Designated according to The Construction Products (Amendment etc.) (EU Exit) Regulations 2020

UK Technical Assessment	UKTA-0836-23/6699 of 23/06/2023
Technical Assessment Body issuing the UK Technical Assessment:	British Board of Agrément
Trade name of the construction product:	Hilti HDA and HDA-R
Product family to which the construction product belongs:	Self-cutting undercut anchor, made of galvanized steel for use in cracked and uncracked concrete: sizes M10, M12, M16 and M20 and made of stainless steel for use in cracked and uncracked concrete: sizes M10, M12 and M16.
Manufacturer:	Hilti Corporation Feldkircherstrasse 100 FL-9494 Schaan Principality of Liechtenstein
Manufacturing plant(s):	Hilti plants
This UK Technical Assessment contains:	41 pages including 3 Annexes which form an integral part of this assessment
This UK Technical Assessment is issued in accordance with The Construction Products (Amendment etc.) (EU Exit) Regulations 2020 on the basis of:	UKAD 330232-00-0601 Mechanical fasteners for use in concrete

1. Technical description of the product

The HILTI HDA anchor in the range of M10 to M20 is a self-cutting undercut anchor made of galvanized steel. The HILTI HDA-R anchor in the range of M10 to M16 is a self-cutting undercut anchor made of stainless steel. Both are available as pre-setting (HDA-P and HDA-PR versions) and as through-fastening anchor (HDA-T and HDA-TR versions). They are placed into a hole drilled with a special stop drill bit and self-cutting undercut using a special setting tool. The nut is torque tightened to complete the fastening of the fixture.

The illustration and the description of the product are given in Annex A.

2. Specification of the intended use(s) in accordance with the applicable UK Assessment Document (hereinafter UKAD)

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

The provisions made in this UK Technical Assessment are based on an assumed 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.

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

3.1. Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic tension resistance in case of static and quasi-static loading according to UKAD 330232-00-0601	See Annexes C1 and C2
Characteristic tension resistance in case of static and quasi-static loading according to CEN/TS 1992-4	See Annexes C3 and C4
Displacements under tension loads in case of static and quasi-static loading	See Annex C5
Characteristic shear resistance in case of static and quasi-static loading according to UKAD 330232-00-0601	See Annexes C6 and C7
Characteristic shear resistance in case of static and quasi-static loading according to CEN/TS 1992-4	See Annexes C8 and C9
Displacements under shear loads in case of static and quasi-static loading	See Annex C10
Characteristic tension resistance in case of seismic performance category C1 according to EOTA TR045	See Annexes C11 and C12

Displacements under tension loads in case of seismic performance category C1	See Annexes C11 and C12
Characteristic shear resistance in case of seismic performance category C1 according to EOTA TR045	See Annexes C13 and C14
Displacements under shear loads in case of seismic performance category C1	See Annexes C13 and C14
Characteristic tension resistance in case of seismic performance category C2 according to EOTA TR045	See Annexes C15 and C16
Displacements under tension loads in case of seismic performance category C2	See Annexes C15 and C16
Characteristic shear resistance in case of seismic performance category C2 according to EOTA TR045	See Annexes C17 and C18
Displacements under shear loads in case of seismic performance category C2	See Annexes C17 and C18

3.2. Safety in case of fire (BWR 2)

Essential characteristic	**Performance**
Reaction to fire	Anchorages satisfy requirements for Class A1

3.3. Health, hygiene and the environment (BWR 3)

Regarding dangerous substances contained in this UK Technical Assessment, there may be requirements applicable to the products falling within its scope (e.g. transposed UK legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the Construction Products Directive, these requirements need also to be complied with, when and where they apply.

3.4. Safety and accessibility in use (BWR 4)

For Basic Works Requirement 4: Safety and accessibility in use, the same criteria are valid as for Basic Works Requirement 1: Mechanical resistance and stability.

3.5. Protection against noise (BWR 5)

Not relevant.

3.6. Energy economy and heat retention (BWR 6)

Not relevant.

3.7. Sustainable use of natural resources (BWR 7)

No performance assessed.

3.8. General aspects relating to fitness for use

Durability and Serviceability are only ensured if the specifications of intended use according to Annex B 1 are kept.

4. Assessment and verification of constancy of performance (hereinafter AVCP) system applied

4.1. System of assessment and verification of constancy of performance

According to UKAD No. 330232-00-0601 and Annex V of the Construction Products Regulation (Regulation (EU) 305/2011) as brought into UK law and amended, the system of assessment and verification of constancy of performance (AVCP) 1 applies.

5. Technical details necessary for the implementation of the AVCP system, as provided for in the applicable UKAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with the British Board of Agrément and made available to the UK Approved Bodies involved in the conformity attestation process.

5.1. UKCA marking for the product/ system must contain the following information:

- Identification number of the Approved Body
- Name/ registered address of the manufacturer of the product/ system
- Marking including date of Marking and the intended use as stated in the Designated technical specification
- Unique identification code of the product type
- The reference number of the Declaration of Performance
- The level or class of the performance declared
- The reference to the Designated technical specification applied
- UKTA number

On behalf of the British Board of Agrément 	
Date of Issue: 23 June 2023	**Hardy Giesler** Chief Executive Officer

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Hatters Lane,
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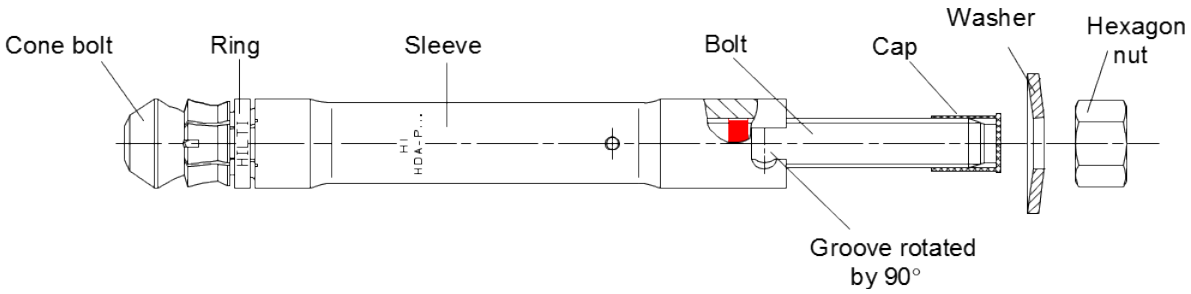
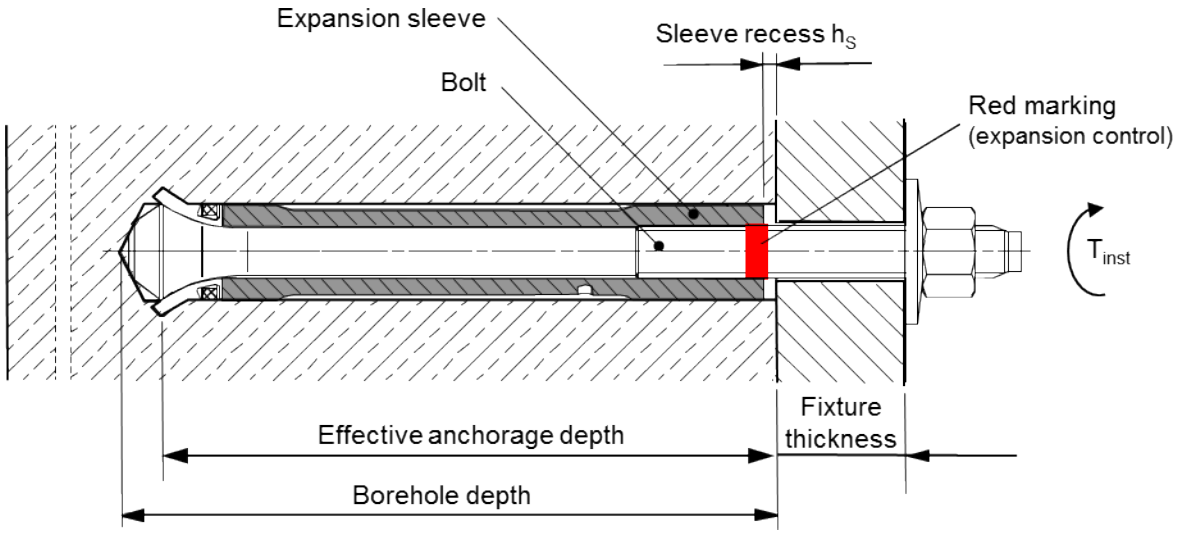
ANNEX A1
Product description – Installation condition
HDA-P and HDA-PR

This annex applies to the product described in the main body of the UK Technical Assessment.

Pre-setting anchor HDA-P and HDA-PR (Pre-positioning)



Pre-setting anchor HDA-P and HDA-PR (Pre-positioning)

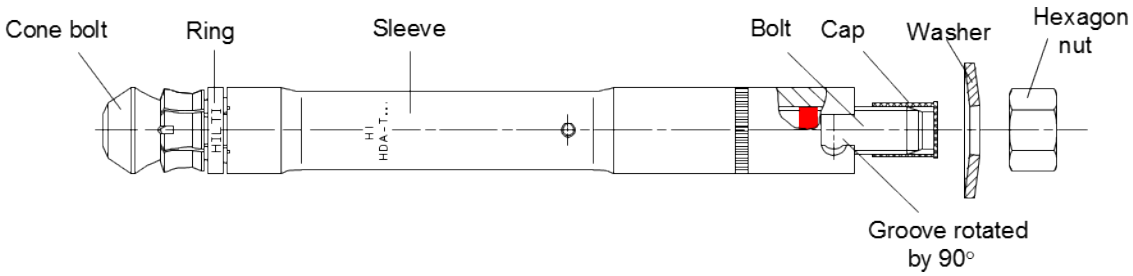


Intended use:
HDA-P for use in cracked or non-cracked concrete in dry internal conditions only
HDA-PR for use in cracked or non-cracked concrete (any conditions except for very aggressive conditions)

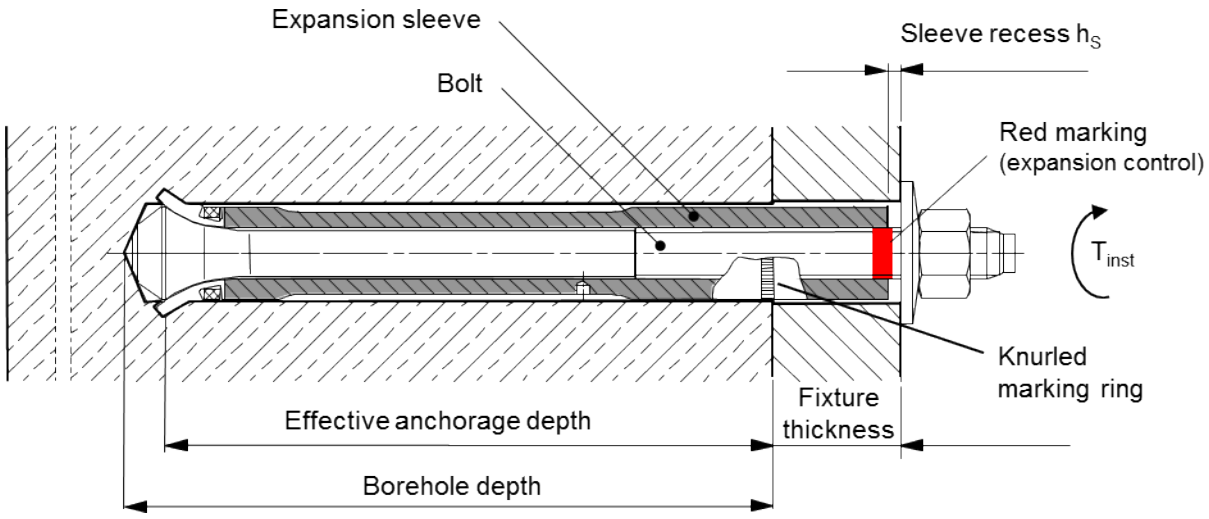
ANNEX A2
Product description – Installation condition
HDA-T and HDA-TR

This annex applies to the product described in the main body of the UK Technical Assessment.

Through-fastening anchor HDA-T and HDA-TR (Post-positioning)



Through-fastening anchor HDA-T and HDA-TR (Post-positioning)

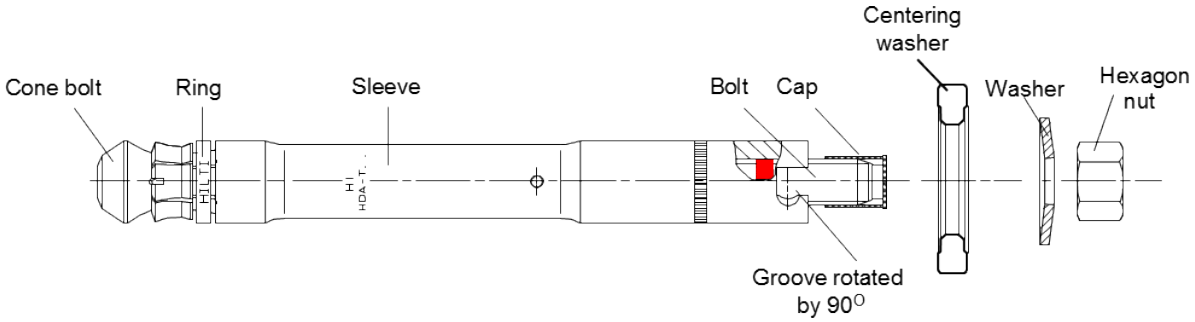


Intended use:
HDA-T for use in cracked or non-cracked concrete in dry internal conditions only
HDA-TR for use in cracked or non-cracked concrete (any conditions except for very aggressive conditions)

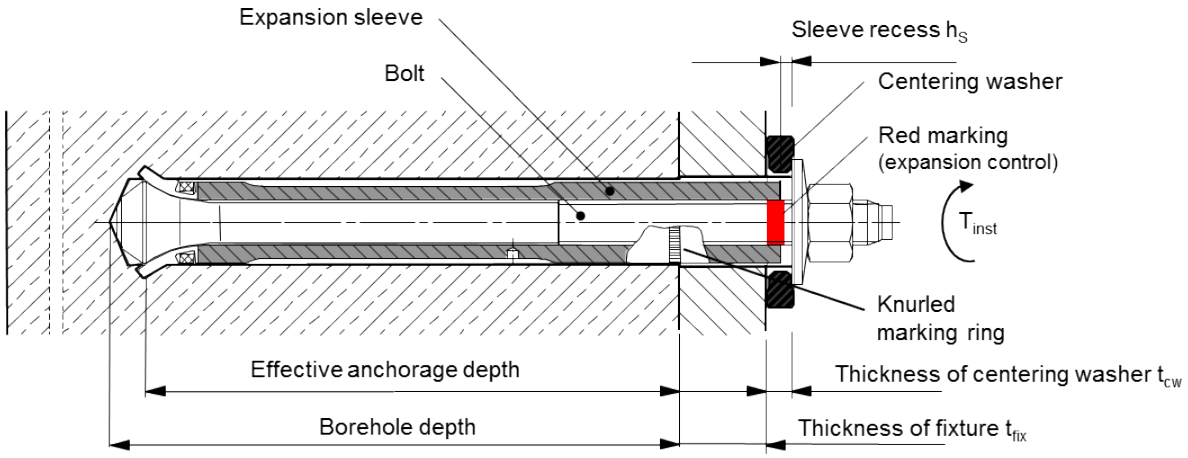
ANNEX A3
Product description – Installation condition
HDA-T and HDA-TR with centring washer

This annex applies to the product described in the main body of the UK Technical Assessment.

Through-fastening anchor HDA-T and HDA-TR with centring washer (Post-positioning)



Through-fastening anchor HDA-T and HDA-TR with centring washer (Post-positioning)



The maximum fastenable thickness $t_{fix,max}$ (see Table 4, Annex B7) is kept if following equation is fulfilled: $t_{fix,max} \geq t_{fix} + t_{cw}$

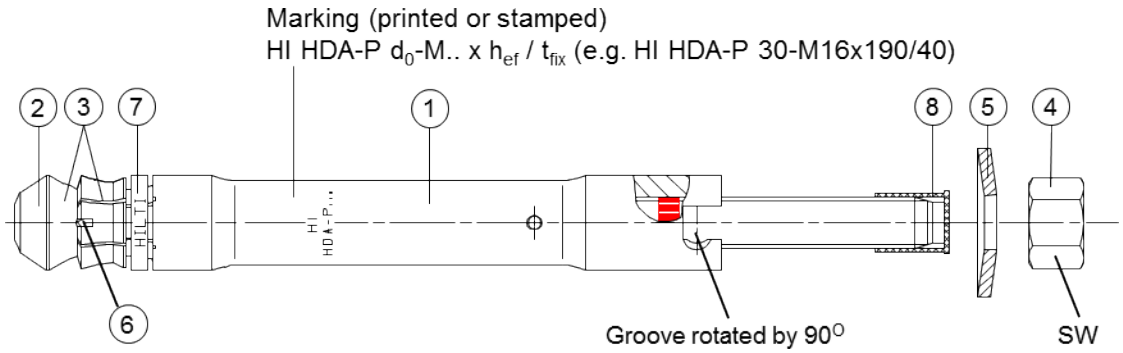
with:
t_{fix} … thickness of the fixture
t_{cw} … thickness of the centring washer (5 mm for all sizes)

Note: The centring washer must be used for the drilling of the hole to ensure the proper embedment depth.

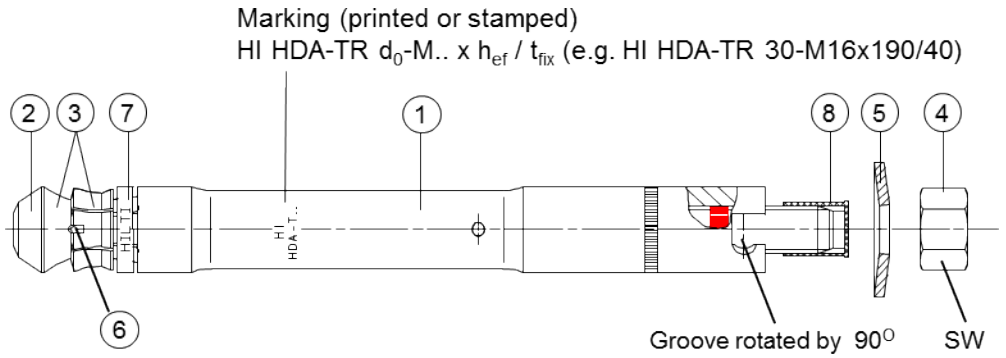
ANNEX A4
Product description - Material of anchor
HDA-P, HDA-PR, HDA-T and HDA-TR

This annex applies to the product described in the main body of the UK Technical Assessment.

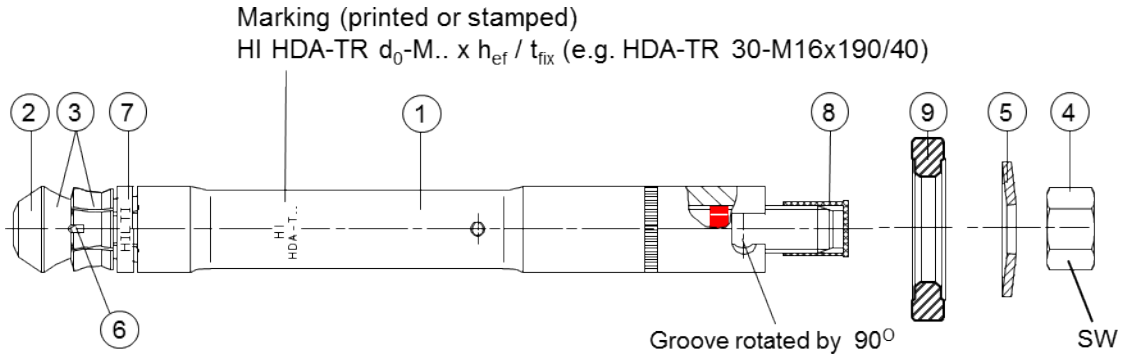
Pre-setting anchor HDA-P and HDA-PR (Pre-positioning)



Through-fastening anchor HDA-T and HDA-TR (Post-positioning)



Through-fastening anchor HDA-T and HDA-TR with centring washer (Post-positioning)



ANNEX A5
Product description - Material of anchor
HDA-P, HDA-PR, HDA-T and HDA-TR

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 1a: Materials HDA-P and HDA-T

Part	Designation	HDA-P / HDA-T (galvanized ≥5µm)
1	Sleeve	Machined carbon steel with brazed tungsten carbide tips
2	Bolt	M10 – M16: Cold formed steel, steel strength 8.8 M20: Cone machined, rod steel strength 8.8
3	Coating of bolt and sleeve	Galvanized 5-25µm
4	Hexagon nut	M10 – M16: Class 8, h=1*d, galvanized M20: Class 8, galvanized
5	Washer	M10 – M16: Spring washer, galvanized or coated M20: Washer, galvanized
6	Cutting edges	Tungsten carbide
7	Ring	Plastic ring
8	Cap	Plastic cap
9	Centring washer	Machined steel

Table 1b: Materials HDA-PR and HDA-TR

Part	Designation	HDA-P / HDA-T (galvanized ≥5µm)
1	Sleeve	Machined stainless steel 1.4401, 1.4404, or 1.4571 with brazed tungsten carbide tips
2	Bolt	Rod: machined stainless steel 1.4401, 1.4404 or 1.4571 Cone: machined stainless steel 1.4401, 1.4404 or 1.4571
3	Coating of cone	Hardchrome > 10 µm
4	Hexagon nut	Grade A4-80, h=1*d
5	Washer	Spring washer stainless steel
6	Cutting edges	Tungsten carbide
7	Ring	Plastic ring
8	Cap	Plastic cap
9	Centring washer	Machined stainless steel, 1.4401

ANNEX B1

Intended use
Specifications

This annex applies to the product described in the main body of the UK Technical Assessment.

Specifications of intended use

Anchorages subject to:

- Static and quasi-static loading
- Seismic actions for Performance Category C1 and Performance Category C2

Base materials:

- Reinforced or unreinforced normal weight concrete of strength classes C20/25 at least to C50/60 at most, according to EN 206: 2000-12.
- Cracked concrete and non-cracked concrete

Use conditions (Environmental conditions):

- The HDA-P and HDA-T anchors may only be used in concrete subject to dry internal conditions.
- The HDA-PR and HDA-TR anchors 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.

Note: Particularly 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 desulphurisation plants or road tunnels where de-icing materials are used).

Design:

- The anchorages are designed in accordance with the UKAD 330232-00-0601 “Mechanical fasteners for use in concrete” under the responsibility of an engineer experienced in anchorages and concrete work.
- For seismic application the anchorages are designed in accordance with EOTA TR045 “Design of Metal Anchors for Use in Concrete Under Seismic Actions”.
- 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.

ANNEX B2
Intended use
Specifications

This annex applies to the product described in the main body of the UK Technical Assessment.

Installation:

- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of 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 and using the appropriate tools (hammer drill, setting tool, stop drill bit, centring washer if needed).
- 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
- Cleaning the hole of drilling dust
- Anchor installation ensuring the specified embedment depth using a special required stop drill bit
- Anchor installation ensuring complete expansion of the sleeve with checking that the non-threaded coloured ring marking on the bolt is visible above the top edge of the anchor sleeve; therefore it is required using the special setting tool, that is the appropriate depth ring marking of the setting tool at least flush with the concrete surface (pre-setting) respecting with the fixture surface (through-fastening).
- Anchor installation ensuring complete shear load capacity, the recess of the top edge of the sleeve respecting with the concrete surface (pre-setting) or with surface of the fixture (through-fastening) has to be in the specified range according to Annex B9; the use of a centring washer (see Annex A3) ensures the shear load capacity for HDA-T anchors with the minimum fixture thickness according Annex C6 and/or Annex C7.
- Keeping of the edge distance and spacing to the specified values without minus tolerances.
- Positioning of the drill holes and the undercut without damaging the reinforcement.
- In case of aborted hole, drilling of new hole at a minimum distance of twice the depth of the aborted hole, or smaller distance provided the aborted drill hole is filled with high strength mortar and no shear or oblique tension loads in the direction of aborted hole.
- Application of the torque moment given in Annex B9 using a calibrated torque wrench

ANNEX B3
Setting tools
HDA-P, HDA-PR, HDA-T and HDA-TR

This annex applies to the product described in the main body of the UK Technical Assessment.

Stop drill bit HDA

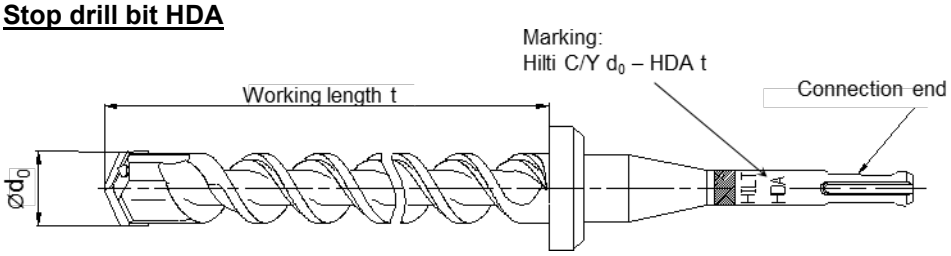
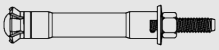


Table 2: Required stop drill bits for HDA and HDA-R

Anchor 	**Stop drill bit with**		**Nominal Working length**	**Drill bit diameter**
	TE-C Connection end 	**TE-Y** Connection end 	**t** [mm]	**d_0** [mm]
HDA-P(R) 20-M10x100/20	TE-C-HDA-B 20x100	TE-Y-HDA-B 20x100	107	20
HDA-T(R) 20-M10x100/20	TE-C-HDA-B 20x120	TE-Y-HDA-B 20x120	127	20
HDA-P(R) 22-M12x125/30 HDA-P(R) 22-M12x125/50	TE-C HDA-B 22x125	TE-Y HDA-B 22x125	133	22
HDA-T(R) 22-M12x125/30	TE-C HDA-B 22x155	TE-Y HDA-B 22x155	163	22
HDA-T(R) 22-M12x125/50	TE-C HDA-B 22x175	TE-Y HDA-B 22x175	183	22
HDA-P(R) 30-M16x190/40 HDA-P(R) 30-M16x190/60	-	TE-Y HDA-B 30x190	203	30
HDA-T(R) 30-M16x190/40	-	TE-Y HDA-B 30x230	243	30
HDA-T(R) 30-M16x190/60	-	TE-Y HDA-B 30x250	263	30
HDA-P 37-M20x250/50 HDA-P 37-M20x250/100	-	TE-Y HDA-B 37x250	266	37
HDA-T 37-M20x250/50	-	TE-Y HDA-B 37x300	316	37
HDA-T 37-M20x250/100	-	TE-Y HDA-B 37x350	366	37

ANNEX B4
Setting tools
HDA-P, HDA-PR, HDA-T and HDA-TR

This annex applies to the product described in the main body of the UK Technical Assessment.

Setting tool HDA

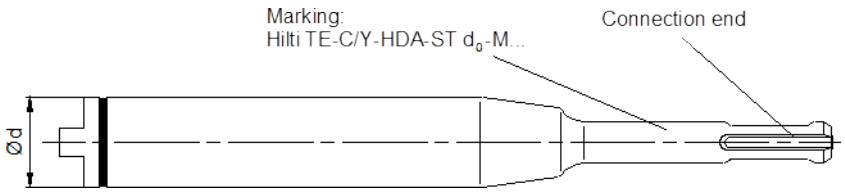


Table 3: Required setting tools and hammer drills for HDA and HDA-R

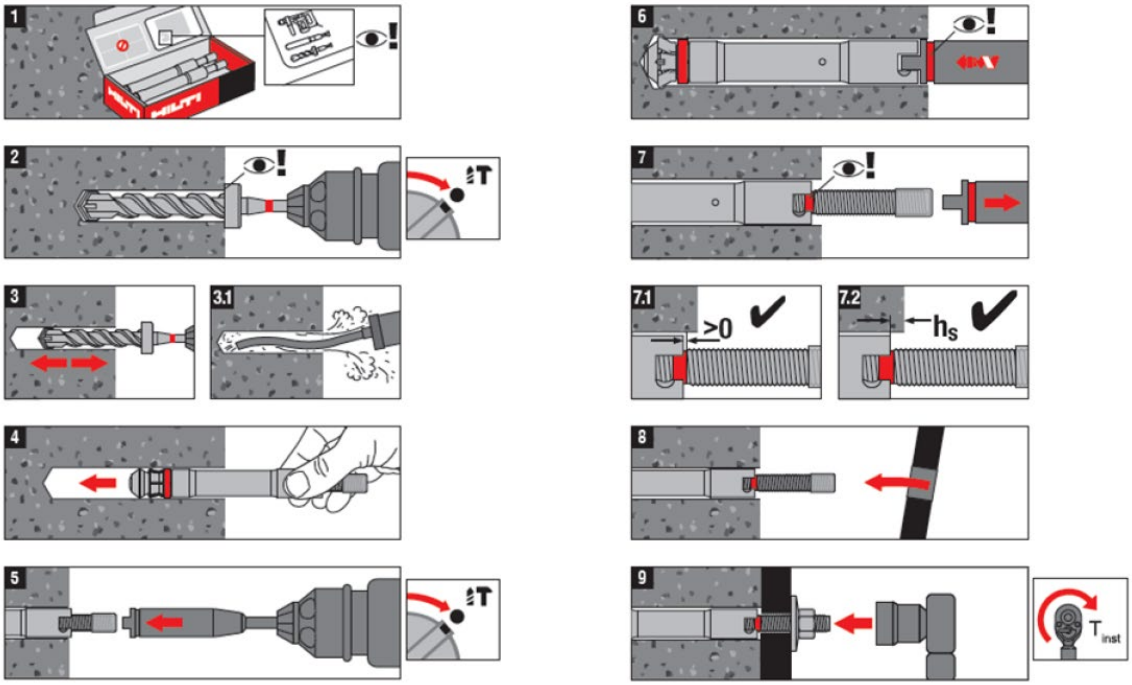
Anchor	Setting tool			Hammer drill											
		Ød [mm]	Connection end	TE 24	TE 25 [1]	TE 30-A36	TE 35	TE 40 TE 40 AVR	TE 56 [2]	TE 56-ATC [2]	TE 60 TE 60-ATC	TE 70 [2]	TE 70-ATC [2]	TE 75 [2]	TE 76 [2]	TE 76-ATC [2]	TE 80 -ATC TE 80-ATC AVR
HDA-P/T 20-M10x100/20	TE-C-HDA-ST 20-M10	20	TE-C	■	■	■		■									
	TE-Y-HDA-ST 20-M10	20	TE-Y						■	■							
HDA-P/T 22-M12x125/30 HDA-P/T 22-M12x125/50	TE-C-HDA-ST 22-M12	22	TE-C	■	■	■		■									
	TE-Y-HDA-ST 22-M12	22	TE-Y						■	■							
HDA-P/T 30-M16x190/40 HDA-P/T 30-M16x190/60	TE-Y-HDA-ST 30-M16	30	TE-Y									■	■	■	■	■	■
HDA-P/T 37-M20x250/50 HDA-P/T 37-M20x250/100	TE-Y-HDA-ST 37-M20	37	TE-Y									■		■	■	■	■
HDA-PR/TR 20-M10x100/20	TE-C-HDA-ST 20-M10	20	TE-C	■	■	■	■	■									
	TE-Y-HDA-ST 20-M10	20	TE-Y						■	■							
HDA-PR/TR 22-M12x125/30 HDA-PR/TR 22-M12x125/50	TE-C-HDA-ST 22-M12	22	TE-C	■	■	■	■	■									
	TE-Y-HDA-ST 22-M12	22	TE-Y						■	■							
HDA-PR/TR 30-M16x190/40 HDA-PR/TR 30-M16x190/60	TE-Y-HDA-ST 30-M16	30	TE-Y									■	■	■	■	■	■

(1) TE25 : first gear only.
(2) TE56 / TE56-ATC, TE76 /TE76-ATC: use with maximum impact energy.

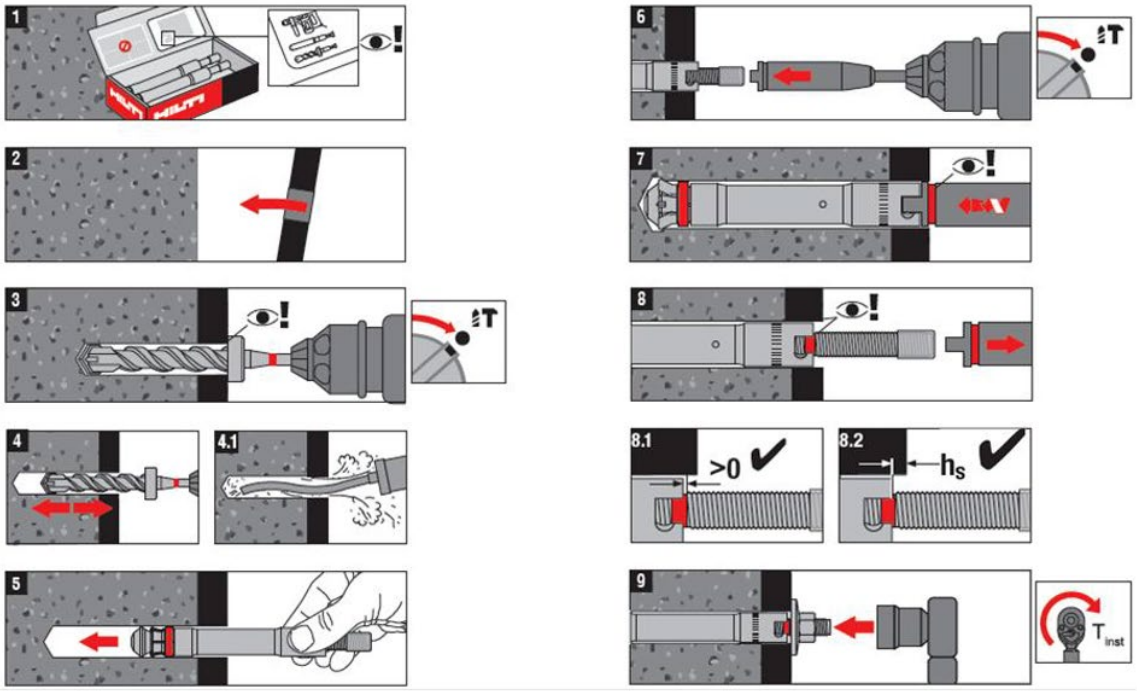
ANNEX B5
Instruction for use
HDA-P, HDA-PR, HDA-T and HDA-TR

This annex applies to the product described in the main body of the UK Technical Assessment.

Instruction for Use: HDA-P and HDA-PR (Pre-positioning)



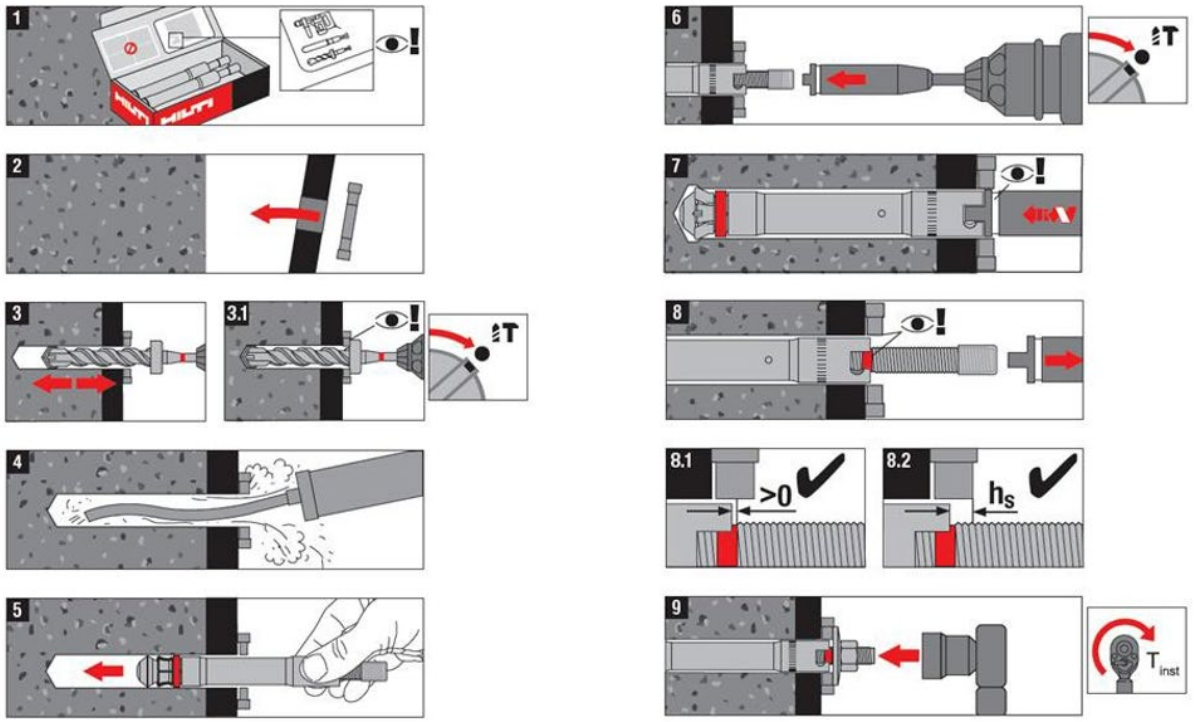
Instruction for Use: HDA-T and HDA-TR (Post-positioning)



ANNEX B6
Instruction for use
HDA-T and HDA-TR with centring washer

This annex applies to the product described in the main body of the UK Technical Assessment.

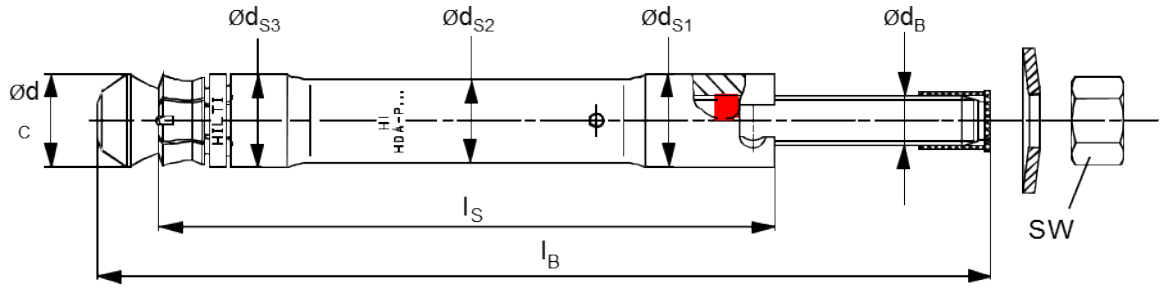
Instruction for Use: HDA-T and HDA-TR with centring washer (Post-positioning)



ANNEX B7
Dimensions of anchor
HDA-P, HDA-PR, HDA-T and HDA-TR

This annex applies to the product described in the main body of the UK Technical Assessment.

Pre-setting anchor HDA-P and HDA-PR (Pre-positioning)



Through-fastening anchor HDA-T and HDA-TR (Post-positioning)

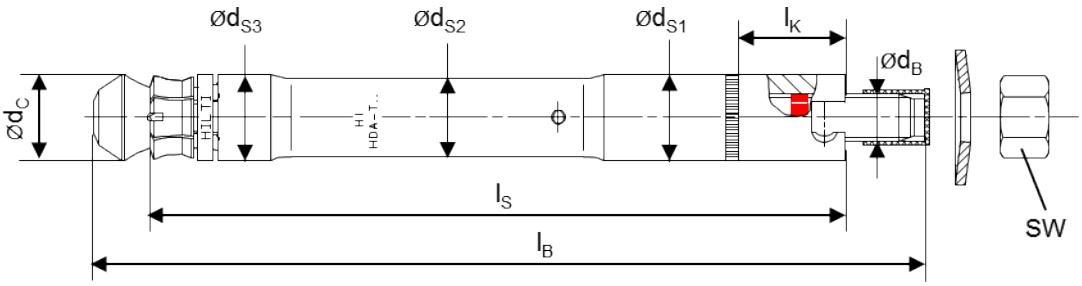


Table 4: Anchor dimensions

Anchor type	t_{fix} (1) min-max [mm]	l_B [mm]	Length code letter	l_S [mm]	l_k [mm]	SW	d_{S1} [mm]	d_{S2} [mm]	d_{S3} [mm]	d_C [mm]	d_B [mm]
HDA-P(R) 20-M10x100/20	0 - 20	150	I	100	-	17	19	16.8	18.5	19.5	10
HDA-T(R) 20-M10x100/20	10 - 20	150	I	120	17	17	19	16.8	18.5	19.5	10
HDA-P(R) 22-M12x125/30	0 - 30	190	L	125	-	19	21	18.8	20.5	21.4	12
HDA-P(R) 22-M12x125/50	0 - 50	210	N	125	-	19	21	18.8	20.5	21.4	12
HDA-T(R) 22-M12x125/30	10 - 30	190	L	155	27	19	21	18.8	20.5	21.4	12
HDA-T(R) 22-M12x125/50	10 - 50	210	N	175	47	19	21	18.8	20.5	21.4	12
HDA-P(R) 30-M16x190/40	0 - 40	275	R	190	-	24	29	26	29	29	16
HDA-P(R) 30-M16x190/60	0 - 60	295	S	190	-	24	29	26	29	29	16
HDA-T(R) 30-M16x190/40	15 - 40	275	R	230	35,5	24	29	26	29	29	16
HDA-T(R) 30-M16x190/60	15 - 60	295	S	250	55,5	24	29	26	29	29	16
HDA-P 37-M20x250/50	0 - 50	360	V	250	-	30	35	32	35	36	20
HDA-P 37-M20x250/100	0 - 100	410	X	250	-	30	35	32	35	36	20
HDA-T 37-M20x250/50	20 - 50	360	V	300	45	30	35	32	35	36	20
HDA-T 37-M20x250/100	50 - 100	410	X	350	95	30	35	32	35	36	20

(1) first value: $t_{fix,min}$ minimum fastenable thickness for pure tension load
(shear load see Tables 11a, 11b, 11c and 11d)
second value: $t_{fix,max}$ maximum fastenable thickness

ANNEX B8
Dimensions of centring washer
HDA-T and HDA-TR

This annex applies to the product described in the main body of the UK Technical Assessment.

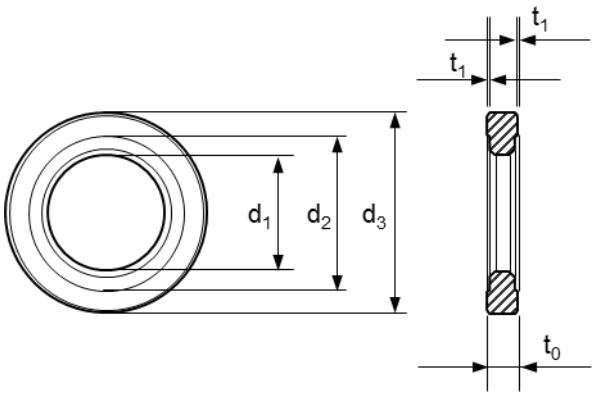


Table 5: Dimensions of centring washer

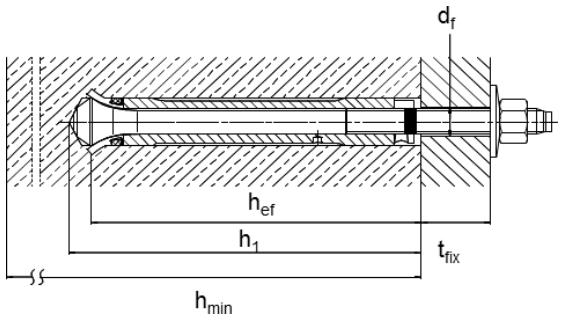
Centring washer	t_{CW} [1] [mm]	t_0 [mm]	t_1 [mm]	d_1 [mm]	d_2 [mm]	d_3 [mm]	**Anchor type**
HDA-F-CW 5-M10	5	5.5	0.5	21	28	36	HDA-T 20-M10x100/20
HDA-F-CW 5-M12	5	5.5	0.5	23	33	42	HDA-T 22-M12x125/30 HDA-T 22-M12x125/50
HDA-F-CW 5-M16	5	5.5	0.5	32	46	56	HDA-T 30-M16x190/40 HDA-T 30-M16x190/60
HDA-F-CW 5-M20	5	5.5	0.5	40	50	62	HDA-T 37-M20x250/50
HDA-R-CW 5-M10	5	5.5	0.5	21	28	36	HDA-TR 20-M10x100/20
HDA-R-CW 5-M12	5	5.5	0.5	23	33	42	HDA-T 20-M10x100/20 HDA-T 20-M10x100/20
HDA-R-CW 5-M16	5	5.5	0.5	32	46	56	HDA-T 20-M10x100/20 HDA-T 20-M10x100/20

[1] Effective thickness of centring washer

ANNEX B9
Installation data
HDA-P, HDA-PR, HDA-T and HDA-TR

This annex applies to the product described in the main body of the UK Technical Assessment.

Pre-setting anchor
HDA-P (Pre-positioning)



Through-fastening anchor
HDA-T (Post-positioning)

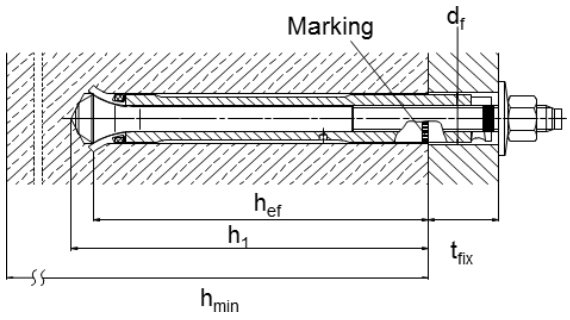


Table 6: Installation data

Anchor type **Pre-setting/Through-setting**			**HDA M10**		**HDA M12**		**HDA M16**		**HDA M20**	
			P(R)	**T(R)**	**P(R)**	**T(R)**	**P(R)**	**T(R)**	**P**	**T**
Nominal diameter of drill bit	d_0	[mm]	20		22		30		37	
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	20.55		22.55		30.55		37.70	
Depth of drill hole	h_1	[mm]	107	≥107	133	≥133	203	≥203	266	≥266
Diameter of clearance hole in the fixture	d_f	[mm]	12	21	14	23	18	32	22	40
Minimum fixture thickness	$t_{fix,min}$	[mm]	0	10	0	10	0	15	0	20
Sleeve recess (1)	h_S	[mm]	$2 \leq h_S \leq 6$		$2 \leq h_S \leq 7$		$2 \leq h_S \leq 8$		$2 \leq h_S \leq 8$	
Installation torque	T_{inst}	[Nm]	50		80		120		300	

(1) Sleeve recess after setting of the anchor
a) Pre-setting anchor HDA-P(R):
distance from surface of the concrete member to top edge of the anchor sleeve, see Annex A1
b) Through-fastening anchor HDA-T(R):
distance from top edge of the fixture to top edge of the anchor sleeve, see Annexes A2 and A3

ANNEX B10
Installation data
HDA-P, HDA-PR, HDA-T and HDA-TR

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 7a: Minimum thickness of concrete member, HDA-P and HDA-PR

Anchor type			**HDA-P M10 HDA-PR M10**	**HDA-P M12 HDA-PR M12**	**HDA-P M16 HDA-PR M16**	**HDA-P M20 HDA-PR M20**
Minimum thickness of concrete member	h_{min}	[mm]	180	200	270	350

Table 7b: Minimum thickness of concrete member, HDA-T and HDA-TR

Anchor type			**HDA-T M10 HDA-TR M10**	**HDA-T M12 HDA-TR M12**		**HDA-T M16 HDA-TR M16**		**HDA-T M20**	
Maximum fastenable thickness	$t_{fix,max}$ (1)	[mm]	20	30	50	40	60	50	100
Minimum thickness of concrete member	h_{min} (2)	[mm]	200-t_{fix}	230-t_{fix}	250-t_{fix}	310-t_{fix}	330-t_{fix}	400-t_{fix}	450-t_{fix}

(1) $t_{fix,max}$ maximum fastenable thickness, see Table 4, Annex B7
(2) h_{min} is dependent on the actual fixture thickness t_{fix} (use of a stop drill bit)
e.g. HDA-T 22-M12x125/50: t_{fix} = 20mm → h_{min} = 250-20 = 230mm
t_{fix} = 50mm → h_{min} = 250-50 = 200mm

Table 8: Minimum spacing and minimum edge distances of anchors

HDA-P (R) / HD—T (R)			**M10**	**M12**	**M16**	**M20**
Cracked concrete						
Minimum spacing (1)	s_{min}	[mm]	100	125	190	250
Minimum edge distance (2)	c_{min}	[mm]	80	100	150	200
Non-cracked concrete						
Minimum spacing (1)	s_{min}	[mm]	100	125	190	250
Minimum edge distance (2)	c_{min}	[mm]	80	100	150	200

(1) Ratio smin / hef = 1,0

(2) Ratio cmin / hef = 0,8

ANNEX C1
Design method A (UKAD 330232-00-0601, Annex C) - tension loads
HDA-P and HDA-T

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 9a: Characteristic values of resistance under tension loads in case of static and quasi-static loading for design method A according to UKAD 330232-00-0601, Annex C, HDA-P and HDA-T

HDA-P / HDA-T			**M10**	**M12**	**M16**	**M20**
Steel failure						
Characteristic resistance	$N_{Rk,s}$	[kN]	**46**	**67**	**126**	**192**
Partial safety factor	γ_{Ms} (1)		1,5			
Pull-out failure (2)						
Characteristic resistance in cracked concrete only C20/25	$N_{Rk,p}$	[kN]	**25**	**35**	**75**	**95**
Partial safety factor in cracked concrete only	γ_{Mp} (1)		1,5 (3)			
Increasing factors for $N_{Rk,p}$ for cracked concrete only	ψ_c	C30/37	1,22			
		C40/50	1,41			
		C50/60	1,55			
Concrete cone failure and splitting failure (4)						
Effective anchorage depth	h_{ef}	[mm]	100	125	190	250
Partial safety factor in cracked and non-cracked concrete	γ_{Mc} (1)		1,5 (3)			
Spacing	$s_{cr,N}$	[mm]	300	375	570	750
Edge distance	$c_{cr,N}$	[mm]	150	190	285	375
Spacing	$s_{cr,sp}$	[mm]	300	375	570	750
Edge distance	$c_{cr,sp}$	[mm]	150	190	285	375

(1) In absence of national regulations.

(2) The pull-out failure mode is not decisive in non-cracked concrete; it does not have to be calculated by the designer.

(3) Partial safety factor γ_2 = 1,0 is included.

(4) For concrete cone failure, the initial value of the characteristic resistance of an HDA anchor placed in cracked or non-cracked concrete is obtained by: $N^0_{Rk,c} = k_1 \cdot \sqrt{f_{ck,cube}} \cdot h_{ef}^{1,5}$

with k_1 = 8,3 for applications in cracked concrete

k_1 = 11,6 for applications in non-cracked concrete

Instead of the factors k1 given in equation (5.2a) in UKAD 330232-00-0601 Annex C

ANNEX C2
Design method A (UKAD 330232-00-0601, Annex C) - tension loads
HDA-PR and HDA-TR

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 9b: Characteristic values of resistance under tension loads in case of static and quasi-static loading for design method A according to UKAD 330232-00-0601, Annex C, HDA-PR and HDA-TR

HDA-P / HDA-T			**M10**	**M12**	**M16**
Steel failure					
Characteristic resistance	$N_{Rk,s}$	[kN]	**46**	**67**	**126**
Partial safety factor	γ_{Ms} (1)		1,6		
Pull-out failure (2)					
Characteristic resistance in cracked concrete only C20/25	$N_{Rk,p}$	[kN]	**25**	**35**	**75**
Partial safety factor in cracked concrete only	γ_{Mp} (1)		1,5 (3)		
Increasing factors for $N_{Rk,p}$ for cracked concrete only	ψ_c	C30/37	1,22		
		C40/50	1,41		
		C50/60	1,55		
Concrete cone failure and splitting failure (4)					
Effective anchorage depth	h_{ef}	[mm]	100	125	190
Partial safety factor in cracked and non-cracked concrete	γ_{Mc} (1)		1,5 (3)		
Spacing	$s_{cr,N}$	[mm]	300	375	570
Edge distance	$c_{cr,N}$	[mm]	150	190	285
Spacing	$s_{cr,sp}$	[mm]	300	375	570
Edge distance	$c_{cr,sp}$	[mm]	150	190	285

(1) In absence of national regulations.

(2) The pull-out failure mode is not decisive in non-cracked concrete; it does not have to be calculated by the designer.

(3) Partial safety factor γ_2 = 1,0 is included.

(4) For concrete cone failure, the initial value of the characteristic resistance of an HDA anchor placed in cracked or non-cracked concrete is obtained by: $N^0_{Rk,c} = k_1 \cdot \sqrt{f_{ck,cube}} \cdot h_{ef}^{1,5}$

with k_1 = 8,3 for applications in cracked concrete

k_1 = 11,6 for applications in non-cracked concrete

Instead of the factors k1 given in equation (5.2a) in UKAD 330232-00-0601 Annex C

ANNEX C3
Design method A (CEN/TS 1992-4) - tension loads
HDA-P and HDA-T

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 9c: Characteristic values of resistance under tension loads in case of static and quasi-static loading for design method A according to CEN/TS 1992-4, HDA-P and HDA-T

HDA-P / HDA-T			**M10**	**M12**	**M16**	**M20**
Steel failure						
Characteristic resistance	$N_{Rk,s}$	[kN]	**46**	**67**	**126**	**192**
Partial safety factor	γ_{Ms} (1)		1,5			
Pull-out failure (2)						
Characteristic resistance in cracked concrete only C20/25	$N_{Rk,p}$	[kN]	**25**	**35**	**75**	**95**
Partial safety factor in cracked concrete only	γ_{Mp} (1)		1,5 (3)			
Increasing factors for $N_{Rk,p}$ for cracked concrete only	ψ_c	C30/37	1,22			
		C40/50	1,41			
		C50/60	1,55			
Concrete cone failure and splitting failure (4)						
Effective anchorage depth	h_{ef}	[mm]	100	125	190	250
Partial safety factor in cracked and non-cracked concrete	γ_{Mc} (1)		1,5 (3)			
Spacing	$s_{cr,N}$	[mm]	300	375	570	750
Edge distance	$c_{cr,N}$	[mm]	150	190	285	375
Spacing	$s_{cr,sp}$	[mm]	300	375	570	750
Edge distance	$c_{cr,sp}$	[mm]	150	190	285	375

(1) In absence of national regulations.

(2) The pull-out failure mode is not decisive in non-cracked concrete; it does not have to be calculated by the designer.

(3) Partial safety factor γ_2 = 1,0 is included.

ANNEX C4
Design method A (CEN/TS 1992-4) - tension loads
HDA-PR and HDA-TR

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 9d: Characteristic values of resistance under tension loads in case of static and quasi-static loading for design method A according to CEN/TS 1992-4, HDA-PR and HDA-TR

HDA-PR / HDA-TR			**M10**	**M12**	**M16**
Steel failure					
Characteristic resistance	$N_{Rk,s}$	[kN]	**46**	**67**	**126**
Partial safety factor	γ_{Ms} (1)		1,6		
Pull-out failure (2)					
Characteristic resistance in cracked concrete only C20/25	$N_{Rk,p}$	[kN]	**25**	**35**	**75**
Partial safety factor in cracked concrete only	γ_{Mp} (1)		1,5 (3)		
Increasing factors for $N_{Rk,p}$ for cracked concrete only	ψ_c	C30/37	1,22		
		C40/50	1,41		
		C50/60	1,55		
Concrete cone failure and splitting failure (4)					
Effective anchorage depth	h_{ef}	[mm]	100	125	190
Partial safety factor in cracked and non-cracked concrete	γ_{Mc} (1)		1,5 (3)		
Spacing	$s_{cr,N}$	[mm]	300	375	570
Edge distance	$c_{cr,N}$	[mm]	150	190	285
Spacing	$s_{cr,sp}$	[mm]	300	375	570
Edge distance	$c_{cr,sp}$	[mm]	150	190	285

(1) In absence of national regulations.

(2) The pull-out failure mode is not decisive in non-cracked concrete; it does not have to be calculated by the designer.

(3) Partial safety factor γ_2 = 1,0 is included.

ANNEX C5
Displacements - tension loads
HDA-P, HDA-PR, HDA-T and HDA-TR

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 10a: Displacements under tension loads in case of static and quasi-static loading HDA-P and HDA-T

HDA-P / HDA-T			**M10**	**M12**	**M16**	**M20**
Tension load in C20/25 to C50/60 cracked concrete		[kN]	**11,9**	**16,7**	**35,7**	**45,2**
Displacement (1)	δ_{N0}	[mm]	0,1	0,8	2,1	2,1
	$\delta_{N\infty}$	[mm]	1,3	1,3	2,1	2,1
Tension load in C20/25 to C50/60 non-cracked concrete		[kN]	**21,9**	**31,9**	**60,0**	**91,4**
Displacement (1)	δ_{N0}	[mm]	0,4	0,8	1,7	2,4
	$\delta_{N\infty}$	[mm]	1,3	1,3	1,7	2,4

(1) Calculation of displacement under service load: N_{sd} design value of tension stress Displacement under short term loading = $\delta_{N0} \cdot N_{sd}/1.4$;
Displacement under long term loading = $\delta_{N\infty} \cdot N_{sd}/1,4$

Table 10b: Displacements under tension loads in case of static and quasi-static loading HDA-PR and HDA-TR

HDA-PR / HDA-TR			**M10**	**M12**	**M16**
Tension load in C20/25 to C50/60 cracked concrete		[kN]	**11,9**	**16,7**	**35,7**
Displacement (1)	δ_{N0}	[mm]	0,8	0,9	2,1
	$\delta_{N\infty}$	[mm]	1,3	1,3	2,1
Tension load in C20/25 to C50/60 non-cracked concrete		[kN]	**20,5**	**29,9**	**56,3**
Displacement (1)	δ_{N0}	[mm]	1,4	1,1	1,7
	$\delta_{N\infty}$	[mm]	1,4	1,1	1,7

(1) Calculation of displacement under service load: N_{sd} design value of tension stress Displacement under short term loading = $\delta_{N0} \cdot N_{sd}/1.4$;
Displacement under long term loading = $\delta_{N\infty} \cdot N_{sd}/1.4$

ANNEX C6
Design method A (UKAD 330232-00-0601, Annex C) - shear loads
HDA-P and HDA-T

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 11a: Characteristic values of resistance under shear loads in case of static and quasi-static loading for design method A according to UKAD 330232-00-0601, Annex C, HDA-P and HDA-T

HDA-P			**M10**	**M12**	**M16**	**M20**
Steel failure without lever arm						
Characteristic resistance	$V_{Rk,s}$	[kN]	**22**	**30**	**62**	**92**
Partial safety factor	γ_{Ms} (1)		1,25			
Steel failure with lever arm						
Distance according to ETAG 001, Annex C, § 4.2.2.4	a_3	[mm]	8	10	13	15
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	**60**	**105**	**266**	**519**
Partial safety factor	γ_{Ms} (1)		1,25			

HDA-T			**M10**		**M12**			**M16**					**M20**			
Steel failure without lever arm																
Characteristic resistance	for t_{fix}	[mm]	10 ≤ < 15	15 ≤ ≤ 20	10 ≤ < 15	15 ≤ < 20	20 ≤ ≤ 50	15 ≤ < 20	20 ≤ < 25	25 ≤ < 30	30 ≤ < 35	35 ≤ ≤ 60	20 ≤ < 25	25 ≤ < 40	40 ≤ < 55	55 ≤ ≤100
	$V_{Rk,s}$	[kN]	**65** (2)	**70**	**80** (2)	**80**	**100**	**140** (2)	**140**	**155**	**170**	**190**	**205** (2)	**205**	**235**	**250**
Partial safety factor	γ_{Ms} (1)		1,5													
Steel failure with lever arm																
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	**60**		**105**			**266**					**519**			
Partial safety factor	γ_{Ms} (1)		1,25													

HDA-P / HDA-T			**M10**	**M12**	**M16**	**M20**
Concrete pryout failure						
Factor in equation (5.6) according to ETAG 001, Annex C, § 5.2.3.3.	k		2,0			
Partial safety factor	γ_{Mc} (1)		1,5 (3)			
Concrete edge failure						
Effective length of anchor in shear loading	l_f	[mm]	70	88	90	120
External diameter of anchor	d_{nom}	[mm]	19	21	29	35
Partial safety factor	γ_{Mc} (1)		1,5 (3)			

(1) In absence of national regulations.

(2) Only with use of centring washer, t_{fix} = thickness of the base plate without thickness of the centring washer, see Annex B8.

(3) Partial safety factor γ_2 = 1.0 is included.

ANNEX C7
Design method A (UKAD 330232-00-0601, Annex C) - shear loads
HDA-PR and HDA-TR

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 11b: Characteristic values of resistance under shear loads in case of static and quasi-static loading for design method A according to UKAD 330232-00-0601, Annex C, HDA-PR and HDA-TR

HDA-PR			**M10**		**M12**			**M16**			
Steel failure without lever arm											
Characteristic resistance	$V_{Rk,s}$	[kN]	**23**		**34**			**63**			
Partial safety factor	γ_{Ms} (1)		1,33								
Steel failure with lever arm											
Distance according to ETAG 001, Annex C, § 4.2.2.4	a_3	[mm]	8		10			13			
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	**60**		**105**			**266**			
Partial safety factor	γ_{Ms} (1)		1,33								
HDA-TR			**M10**		**M12**			**M16**			
Steel failure without lever arm											
Characteristic resistance	for t_{fix}	[mm]	10 ≤ < 15	15 ≤ ≤ 20	10 ≤ < 15	15 ≤ < 20	20 ≤ < 30	30 ≤ ≤ 50	15 ≤ < 20	20 ≤ < 25	25 ≤ < 35	35≤ ≤ 60
	$V_{Rk,s}$	[kN]	**71** (2)	**71**	**87** (2)	**87**	**94**	**109**	**152** (2)	**152**	**158**	**170**
Partial safety factor	γ_{Ms} (1)		1,33									
Steel failure with lever arm												
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	**60**		**105**			**266**				
Partial safety factor	γ_{Ms} (1)		1,33									
HDA-PR / HDA-TR			**M10**		**M12**			**M16**			
Concrete pryout failure											
Factor in equation (5.6) according to ETAG 001, Annex C, § 5.2.3.3.	k		2,0								
Partial safety factor	γ_{Mc} (1)		1,5 (3)								
Concrete edge failure											
Effective length of anchor in shear loading	l_f	[mm]	70		88			90			
External diameter of anchor	d_{nom}	[mm]	19		21			29			
Partial safety factor	γ_{Mc} (1)		1,5 (3)								

(1) In absence of national regulations.

(2) Only with use of centring washer, t_{fix} = thickness of the base plate without thickness of the centring washer, see Annex B8.

(3) Partial safety factor γ_2 = 1.0 is included.

ANNEX C8
Design method A (CEN/TS 1992-4) - shear loads
HDA-P and HDA-T

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 11c: Characteristic values of resistance under shear loads in case of static and quasi-static loading for design method A according to CEN/TS 1992-4, HDA-P and HDA-T

HDA-P			**M10**	**M12**	**M16**	**M20**
Steel failure without lever arm						
Characteristic resistance	$V_{Rk,s}$	[kN]	**22**	**30**	**62**	**92**
Factor for non-ductile steel	k_2		1,0			
Partial safety factor	γ_{Ms} (1)		1,25			
Steel failure with lever arm						
Distance according to CEN/TS 1992-4-1, § 5.2.3.4	a_3	[mm]	8	10	13	15
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	**60**	**105**	**266**	**519**
Partial safety factor	γ_{Ms} (1)		1,25			

HDA-T			**M10**		**M12**			**M16**					**M20**			
Steel failure without lever arm																
Characteristic resistance	for t_{fix}	[mm]	10 ≤ < 15	15 ≤ ≤ 20	10 ≤ < 15	15 ≤ < 20	20 ≤ ≤ 50	15 ≤ < 20	20 ≤ < 25	25 ≤ < 30	30 ≤ < 35	35 ≤ ≤ 60	20 ≤ < 25	25 ≤ < 40	40 ≤ < 55	55 ≤ ≤100
	$V_{Rk,s}$	[kN]	**65** (2)	**70**	**80** (2)	**80**	**100**	**140** (2)	**140**	**155**	**170**	**190**	**205** (2)	**205**	**235**	**250**
Factor for non-ductile steel	k_2		1,0													
Partial safety factor	γ_{Ms} (1)		1,5													
Steel failure with lever arm																
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	**60**		**105**			**266**					**519**			
Partial safety factor	γ_{Ms} (1)		1,25													

HDA-P / HDA-T			**M10**	**M12**	**M16**	**M20**
Concrete pryout failure						
Factor in equation (16) according to CEN/TS 1992-4-4, §6.2.2.3.	k_3		2,0			
Partial safety factor	γ_{Mcp} (1)		1,5 (3)			
Concrete edge failure						
Effective length of anchor in shear loading	l_f	[mm]	70	88	90	120
External diameter of anchor	d_{nom}	[mm]	19	21	29	35
Partial safety factor	γ_{Mc} (1)		1,5 (3)			

(1) In absence of national regulations.

(2) Only with use of centring washer, t_{fix} = thickness of the base plate without thickness of the centring washer, see Annex B8.

(3) Partial safety factor γ_2 = 1.0 is included.

ANNEX C9
Design method A (CEN/TS 1992-4) - shear loads
HDA-PR and HDA-TR

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 11d: Characteristic values of resistance under shear loads in case of static and quasi-static loading for design method A according to CEN/TS 1992-4, HDA-PR and HDA-TR

HDA-PR		**M10**	**M12**	**M16**
Steel failure without lever arm				
Characteristic resistance	$V_{Rk,s}$ [kN]	**23**	**34**	**63**
Factor for non-ductile steel	k_2	1,0		
Partial safety factor	γ_{Ms} (1)	1,33		
Steel failure with lever arm				
Distance according to CEN/TS 1992-4-1, § 5.2.3.4	a_3 [mm]	8	10	13
Characteristic resistance	$M^0_{Rk,s}$ [Nm]	**60**	**105**	**266**
Partial safety factor	γ_{Ms} (1)	1,33		

HDA-TR		**M10**		**M12**			**M16**			
Steel failure without lever arm										
Characteristic resistance	for t_{fix} [mm]	10 ≤ < 15	15 ≤ ≤ 20	10 ≤ < 15	15 ≤ < 20	20 ≤ < 30	30 ≤ ≤ 50	15 ≤ < 20	20 ≤ < 25	25 ≤ < 35	35≤ ≤ 60
	$V_{Rk,s}$ [kN]	**71** (2)	**71**	**87** (2)	**87**	**94**	**109**	**152** (2)	**152**	**158**	**170**
Factor for non-ductile steel	k_2	1,0									
Partial safety factor	γ_{Ms} (1)	1,33									
Steel failure with lever arm										
Characteristic resistance	$M^0_{Rk,s}$ [Nm]	**60**		**105**			**266**			
Partial safety factor	γ_{Ms} (1)	1,33								

HDA-PR / HDA-TR		**M10**	**M12**	**M16**
Concrete pryout failure				
Factor in equation (16) according to CEN/TS 1992-4-4, §6.2.2.3.		2,0		
Partial safety factor	γ_{Mcp} (1)	1,5 (3)		
Concrete edge failure				
Effective length of anchor in shear loading	l_f [mm]	70	88	90
External diameter of anchor	d_{nom} [mm]	19	21	29
Partial safety factor	γ_{Mc} (1)	1,5 (3)		

(1) In absence of national regulations.

(2) Only with use of centring washer, t_{fix} = thickness of the base plate without thickness of the centring washer, see Annex B8.

(3) Partial safety factor γ_2 = 1.0 is included.

ANNEX C10
Displacements - shear loads
HDA-P, HDA-PR, HDA-T and HDA-TR

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 12a: Displacements under shear loads in case of static and quasi-static loading HDA-P and HDA-T

HDA-P			**M10**	**M12**	**M16**	**M20**
Shear load in C20/25 to C50/60 cracked and non-cracked concrete		[kN]	11,4	17,1	35,9	51
Displacement	δ_{V0}	[mm]	2,8	2,5	4,1	5,0
	$\delta_{V\infty}$	[mm]	4,1	3,8	6,2	7,5
HDA-T			**M10**	**M12**	**M16**	**M20**
Shear load in C20/25 to C50/60 cracked and non-cracked concrete		[kN]	33,3	42,8	95,2	119
Displacement	δ_{V0}	[mm]	6,2	6,9	10,1	12,0
	$\delta_{V\infty}$	[mm]	9,3	10,3	15,1	18,0

(1) Calculation of displacement under service load: V_{sd} design value of shear stress
Displacement under short term loading = $\delta_{V0} \bullet V_{sd}/1.4$;
Displacement under long term loading = $\delta_{V\infty} \bullet V_{sd}/1.4$

Table 12b: Displacements under shear loads in case of static and quasi-static loading HDA-PR and HDA-TR

HDA-PR			**M10**	**M12**	**M16**
Shear load in C20/25 to C50/60 cracked and non-cracked concrete		[kN]	13,3	19,3	35,9
Displacement	δ_{V0}	[mm]	4,2	3,0	6,9
	$\delta_{V\infty}$	[mm]	6,3	4,5	10,4
HDA-TR			**M10**	**M12**	**M16**
Shear load in C20/25 to C50/60 cracked and non-cracked concrete		[kN]	41,7	46,9	73,7
Displacement	δ_{V0}	[mm]	4,2	3,0	6,9
	$\delta_{V\infty}$	[mm]	6,3	4,5	10,4

(1) Calculation of displacement under service load: V_{sd} design value of shear stress Displacement under short term loading = $\delta_{V0} \bullet V_{sd}/1.4$;
Displacement under long term loading = $\delta_{V\infty} \bullet V_{sd}/1.4$

ANNEX C11
Design - Seismic Category C1 (EOTA TR045) - tension loads
HDA-P and HDA-T

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 13a: Characteristic values of resistance under tension loads in case of seismic performance category C1 for design according to EOTA TR045, HDA-P and HDA-T

HDA-PR / HDA-TR			**M10**	**M12**	**M16**	**M20**
Steel failure						
Characteristic resistance	$N_{Rk,s,seis}$	[kN]	**46**	**67**	**126**	**192**
Partial safety factor	$\gamma_{Ms,seis}$ (1)		1,5			
Pull-out failure						
Characteristic resistance in cracked concrete only C20/25	$N_{Rk,p,seis}$	[kN]	$N_{Rk,c}$			
Partial safety factor	$\gamma_{Mp,seis}$ (1)		1,5 (2)			
Concrete cone failure (3)						
Partial safety factor	$\gamma_{Mc,seis}$ (1)		1,5 (2)			
Splitting failure (3)						
Partial safety factor	$\gamma_{MSp,seis}$ (1)		1,5 (2)			

(1) In absence of other national regulations.

(2) The partial safety factor γ_2 = 1.0 is included.

(3) For concrete cone failure and splitting failure, see Annex C20.

Table 14a: Displacements under tension loads in case of seismic performance category C1 (1), HDA-P and HDA-T

HDA-P / HDA-T			**M10**	**M12**	**M16**	**M20**
Displacement	$\delta_{N,seis}$	[mm]	**3,1**	**1,3**	**1,9**	**2,0**

(1) Maximum displacement during cycling (seismic event)

The definition of seismic performance category C1 is given in Annex C19.

ANNEX C12
Design - Seismic Category C1 (EOTA TR045) - tension loads
HDA-PR and HDA-TR

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 13b: Characteristic values of resistance under tension loads in case of seismic performance category C1 for design according to EOTA TR045, HDA-PR and HDA-TR

HDA-PR / HDA-TR			**M10**	**M12**	**M16**
Steel failure					
Characteristic resistance	$N_{Rk,s,seis}$	[kN]	**46**	**67**	**126**
Partial safety factor	$\gamma_{Ms,seis}$ (1)		1,6		
Pull-out failure					
Characteristic resistance in cracked concrete only C20/25	$N_{Rk,p,seis}$	[kN]	$N_{Rk,c}$		
Partial safety factor	$\gamma_{Mp,seis}$ (1)		1,5 (2)		
Concrete cone failure (3)					
Partial safety factor	$\gamma_{Mc,seis}$ (1)		1,5 (2)		
Splitting failure (3)					
Partial safety factor	$\gamma_{MSp,seis}$ (1)		1,5 (2)		

(1) In absence of other national regulations.
(2) The partial safety factor γ_2 = 1.0 is included.
(3) For concrete cone failure and splitting failure, see Annex C20.

Table 14b: Displacements under tension loads in case of seismic performance category C1 (1), HDA-PR and HDA-TR

HDA-PR / HDA-TR			**M10**	**M12**	**M16**
Displacement	$\delta_{N,seis}$	[mm]	**3,1**	**1,3**	**1,9**

(1) Maximum displacement during cycling (seismic event)

The definition of seismic performance category C1 is given in Annex C19.

ANNEX C13
Design - Seismic Category C1 (EOTA TR045) - shear loads
HDA-P and HDA-T

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 15a: Characteristic values of resistance under shear loads in case of seismic performance category C1 for design according to EOTA TR045, HDA-P and HDA-T

HDA-P			**M10**		**M12**			**M16**					**M20**			
Steel failure																
Characteristic resistance	$V_{Rk,s,seis}$	[kN]	**22**		**30**			**62**					**92**			
Partial safety factor	$\gamma_{Ms,seis}$ (1)		1,25													
HDA-T			**M10**		**M12**			**M16**					**M20**			
Steel failure																
Characteristic resistance	for t_{fix}	[mm]	10 ≤ < 15	15 ≤ ≤ 20	10 ≤ < 15	15 ≤ < 20	20 ≤ ≤ 50	15 ≤ < 20	20 ≤ < 25	25 ≤ < 30	30 ≤ < 35	35 ≤ ≤ 60	20 ≤ < 25	25 ≤ < 40	40 ≤ < 55	55 ≤ ≤100
	$V_{Rk,s,seis}$	[kN]	**65** (2)	**70**	**80** (2)	**80**	**100**	**140** (2)	**140**	**155**	**170**	**190**	**205** (2)	**205**	**235**	**250**
Partial safety factor	$\gamma_{Ms,seis}$ (1)		1,5													
HDA-P / HDA-T			**M10**		**M12**			**M16**					**M20**			
Concrete pryout failure (4)																
Partial safety factor	$\gamma_{Mcp,seis}$ (1)		1,5 (3)													
Concrete edge failure (4)																
Partial safety factor	$\gamma_{Mc,seis}$ (1)		1,5 (3)													

(1) In absence of other national regulations.

(2) only with use of centring washer, t_{fix} = thickness of the base plate without thickness of the centring washer, see Annex B8.

(3) The partial safety factor γ_2 = 1.0 is included.

(4) For concrete pry-out failure and concrete edge failure see Annex C20.

Table 16a: Displacements under shear loads in case of seismic performance category C1[1)], HDA-P and HDA-T

HDA-P / HDA-T			**M10**	**M12**	**M16**	**M20**
Displacement HDA-P	$\delta_{N,seis}$	[mm]	**3,0**	**2,6**	**4,2**	**4,8**
Displacement HDA-T	$\delta_{N,seis}$	[mm]	**3,0**	**2,6**	**4,2**	**4,8**

(1) Maximum displacement during cycling (seismic event)

The definition of seismic performance category C1 is given in Annex C19.

ANNEX C14
Design - Seismic Category C1 (EOTA TR045) - shear loads
HDA-PR and HDA-TR

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 15b: Characteristic values of resistance under shear loads in case of seismic performance category C1 for design according to EOTA TR045, HDA-PR and HDA-TR

HDA-PR		**M10**		**M12**				**M16**			
Steel failure											
Characteristic resistance	$V_{Rk,s,seis}$ [kN]	**23**		**34**				**63**			
Partial safety factor	$\gamma_{Ms,seis}$ (1)	1,33									
HDA-TR		**M10**		**M12**				**M16**			
Steel failure											
Characteristic resistance	for t_{fix} [mm]	10 ≤ < 15	15 ≤ ≤ 20	10 ≤ < 15	15 ≤ < 20	20 ≤ < 30	30 ≤ ≤ 50	15 ≤ < 20	20 ≤ < 25	25 ≤ < 35	35 ≤ ≤ 60
	$V_{Rk,s,seis}$ [kN]	**71** (2)	**71**	**87** (2)	**87**	**94**	**109**	**152** (2)	**152**	**158**	**170**
Partial safety factor	$\gamma_{Ms,seis}$ (1)	1,33									
HDA-PR / HDA-TR		**M10**		**M12**				**M16**			
Concrete pryout failure (4)											
Partial safety factor	$\gamma_{Mcp,seis}$ (1)	1,5 (3)									
Concrete edge failure (4)											
Partial safety factor	$\gamma_{Mc,seis}$ (1)	1,5 (3)									

(1) In absence of other national regulations.

(2) only with use of centring washer, t_{fix} = thickness of the base plate without thickness of the centring washer, see Annex B8.

(3) The partial safety factor γ_2 = 1.0 is included.

(4) For concrete pry-out failure and concrete edge failure see Annex C20.

Table 16b: Displacements under shear loads in case of seismic performance category C1[1)], HDA-PR and HDA-TR

HDA-PR / HDA-TR		**M10**	**M12**	**M16**
Displacement HDA-PR	$\delta_{N,seis}$ [mm]	**3,0**	**2,6**	**4,2**
Displacement HDA-TR	$\delta_{N,seis}$ [mm]	**3,0**	**2,6**	**4,2**

(1) Maximum displacement during cycling (seismic event)

The definition of seismic performance category C1 is given in Annex C19.

ANNEX C15
Design - Seismic Category C2 (EOTA TR045) - tension loads
HDA-P and HDA-T

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 17a: Characteristic values of resistance under tension loads in case of seismic performance category C2 for design according to EOTA TR045, HDA-P and HDA-T

HDA-P / HDA-T			**M10**	**M12**	**M16**	**M20**
Steel failure						
Characteristic resistance	$N_{Rk,s,seis}$	[kN]	**46**	**67**	**126**	**192**
Partial safety factor	$\gamma_{Ms,seis}$ (1)		1,5			
Pull-out failure						
Characteristic resistance in cracked concrete only C20/25	$N_{Rk,s,seis}$	[kN]	**25**	**35**	**75**	**95**
Partial safety factor	$\gamma_{Mp,seis}$ (1)		1,5 (2)			
Concrete cone failure (3)						
Partial safety factor	$\gamma_{Mc,seis}$ (1)		1,5 (2)			
Splitting failure (3)						
Partial safety factor	$\gamma_{MSp,seis}$ (1)		1,5 (2)			

(1) In absence of other national regulations.

(2) The partial safety factor γ_2 = 1.0 is included.

(3) For concrete cone failure and splitting failure, see Annex C20.

Table 18a: Displacements under tension loads in case of seismic performance category C2, HDA-P and HDA-T

HDA-P / HDA-T			**M10**	**M12**	**M16**	**M20**
Displacement DLS	$\delta_{N,seis(DLS)}$	[mm]	**4,6**	**3,2**	**3,3**	**1,7**
Displacement ULS	$\delta_{N,seis(ULS)}$	[mm]	**11,4**	**8,3**	**8,1**	**6,7**

The definition of seismic performance category C2 is given in Annex C19.

ANNEX C16
Design - Seismic Category C2 (EOTA TR045) - tension loads
HDA-PR and HDA-TR

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 17b: Characteristic values of resistance under tension loads in case of seismic performance category C2 for design according to EOTA TR045, HDA-PR and HDA-TR

HDA-PR / HDA-TR			**M10**	**M12**	**M16**
Steel failure					
Characteristic resistance	$N_{Rk,s,seis}$	[kN]	**46**	**67**	**126**
Partial safety factor	$\gamma_{Ms,seis}$ (1)		1,5		
Pull-out failure					
Characteristic resistance in cracked concrete only C20/25	$N_{Rk,s,seis}$	[kN]	**25**	**35**	**75**
Partial safety factor	$\gamma_{Mp,seis}$ (1)		1,5 (2)		
Concrete cone failure (3)					
Partial safety factor	$\gamma_{Mc,seis}$ (1)		1,5 (2)		
Splitting failure (3)					
Partial safety factor	$\gamma_{MSp,seis}$ (1)		1,5 (2)		

(1) In absence of other national regulations.

(2) The partial safety factor γ_2 = 1.0 is included.

(3) For concrete cone failure and splitting failure see Annex C20.

Table 18b: Displacements under tension loads in case of seismic performance category C2, HDA-PR and HDA-TR

HDA-PR / HDA-TR			**M10**	**M12**	**M16**
Displacement DLS	$\delta_{N,seis(DLS)}$	[mm]	**4,6**	**3,2**	**3,3**
Displacement ULS	$\delta_{N,seis(ULS)}$	[mm]	**11,4**	**8,3**	**8,1**

The definition of seismic performance category C2 is given in Annex C19.

ANNEX C17
Design - Seismic Category C2 (EOTA TR045) - shear loads
HDA-P and HDA-T

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 19a: Characteristic values of resistance under shear loads in case of seismic performance category C2 for design according to EOTA TR045, HDA-P and HDA-T

HDA-P			**M10**		**M12**			**M16**					**M20**			
Steel failure																
Characteristic resistance	$V_{Rk,s,seis}$	[kN]	**20**		**24**			**56**					**83**			
Partial safety factor	$\gamma_{Ms,seis}$ (1)		1,25													
HDA-T			**M10**		**M12**			**M16**					**M20**			
Steel failure																
Characteristic resistance	for t_{fix}	[mm]	10 ≤	15 ≤	10 ≤	15 ≤	20 ≤	15 ≤	20 ≤	25 ≤	30 ≤	35 ≤	20 ≤	25 ≤	40 ≤	55 ≤
			< 15	≤ 20	< 15	< 20	≤ 50	< 20	< 25	< 30	< 35	≤ 60	< 25	< 40	< 55	≤100
	$V_{Rk,s,seis}$	[kN]	**39** (2)	**42**	**56** (2)	**56**	**70**	**84** (2)	**84**	**93**	**102**	**114**	**144** (2)	**144**	**165**	**175**
Partial safety factor	$\gamma_{Ms,seis}$ (1)		1,5													
HDA-P / HDA-T			**M10**		**M12**			**M16**					**M20**			
Concrete pryout failure (4)																
Partial safety factor	$\gamma_{Mcp,seis}$ (1)		1,5 (3)													
Concrete edge failure (4)																
Partial safety factor	$\gamma_{Mc,seis}$ (1)		1,5 (3)													

(1) In absence of other national regulations.

(2) Only with use of centring washer, t_{fix} = thickness of the base plate without thickness of the centring washer, see Annex B8.

(3) The partial safety factor γ_2 = 1.0 is included.

(4) For concrete pry-out failure and concrete edge failure see Annex C20.

Table 20a: Displacements under shear loads in case of seismic performance category C2, HDA-P and HDA-T

HDA-P / HDA-T			**M10**	**M12**	**M16**	**M20**
Displacement DLS HDA-P	$\delta_{V,seis(DLS)}$	[mm]	**1,8**	**2,0**	**3,0**	**3,7**
Displacement ULS HDA-P	$\delta_{V,seis(ULS)}$	[mm]	**3,7**	**4,2**	**6,5**	**7,9**
Displacement DLS HDA-T	$\delta_{V,seis(DLS)}$	[mm]	**2,0**	**2,3**	**3,1**	**3,8**
Displacement ULS HDA-T	$\delta_{V,seis(ULS)}$	[mm]	**4,4**	**6,0**	**9,8**	**16,3**

The definition of seismic performance category C2 is given in Annex C19.

ANNEX C18
Design - Seismic Category C2 (EOTA TR045) - shear loads
HDA-PR and HDA-TR

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 19b: Characteristic values of resistance under shear loads in case of seismic performance category C2 for design according to EOTA TR045, HDA-PR and HDA-TR

HDA-PR			**M10**		**M12**			**M16**			
Steel failure											
Characteristic resistance	$V_{Rk,s,seis}$	[kN]	**21**		**27**			**57**			
Partial safety factor	$\gamma_{Ms,seis}$ (1)		1,33								
HDA-TR			**M10**		**M12**			**M16**			
Steel failure											
Characteristic resistance	for t_{fix}	[mm]	10 ≤ < 15	15 ≤ ≤ 20	10 ≤ < 15	15 ≤ < 20	20 ≤ < 30	30 ≤ ≤ 50	15 ≤ < 20	20 ≤ < 25	25 ≤ < 35	35≤ ≤ 60
	$V_{Rk,s,seis}$	[kN]	**43** (2)	**43**	**61** (2)	**61**	**66**	**76**	**91** (2)	**91**	**95**	**102**
Partial safety factor	$\gamma_{Ms,seis}$ (1)		1,33									
HDA-PR / HDA-TR			**M10**		**M12**			**M16**			
Concrete pryout failure (4)											
Partial safety factor	$\gamma_{Mcp,seis}$ (1)		1,5 (3)								
Concrete edge failure (4)											
Partial safety factor	$\gamma_{Mc,seis}$ (1)		1,5 (3)								

(1) In absence of other national regulations.

(2) Only with use of centring washer, t_{fix} = thickness of the base plate without thickness of the centring washer, see Annex B8.

(3) The partial safety factor γ_2 = 1.0 is included.

(4) For concrete pry-out failure and concrete edge failure see Annex C20.

Table 20b: Displacements under shear loads in case of seismic performance category C2, HDA-PR and HDA-TR

HDA-PR / HDA-TR			**M10**	**M12**	**M16**
Displacement DLS HDA-PR	$\delta_{V,seis(DLS)}$	[mm]	**1,8**	**2,0**	**3,0**
Displacement ULS HDA-PR	$\delta_{V,seis(ULS)}$	[mm]	**3,7**	**4,2**	**6,5**
Displacement DLS HDA-TR	$\delta_{V,seis(DLS)}$	[mm]	**2,0**	**2,3**	**3,1**
Displacement ULS HDA-TR	$\delta_{V,seis(ULS)}$	[mm]	**4,4**	**6,0**	**9,8**

The definition of seismic performance category C2 is given in Annex C19.

ANNEX C19
Recommended seismic performance categories for anchors
HDA-P, HDA-PR, HDA-T and HDA-TR

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 21: Recommended seismic performance categories for anchors (1)

Seismicity level [a]		**Importance Class according to EN 1998-1:2004, 4.2.5**			
Class	$a_g \cdot S$ [c]	**I**	**II**	**III**	**IV**
Very low [b]	$a_g \cdot S \leq 0{,}05\ g$	No additional requirement			
Low [b]	$0{,}05\ g < a_g \cdot S \leq 0{,}1\ g$	C1	C1 [d] or C2 [e]		C2
> Low	$a_g \cdot S \leq 0{,}1\ g$	C1	C2		

[a] The values defining the seismicity levels may be found in the National Annex of EN 1988-1.
[b] Definition according to EN 1998-1, 3.2.1.
[c] a_g = Design ground acceleration on Type A ground (EN 1998-1, 3.2.1),
S = Soil factor (See e.g. EN 1998-1, 3.2.2).
[d] C1 for attachments of non-structural elements
[e] C2 for connections between structural elements of primary and/or secondary seismic members

(1) The seismic performance of anchors subjected to seismic loading is categorized by performance categories C1 and C2. The assessment is carried out according to UKAD 330232-00-0601.

Table 21 relates the seismic performance categories C1 and C2 to the seismicity level and building importance class. The level of seismicity is defined as a function of the product $a_g \cdot S$, where a_g is the design ground acceleration on Type A ground and S the soil factor, both in accordance with EN 1998-1: 2004.

The value of a_g or that of the product $a_g \cdot S$ used in The UK to define thresholds for the seismicity classes may be found in its National Annex of EN 1998-1 and may be different to the values given in Table 18. Furthermore, the assignment of the seismic performance categories C1 and C2 to the seismicity level and building importance classes is in the responsibility of The UK BSI.

ANNEX C20
Reduction factors and characteristic seismic performance
HDA-P, HDA-PR, HDA-T and HDA-TR

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 22: Reduction factor α_{seis}

Loading	Failure mode	Single anchor (1)	Anchor group
Tension	Steel failure	1,0	1,0
	Pull-out failure	1,0	0,85
	Concrete cone failure	1,0	0,85
	Splitting failure	1,0	0,85
Shear	Steel failure	1,0	0,85
	Concrete edge failure	1,0	0,85
	Concrete pry-out failure	1,0	0,85

(1) In case of tension loading, single anchor also addresses situations where only one anchor in a group of anchors is subjected to tension.

For every failure mode the characteristic seismic resistance $R_{k,seis}$ of a fastening shall be determined as follows:

$$R_{k,seis} = \alpha_{gap} \cdot \alpha_{seis} \cdot R^{0}_{k,seis}$$

where:

α_{gap} Reduction factor to take into account inertia effects due to an annular gap between anchor and fixture in case of shear loading;

= 1,0 in case of no hole clearance between anchor and fixture;
= 0,5 in case of connections with standard hole clearance according UKAD 330232-00-0601 Annex C, Table 4.1

α_{seis} Reduction factor to take into account the influence of large cracks and scatter of load displacement curves, see Table 22;

$R^{0}_{k,seis}$ Basic characteristic seismic resistance for a given failure mode:
For steel and pull-out failure under tension load and steel failure under shear load $R^{0}_{k,seis}$ (i.e. $N_{Rk,s,seis}$, $N_{Rk,p,seis}$, $V_{Rk,s,seis}$) shall be taken from Annexes C11, C12, C13 and C14 (in case of seismic performance category C1) and from Annexes C15, C16, C17 and C18 (in case of seismic performance category C2).
For all other failure modes $R^{0}_{k,seis}$
shall be determined as for the design situation for static and quasi-static loading according to UKAD 330232-00-0601, Annex C or CEN/TS 1992-4
(i.e. $N_{Rk,c}$, $N_{Rk,sp}$, $V_{Rk,c}$, $V_{Rk,cp}$).

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