Square 7, Kowloon Station	HANG TAK ENGINEERING CO LTD		Std stud anchor HSA-R M8X57/-/5	cladding / pre-cast panel fixing
40709	09-10	Union Square 7, Kowloon Station	HANG TAK ENGINEERING CO LTD		Std stud anchor HSA-R M10X90/20/25	cladding / pre-cast panel fixing
40708	09-10	Union Square 7, Kowloon Station	HANG TAK ENGINEERING CO LTD		Std stud anchor HSA M10X68/-/5	cladding / pre-cast panel fixing
40743	09-10	Galaxy Mega Resort	CREATOR'S METAL & GLASS ENG (MACAU)		Std stud anchor HSA M12X80/-/5	water pipe / pipe duct fixing
40219	06-10	City of Dreams Resort	CREATOR'S METAL & GLASS ENG (MACAU)		Std stud anchor HSA M10X68/-/5	glass fencing / balustrade fixing
40182	06-10	MTR West Island Line	GAMMON - NISHIMATSU WIL JV		Std stud anchor HSA M12X100/5/25	steel bracket fixing
40185	06-10	Ocean Park Master Development	LEIGHTON CONT (ASIA) LTD		Std stud anchor HSA M16X140/25/45	steel bracket fixing
40189	06-10	Ocean Park Master Development	YKK AP FACADE HONG KONG LTD		Std stud anchor HSA-R M16X140/25/45	steel bracket fixing
40196	06-10	Galaxy Mega Resort	MACAO JIANGHE CURTAIN-WALL ENG		Std stud anchor HSA-F M6X65/10/20	cladding / pre-cast panel fixing
40211	06-10	Ocean Park Master Development	PA ROCKSCAPES LTD		Std stud anchor HSA-R M10X90/20/25	marble / granite fixing
40215	06-10	SHK Development, Tseung Kwan O (Area 56)	JUMBO ORIENT CONTRACTING LTD		Std stud anchor HSA M12X100/5/25	steel hanger fixing
40216	06-10	SHK, Tuen Mun Station (TMTL 447)	JUMBO ORIENT CONTRACTING LTD		Std stud anchor HSA M12X100/5/25	steel hanger fixing
40218	06-10	KCRC Tai Wai Depot	KAM KEE STEEL WORKS LTD		Std stud anchor HSA M12X80/-/5	steel hanger fixing
40217	06-10	KCRC Tai Wai Depot	KAM KEE STEEL WORKS LTD		Std stud anchor HSA M12X100/5/25	steel hanger fixing

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Ref No	Date	Project	Contractor	Consulting Engineer	Product	Application
40177	06-10	Airport	GAMMON - HIP HING JOINT VENTURE		Std stud anchor HSA M16X140/25/45	steel bracket fixing
40141	06-10	City of Dreams Resort	HONG LIK (MACAU) ENGINEERING		Std stud anchor HSA M8X75/10/23	steel bracket fixing
40226	06-10	Galaxy Mega Resort	BOYA DECORATION AND ENGINEERING		Std stud anchor HSA M10X90/20/25	block work fixing
40171	06-10	Tamar Development	PERFECT MARBLE CO LTD		Std stud anchor HSA-R M8X75/10/23	marble / granite fixing
40168	06-10	Tamar Development	CHOI KEE ENG (HK) CO LTD		Std stud anchor HSA M12X100/5/25	steel bracket fixing
40167	06-10	Tamar Development	CHOI KEE ENG (HK) CO LTD		Std stud anchor HSA M10x108/37/45	steel bracket fixing
40158	06-10	Hotel Grand Lisboa Development	CHINA ZHONG JI MECHINA		Std stud anchor HSA M8X75/10/23	electrical services fixing
40157	06-10	Hotel Grand Lisboa Development	CHINA ZHONG JI MECHINA		Std stud anchor HSA M8X57/-/5	electrical services fixing
40139	06-10	KCRC Tai Wai Depot	MAINTOP ENGINEERING LIMITED		Std stud anchor HSA-R M12X120/25/45	steel bracket fixing
40232	06-10	Galaxy Mega Resort	GOOD PROFIT ENGINEERING LTD		Std stud anchor HSA M8X75/10/23	steel hanger fixing
40135	06-10	Ocean Park Master Development	HONG KI ENG LTD		Std stud anchor HSA-F M20X170/30/55	steel bracket fixing
40246	06-10	Shangri-la and Traders HotelsSheraton and St. Regis Hotels (Parcel 5&6)	DECORACAO CHEONG KONG		Std stud anchor HSA M12X80/-/5	steel hanger fixing
40251	06-10	Galaxy Mega Resort	WAI CHUI SHUTTER CO		Std stud anchor HSA M16X100/-/5	fire roller shutter fixing
40252	06-10	Galaxy Mega Resort	WAI CHUI SHUTTER CO		Std stud anchor HSA M16X120/5/25	fire roller shutter fixing
40254	06-10	The Venetian Casino Resort (Parcel 1)	JUN FENG (MACAU) ENGINEERING CO LTD		Std stud anchor HSA M12X120/25/45	scaffolding fixing
40031	05-10	Tung Ying Re-development, Nathan Road	REX DECORATION LTD		Std stud anchor HSA M20X170/30/55	steel bracket fixing

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Ref No	Date	Project	Contractor	Consulting Engineer	Product	Application
40128	05-10	Galaxy Mega Resort	DING LIK (MACAU) ENGINEERING CO LTD		Std stud anchor HSA M8x92/27/40	block work fixing
40098	05-10	Ocean Park Master Development	PA ROCKSCAPES LTD		Std stud anchor HSA-R M12X80/-/5	marble / granite fixing
40101	05-10	Galaxy Mega Resort	CREATOR'S METAL & GLASS ENG (MACAU)		Std stud anchor HSA M10X68/-/5	glass fencing / balustrade fixing
40102	05-10	Galaxy Mega Resort	CREATOR'S METAL & GLASS ENG (MACAU)		Std stud anchor HSA M8X75/10/23	glass fencing / balustrade fixing
40110	05-10	Four Seasons Hotel, Macau (Parcel 2)	SAN CHON FUNG DECORACAO		Std stud anchor HSA M10X68/-/5	block work fixing
40111	05-10	Four Seasons Hotel, Macau (Parcel 2)	SAN CHON FUNG DECORACAO		Std stud anchor HSA M10X90/20/25	block work fixing
40114	05-10	Shangri-la and Traders HotelsSheraton and St. Regis Hotels (Parcel 5&6)	NEW DICKY DECORATION & ENG (MACAU)		Std stud anchor HSA M12X100/5/25	glass rail fixing
40120	05-10	SHK Development, Tseung Kwan O (Area 56)	KWONG KAM TIM CO LTD		Std stud anchor HSA-R M8X75/10/23	marble / granite fixing
40087	05-10	MTR West Island Line	COMMANDING VIEW ENG CO LTD		Std stud anchor HSA-R M12X100/5/25	hoarding fixing
40124	05-10	Lohas Park Phase 1 & Phase 2	CHINA STATE CONST ENG COR		Std stud anchor HSA M12X120/25/45	catch fence fixing
40123	05-10	SHK Development, Tseung Kwan O (Area 56)	LUEN ON ALUM ENGRG CO LTD		Std stud anchor HSA-R M8X75/10/23	window fixing
40129	05-10	Galaxy Mega Resort	XIN HUI XUAN ENGINEERING (MACAU)		Std stud anchor HSA M10X68/-/5	block work fixing
40130	05-10	Galaxy Mega Resort	XIN HUI XUAN ENGINEERING (MACAU)		Std stud anchor HSA M8X57/-/5	block work fixing
40131	05-10	One Central Macau	WING CHEUNG ENGINEERING CO LTD		Std stud anchor HSA M8X75/10/23	block work fixing
40132	05-10	The Venetian Casino Resort (Parcel 1)	AST EQUIPMENT (HK) CO LTD		Std stud anchor HSA M12X150/55/75	block work fixing

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Ref No	Date	Project	Contractor	Consulting Engineer	Product	Application
40133	05-10	The Venetian Casino Resort (Parcel 1)	AST EQUIPMENT (HK) CO LTD		Std stud anchor HSA M16X140/25/45	block work fixing
40027	05-10	Ocean Park Master Development	LEIGHTON CONT (ASIA) LTD		Std stud anchor HSA-R M12X120/25/45	steel bracket fixing
40026	05-10	Ocean Park Master Development	HONG KI ENG LTD		Std stud anchor HSA M10X90/20/25	steel bracket fixing
40122	05-10	SHK Development, Tseung Kwan O (Area 56)	LUEN ON ALUM ENGRG CO LTD		Std stud anchor HSA M10X90/20/25	window fixing
40060	05-10	Tamar Development	GAMMON - HIP HING JOINT VENTURE		Std stud anchor HSA M6X65/10/20	steel bracket fixing
40127	05-10	Galaxy Mega Resort	DING LIK (MACAU) ENGINEERING CO LTD		Std stud anchor HSA M8X75/10/23	block work fixing
40084	05-10	One Central Macau	KIN PANG CONSTRUCTION & ENGINEERING		Std stud anchor HSA-R M10x120/50/57	cladding / pre-cast panel fixing
40054	05-10	MTR West Island Line	DRAGAGES-MAEDA-BSG JOINT VENTURE		Std stud anchor HSA M20X170/30/55	steel bracket fixing
40056	05-10	MTR Express Rail Link	WING TAK CONSTRUCTION COMPANY		Std stud anchor HSA M8X75/10/23	metal fixing
40058	05-10	SHK Development, Tseung Kwan O (Area 56)	GREEN VALLEY LANDFILL LTD		Std stud anchor HSA M12X150/55/75	sanitary equipment
40028	05-10	Ocean Park Master Development	LEIGHTON CONT (ASIA) LTD		Std stud anchor HSA-R M16X140/25/45	steel bracket fixing
40063	05-10	Tamar Development	GAMMON CONSTRUCTION LTD		Std stud anchor HSA M12X100/5/25	steel bracket fixing
40064	05-10	Tamar Development	GAMMON CONSTRUCTION LTD		Std stud anchor HSA M6X65/10/20	steel bracket fixing
40077	05-10	Galaxy Mega Resort	ENGENHARIA DE ARTE CTR WEN XING		Std stud anchor HSA M10X90/20/25	cladding / pre-cast panel fixing
40083	05-10	Galaxy Mega Resort	TONG UN TIT LOI KONG CHENG KONG SI		Std stud anchor HSA M12X80/-/5	hand rail fixing
40057	05-10	Ocean Park Master Development	W. HING CONSTRUCTION CO LTD		Std stud anchor HSA-R M8X115/50/63	marble / granite fixing

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Ref No	Date	Project	Contractor	Consulting Engineer	Product	Application
40082	05-10	Galaxy Mega Resort	TONG UN TIT LOI KONG CHENG KONG SI		Std stud anchor HSA M12X100/5/25	hand rail fixing
40074	05-10	Ocean Park Master Development	LEIGHTON CONT (ASIA) LTD		Std stud anchor HSA-R M16X140/25/45	steel bracket fixing
40073	05-10	Ocean Park Master Development	LEIGHTON CONT (ASIA) LTD		Std stud anchor HSA-R M12X120/25/45	steel bracket fixing
40072	05-10	Ocean Park Master Development	LEIGHTON CONT (ASIA) LTD		Std stud anchor HSA M6X50/-/5	steel bracket fixing
40070	05-10	MTR West Island Line	GAMMON - NISHIMATSU WIL JV		Std stud anchor HSA M20X170/30/55	steel bracket fixing
40065	05-10	Airport	GAMMON - HIP HING JOINT VENTURE		Std stud anchor HSA M10X90/20/25	safety system fixing
39992	04-10	SHK Development, Tseung Kwan O (Area 56)	CHINA SKY FIRE ENGINEERING LTD		Std stud anchor HSA M10x120/50/57	steel hanger fixing
39985	04-10	MTR Express Rail Link	WINNER IRON & STEEL		Std stud anchor HSA-R M10X90/20/25	hoarding fixing
40002	04-10	Galaxy Mega Resort	SUN HONG HING KONG CHENG		Std stud anchor HSA M10X68/-/5	steel hanger fixing
40017	04-10	Galaxy Mega Resort	SUZUKI SHUTTER COMPANY (MACAU)		Std stud anchor HSA M10X90/20/25	block work fixing
40018	04-10	Galaxy Mega Resort	SUZUKI SHUTTER COMPANY (MACAU)		Std stud anchor HSA M12X100/5/25	block work fixing
40019	04-10	One Central Macau	SAN YIU CHEONG DECORATION		Std stud anchor HSA M10x120/50/57	block work fixing
39997	04-10	Galaxy Mega Resort	CREATOR'S METAL & GLASS ENG (MACAU)		Std stud anchor HSA-R M10X68/-/5	glass fencing / balustrade fixing
39903	03-10	Kai Tak Development	YKK AP FACADE HONG KONG LTD		Std stud anchor HSA-R M8X75/10/23	window fixing
39910	03-10	Ocean Park Master Development	YKK AP FACADE HONG KONG LTD		Std stud anchor HSA-R M10X90/20/25	steel bracket fixing
39909	03-10	Ocean Park Master Development	YKK AP FACADE HONG KONG LTD		Std stud anchor HSA-R M10x120/50/57	window fixing

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39902	03-10	Kai Tak Development	YKK AP FACADE HONG KONG LTD		Std stud anchor HSA-R M10X90/20/25	window fixing
39900	03-10	Lohas Park Phase 1 & Phase 2	GREEN VALLEY LANDFILL LTD		Std stud anchor HSA M12X150/55/75	sanitary equipment
39898	03-10	Pak Shek Kok Development	CHINA RESOURCES CONSTRUCTION CO LTD		Std stud anchor HSA M12X80/-/5	metal fixing
39897	03-10	Pak Shek Kok Development	CHINA RESOURCES CONSTRUCTION CO LTD		Std stud anchor HSA M10X90/20/25	metal fixing
39896	03-10	Tamar Development	GOLDFIELD N & W CONST CO LTD		Std stud anchor HSA M20X170/30/55	metal fixing
39894	03-10	Tamar Development	JOSEF GARTNER & CO (HK) LTD		Std stud anchor HSA-R M10X90/20/25	curtain wall fixing
39893	03-10	Tamar Development	JOSEF GARTNER & CO (HK) LTD		Std stud anchor HSA M16X140/25/45	curtain wall fixing
39892	03-10	KCRC Fo Tan Depot - Ho Tung Lau	CHOI KEE ENG (HK) CO LTD		Std stud anchor HSA M8X75/10/23	steel bracket fixing
39861	03-10	Galaxy Mega Resort	FOUR DIN ELECTRICAL ENGINEERING		Std stud anchor HSA M10X90/20/25	electrical services fixing
39891	03-10	KCRC Fo Tan Depot - Ho Tung Lau	CHOI KEE ENG (HK) CO LTD		Std stud anchor HSA M6X65/10/20	steel bracket fixing
39851	03-10	Ocean Park Master Development	HONG KI ENG LTD		Std stud anchor HSA M12X120/25/45	steel bracket fixing
39933	03-10	MTR West Island Line	COMMANDING VIEW ENG CO LTD		Std stud anchor HSA M16X140/25/45	hoarding fixing
39981	03-10	Wynn Macau Casino	SUN KONG HING CONSTRUCTION (MACAU)		Std stud anchor HSA-R M8x92/27/40	block work fixing
39852	03-10	I-Square Development, Nathan Road	REX DECORATION LTD		Std stud anchor HSA-R M12X100/5/25	steel bracket fixing
39914	03-10	Lohas Park Phase 1 & Phase 2	SHUN WING ALUMINIUM WORKS CO., LTD		Std stud anchor HSA M10X68/-/5	window fixing
39915	03-10	SHK, Tuen Mun Station (TMTL 447)	GAMMON CONSTRUCTION LTD		Std stud anchor HSA M20X170/30/55	safety system fixing

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39932	03-10	MTR West Island Line	COMMANDING VIEW ENG CO LTD		Std stud anchor HSA M12X100/5/25	hoarding fixing
39934	03-10	MTR West Island Line	COMMANDING VIEW ENG CO LTD		Std stud anchor HSA M8X57/-/5	hoarding fixing
39942	03-10	Airport	LEE WO CONSTRUCTION ENG CO LTD		Std stud anchor HSA-R M12X120/25/45	hanger fixing
39948	03-10	Le Royal Arc	GOLD RIVER (INT'L) ENGINEERING		Std stud anchor HSA M10X68/-/5	steel hanger fixing
39949	03-10	Le Royal Arc	GOLD RIVER (INT'L) ENGINEERING		Std stud anchor HSA M10X90/20/25	steel hanger fixing
39978	03-10	Wynn Macau Casino	DING LIK (MACAU) ENGINEERING CO LTD		Std stud anchor HSA-R M12X120/25/45	block work fixing
39931	03-10	MTR West Island Line	COMMANDING VIEW ENG CO LTD		Std stud anchor HSA M10X90/20/25	hoarding fixing
39979	03-10	Wynn Macau Casino	IBI MACAU LIMITADA		Std stud anchor HSA-R M10X90/20/25	block work fixing
39961	03-10	One Grantai	MAN KIN CONSTRUCTION ENG LTD		Std stud anchor HSA-R M10X90/20/25	marble / granite fixing
39977	03-10	Wynn Macau Casino	DING LIK (MACAU) ENGINEERING CO LTD		Std stud anchor HSA-R M12X100/5/25	block work fixing
39976	03-10	One Grantai	LAI HENG KONG CHENG		Std stud anchor HSA M12X100/5/25	block work fixing
39974	03-10	One Central Macau	SAN YIU CHEONG DECORATION		Std stud anchor HSA M10X90/20/25	block work fixing
39973	03-10	City of Dreams Resort	TIN LOONG (MACAU) ENGINEERING		Std stud anchor HSA M10X68/-/5	block work fixing
39964	03-10	The Venetian Casino Resort (Parcel 1)	MERCURIO SERVICOS DE ENGENHARIA		Std stud anchor HSA M12X120/25/45	steel hanger fixing
39962	03-10	One Grantai	MAN KIN CONSTRUCTION ENG LTD		Std stud anchor HSA-R M8X75/10/23	marble / granite fixing

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39975	03-10	One Central Macau	SAN YIU CHEONG DECORATION		Std stud anchor HSA M8x92/27/40	block work fixing
39781	02-10	KCRC Tai Wai Depot	GOLDEN RESOURCES ENG. LTD.		Std stud anchor HSA M8X57/-/5	steel bracket fixing
39813	02-10	SHK, Tuen Mun Station (TMTL 447)	GAMMON CONSTRUCTION LTD		Std stud anchor HSA M12X150/55/75	steel bracket fixing
39810	02-10	Ocean Park Master Development	YKK AP FACADE HONG KONG LTD		Std stud anchor HSA-R M12X120/25/45	steel bracket fixing
39809	02-10	Hennessy Center Redevelopment	GAMMON CONSTRUCTION LTD		Std stud anchor HSA M16X140/25/45	steel bracket fixing
39802	02-10	SHK, Tuen Mun Station (TMTL 447)	SANFIELD BLDG CONTRACTOR		Std stud anchor HSA-R M20X170/30/55	steel bracket fixing
39801	02-10	SHK, Tuen Mun Station (TMTL 447)	SANFIELD BLDG CONTRACTOR		Std stud anchor HSA-R M20X125/-/10	steel bracket fixing
39794	02-10	One Central Macau	SZE CHEONG (HK) ENG CO LTD		Std stud anchor HSA-R M8x92/27/40	staircase fencing fixing
39775	02-10	SHK, Tuen Mun Station (TMTL 447)	SANFIELD BLDG CONTRACTOR		Std stud anchor HSA-R M20X170/30/55	glass fencing / balustrade fixing
39782	02-10	City of Dreams Resort	BIWATER MACAU LIMITED		Std stud anchor HSA M16X100/-/5	Plumbing works fixing
39814	02-10	City of Dreams Resort	UNISON PROJECTS CO LTD		Std stud anchor HSA-R M12X100/5/25	cladding / pre-cast panel fixing
39774	02-10	SHK, Tuen Mun Station (TMTL 447)	SANFIELD BLDG CONTRACTOR		Std stud anchor HSA-R M20X125/-/10	glass fencing / balustrade fixing
39783	02-10	City of Dreams Resort	LEIGHTON - CHINA STATE - JOHN		Std stud anchor HSA-R M8X115/50/63	steel bracket fixing
39841	02-10	One Central Macau	OFIC REPAR MAQUINAS CHONG TOU		Std stud anchor HSA M8x92/27/40	block work fixing
39812	02-10	Lohas Park Phase 1 & Phase 2	SHUN WING ALUMINIUM WORKS CO., LTD		Std stud anchor HSA-R M16X140/25/45	window fixing

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39815	02-10	City of Dreams Resort	UNISON PROJECTS CO LTD		Std stud anchor HSA-R M12X120/25/45	cladding / pre-cast panel fixing
39842	02-10	One Grantai	LAI HENG KONG CHENG		Std stud anchor HSA M10X68/-/5	block work fixing
39839	02-10	Union Square 7, Kowloon Station	ALAN MARBLE ENGINEERING CO LTD		Std stud anchor HSA-R M10X90/20/25	marble / granite fixing
39838	02-10	Ocean Park Master Development	KADEN CONSTRUCTION LTD		Std stud anchor HSA M20X170/30/55	metal gate fixing
39834	02-10	Wynn Macau Casino	CHI WO ENG CO		Std stud anchor HSA M12X100/5/25	steel hanger fixing
39827	02-10	KCRC Tai Wai Depot	HANG TAK ENGINEERING CO LTD		Std stud anchor HSA M20X170/30/55	cladding / pre-cast panel fixing
39832	02-10	Wynn Macau Casino	CHI WO ENG CO		Std stud anchor HSA M10X68/-/5	steel hanger fixing
39831	02-10	Wynn Macau Casino	CHI WO ENG CO		Std stud anchor HSA M10x120/50/57	steel hanger fixing
39830	02-10	Crown Macau	MENG HENG FERREIRO DEC ENG CO		Std stud anchor HSA M12X100/5/25	block work fixing
39833	02-10	Wynn Macau Casino	CHI WO ENG CO		Std stud anchor HSA M10X90/20/25	steel hanger fixing
39825	02-10	Airport East Hall Works	FULL WEALTH CONSTRUCTION LIMITED	Airport Authority	Std stud anchor HSA M10X90/20/25	safety system fixing
39843	02-10	One Grantai	LAI HENG KONG CHENG		Std stud anchor HSA M10X90/20/25	block work fixing
39687	01-10	SHK Development, Tseung Kwan O (Area 56)	CHEVALIER (ALUMINIUM ENG) LTD		Std stud anchor HSA-R M12X120/25/45	curtain wall fixing
39688	01-10	SHK Development, Tseung Kwan O (Area 56)	CHEVALIER (ALUMINIUM ENG) LTD		Std stud anchor HSA-R M16X140/25/45	curtain wall fixing
39689	01-10	SHK Development, Tseung Kwan O (Area 56)	CHEVALIER (ALUMINIUM ENG) LTD		Std stud anchor HSA-R M6X65/10/-	curtain wall fixing
39690	01-10	SHK Development, Tseung Kwan O (Area 56)	CHEVALIER (ALUMINIUM ENG) LTD		Std stud anchor HSA-R M8X75/10/23	curtain wall fixing

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39691	01-10	PTM Projects - Yau Lee	HIGHWELL CONSTRUCTION ENG. LTD.		Std stud anchor HSA-R M10x120/50/57	steel bracket fixing
39696	01-10	PTM Projects - Yau Lee	YAU LEE CONSTRUCTION MATERIALS &		Std stud anchor HSA M10X90/20/25	steel bracket fixing
39701	01-10	Tamar Development	LEIGHTON-CHINA STATE-VAN OORD J.V.		Std stud anchor HSA-R M12X100/5/25	steel bracket fixing
39686	01-10	SHK Development, Tseung Kwan O (Area 56)	CHEVALIER (ALUMINIUM ENG) LTD		Std stud anchor HSA-R M10X90/20/25	curtain wall fixing
39706	01-10	PTM Projects - Cheung Kong	SHUN WING ALUMINIUM WORKS CO., LTD		Std stud anchor HSA-R M10X90/20/25	window fixing
39655	01-10	KCRC Tai Wai Depot	GOLDEN RESOURCES ENG. LTD.		Std stud anchor HSA M10X90/20/25	hand rail fixing
39692	01-10	PTM Projects - Yau Lee	TONG KIN ENGINEERING CO., LTD		Std stud anchor HSA-R M8X75/10/23	steel bracket fixing
39685	01-10	SHK Development, Tseung Kwan O (Area 56)	CHEVALIER (ALUMINIUM ENG) LTD		Std stud anchor HSA M16X140/25/45	curtain wall fixing
39684	01-10	SHK Development, Tseung Kwan O (Area 56)	CHEVALIER (ALUMINIUM ENG) LTD		Std stud anchor HSA M12X120/25/45	curtain wall fixing
39681	01-10	PTM Projects - Hip Hing	CHOI KEE ENG (HK) CO LTD		Std stud anchor HSA M8X75/10/23	steel bracket fixing
39670	01-10	Windsor Arch	JUN FENG (MACAU) ENGINEERING CO LTD		Std stud anchor HSA M16X140/25/45	steel bracket fixing
39668	01-10	One Grantai	TUNG TAT E&M ENG CO LTD		Std stud anchor HSA M10X90/20/25	electrical services fixing
39661	01-10	City of Dreams Resort	MELCO CROWN (COD) DEVELOPMENTS LTD		Std stud anchor HSA M20X170/30/55	steel bracket fixing
39656	01-10	KCRC Tai Wai Depot	GOLDEN RESOURCES ENG. LTD.		Std stud anchor HSA M12X100/5/25	hand rail fixing
39653	01-10	PTM Projects - Shui On	MING TAI ENG CO LTD		Std stud anchor HSA M8X57/-/5	steel bracket fixing
39651	01-10	PTM Projects - China State	TEAMBO ENGINEERING LTD		Std stud anchor HSA M10X90/20/25	steel bracket fixing

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39652	01-10	PTM Projects - China State	TEAMBO ENGINEERING LTD		Std stud anchor HSA M8x92/27/40	steel bracket fixing
39707	01-10	PTM Projects - Cheung Kong	SHUN WING ALUMINIUM WORKS CO., LTD		Std stud anchor HSA-R M12X120/25/45	window fixing
39657	01-10	KCRC Tai Wai Depot	GOLDEN RESOURCES ENG. LTD.		Std stud anchor HSA M12X120/25/45	hand rail fixing
39737	01-10	PTM Projects - Hsin Chong	KAM FUNG ENG LTD		Std stud anchor HSA M8X57/-/5	steel hanger fixing
39647	01-10	Ocean Park Master Development	HONG KI ENG LTD		Std stud anchor HSA M8X75/10/23	steel bracket fixing
39768	01-10	Wynn Macau Casino	IBI MACAU LIMITADA		Std stud anchor HSA M10X90/20/25	block work fixing
39759	01-10	PTM Projects - China State	CHINA STATE CONST ENG COR		Std stud anchor HSA-R M12X80/-/5	steel hanger fixing
39758	01-10	PTM Projects - China State	CHINA STATE CONST ENG COR		Std stud anchor HSA-R M10X68/-/5	steel hanger fixing
39757	01-10	Wynn Macau Casino	WAI WING ENGINEERING LIMITED		Std stud anchor HSA M10X90/20/25	steel hanger fixing
39756	01-10	Wynn Macau Casino	LUCKY WIDE ENG CO		Std stud anchor HSA-R M8X75/10/23	marble / granite fixing
39754	01-10	The Venetian Casino Resort (Parcel 1)	MERCURIO SERVICOS DE ENGENHARIA		Std stud anchor HSA M10X90/20/25	steel hanger fixing
39746	01-10	Union Square 7, Kowloon Station	KAM KEE STEEL WORKS LTD		Std stud anchor HSA M8x92/27/40	steel hanger fixing
39745	01-10	Union Square 7, Kowloon Station	KAM KEE STEEL WORKS LTD		Std stud anchor HSA M8X115/50/63	steel hanger fixing
39760	01-10	PTM Projects - China State	CHINA STATE CONST ENG COR		Std stud anchor HSA-R M6X65/10/-	steel hanger fixing
39738	01-10	PTM Projects - Hsin Chong	KAM FUNG ENG LTD		Std stud anchor HSA M8X75/10/23	steel hanger fixing
39708	01-10	PTM Projects - Gammon	GAMMON CONSTRUCTION LTD		Std stud anchor HSA M16X240/125/145	steel bracket fixing
39735	01-10	PTM Projects - China State	CHI SHING ENG CO		Std stud anchor HSA M10X90/20/25	singage / advertising sign fixing