Deutsches Institut für Bautechnik

Zulassungsstelle für Bauprodukte und Bauarten

Bautechnisches Prüfamt

Eine vom Bund und den Ländern gemeinsam getragene Anstalt des öffentlichen Rechts

Kolonnenstraße 30 B
D-10829 Berlin
Tel.: +49 30 78730-0
Fax: +49 30 78730-320
E-Mail: dibt@dibt.de
www.dibt.de

Authorised and notified according to Article 10 of the Council Directive of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products (89/106/EEC)

Deutsches Institut für Bautechnik

DIBt

Mitglied der EOTA
Member of EOTA

European Technical Approval ETA-08/0307

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung *Trade name*		Hilti Betonschraube HUS *Hilti screw anchor HUS*
Zulassungsinhaber *Holder of approval*		Hilti Aktiengesellschaft 9494 SCHAAN FÜRSTENTUM LIECHTENSTEIN
Zulassungsgegenstand und Verwendungszweck *Generic type and use of construction product*		Betonschraube aus galvanisch verzinktem und nichtrostendem Stahl in den Größen 6, 8, 10 und 14 zur Verankerung im Beton *Concrete screw made of galvanizes and stainless steel of sizes 6, 8, 10 and 14 for use in concrete*
Geltungsdauer: *Validity:*	vom *from* bis *to*	4 June 2013 4 June 2018
Herstellwerk *Manufacturing plant*		Hilti Werke

Diese Zulassung umfasst *This Approval contains*	24 Seiten einschließlich 16 Anhänge *24 pages including 16 annexes*
Diese Zulassung ersetzt *This Approval replaces*	ETA-08/0307 mit Geltungsdauer vom 21.01.2011 bis 12.12.2013 *ETA-08/0307 with validity from 21.01.2011 to 12.12.2013*

I LEGAL BASES AND GENERAL CONDITIONS

1 This European technical approval is issued by Deutsches Institut für Bautechnik 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 Council Directive 93/68/EEC[2] and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council[3];
- *Gesetz über das In-Verkehr-Bringen von und den freien Warenverkehr mit Bauprodukten zur Umsetzung der Richtlinie 89/106/EWG des Rates vom 21. Dezember 1988 zur Angleichung der Rechts- und Verwaltungsvorschriften der Mitgliedstaaten über Bauprodukte und anderer Rechtsakte der Europäischen Gemeinschaften (Bauproduktengesetz - BauPG) vom 28. April 1998[4], as amended by Article 2 of the law of 8 November 2011[5];*
- Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC[6];
- Guideline for European technical approval of "Metal anchors for use in concrete - Part 3: Undercut anchors", ETAG 001-03.

2 Deutsches Institut für Bautechnik is authorized to check whether the provisions of this European technical approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to 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 manufacturers 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 Deutsches Institut für Bautechnik, in particular pursuant to information by the Commission according to Article 5(1) of 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 Deutsches Institut für Bautechnik. 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 fully to the version circulated within EOTA. Translations into other languages have to be designated as such.

1 Official Journal of the European Communities L 40, 11 February 1989, p. 12
2 Official Journal of the European Communities L 220, 30 August 1993, p. 1
3 Official Journal of the European Union L 284, 31 October 2003, p. 25
4 *Bundesgesetzblatt Teil I 1998*, p. 812
5 *Bundesgesetzblatt Teil I 2011*, p. 2178
6 Official Journal of the European Communities L 17, 20 January 1994, p. 34

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of product and intended use

1.1 Definition of the construction product

The Hilti screw anchor HUS is made of galvanised steel (HUS-A; -H; -I; -P) of sizes 6, 8 and 10 or made of stainless steel (HUS-HR) of sizes 6, 8, 10 and 14. The anchor is screwed into a predrilled cylindrical drill hole. The special thread of the anchor cuts an internal thread into the member while setting. The anchorage is characterised by mechanical interlock in the special thread.

An illustration of the product and intended use is given in Annexes 1 and 2.

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 cause risk to human life and/or lead to considerable economic consequences.

The anchor is to be used for anchorages subject to static, quasi-static or seismic action (seismic performance category C1 only for anchor sizes specified for in Annex 3) or for anchorages with requirements related to resistance to fire. It may be used in reinforced or unreinforced normal weight concrete of strength classes C20/25 at minimum and C50/60 at most according to EN 206:2000-12. It may be anchored in cracked and non-cracked concrete.

The Hilti screw anchor HUS-A, -H, -I, -P made of galvanised carbon steel and HUS-HR made of stainless steel may be used for anchorages with requirements related to resistance to fire.

Hilti screw anchor HUS-A, -H, -I, -P made of galvanised steel:

The anchor made of galvanised steel may only be used in structures subject to dry internal conditions.

Hilti screw anchor HUS-HR made of stainless steel A4:

The anchor made of stainless steel A4 may be used in structures subject to dry internal conditions and also in structures 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 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 the product and methods of verification

2.1 Characteristics of the product

The anchor corresponds to the drawings and information given in the Annexes. The characteristic values, dimensions and tolerances of the anchor not indicated in the Annexes shall correspond to the respective values laid down in the technical documentation[7] of this European technical approval.

Regarding the requirements concerning safety in case of fire it is assumed that the anchor meets the requirements of class A1 in relation to reaction to fire in accordance with the stipulations of the Commission decision 96/603/EC, amended by 200/605/EC.

The characteristic values for the design of the anchorages are given in the Annexes.

Each anchor shall be marked with the identifying mark of the producer, the anchor type, the diameter and the length of the anchor according to Annex 1 and 2. Each anchor HUS-A 6 for h_{nom} = 55 mm is marked with a circle mark according to Annex 1. Each anchor HUS-I 6 for h_{nom} = 55 mm is marked with two circle marks according to Annex 1.

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 3 "Undercut anchors", on the basis of Option 1 and ETAG 001 Annex E "Assessment of Metal Anchors under Seismic Action".

The assessment of the anchor for the intended use in relation to the requirements for resistance to fire has been made in accordance with the Technical Report TR 020 "Evaluation of anchorages in concrete concerning resistance to fire".

In addition to the specific clauses relating to dangerous substances contained in this European technical approval, there may be other requirements applicable to the products falling within its scope (e.g. transposed European 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.

[7] The technical documentation of this European technical approval is deposited at the Deutsches Institut für Bautechnik 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.

3 Evaluation and attestation of conformity and CE marking

3.1 System of attestation of conformity

According to the decision 96/582/EG of the European Commission[8] the system 2(i) (referred to as system 1) of attestation of conformity applies.

This system of attestation of conformity is defined as follows:

System 1: Certification of the conformity of the product by an approved certification body on the basis of:

(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 control 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.

Note: Approved bodies are also referred to as "notified bodies".

3.2 Responsibilities

3.2.1 Tasks of the manufacturer

3.2.1.1 Factory production control

The manufacturer shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of results performed. This production control system shall insure that the product is in conformity with this European technical approval.

The manufacturer may only use initial / raw / constituent materials stated in the technical documentation of this European technical approval.

The factory production control shall be in accordance with the control plan which is part of the technical documentation of this European technical approval. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited at Deutsches Institut für Bautechnik.[9]

The results of factory production control shall be recorded and evaluated in accordance with the provisions of the control plan.

3.2.1.2 Other tasks of manufacturer

The manufacturer shall, on the basis of a contract, involve a body which is approved for the tasks referred to in section 3.1 in the field of anchors in order to undertake the actions laid down in section 3.2.2. For this purpose, the control plan referred to in sections 3.2.1.1 and 3.2.2 shall be handed over by the manufacturer to the approved body involved.

The manufacturer shall make a declaration of conformity, stating that the construction product is in conformity with the provisions of this European technical approval.

[8] Official Journal of the European Communities L 254 of 08.10.1996.

[9] The control plan is a confidential part of the documentation of the European technical approval, but not published together with the European technical approval and only handed over to the approved body involved in the procedure of attestation of conformity.
See section 3.2.2.

3.2.2 Tasks of approved bodies

The approved body shall perform the

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

in accordance with the provisions laid down in the control plan.

The approved body shall retain the essential points of its actions referred to above and state the results obtained and conclusions drawn in a written report.

The approved certification body involved by the manufacturer shall issue an EC certificate of conformity of the factory production control stating the conformity with the factory production control of this European technical approval.

In cases where the provisions of the European technical approval and its control plan are no longer fulfilled the certification body shall withdraw the certificate of conformity and inform Deutsches Institut für Bautechnik without delay.

3.3 CE marking

The CE marking shall be affixed on each packaging of the anchor. The letters "CE" shall be followed by the identification number of the approved certification body, where relevant, and be accompanied by the following additional information:

- the name and address of the producer (legal entity responsible for the manufacturer),
- the last two digits of the year in which the CE marking was affixed,
- the number of the EC certificate of conformity for the product,
- the number of the European technical approval,
- the number of the guideline for European technical approval,
- use category (ETAG 001-1 Option 1, in addition: seismic performance category C1 where applicable),
- size.

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

4.1 Manufacturing

The European technical approval is issued for the product on the basis of agreed data/information, deposited with the Deutsches Institut für Bautechnik, which identifies the product that has been assessed and judged. Changes to the product or production process, which could result in this deposited data/information being incorrect, should be notified to the Deutsches Institut für Bautechnik before the changes are introduced. Deutsches Institut für Bautechnik will decide whether or not such changes affect the approval and consequently the validity of the CE marking on the basis of the approval and if so whether further assessment or alterations to the approval shall be necessary.

4.2 Design of anchorages

The fitness of the anchor 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 and Technical Report TR 045 "Design of metal Anchors under Seismic Action" under the responsibility of an engineer experienced in anchorages and concrete work.

Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored.

The position of the anchor is indicated on the design drawings (e.g. position of the anchor relative to reinforcement or to supports, in cracked or non-cracked concrete, etc.).

Anchorages shall be positioned outside of critical regions (e.g. plastic hinges) of the concrete structure. Fastenings in stand-off installation or with a grout layer under seismic action are not covered.

The design of anchorages under fire exposure has to consider the conditions given in the Technical Report TR 020 "Evaluation of anchorages in concrete concerning resistance to fire". The design method covers anchors with a fire attack from one side only. If the fire attack is from more than one side, the design method may be taken only, if the edge distance of the anchor is $c \geq 300$ mm.

Local spalling is possible at fire attack. To avoid any influence of the spalling on the anchorage, the concrete member must be designed according to prEN 1992-1-2. The members shall be made of concrete with quartzite additives and have to be protected from direct moisture; and the moisture content of the concrete has to be like in dry internal conditions respectively. The anchorage depth has to be increased for wet concrete by at least 30 mm compared to the given value in the approval.

4.3 Installation of anchors

The fitness for use of the anchor can only be assumed if the following conditions of installation are met:

- Anchor installation carried out by appropriately qualified personnel under the supervision of the person responsible for technical matters on site,
- Use of the anchor only as supplied by the manufacturer,
- Anchor installation in accordance with the manufacturer's specifications and drawings,
- Checks before placing the anchor, to ensure that the characteristic values of the base material in which the anchor is to be placed, is identical with the values, which the characteristic loads apply,
- Check of the concrete being well compacted, e.g. without significant voids,
- Edge distances and spacing not less than the specified values without minus tolerances,
- Placing 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 hole is filled with high strength mortar and if under shear or oblique tension load it is not the direction of the load application,
- Cleaning of the hole of drilling dust,

- Anchor installation such that the embedment depth of the anchor in the concrete is not smaller then the value h_{nom} given in the Annexes,
- The fixture is fully pressed on the concrete surface without intermediate layers,
- Further turning of the anchor is not possible,
- The head of the anchor is fully supported on the fixture and is not damaged.

5 Indications to the manufacturer

The manufacturer is responsible to ensure that the information on the specific conditions according to 1 and 2 including Annexes referred to 4.2 and 4.3 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 packaging and/or on an enclosed instruction sheet, preferably using illustrations.

The minimum data required are:

- Drill bit diameter,
- Size of the anchor,
- Maximum thickness of the fixture,
- Minimum embedment depth,
- Minimum hole depth,
- 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.

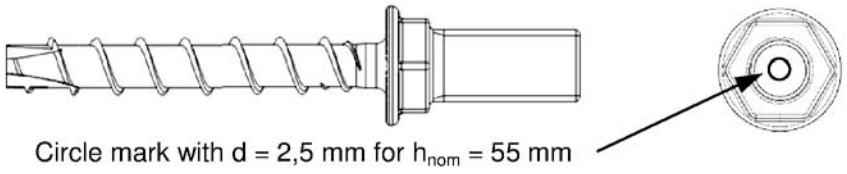
Andreas Kummerow
p. p. Head of Department

beglaubigt:
Lange

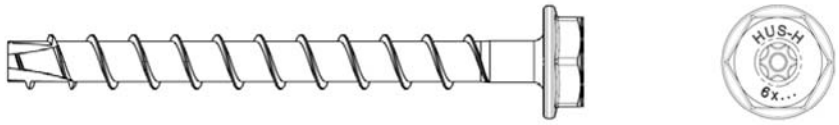
Deutsches Institut für Bautechnik DIBt

Hilti screw anchor HUS

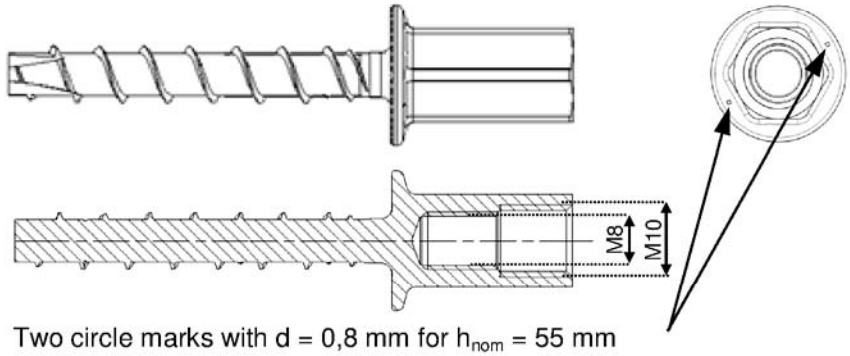
HUS-A 6
External thread
M8 or M10



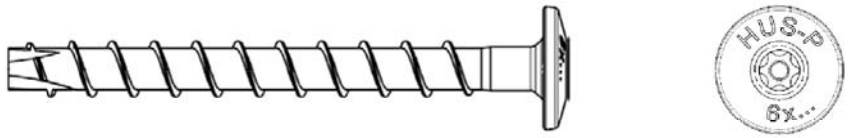
HUS-H 6
Hex head



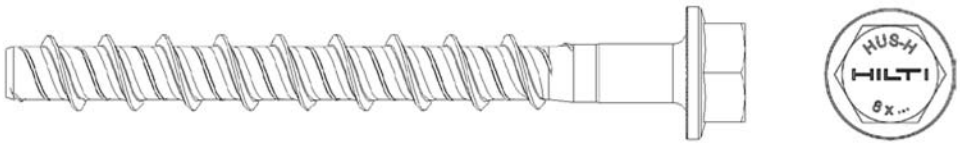
HUS-I 6
Internal threads
M8 and M10



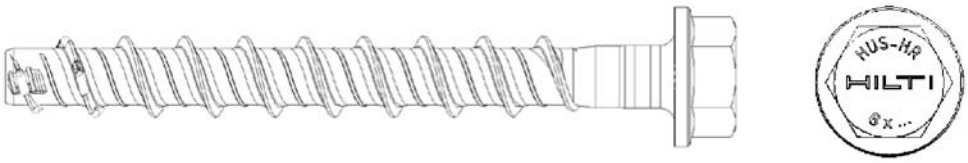
HUS-P 6
Pan head



HUS-H 8
HUS-H 10
Hex head



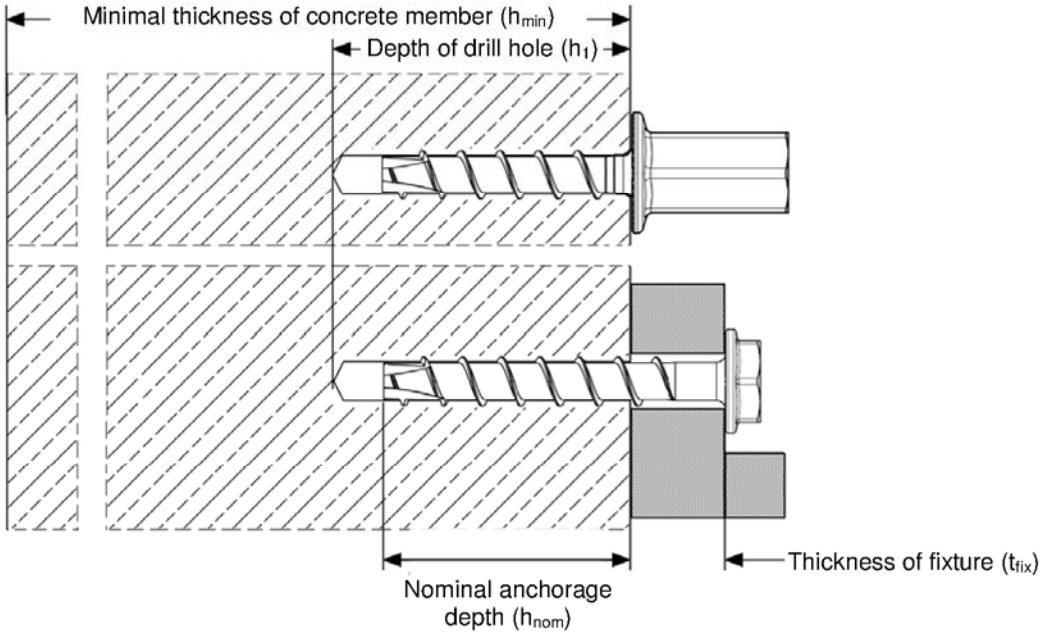
HUS-HR 6
HUS-HR 8
HUS-HR 10
HUS-HR 14
Hex head

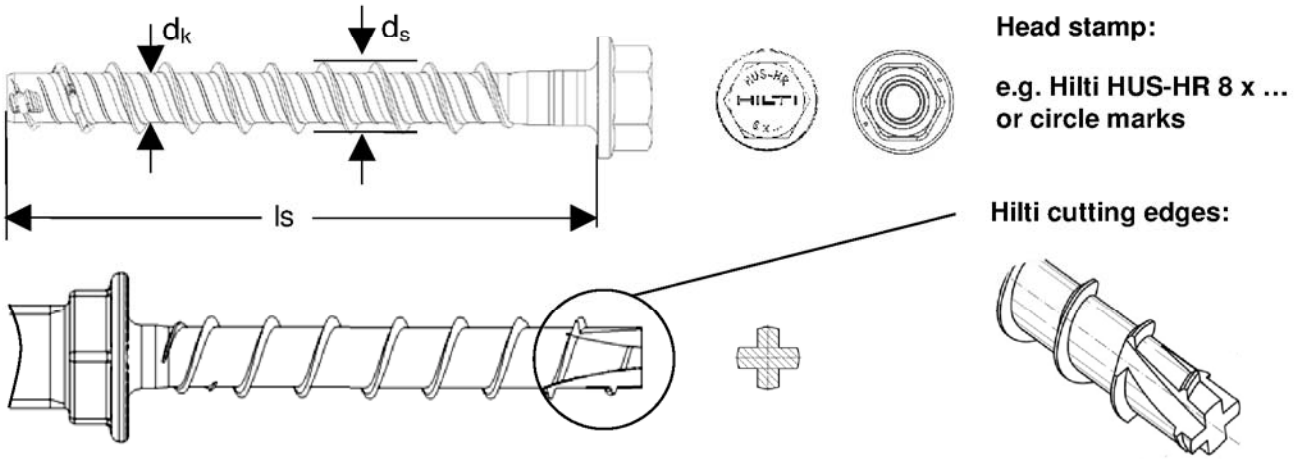


Hilti screw anchor HUS	Annex 1
Product	

Deutsches Institut für Bautechnik DIBt

Intended use





HILTI	…Manufacturer
Hilti cutting edges	…**H**ilti **U**niversal **S**crew anchor, anchor diameter/ drill bit diameter 6 mm
HUS	…**H**ilti **U**niversal **S**crew anchor } Type
e.g. „H“ resp. circle marks	…Head configuration (A, H, I, P) } Type
R	…Corrosion **R**esistance (stainless steel, grade A4)
8	…Nominal anchor diameter/ drill bit diameter (6…14)
…	…Nominal anchor length (ls)/ under head length

Hilti screw anchor HUS	**Annex 2**
Intended use	

Deutsches Institut für Bautechnik DIBt

Table 1: Use category

Nominal anchor diameter	Annex	6	8	10	14
Static and quasi static loading in cracked and non-cracked concrete	5-7	HUS-A HUS-H HUS-I HUS-P HUS-HR	HUS-H HUS-HR	HUS-H HUS-HR	HUS-HR
Fire resistance R30 – R120	13-14				
Seismic performance category C1	8-12	-			

Table 2: Materials

Part	Designation	Material
Screw anchor	HUS-A 6 HUS-H 6 HUS-I 6 HUS-P 6 HUS-H 8 HUS-H 10	Carbon Steel, galvanized (≥ 5 µm)
	HUS-HR 6 HUS-HR 8 HUS-HR 10 HUS-HR 14	Stainless Steel (A4 grade)

Table 3: Anchor dimensions

Nominal anchor diameter			6					8		10		14
Type		HUS-	A	H	I	P	HR	H	HR	H	HR	HR
Nominal length	l_S	[mm]	55	60..120	55	60..80	60..70	65..150	65..105	75..280	75..130	80..135
Outer diameter of thread	d_S	[mm]	7,85				7,6	10,1		12,3		16,6
Core diameter	d_k	[mm]	5,85				5,4	7,1		8,4		12,6

Hilti screw anchor	Annex 3
Use category, materials and anchor dimensions	

Deutsches Institut für Bautechnik DIBt

Table 4: Installation data

Nominal anchor diameter				6					8				10				14	
Type			HUS-	A	H	I	P	HR	H		HR		H		HR		HR	
Nominal anchorage depth	h_{nom}		[mm]	55					60	75	60	80	70	85	70	90	70	110
Nominal diameter of drill bit	d_0		[mm]	6					8				10				14	
Cutting diameter of drill bit	d_{cut}	≤	[mm]	6,4					8,45				10,45				14,50	
Clearance hole diameter	d_f		[mm]	9					12				14				18	
Wrench size	SW		[mm]	13	13	13	-	13	13				15				21	
TORX				-	T30	-	T30	-	-				-				-	
Installation torque	T_{inst}		[Nm]	25				- [1]	35	45	- [1]	- [1]	45	55	45		65	35
Setting tool				Impact screw driver,e.g. Hilti SIW 14-A or 22-A [2]					Impact screw driver, e.g. Hilti SIW 22T-A [2]									
Depth of drill hole in floor/ wall position	h_1	≥	[mm]	h_{nom}+10 mm					h_{nom}+10 mm				h_{nom}+10 mm				h_{nom}+10 mm	
Depth of drill hole in ceiling position	h_1	≥	[mm]	h_{nom}+3 mm														
Thickness of fixture	t_{fix}	≤	[mm]	-	65	-	25	15	90	75	45	25	210	195	60	40	65	25

[1] Hand setting in concrete base material not allowed (machine setting only)
[2] Hilti recommended electrical impact screw drivers are listed in the instruction for use included in the sales box.

Table 5: Minimum member thickness, spacing and edge distance

Nominal anchor diameter					6					8				10				14	
Type				HUS-	A	H	I	P	HR	H		HR		H		HR		HR	
Nominal anchorage depth		h_{nom}		[mm]	55					60	75	60	80	70	85	70	90	70	110
Minimum member thickness		h_{min}		[mm]	100					110	120	100	120	110	130	120	140	140	160
Cracked concrete	Minimum edge distance	c_{min}		[mm]	35					50		45	50	50		50		50	60
	Minimum spacing	s_{min}		[mm]						40									
Non-cracked concrete	Minimum edge distance	c_{min}		[mm]	35					55		45	50	65		50		50	60
	Minimum spacing	s_{min}		[mm]															

Hilti screw anchor HUS

Installation data, minimum member thickness, spacing and edge distance

Annex 4

Deutsches Institut für Bautechnik DIBt

Table 6: Characteristic tension resistance for static and quasi-static loading

Nominal anchor diameter			**6**			**8**				**10**				**14**	
Type		**HUS-**	**AHI**	**P**	**HR**	**H**		**HR**		**H**		**HR**		**HR**	
Nominal anchorage depth	h_{nom}	[mm]	**55**			**60**	**75**	**60**	**80**	**70**	**85**	**70**	**90**	**70**	**110**
Steel failure															
Characteristic resistance	$N_{Rk,s}$	[kN]	**25**		**24**	**37,1**		**34,0**		**55,4**		**52,6**		**102,2**	
Partial safety factor	γ_{Ms} [1]	[kN]	**1,5**		**1,4**	**1,4**				**1,4**				**1,4**	
Pull-out failure															
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	**6**		**5**	**6**	**9**	**6**	**12**	**7,5**	**16**	**9**	**16**	**12**	**25**
Characteristic resistance in non-cracked concrete C20/25	$N_{Rk,p}$	[kN]	**9**	**7,5**	**9**	**12**	**16**	**12**	**16**	**12**	**20**	**16**	**25**	**-** [4]	**-** [4]
Increasing factors for $N_{Rk,p}$ in cracked and non-cracked concrete	ψ_c	C30/37	1,22			1,22				1,17	1,22			1,22	
		C40/50	1,41			1,41				1,32	1,41			1,41	
		C50/60	1,55			1,55				1,42	1,55			1,55	
Concrete cone failure and splitting failure															
Effective anchorage depth	h_{ef}	[mm]	42		45	47	60	47	64	54	67	54	71	52	86
Characteristic spacing	$s_{cr,N}$	[mm]	3 h_{ef}			3 h_{ef}				3 h_{ef}				3 h_{ef}	
	$s_{cr,sp}$	[mm]	3 h_{ef}			3 h_{ef}				3 h_{ef}		3,6 h_{ef}		3,6 h_{ef}	
Characteristic edge distance	$c_{cr,N}$	[mm]	1,5 h_{ef}			1,5 h_{ef}				1,5 h_{ef}				1,5 h_{ef}	
	$c_{cr,sp}$	[mm]	1,5 h_{ef} [5]		1,5 h_{ef}	1,5 h_{ef}				1,5 h_{ef}		1,8 h_{ef}		1,8 h_{ef}	
Partial safety factor	$\gamma_{Mc} = \gamma_{Mp}$ [1]		**1,8**[2]		**2,1**[3]	**1,8**[2]				**1,8**[2]	**2,1**[3]	**1,8**[2]		**1,8**[2]	

[1] In absence of other national regulations.
[2] The installation factor γ_2 = 1,2 is included.
[3] The installation factor γ_2 = 1,4 is included.
[4] Pull-out is not decisive
[5] To give proof of splitting failure due to loading according to ETAG 001, Annex C, replace $N^0_{Rk,c}$ in equation 5.3 by $N_{Rk,p}$

Hilti screw anchor HUS	**Annex 5**
Characteristic tension resistance for static and quasi-static loading	

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Table 7: Characteristic shear resistance for static and quasi-static loading

Nominal anchor diameter			6					8				10				14	
Type		**HUS-**	**A**	**H**	**I**	**P**	**HR**	**H**		**HR**		**H**		**HR**		**HR**	
Nominal anchorage depth	h_{nom}	[mm]	**55**					**60**	**75**	**60**	**80**	**70**	**85**	**70**	**90**	**70**	**110**
Steel failure without lever arm																	
Characteristic resistance	$V_{Rk,s}$	[kN]	**12,5**				**17**	**15,9**		**26**		**23,8**		**33**		**55**	**77**
Steel failure with lever arm																	
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	**21**				**19**	**39**		**36**		**70**		**66**		**193**	
Partial safety factor	γ_{Ms} [1]		**1,5**					**1,5**				**1,5**				**1,5**	
Concrete pry-out failure																	
Factor in Eq. (5.6) of ETAG 001, Annex C, section 5.2.3.3	k		1,5					2				2				2	
Concrete edge failure																	
Effective length of anchor in shear loading	l_f	[mm]	42				45	47	60	47	64	54	67	54	71	52	86
Effective diameter of anchor	d_{nom}	[mm]	6					8				10				14	
Partial safety factor	$\gamma_{Mc} = \gamma_{Mcp}$ [1]		**1,5** [2]					**1,5** [2]				**1,5** [2]				**1,5** [2]	

[1] In absence of other national regulations.
[2] The installation factor γ_2 = 1,0 is included.

Remark for design in shear
The conditions given in ETAG 001, Annex C, section 4.2.2.1 and 4.2.2.2 are not fulfilled because the diameter d_f acc. to Annex 4, Table 4 is greater than the value given in Annex C, Table 4.1. Therefore, for anchor groups the additional proof $V_{Sd}^g \leq 2 \times V_{Rk,s}/\gamma_{Ms}$ shall be fulfilled.

Hilti screw anchor HUS	Annex 6
Characteristic shear resistance for static and quasi-static loading	

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Table 8: Displacements under tension loads for static and quasi-static loading

Nominal anchor diameter				6			8				10				14	
Type			HUS-	AHI	P	HR	H		HR		H		HR		HR	
Nominal anchorage depth		h_{nom}	[mm]	55			60	75	60	80	70	85	70	90	70	110
Cracked concrete C20/25 to C50/60	Tension load	N	[kN]	2,4		1,7	2,4	3,6	2,4	4,8	3,0	4,1	3,6	6,3	4,8	9,9
	Displacement	δ_{N0}	[mm]	0,1		0,4	0,1	0,1	0,5	0,7	0,2	0,3	0,3	0,6	0,9	1,4
		$\delta_{N\infty}$	[mm]	0,6		0,5	0,5	0,4	0,7	1,1	0,3	0,7	0,6	1,1	1,1	1,4
Non-cracked concrete C20/25 to C50/60	Tension load	N	[kN]	3,6	3,0	3,1	3,6	4,8	4,8	6,3	4,8	6,8	6,3	9,9	7,5	16,0
	Displacement	δ_{N0}	[mm]	0,2		0,8	0,1	0,2	0,7	1,6	0,2	0,3	0,3	1,3	0,7	1,0
		$\delta_{N\infty}$	[mm]	0,3		0,8	0,5	0,4	0,7	1,6	0,3	0,7	0,3	1,3	0,7	1,0

Table 9: Displacements under shear loads for static and quasi-static loading

Nominal anchor diameter				6			8				10				14	
Type			HUS-	AHI	P	HR	H		HR		H		HR		HR	
Nominal anchorage depth		h_{nom}	[mm]	55			60	75	60	80	70	85	70	90	70	110
Cracked and Non-cracked concrete C20/25 to C50/60	Shear load	V	[kN]	6,0		7,8	6,9	6,9	11,0	12,4	10,3	10,3	13,6	15,7	12,9	27,3
	Displacement	δ_{V0}	[mm]	1,9		0,4	1,5	1,5	2,0	2,3	1,5	1,5	1,1	1,7	3,5	3,9
		$\delta_{V\infty}$	[mm]	2,8		0,5	2,3	2,3	2,4	2,9	2,3	2,3	1,5	2,4	3,9	4,3

Hilti screw anchor HUS	Annex 7
Displacement under tension and shear loads for static and quasi-static loading	

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Table 10: Characteristic tension resistance for seismic loading, performance category C1

Nominal anchor diameter			8		10		14
Type		HUS-	H	HR	H	HR	HR
Nominal anchorage depth	h_{nom}	[mm]	75	80	85	90	110
Steel failure							
Characteristic resistance	$N_{Rk,s,seis}$	[kN]	37,1	34,0	55,4	52,6	102,2
Partial safety factor	$\gamma_{Ms,seis}$ [1]	[kN]	1,4		1,4		1,4
Pull-out failure							
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p,seis}$	[kN]	7,7		12,5		17,5
Partial safety factor	$\gamma_{Mp,seis}$ [1]		1,8 [2]		2,1 [3]	1,8 [2]	1,8 [2]
Concrete cone failure [4]							
Partial safety factor	$\gamma_{Mc,seis}$ [1]		1,8 [2]		2,1 [3]	1,8 [2]	1,8 [2]
Splitting failure [4]							
Partial safety factor	$\gamma_{Msp,seis}$ [1]		1,8 [2]		2,1 [3]	1,8 [2]	1,8 [2]

[1] In absence of other national regulations.
[2] The installation factor γ_2 = 1,2 is included.
[3] The installation factor γ_2 = 1,4 is included.
[4] For concrete cone failure and splitting failure see Annex 12.

Hilti screw anchor HUS	Annex 8
Characteristic tension resistance for seismic loading, performance category C1	

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Table 11: Characteristic shear resistance for seismic loading, performance category C1

Nominal anchor diameter			8		10		14
Type		HUS-	H	HR	H	HR	HR
Nominal anchorage depth	h_{nom}	[mm]	75	80	85	90	110
Steel failure							
Characteristic resistance	$V_{Rk,s,seis}$	[kN]	11,1		17,9		53,9
Partial safety factor	$\gamma_{Ms,seis}$ [1]	[kN]	1,5		1,5		1,5
Concrete pryout failure [3]							
Partial safety factor	$\gamma_{Mc,seis}$ [1]		1,5[2]		1,5[2]		1,5[2]
Concrete edge failure [3]							
Partial safety factor	$\gamma_{Mc,seis}$ [1]		1,5[2]		1,5[2]		1,5[2]

[1] In absence of other national regulations.
[2] The installation factor γ_2 = 1,0 is included.
[3] For concrete pry-out and concrete edge failure see Annex 12

Remark for design in shear
The conditions given in ETAG 001, Annex C, section 4.2.2.1 and 4.2.2.2 are not fulfilled because the diameter d_f acc. to Annex 4, Table 4 is greater than the value given in Annex C, Table 4.1. Therefore, for anchor groups the additional proof $V^g_{Sd,seis} \leq 2 \times V_{Rk,s,seis}/\gamma_{Ms,seis}$ shall be fulfilled.

Hilti screw anchor HUS	Annex 9
Characteristic shear resistance for seismic loading, performance category C1	

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Table 12: Displacements under tension loads for seismic loading, performance category C1[1)]

Nominal anchor diameter			8		10		14
Type		HUS-	H	HR	H	HR	HR
Nominal anchorage depth	h_{nom}	[mm]	75	80	85	90	110
Displacement	$\delta_{N,seis}$	[mm]	1,2		1,2		0,4

[1)] Maximum displacement during cycling (seismic event)

Table 13: Displacements under shear loads for seismic loading, performance category C1[1)]

Nominal anchor diameter			8		10		14
Type		HUS-	H	HR	H	HR	HR
Nominal anchorage depth	h_{nom}	[mm]	75	80	85	90	110
Displacement	$\delta_{V,seis}$	[mm]	4,8		5,3		7,6

[1)] Maximum displacement during cycling (seismic event)

The definition of seismic performance category C1 is given in Annex 11.

Hilti screw anchor HUS	Annex 10
Displacements under tension and shear loads for Seismic loading, performance category C1	

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Table 14: Recommended seismic performance categories[1)] for metal anchors

Seismicity level[a]		Importance Class acc. 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	$a_g \cdot S > 0{,}1\ g$	C1	C2		

[a] The values defining the seismicity levels may be found in the National Annex of EN 1998-1.

[b] Definition according to EN 1998-1: 2004, 3.2.1.

[c] a_g = Design ground acceleration on Type A ground (EN 1998-1: 2004, 3.2.1),
S = Soil factor (see e.g. EN 1998-1: 2004, 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.

Table 14 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 a Member State 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 14. Furthermore, the assignment of the seismic performance categories C1 and C2 to the seismicity level and building importance classes is in the responsibility of each individual Member State.

Hilti screw anchor HUS	**Annex 11**
Seismic performance categories	

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Table 15: 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	0,85	0,75
	Splitting failure	1,0	0,85
shear	Steel failure	1,0	0,85
	Concrete edge failure	1,0	0,85
	Concrete pry-out failure	0,85	0,75

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

Design information for seismic actions:

The seismic design shall be carried out according to the TR 045 „Design of metal anchors for use in concrete under seismic actions ". 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 ETAG 001, 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 15;

$R^{0}_{k,seis}$ 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 Annex 8 and Annex 9.

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 ETAG 001, Annex C (i.e. $N_{Rk,c}$, $N_{Rk,sp}$, $V_{Rk,c}$, $V_{Rk,cp}$).

Hilti screw anchor HUS	Annex 12
Reduction factors and characteristic seismic resistance	

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Table 16: Characteristic tension resistance under fire exposure in cracked and non-cracked concrete C20/25 to C50/60

Nominal anchor diameter				6		8				10				14	
Type			HUS-	A H I P	HR	H		HR		H		HR		HR	
Nominal anchorage depth		h_{nom}	[mm]	55		60	75	60	80	70	85	70	90	70	110
Steel failure															
Characteristic resistance	R30	$N_{Rk,s,fi}$	[kN]	1,6	4,9	3,1		9,3		5,0		18,5		41,7	
	R60	$N_{Rk,s,fi}$	[kN]	1,2	3,3	2,2		6,3		3,6		12,0		26,9	
	R90	$N_{Rk,s,fi}$	[kN]	0,8	1,8	1,3		3,2		2,2		5,4		12,2	
	R120	$N_{Rk,s,fi}$	[kN]	0,7	1,0	0,8		1,7		1,5		2,4		5,4	
Concrete pull-out failure															
Characteristic resistance	R30 R60 R90	$N_{Rk,p,fi}$	[kN]	1,5	1,3	1,5	2,3	1,5	3,0	1,9	4,0	2,3	4,0	3,0	6,3
	R120	$N_{Rk,p,fi}$	[kN]	1,2	1,0	1,2	1,8	1,2	2,4	1,5	3,2	1,8	3,2	2,4	5,0
Edge distance	R30	$c_{cr,N}$	[mm]	$2\ h_{ef}$											
	R60 R90 R120	c_{min}	[mm]	Fire attack from one side : $c_{min} = 2\ h_{ef}$ Fire attack from more than one side: $c_{min} \geq 300$ mm											
Anchor spacing	R30	$s_{cr,N}$	[mm]	$4\ h_{ef}$											
	R60 R90 R120	s_{min}	[mm]	35		55		45	50	50				50	60

In absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi} = 1,0$ is recommended.

Hilti screw anchor HUS	Annex 13
Characteristic tension resistance under fire exposure	

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Table 17: Characteristic shear resistance under fire exposure in cracked and non-cracked concrete C20/25 to C50/60

Nominal anchor diameter				6		8				10				14	
Type			HUS-	AHIP	HR	H		HR		H		HR		HR	
Nominal anchorage depth		h_{nom}	[mm]	55		60	75	60	80	70	85	70	90	70	110
Steel failure without leaver arm															
Characteristic resistance	R30	$V_{Rk,s,fi}$	[kN]	1,6	4,9	3,1		9,3		5,0		18,5		41,7	
	R60	$V_{Rk,s,fi}$	[kN]	1,2	3,3	2,2		6,3		3,6		12,0		26,9	
	R90	$V_{Rk,s,fi}$	[kN]	0,8	1,8	1,3		3,2		2,2		5,4		12,2	
	R120	$V_{Rk,s,fi}$	[kN]	0,7	1,0	0,8		1,7		1,5		2,4		5,4	
Steel failure with leaver arm															
Characteristic resistance	R30	$M^0_{Rk,s,fi}$	[Nm]	1,4	4,0	3,3		8,2		6,3		19,4		65,6	
	R60	$M^0_{Rk,s,fi}$	[Nm]	1,1	2,7	2,3		5,5		4,6		12,6		42,4	
	R90	$M^0_{Rk,s,fi}$	[Nm]	0,7	1,4	1,4		2,8		2,8		5,7		19,2	
	R120	$M^0_{Rk,s,fi}$	[Nm]	0,6	0,8	0,9		1,5		1,9		2,5		8,5	
Concrete pry-out failure															
factor in eq. (5.6) of ETAG 001 Annex C, 5.2.3.3	R30 R60 R90 R120	k		1,5		2									
Concrete edge failure															
Characteristic resistance in C20/25 to C50/60 under fire exposure	R30 R60 R90	$V^0_{Rk,c,fi}$	[kN]	$0,25 \times V^0_{Rk,c}$											
	R120	$V^0_{Rk,c,fi}$	[kN]	$0,20 \times V^0_{Rk,c}$											
With $V^0_{Rk,c}$ as initial value of the characteristic resistance in cracked concrete C20/25 under normal temperature.															

In absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi} = 1,0$ is recommended.

Hilti screw anchor HUS	Annex 14
Characteristic values of shear load resistance under fire exposure	

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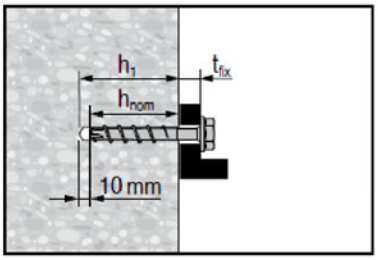
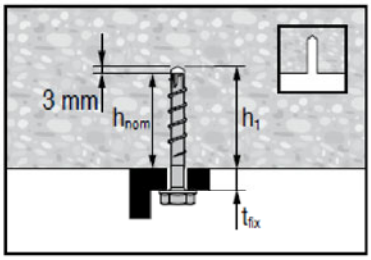
Instruction for use: HUS-H 6, HUS-P 6, HUS-A 6, HUS-I 6 and HUS-HR 6





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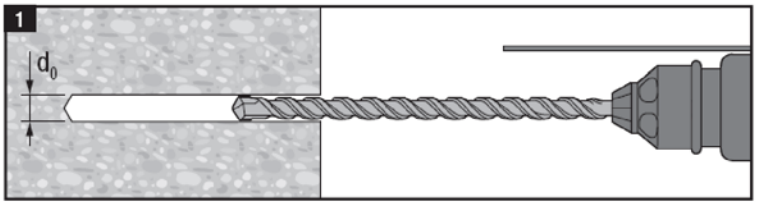

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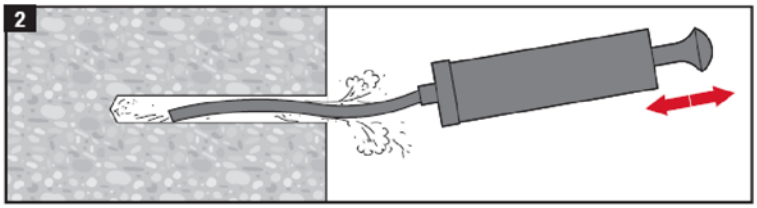

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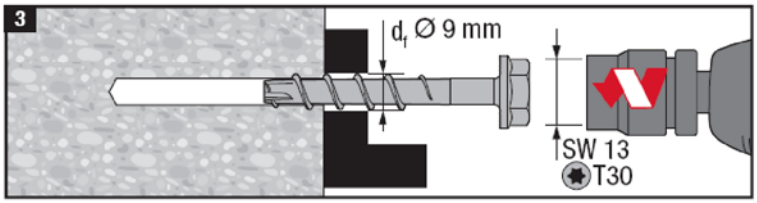
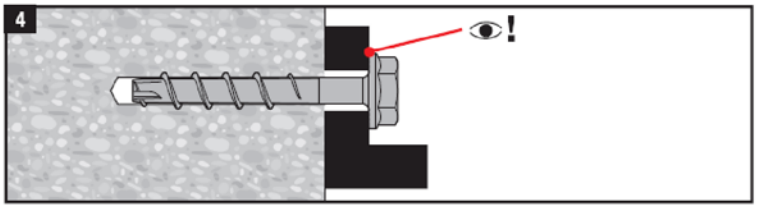


Nominal anchor diameter		6				
Type		A	H	I	P	HR
h_{nom}	[mm]	55				
T_{inst}	[Nm]	25				- [1]
Setting tool		Electrical impact screw driver, e.g. Hilti SIW 14-A or SIW 22-A				
d_0	[mm]	6				
d_f	[mm]	9				
Wrench size	[mm]	13	13	13	-	13
Torx		-	T30	-	T30	-

[1] Hand setting of HUS-HR in concrete base material not allowed (machine setting only)

Hilti recommended electrical impact screw drivers are listed in the instruction for use included in the sales box.

4



Installation with other electrical impact screw drivers of equivalent force and performance is possible.

Hilti screw anchor HUS	Annex 15
Instruction for use: HUS-H 6, HUS-P 6, HUS-A 6, HUS-I 6 and HUS-HR 6	

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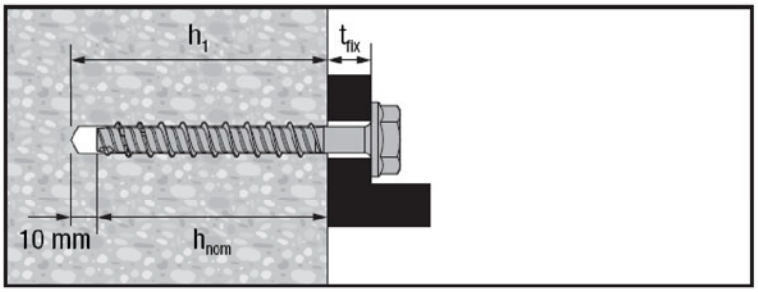
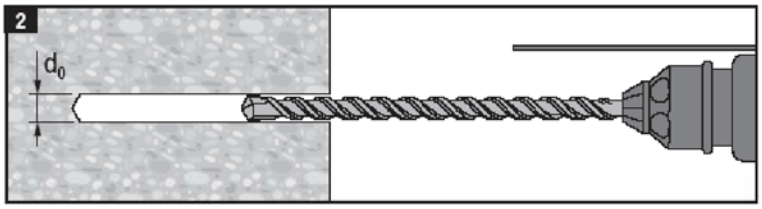
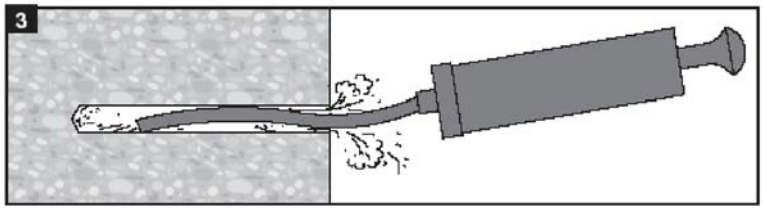
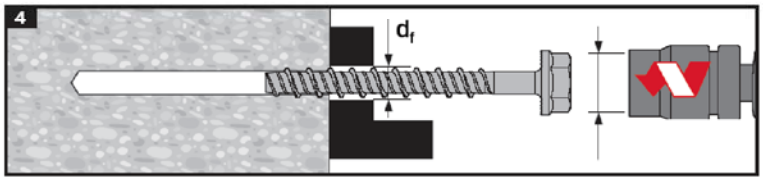
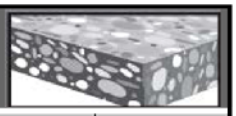
Instruction for use: HUS-H 8 - 10 and HUS-HR 8 - 14







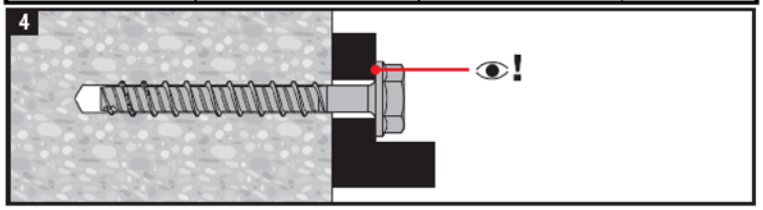




Nominal anchor diameter		8				10				14	
Type		H		HR		H		HR		HR	
h_{nom}	[mm]	60	75	60	80	70	85	70	90	70	110
T_{inst}	[Nm]	35	45	-[1]	-[1]	45	55	45		65	
Setting tool		Electrical impact screw driver, e.g. Hilti SIW 22T-A.									
d_0	[mm]	8				10				14	
d_f	[mm]	12				14				18	
Wrench size	[mm]	13				15				21	

[1] Hand setting of HUS-HR in concrete base material not allowed (machine setting only)

Hilti recommended electrical impact screw drivers are listed in the instruction for use included in the sales box.



Installation with other electrical impact screw drivers of equivalent force and performance is possible.

Hilti screw anchor HUS	Annex 16
Instruction for use: HUS-H 8 - 10 and HUS-HR 8 - 14	