ANCHOR FASTENING

Technology manual

Important notices

1. The technical data presented in this Anchor Fastening Technology Manual is based on numerous tests and evaluation criteria according to the current state-of-the-art and the relevant European regulations.
2. For all those anchors holding a European Technical Assessment (ETA), noted in the cover with the respective icon, the technical data given in this manual is based and in accordance with the information given in the respective ETA. Additional Hilti technical data, supplementing the ETA technical data, may be available, in which case, it will be clearly noted on footnotes and/or tables.
3. For all those anchors not holding an ETA, the technical data given in this manual is based on numerous tests and evaluation criteria according to the current state-of-the-art and/or the relevant European applicable regulations for the assessment of fasteners, which is the basis for obtaining an ETA.
4. In addition to the tests for standard service conditions (including, in some cases, seismic as an option), fire resistance, shock and fatigue tests may have been performed – see respective reports for full details.
5. The data and values are based on the respective average values obtained from tests under laboratory or other controlled conditions, or on generally-accepted methodology. It is the responsibility of the customer to use the data given in the light of conditions on site and taking into account the intended use of the products concerned. The customer must check the listed prerequisites and criteria conform with the conditions actually existing on the job-site. Whilst Hilti can give general guidance and advice, the nature of Hilti products means that the ultimate responsibility for selecting the right product for a particular application must lie with the customer.
6. The given technical data in the Anchor Fastening Technology Manual is valid only for the indicated test conditions. Due to variations in local base materials, on-site testing maybe required to determine performance at any specific jobsite.
7. Technical data presented herein was current as of the date of publication (see back cover). Hilti´s policy is one of continuous development. We therefore reserve the right to alter technical data and specifications, etc. without notice.
8. Construction materials and conditions vary on different sites. If it is suspected that the base material has insufficient strength to achieve a suitable fastening, contact the Technical Competence Center of your local Hilti organization.
9. All products must be used, handled and applied strictly in accordance with all current instructions for use published by Hilti, i.e. technical instructions, operating manuals, setting instructions, installation manuals and others.
10. All products are supplied and advice is given subject to the local Hilti organization terms of business.
11. While reasonable measures have been taken to provide accurate information, no warranty is provided that it is without error. Hilti shall in no event be obligated for direct, indirect, incidental, consequential, or any other damages, losses or expenses in connection with, or by reason of, the use of, or inability to use, the products or information for any purpose. Implied warranties of merchantability and fitness for a particular purpose are specially excluded.

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Anchor technology & design

Heavy / medium duty metal anchors

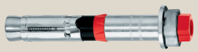
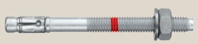
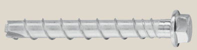
Plastic / light duty / other metal anchors

Chemical anchors

ANCHOR TECHNOLOGY & DESIGN

Anchor Application Selector

Steel & Metal

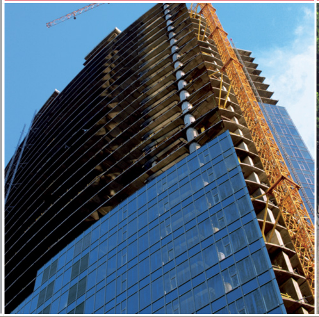
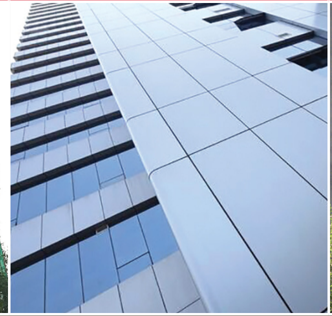
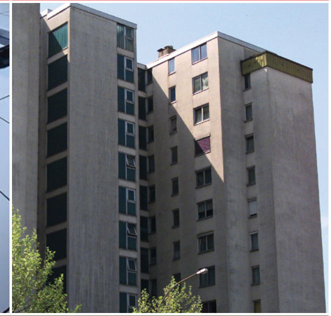
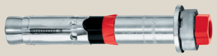
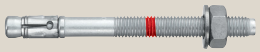
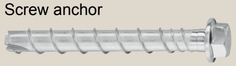
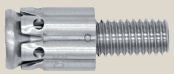
Application / Recommended product	Page	Structural steel beam / frame	Canopy	Balustrade / Railing	Solar panel
					
Heavy duty metal anchors					
HDA-T/P Undercut anchor 	57	• Optimized design/ anchor layout in high loading conditions in both cracked and un-cracked concrete • Tested and approved for use in seismic, fatigue and shock loading conditions	• Ideal for external applications; corrosion resistance of A4 stainless steel • Optimized design/ anchor layout in high loading conditions in both cracked and un-cracked concrete • Tested and approved for use in seismic, fatigue and shock loading conditions	–	–
HSL-3-R / HSL4 Heavy duty anchor 	79			–	–
Medium duty metal anchors					
HSC Safety anchor 	89	–	–	• Applicable on narrow curb, parapet wall and thin base material • Internal threads allows bolt re-installation	–
HST3 Stud anchor 	99	• Simple and flexible installation • Ideal for u se in A&A works; applicable in extended concrete grades C15/20	–	• Versatile application in different concrete conditions with two embedment depths	–
HUS-HR / -CR / HUS3 Screw anchor 	117 131	–	–	• Fast installation and small edge and spacing in cracked and un-cracked concrete • Nice flush finish with countersunk head version	
Chemical anchors					
HIT-HY 200 Injection adhesive anchor 	201	• High loads in cracked concrete conditions, design with variable embedment depth		–	–
HVU2 Capsule adhesive anchor 	241	–	–	• Fast cure and simple installation chemical mortar for high loads • Good corrosion protection of bolts by mortar	• Fast cure and simple installation chemical mortar for high loads • Water tight properties to minimize water penetration through the borehole esp on rooftops
HIT-HY 270 Injection adhesive anchor 	255	–	–	–	–

* The above recommendations are provided based on typical requirements of the stated applications, for reference only. Project specific conditions such as loading, edge/spacing, base material, environmental conditions etc. should be considered in the selection of anchors and final decision is subject to the engineers design and/or judgment.
* For unknown base materials, e.g. natural stone, Hilti recommends conducting on-site pull-out tests to evaluate the recommended load values and proper functionality of the system.

Recommended product	Temporary hoarding / fencing	Architectural metal	Signage	Laundry rack	Roller-shutter / collapsible gate
					
Heavy duty metal anchors					
HDA-T/P	• Fully removable, using specialized removal tools	–	• Ideal for external applications; corrosion resistance of A4 stainless steel • Optimized design/ anchor layout in high loading conditions in both cracked and un-cracked concrete • Tested and approved for use in seismic, fatigue and shock loading conditions	–	–
HSL-3-R / HSL4	• Easy installation and removal • Partially removable, leaving no steel parts on concrete surface	–		–	–
Medium duty metal anchors					
HSC	–	–	–	–	–
HST3	–	• Simple and flexible installation • Ideal for use in A&A works; applicable in extended concrete grades C15/20			
HUS-HR / -CR / HUS3	• Fastest installation and fully removable • Approved for reuse in fresh concrete temporary applications	• Fast installation and small edge and spacing in cracked and un-cracked concrete • Nice flush finish with countersunk head version	–	• Nice flush finish with countersunk head version • Applicable for use in brickworks	
Chemical anchors					
HIT-HY 200	–	–	–	• Minimize chance of workmanship error with no hole cleaning when used with HIT-Z • Suitable for use in low grade concrete e,g 15/20	–
HVU2	–	–	–	–	–
HIT-HY 270	–	–	–	–	• Safe anchoring on solid/ hollow brickworks in combined use with HIT-SC sleeve (interlocking to the base material)

Anchor Application Selector

Façade

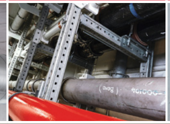
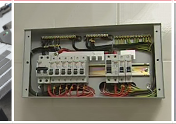
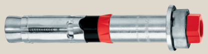
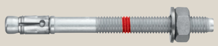
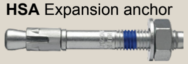
Application / Recommended product	Page	Curtain wall	Stone façade	Louvre	Cladding / Roofing	Window frame
						
Heavy duty anchors						
HDA-T/P Undercut anchor 	57	• Ideal for external applications; corrosion resistance of A4 stainless steel • Optimized design/anchor layout in high loading conditions in both cracked and un-cracked concrete • Tested and approved for use in seismic, fatigue and shock loading conditions	–	–	• Ideal for external applications; corrosion resistance of A4 stainless steel • Optimized design/anchor layout in high loading conditions in both cracked and un-cracked concrete • Tested and approved for use in seismic, fatigue and shock loading conditions	–
HSL-3-R / HSL4 Heavy duty anchor 	79		–			–
Medium duty anchors						
HST3 Stud anchor 	99	• Simple and flexible installation • Wide range of sizes from medium-heavy duty loading in cracked and un-cracked concrete		• Simple and flexible installation • Wide range of sizes from medium-heavy duty loading in cracked and un-cracked concrete	–	–
HUS-HR / -CR / HUS3 Screw anchor 	117 131	–	–	–	–	• Fast installation and small edge and spacing in cracked and un-cracked concrete • Nice flush finish with countersunk head version
Plastic / light duty / other metal anchors						
HSU-R Stone undercut anchor 	191	–	• Approved anchors for natural stone panel fixing • Head mark to verify Hilti stone anchor • Gauge for checking drill hole geometry • Setting mark to verify undercut completion	–	–	–
Chemical anchors						
HIT-HY 270 Injection adhesive anchor 	255	–	• Safe anchoring on solid/ hollow brickworks in combined use with HIT-SC sleeve (interlocking to the base material)	–	–	–

* The above recommendations are provided based on typical requirements of the stated applications, for reference only. Project specific conditions such as loading, edge/spacing, base material, environmental conditions etc. should be considered in the selection of anchors and final decision is subject to the engineers design and/or judgment.

* For unknown base materials, e.g. natural stone, Hilti recommends conducting on-site pull-out tests to evaluate the recommended load values and proper functionality of the system.

Anchor Application Selector

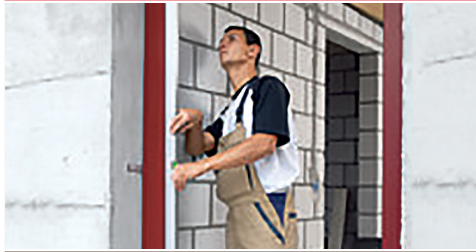
Mechanical & Electrical

Application / Recommended product	Page	Cable tray / trunking	HVAC duct & pipe	Plumbing and drainage	Air conditioner	Elevator guide rail	Water tank / roof fixings	Plant room equipment	Conveyor belt	Socket box	Fire services
											
Heavy duty anchors											
HSL-3-R / HSL4 Heavy duty anchor 	79	–	–	–	–	–	–	• Corrosion resistance of A4 stainless steel • Optimized design/ anchor layout in high loading conditions in both cracked and un-cracked concrete • Tested and approved for use in seismic, fatigue and shock loading conditions	–	–	–
Medium duty anchors											
HSC Safety anchor 	89	• Cracked concrete approved anchor for overhead installation of fastening with bolts or threaded rods			–	–	–	–	–	–	–
HST3 Stud anchor 	99	–	–	–	• Simple and flexible installation of frames • Ideal for short edge distances and spacing • Approved for cracked concrete	• Cracked concrete approved anchor, ideal for short edge and spacing conditions	• Simple and flexible installation • Ideal in short edge distances and/or thin concrete slab conditions		–	–	–
HSA Expansion anchor 	109				• Conventional approved anchor for installation on canopy/slabs	• Conventional approved anchor, preferred choice for elevator installers	–	–	–	–	–
HUS-HR / -CR / HUS3 Screw anchor 	117 131	–	–	–	• Fast installation and small edge and spacing in cracked and un-cracked concrete	–	–	–	–	• Fast installation and small edge and spacing in cracked and un-cracked concrete • Nice flush finish with countersunk head version	–
HKD Push-in anchor 	139	• Approved and tested for overhead installation of fastening with bolts or threaded rods • Reliable setting with simple visual check			–	• Simple and well proven anchor with approval, preferred choice for elevator installers • Reliable setting with simple visual check	–	–	–	–	• Simple and well proven anchor with approval • Reliable setting with simple visual check
Plastic / light duty / other metal anchors											
HLC-H 	179	–	–	–	–	–	–	–	–	• Well proven sleeve anchor with fire assessment	• Well proven sleeve anchor with fire assessment, preferred choice for fire service installers
Adhesive anchors											
HIT-HY 200 Injection adhesive anchor 	201	–	–	–	–	–	• High load resistance in cracked and uncracked concrete with variable embedment depths • Water tight and approved for use in drinking water	–	–	–	–
HVU2 Capsule adhesive anchor 	241	–	–	–	–	–	• Fast cure and simple installation chemical mortar for high loads • Water tight and approved for use in drinking water	• Fast cure and simple installation chemical mortar for high loads • Pre-dose mortar per drill hole for easy workmanship control		–	–

* The above recommendations are provided based on typical requirements of the stated applications, for reference only. Project specific conditions such as loading, edge/spacing, base material, environmental conditions etc. should be considered in the selection of anchors and final decision is subject to the engineers design and/or judgment.
* For unknown base materials, e.g. natural stone, Hilti recommends conducting on-site pull-out tests to evaluate the recommended load values and proper functionality of the system.

Anchor Application Selector

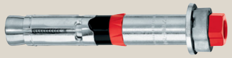
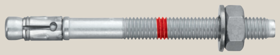
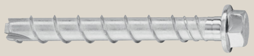
Interior finishing

Application / Recommended product	Page	Windproof ceiling	Suspended ceiling	Door frame	Interior finishings
					
Medium duty anchors					
HST3 Stud anchor	99	• Flexible and simple installation, for medium loads in cracked concrete		–	–
HSA Expansion anchor	109	• Conventional approved anchor for medium loads in uncracked concrete		–	–
HUS-HR / -CR / HUS3 Screw anchor	117 131	–	–	–	• Ideal for light duty fastenings such as cabinets, sanitary fixtures, electrical installations etc. in different base materials***
HKD Push-in anchor	139	–	• Approved and tested for overhead installation of fastening with bolts or threaded rods • Reliable setting with simple visual check	–	–
Plastic / light duty / other metal anchors					
HRD Frame anchor	155	–	–	• Approved anchor, suitable for installation of variable door frame thickness on different base materials***	–
HPS-1 Plastic anchors	163	–	–	–	• Light duty impact anchor, ideal for fastening cabinets
HUD Universal anchor	167	–	–	–	• Ideal for light duty fastenings such as cabinets, sanitary fixtures, electrical installations etc. in different base materials***
HLC-H	179	–	–	–	• Ideal for light duty fastenings such as mounted fans, sanitary fixtures, kitchen equipment, electrical installations etc. in different base materials***
Adhesive anchors					
HIT-HY 270 Injection adhesive anchor	255	–	–	–	• Highest load in masonry base materials e.g sand bricks, hollow bricks

* The above recommendations are provided based on typical requirements of the stated applications, for reference only. Project specific conditions such as loading, edge/spacing, base material, environmental conditions etc. should be considered in the selection of anchors and final decision is subject to the engineers design and/or judgment.
* For unknown base materials, e.g. natural stone, Hilti recommends conducting on-site pull-out tests to evaluate the recommended load values and proper functionality of the system.
*** Please refer to anchor selector for information on different base materials

Anchor Application Selector

Building construction

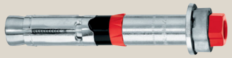
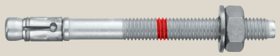
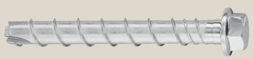
Application / Recommended product	Page	Formwork	Temporary works	Scaffolding	Tower crane	Wall tie bracket
						
Heavy duty metal anchors						
HSL-3-R / HSL4 Heavy duty anchor 	79	–	• Ideal for heavy loading conditions • Partially removable, leaving no steel parts on concrete surface	• Ideal for heavy loading conditions • Partially removable, leaving no steel parts on concrete surface	–	–
Medium duty metal anchors						
HST3 Stud anchor 	99	–	–	• Flexible and simple installation • Small edge and spacing • Approved for use in cracked concrete	–	• Flexible and simple installation • Small edge and spacing
HUS3 Screw anchor 	117	• Fast installation and complete removal • Approved for re-use		–	–	–
Chemical anchors						
HIT-HY 200 Injection adhesive anchor 	201	–	–	–	• Variable embedment depths offers highest tension and shear loads in cracked and uncracked concrete	• High loads for use in cracked and uncracked concrete
HIT-RE 100 Injection adhesive anchor 	233	–	–	–	• Variable embedment depths offers highest tension and shear loads	• Applicable on various base material e.g natural stones, brickworks

* The above recommendations are provided based on typical requirements of the stated applications, for reference only. Project specific conditions such as loading, edge/spacing, base material, environmental conditions etc. should be considered in the selection of anchors and final decision is subject to the engineers design and/or judgment.
* For unknown base materials, e.g. natural stone, Hilti recommends conducting on-site pull-out tests to evaluate the recommended load values and proper functionality of the system.
*** Please refer to anchor selector for information on different base materials

Anchor technology & design
Heavy / medium duty metal anchors
Plastic / light duty / other metal anchors
Chemical anchors

Anchor Application Selector

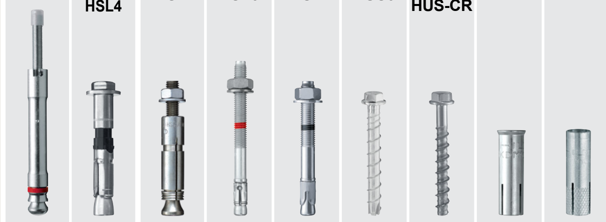
Civil construction

Application / Recommended product	Page	Wire mesh on soil nails	Excavation Lateral Support System	Noise / crash barrier	Light pole	Pier fencing	Platform screen door
							
Heavy duty metal anchors							
HDA-T/P Undercut anchor 	57	–	• Ideal for heavy shear loading conditions • Fully removable using special removal tools	–	–	–	• Corrosion resistance of A4 stainless steel • Optimized design/anchor layout in high loading conditions in both cracked and un-cracked concrete • Tested and approved for use in seismic, fatigue and shock loading conditions
HSL-3-R / HSL4 Heavy duty anchor 	79	–	• Ideal for heavy shear loading conditions • Partially removable, leaving no steel parts on concrete surface	–	–	–	
Medium duty metal anchors							
HST3 Stud anchor 	99	• Ideal for external applications; corrosion resistance of A4 stainless steel • Flexible and simple installation in cracked and un-cracked concrete	–	–	–	–	–
HUS-HR / -CR / HUS3 Screw anchor 	117 131	• Ideal for external applications; corrosion resistance of A4 stainless steel • Fast installation and easy surface finish with countersunk/hexagonal head	–	–	–	–	–
Chemical anchors							
HIT-HY 200 Injection adhesive anchor 	201	–	• High shear loads to withstand lateral shear force from diaphragm wall • Fast curing	• Variable embedment depths for highest tension and shear loads in cracked and uncracked concrete • No hole cleaning to minimize workmanship error when used with HIT-Z thread rods • Fast curing			
HIT-RE 500 V3 Injection adhesive anchor 	219	–	• High shear loads to withstand lateral shear force from diaphragm wall	• 120 years service life • Variable embedment depths for highest tension and shear loads			
HIT-RE 100 Injection adhesive anchor 	233	–	–	• Variable embedment depths for highest tension and shear loads			

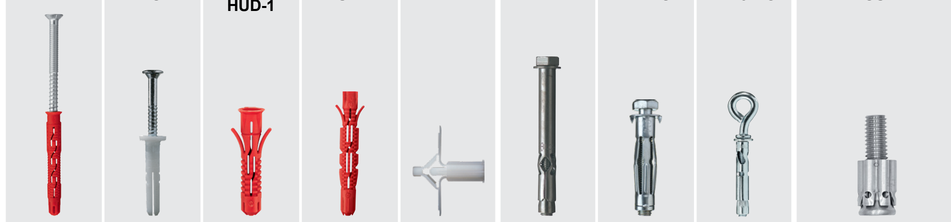
* The above recommendations are provided based on general requirements as per the specific applications. You should also consider case specific project requirements like loads, edge distance/spacing, materials, approvals, removability, base materials, ease of installation, etc.
* The applicability of anchors without recommendation is also possible depending on actual situation and designer's technical judgement.
* For unknown base materials, e.g. natural stone, Hilti recommends to conduct onsite pullout test to evaluate the recommended load values and check proper function of the system

Anchor Overview

Mechanical anchors



Anchor type		Heavy duty		Medium duty						
		HDA	HSL-3-R HSL4	HSC	HST3	HSA	HUS3	HUS-HR HUS-CR	HKD	HKV
Anchor size*		M10-M20	M8-M24	M6-M12	M8-M24	M6-M20	6Φ-14Φ	6Φ-14Φ	M6-M20	M6-M16
Base material	Cracked concrete	■	■	■	■		■	■		
	Non-cracked concrete	■	■	■	■	■	■	■	■	■
	Lightweight concrete									
	Aerated concrete						■			
	Solid brick masonry						■			
	Hollow brick masonry									
	Drywall									
	Natural stone									
Approvals	European Technical approval (ETA)	■	■	■	■	■	■	■	■	
	ETA seismic	■	■		■		■	◩		
	Fatigue approval	■	■							
	Shock approval	■	■	■	■					
	Fire tested	■	■	■	■	■	■	■		
Head versions	Steel, galvanized	■	■	■	■	■	■		■	■
	Steel, hot dip galvanized	■				■			■	
	Stainless steel A2					■				■
	Stainless steel A4	■	■	■	■	■		■	■	
Material	External thread	■	■	■	■	■	◩			
	Internal thread			■			◩		■	■
	Hexagonal		■				■	■		
	Countersunk		◩				◩	◩		
Setting	Pre-setting	■	■	■	■	■			■	■
	Through-fastening		■		■	■	■	■		
Features	Removable	■	◩				■	■		
	Extended concrete grades				■					
	Short edge distance / spacing			■	■		■	■		
	Variable embedment depth		■		■	■	■	■		
PROFIS		■	■	■	■	■	■	■	■	
Page		57	79	89	99	109	117	131	139	145



Anchor type		Plastic anchors					Light duty metal anchors			Other anchors
		HRD	HPS-1	HUD-2 HUD-1	HUD-L	HLD	HLC	HHD-S	HA 8 NG	HSU-R
Anchor size*		M8-M10	M4-M8	M5-M14	M6-M10	M10	M5-M16	M4-M8	M8	M6-M8
Base material	Cracked concrete									
	Non-cracked concrete	■	■	■	■	◩	■		■	
	Lightweight concrete	◩	◩	■	■					
	Aerated concrete	◩	◩	■	■					
	Solid brick masonry	◩	■	■	■		■			
	Hollow brick masonry	◩	■	■	■	■		◩		
	Drywall	◩		◩	◩	◩		■		
	Natural stone									■
Approvals	European Technical approval (ETA)	■								■
	ETA seismic									
	Fatigue approval									
	Shock approval									
	Fire tested	■					■			
Head versions	Steel, galvanized	■	■				■	■	■	
	Steel, hot dip galvanized									
	Stainless steel A2		■							
	Stainless steel A4	■								■
Material	External thread						■			■
	Internal thread							■	■	
	Hexagonal						■			
	Countersunk	■					■			
Setting	Pre-setting			■	■	■	■	■	■	■
	Through-fastening	■	■	■	■		■			
Features	Removable									
	Extended concrete grades									
	Short edge distance / spacing									
	Variable embedment depth									
PROFIS										
Page		155	163	167	171	175	179	185	187	191

◩ **May be suitable for specific applications / product versions**

* Please refer to the product catalogue on the Hilti website for standard portfolio

Anchor technology & design
Heavy / medium duty metal anchors
Plastic / light duty / other metal anchors
Chemical anchors

Anchor type	Ultimate performance					Day-to-day applications				Masonry application
	HIT-HY 200 R			HIT-RE 500 V3		HIT-RE 100		HVU2		HIT-HY 270
Anchor size*	M8-M20	M8-M30	M8-M20	M8-M39	M8-M20	M8-M39	M8-M20	M8-M20	M8-M16	M6-M16
Base material – Cracked concrete	■	■	■	■	■			■		
Base material – Non-cracked concrete	■	■	■	■	■	■	■	■		
Base material – Lightweight concrete										
Base material – Aerated concrete										
Base material – Solid brick masonry										■
Base material – Hollow brick masonry										■
Base material – Drywall										
Approvals – European Technical approval (ETA)	■	■	■	■	■	■	■	■		■
Approvals – ETA seismic	■	■		■	■			■		
Approvals – Fatigue approval				■	■					
Approvals – Fire tested	■	■	■	■	■	■	■	■	■	
SafeSet	■	■	■	■	■	■	■	■	■	
Material – Steel, galvanized	■	■	■	■	■	■	■	■	■	■
Material – Steel, hot dip galvanized		■		■		■		■		
Material – Stainless steel A4	■	■		■	■	■	■	■	■	■
Material – External thread	■	■		■		■		■		■
Material – Internal thread	■	■	■		■		■			■
Features – NSF (Contact with drinking water)	■	■	■	■	■	■	■	■	■	
Features – Short edge distance / spacing	■	■	■	■	■	■	■	■	■	
Features – Variable embedment depth	■	■	■	■	■	■	■			■
Profis	■	■	■	■	■	■	■	■	■	
Page	201			219		233		241		255

◪ **May be suitable for specific applications / product versions**

* Please refer to the product catalogue on the Hilti website for standard portfolio

Base material

General

Different anchoring conditions

The wide variety of building materials used today provide different anchoring conditions for anchors. There is hardly a base material in or to which a fastening cannot be made with a Hilti product. However, the properties of the base material play a decisive role when selecting a suitable fastener / anchor and determining the load it can hold.

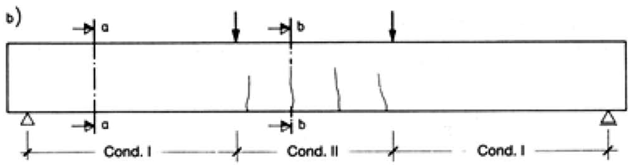
The main building materials suitable for anchor fastenings have been described in the following.

Concrete

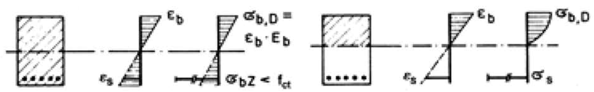
A mixture of cement, aggregates and water

Concrete is synthetic stone, consisting of a mixture of cement, aggregates and water, possibly also additives, which is produced when the cement paste hardens and cures. Concrete has a relatively high compressive strength, but only low tensile strength. Steel reinforcing bars are cast in concrete to take up tensile forces. It is then referred to as reinforced concrete.

Cracking from bending



Stress and strain in sections with conditions I and II



$\sigma_{b,D}$	calculated compressive stress
$\sigma_{b,Z}$	calculated tensile stress
f_{ct}	concrete tensile strength

If cracks in the tension zone exist, suitable anchor systems are required

If the tensile strength of concrete is exceeded, cracks form, which, as a rule, cannot be seen. Experience has shown that the crack width does not exceed the figure regarded as admissible, i.e. $w \cong 0.3$mm, if the concrete is under a constant load. If it is subjected predominately to forces of constraint, individual cracks might be wider if no additional reinforcement is provided in the concrete to restrict the crack width. If a concrete component is subjected to a bending load, the cracks have a wedge shape across the component cross-section and they end close to the neutral axis. It is recommended that anchors that are suitable in cracked concrete be used in the tension zone of concrete components. Other types of anchors can be used if they are set in the compression zone.

Observe curing of concrete when using expansion anchors

Anchors are set in both low-strength and high-strength concrete. Generally, the range of the cube compressive strength, $f_{ck,cube,150}$, is between 25 and 60 N/mm^2. Expansion anchors should not be set in concrete which has not cured for more than seven days. If anchors are loaded immediately after they have been set, the loading capacity can be assumed to be only the actual strength of the concrete at that time. If an anchor is set and the load applied later, the loading capacity can be assumed to be the concrete strength determined at the time of applying the load.

Cutting through reinforcement when drilling anchor holes must be avoided. If this is not possible, the responsible design engineer must be consulted first.

Avoid cutting reinforcement

Masonry

Different types and shapes

Masonry is a heterogeneous base material. The hole being drilled for an anchor can run into mortar joints or cavities. Owing to the relatively low strength of masonry, the loads taken up locally cannot be particularly high. A tremendous variety of types and shapes of masonry bricks are on the market, e.g. clay bricks, sand-lime bricks or concrete bricks, all of different shapes and either solid or with cavities. Hilti offers a range of different fastening solutions for this variety of masonry base material, e.g. the HPS-1, HRD, HUD, HIT, etc.

It is highly recommended to conduct on-site pullout test to verify anchor capacity because masonry strength and consistency can be varied.

If there are doubts when selecting a fastener / anchor, your local Hilti sales representative will be pleased to provide assistance.

Plaster coating is not a base material for fastenings

When making a fastening, care must be taken to ensure that a lay of insulation or plaster is not used as the base material. The specified anchorage depth (depth of embedment) must be in the actual base material.

Other base materials

Aerated concrete

Aerated concrete: This is manufactured from fine-grained sand as the aggregate, lime and/or cement as the binding agent, water and aluminium as the gas-forming agent. The density is between 0.4 and 0.8 kg/dm^3 and the compressive strength 2 to 6 N/mm^2. Hilti offers the HRD-C anchors for this base material.

Lightweight concrete

Lightweight concrete: This is concrete which has a low density, i.e. ≤ 1800 kg/m^3, and a porosity that reduces the strength of the concrete and thus the loading capacity of an anchor. Hilti offers the HRD and HUD, etc anchor systems for this base material.

Drywall / gypsum panels

Drywall (plasterboard/gypsum) panels: These are mostly building components without a supporting function, such as wall and ceiling panels, to which less important, so-called secondary fastenings are made. The Hilti anchors suitable for this material are the HUD and HUS.

Variety of base materials

In addition to the previously named building materials, a large variety of others, e.g. natural stone, etc, can be encountered in practice. Furthermore, special building components are also made from the previously mentioned materials which, because of manufacturing method and configuration, result in base materials with peculiarities that must be given careful attention, e.g. hollow ceiling floor components, etc.

Descriptions and explanations of each of these would go beyond the bounds of this manual. Generally though, fastenings can be made to these materials. In some cases, test reports exist for these special materials. It is also recommended that the design engineer, company carrying out the work and Hilti technical staff hold a discussion in each case.

Jobsite tests

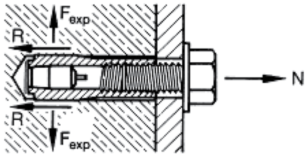
In some cases, testing on the jobsite should be arranged to verify the suitability and the loading capacity of the selected anchor.

Why does an anchor hold in a base material?

Working principles

There are three basic working principles which make an anchor hold in a building material:

Friction

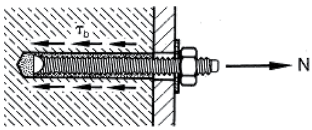


The tensile load, N, is transferred to the base material by friction, R. The expansion force, Fexp, is necessary for this to take place. It is produced, for example, by driving in an expansion plug (HKD).

Keying

The tensile load, N, is in equilibrium with the supporting forces, R, acting on the base material, such as with the HDA anchor.

Bonding



An adhesive bond is produced between the anchor rod and the hole wall by a synthetic resin adhesive, such as with HVU2 with HAS-U anchor rods.

Combination of working principles

Many anchors obtain their holding power from a combination of the above mentioned working principles.

For example, an anchor exerts an expansion force against wall of its hole as a result of the displacement of a cone relative to a sleeve. This permits the longitudinal force to be transferred to the anchor by friction. At the same time, this expansion force causes permanent local deformation of the base material, above all in the case of metal anchors. A keying action results which enables the longitudinal force in the anchor to be transferred additionally to the base material

Force-controlled and displacement-controlled expansion anchors

In the case of expansion anchors, a distinction is made between force-controlled and movement-controlled types. The expansion force of force-controlled expansion anchors is dependent on the tensile force in the anchor (HSL-3 heavy-duty anchor). This tensile force is produced, and thus controlled, when a tightening torque is applied to expand the anchor.

In the case of movement-controlled types, expansion takes place over a distance that is predetermined by the geometry of the anchor in the expanded state. Thus an expansion force is produced (HKD anchor) which is governed by the modulus of elasticity of the base material.

Adhesive/resin anchor

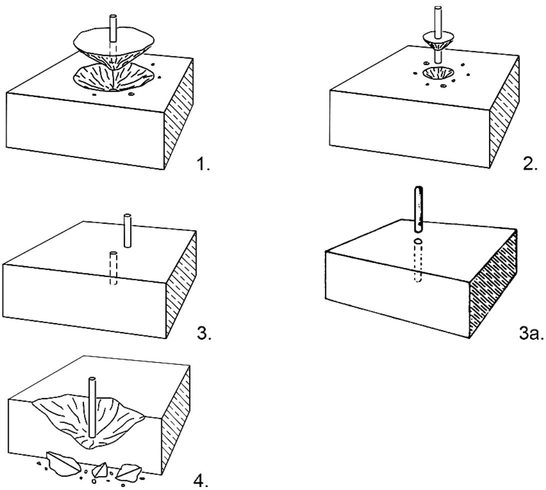
The synthetic resin of an adhesive anchor infiltrates into the pores of the base material and, after it has hardened and cured, achieves a local keying action in addition to the bond.

Failure modes

Effects of static loading

Failure patterns

The failure patterns of anchor fastenings subjected to a continually increased load can be depicted as follows:



Causes of failure

The weakest point in an anchor fastening determines the cause of failure. Modes of failure, 1. break-out, 2. anchor pull-away and, 3., 3a., failure of anchor parts, occur mostly when single anchors that are a suitable distance from an edge or the next anchor, are subjected to a pure tensile load. These causes of failure govern the max. loading capacity of anchors. On the other hand, a small edge distance causes mode of failure 4. edge breaking. The ultimate loads are then smaller than those of the previously mentioned modes of failure. The tensile strength of the fastening base material is exceeded in the cases of break-out, edge breaking and splitting.

Combined load

Basically, the same modes of failure take place under a combined load. The mode of failure 1. break-out, becomes more seldom as the angle between the direction of the applied load and the anchor axis increases.

Shear load

Generally, a shear load causes a conchoidal (shell-like) area of spall on one side of the anchor hole and, subsequently, the anchor parts suffer bending tension or shear failure. If the distance from an edge is small and the shear load is towards the free edge of a building component, however, the edge breaks away.

Influence of cracks

Very narrow cracks are not defects in a structure

It is not possible for a reinforced concrete structure to be built which does not have cracks in it under working conditions. Provided that they do not exceed a certain width, however, it is not at all necessary to regard cracks as defects in a structure. With this in mind, the designer of a structure assumes that cracks will exist in the tension zone of reinforced concrete components when carrying out the design work (condition II). Tensile forces from bending are taken up in a composite construction by suitably sized reinforcement in the form of ribbed steel bars, whereas the compressive forces from bending are taken up by the concrete (compression zone).

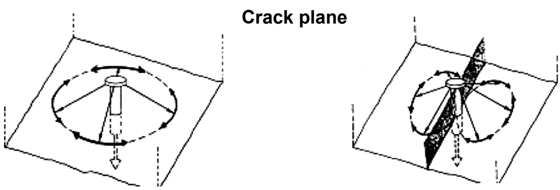
Efficient utilisation of reinforcement

The reinforcement is only utilised efficiently if the concrete in the tension zone is permitted to be stressed (elongated) to such an extent that it cracks under the working load. The position of the tension zone is determined by the static / design system and where the load is applied to the structure. Normally, the cracks run in one direction (line or parallel cracks). Only in rare cases, such as with reinforced concrete slabs stressed in two planes, can cracks also run in two directions.

Testing and application conditions for anchors are currently being drafted internationally based on the research results of anchor manufacturers and universities. These will guarantee the functional reliability and safety of anchor fastenings made in cracked concrete.

Loadbearing mechanisms

When anchor fastenings are made in non-cracked concrete, equilibrium is established by a tensile stress condition of rotational symmetry around the anchor axis. If a crack exists, the loadbearing mechanisms are seriously disrupted because virtually no annular tensile forces can be taken up beyond the edge of the crack. The disruption caused disrupted by the crack reduces the loadbearing capacity of the anchor system.



a) Non-cracked concrete b) Cracked concrete

Resistance values for cracked concrete

The width of a crack in a concrete component has a major influence on the tensile loading capacity of all fasteners, not only anchors, but also cast-in items, such as headed studs. A crack width of about 0.3mm is assumed when designing anchor fastenings. The reduction factor for the ultimate tensile loads can not be established without a proper testing program conducted in cracked concrete. This is an unacceptable situation for anchor manufacturer giving a general reduction factor for anchor performance in cracked concrete without passing one of the international testing standard of anchors in cracked concrete and adding on unsuitable information to the product description sheets.

Since international testing conditions for anchors are based on the above-mentioned crack widths, no theoretical relationship between ultimate tensile loads and different crack widths has been giving.

Pretensioning force in anchor bolts / rods

The statements made above apply primarily to static loading conditions. If the loading is dynamic, the clamping force and pretensioning force in an anchor bolt / rod play a major role. If a crack propagates in a reinforced concrete component after an anchor has been set, it must be assumed that the pretensioning force in the anchor will decrease and, as a result, the clamping force from the fixture (part fastened) will be reduced (lost). The properties of this fastening for dynamic loading will then have deteriorated.

Loss of pretensioning force due to cracks

To ensure that an anchor fastening remains suitable for dynamic loading even after cracks appear in the concrete, the clamping force and pretensioning force in the anchor must be upheld. Suitable measures to achieve this can be sets of springs or similar devices.

Seismic loads and cracked concrete

As a structure responds to earthquake ground motion it experiences displacement and consequently deformation of its individual members. This deformation leads to the formation and opening of cracks in members. Consequently all anchorages intended to transfer earthquake loads should be suitable for use in cracked concrete and their design should be predicted on the assumption that cracks in the concrete will cycle open and closed for the duration of the ground motion.

Parts of the structures may be subjected to extreme inelastic deformation. In the reinforced areas yielding of the reinforcement and cycling of cracks may result in cracks width of several millimetres, particularly in regions of plastic hinges. Qualification procedures for anchors do not currently anticipate such large crack widths. For this reason, anchorages in this region where plastic hinging is expected to occur, such as the base of shear wall and joint regions of frames, should be avoided unless apposite design measures are taken.

Anchor design

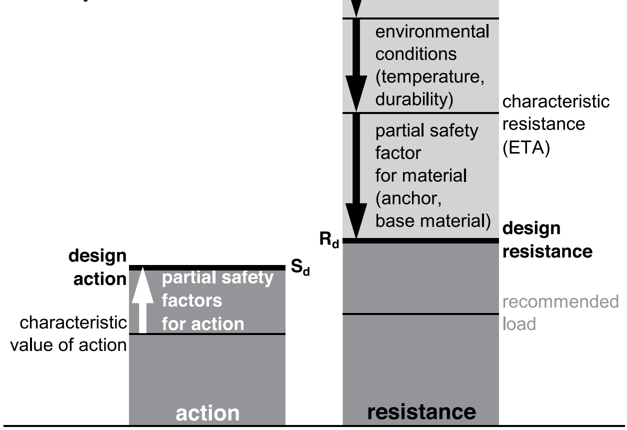
Safety concept

Depending on the application and the anchor type one of the following two concepts can be applied:

Partial safety factor concept

For anchors for use in concrete having an European T echnical Approval (ETA) the partial safety factor concept according to the European T echnical Approval Guidelines ETAG 001 or ETAG 020 shall be applied. It has to be shown, that the value of design actions does not exceed the value of the design resistance: $S_d \le R_d$.

For the characteristic resistance given in the respective ETA, reduc- tion factors due to e.g. freeze/thaw, service temperature, durability, creep behaviour and other environmental or application conditions are already considered.

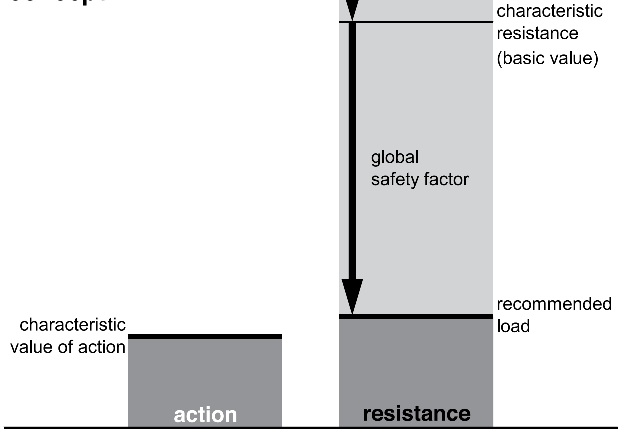


Global safety factor concept

For the global safety factor concept it has to be shown, that the characteristic value of action does not exceed the recommend load value.

The characteristic resistance given in the tables is the 5% fractile value obtained from test results under standard test conditions. With a global safety factor all environmental and application conditions for action and resistance are considered, leading to a recommended load.

According to the Hong Kong Building Department requirement, the overall safety factor should not be less than 3. i.e. the partial safety factor for material times the partial safety factor for action should be greater than 3.



Design methods

Metal anchors for use in concrete according ETAG 001

The design methods for metal anchors for use in concrete are described in detail in Annex C of the European Technical Approval guideline ETAG 001 and for bonded anchors with variable embedment depth in EOTA Technical Report TR 029. Additional design rules for redundant fastenings are given in Part 6 of ETAG 001.

The design method given in this Anchor Fastening Technology Manual is based on these guidelines. The calculations according to this manual are simplified and lead to conservative results, i.e. the results are on the save side. Tables with basic load values and influecing factors and the calculation method are given for each anchor in the respective section.

Anchors for use in other base materials and for special applications

If no special calculation method is given, the basic load values given in this manual are valid, as long as the application conditions (e.g. base material, geometrie, environmental conditions) are observed.

Resistance to fire

When resistance to fire has to be considered, the load values given in the fire test report should be observed. The values are valid for a single anchor. Please consult Hilti technical advisory service for more details.

Redundant fastenings with plastic anchors

Design rules for redundant fastings with plastic anchors for use in concrete and masonry for non-structural applications are given in Annex C of ETAG 020. The additional design rules for redundant fastenings are considered in this manual.

Hilti design software PROFIS Engineering Suite

For a more complex and accurate design according to international and national guidelines and for applications beyond the guidelines, e.g. group of anchors with more than four anchors close to the edge or more than eight anchors far away from the edge, the Hilti design software PROFIS Engineering yields customised fastening solutions. The results can be different from the calculations according to this manual.

The following methods can be used for design using PROFIS Anchor:

- ETAG
- CEN/TS
- ACI 318-08
- EN1992-4
- Solution for Fastening (Hilti internal design method)

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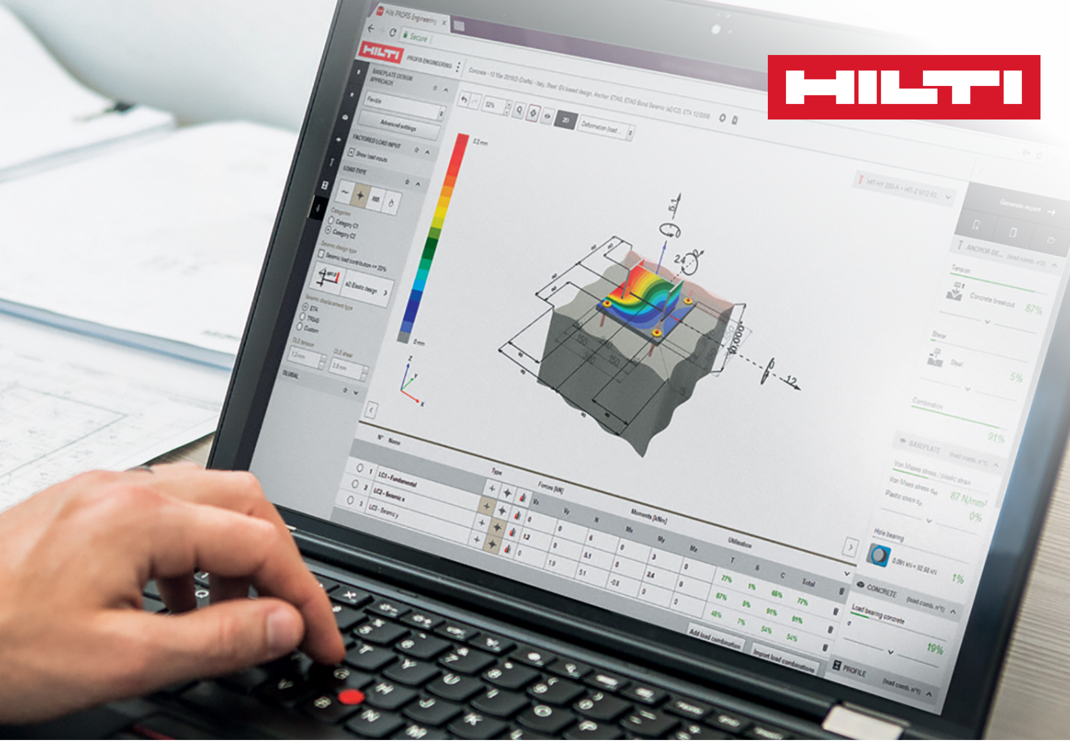
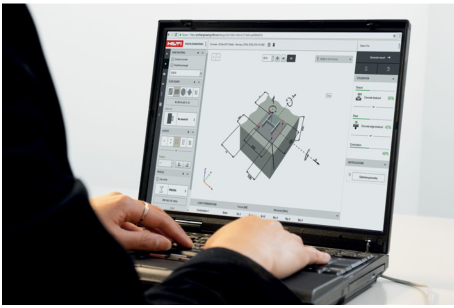
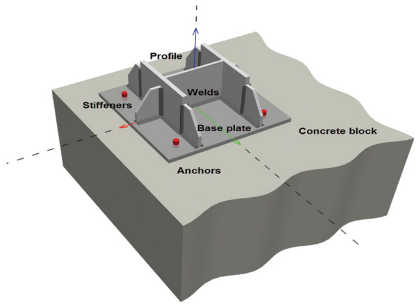


INCREASE DESIGN PRODUCTIVITY



- Cloud version allows easy access to you design at different locations



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Anchor design method according to Annex C of ETAG 001 and EOTA TR 29

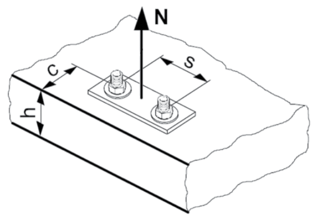
Design resistance according data given in the relevant European Technical Approval (ETA)

- Influence of concrete strength
- Influence of edge distance
- Influence of spacing
- Valid for a group of two anchors. (The method may also be applied for anchor groups with more than two anchors or more than one edge. The influencing factors must then be considered for each edge distance and spacing. The calculated design loads are then on the save side: They will be lower than the exact values according ETAG 001, Annex C. To avoid this, it is recommended to use the anchor design software PROFIS anchor)
- Anchors for use in other base materials and for special applications is not covered in this section

Design tensile resistance

The design tensile resistance is the lower value of

- Design steel resistance $N_{Rd,s}$
- Design pull-out resistance (Design combined pull-out and concrete cone resistance for bonded anchors) $N_{Rd,p}$
- Design concrete cone resistance $N_{Rd,s}$
- Design splitting resistance $N_{Rd,sp}$



Design steel resistance $N_{Rd,s}$

Annex C of ETAG 001 / EOTA TR 029 and relevant ETA

$N_{Rd,s}$ = $N_{Rk,s} / \gamma_{Ms}$

* $N_{Rk,s}$: characteristic steel resistance

* γ_{Ms}: partial safety factor for steel failure

* Values given in the relevant ETA

Design pull-out resistance $N_{Rd,p}$ for anchors designed according Annex C of ETAG 001

Annex C of ETAG 001 and relevant ETA

$N_{Rd,p}$ = $(N_{Rk,p} / \gamma_{Mp}) \cdot \psi_c$

* $N_{Rk,p}$: characteristic pull-out resistance

* γ_{Mp}: partial safety factor for pull-out failure

* ψ_c: influence of concrete strength

* Values given in the relevant ETA

Design combined pull-out and concrete cone resistance $N_{Rd,p}$ for bonded anchors designed according EOTA TR 029

EOTA TR 029 and relevant ETA

$N_{Rd,p}$ = $(N^0_{Rd,p} / \gamma_{Mp}) \cdot (A_{p.N} / A^0_{p,N}) \cdot \psi_{s,Np} \cdot \psi_{g,Np} \cdot \psi_{ec,Np} \cdot \psi_{re,Np} \cdot \psi_c$

where
$N^0_{Rd,p} = \pi \cdot d \cdot h_{ef} \cdot \tau_{Rk}$

$\psi_{g,Np} = \psi^0_{g,Np} - (s / s_{cr,Np})^{0.5} \cdot (\psi^0_{g,Np} - 1) \geq 1$

$\psi^0_{g,Np} = n^{0.5} - (n^{0.5} - 1) \geq 1 \cdot$
$\cdot \{(d \cdot \tau_{Rk})/[k \cdot (h_{ef} \cdot f_{ck,cube})^{0.5}]\}^{1,5} \geq 1$

$s_{cr,Np} = 20 \cdot d \cdot (\tau_{Rk,ucr} / 7,5)^{0.5} \leq 3 \cdot h_{ef}$

- * γ_{Mp}: partial safety factor for combined pull-out and concrete cone failure
- \+ $A^0_{p,N}$: influence area of an individual anchor with large spacing and edge distance at the concrete surface (idealised)
- \+ $A_{p,N}$: actual influence area of the anchorage at the concrete surface, limited by overlapping areas of adjoining anchors and by edges of the concrete member
- \+ $\psi_{s,Np}$: influence of the disturbance of the distribution of stresses due to edges
- \+ $\psi_{ec,Np}$: influence of excentricity
- \+ $\psi_{re,Np}$: influence of dense reinforcement
- * ψ_c: influence of concrete strength
- * **d**: anchor diameter
- * h_{ef}: (variable) embedment depth
- * τ_{Rk}: characteristic bond resistance
- **s**: anchor spacing
- $s_{cr,Np}$: critical anchor spacing
- **n**: number of anchors in a anchor group
- **k**: = 2,3 in cracked cocrete
= 2,3 in cracked cocrete
- $f_{ck,cube}$: concrete compressive strength
- * $\tau_{Rk,ucr}$: characteristic bond resistance for non-cracked concrete

* Values given in the relevant ETA

\+ Values have to be calculated according data given in the relavant ETA (details of calculation see TR 029. The basis of the calculations may depend on the critical anchor spacing)

Influence of concrete strength

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

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

Design concrete cone resistance $N_{Rd,c}$

Annex C of ETAG 001 / EOTA TR 029 and relevant ETA

$N_{Rd,c}$ = $(N^0_{Rk,c} / \gamma_{Mc}) \cdot (A_{c,N} / A^0_{c,N}) \cdot \psi_{s,N} \cdot \psi_{re,N} \cdot \psi_{ec,N}$

where $N^0_{Rk,c} = k_1 \cdot f_{ck,cube}^{0.5} \cdot h_{ef}^{1,5}$

* γ_{Mc}: partial safety factor for concrete cone failure

\+ $A^0_{c,N}$: area of concrete cone of an individual anchor with large spacing and edge distance at the concrete surface (idealised)

\+ $A_{c,N}$: actual area of concrete cone of the anchorage at the concrete surface, limited by overlapping concrete cones of adjoining anchors and by edges of the concrete member

\+ $\psi_{s,N}$: influence of the disturbance of the distribution of stresses due to edges

\+ $\psi_{re,N}$: influence of dense reinforcement

\+ $\psi_{ec,N}$: influence of excentricity

k_1: = 7,2 for anchorages in cracked concrete
= 10,1 for anchorages in non-cracked concrete

$f_{ck,cube}$: concrete compressive strength

* h_{ef}: effective anchorage depth

* Values given in the relevant ETA

\+ Values have to be calculated according data given in the relavant ETA (details of calculation see Annex C of ETAG 001 or EOTA TR 029)

Design concrete splitting resistance $N_{Rd,sp}$

Annex C of ETAG 001 / EOTA TR 029 and relevant ETA

$N_{Rd,sp}$ = $(N^0_{Rk,c} / \gamma_{Mc}) \cdot (A_{c,N} / A^0_{c,N}) \cdot \psi_{s,N} \cdot \psi_{re,N} \cdot \psi_{ec,N} \cdot \psi_{h,sp}$

where $N^0_{Rk,c} = k_1 \cdot f_{ck,cube}^{0.5} \cdot h_{ef}^{1,5}$

* γ_{Mc}: partial safety factor for concrete cone failure

++ $A^0_{c,N}$: area of concrete cone of an individual anchor with large spacing and edge distance at the concrete surface (idealised)

++ $A_{c,N}$: actual area of concrete cone of the anchorage at the concrete surface, limited by overlapping concrete cones of adjoining anchors and by edges of the concrete member

\+ $\psi_{s,N}$: influence of the disturbance of the distribution of stresses due to edges

\+ $\psi_{re,N}$: influence of dense reinforcement

\+ $\psi_{ec,N}$: influence of excentricity

k_1: = 7,2 for anchorages in cracked concrete
= 10,1 for anchorages in non-cracked concrete

\+ $\psi_{h,sp}$: iinfluence of the actual member depth

$f_{ck,cube}$: concrete compressive strength

* h_{ef}: embedment depth

* Values given in the relevant ETA

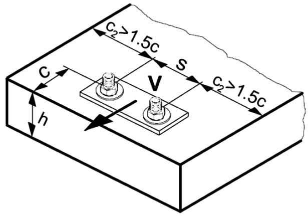
\+ Values have to be calculated according data given in the relavant ETA (details of calculation see Annex C of ETAG 001 or EOTA TR 029)

++ Values of $A^0_{c,N}$ and $A_{c,N}$ for splitting failure may be different from those for concrete cone failure, due to different values for the critical edge distance and critical anchor spacing

Design shear resistance

The design shear resistance is the lower value of

- Design steel resistance $V_{Rd,s}$
- Design concrete pryout resistance $V_{Rd,cp}$
- Design concrete edge resistance $V_{Rd,c}$



Design steel resistance $V_{Rd,s}$ (without lever arm)

Annex C of ETAG 001 / EOTA TR 029 and relevant ETA

$V_{Rd,s} = V_{Rk,s} / \gamma_{Ms}$

* $V_{Rk,s}$: characteristic steel resistance

* γ_{Ms}: partial safety factor for steel failure

* Values given in the relevant ETA

For steel failure with lever arm see Annex C of ETAG 001 or EOTA TR 029

Design concrete pryout resistance $V_{Rd,cp}$ for anchors designed according Annex C of ETAG 001

Annex C of ETAG 001 and relevant ETA

$V_{Rd,cp} = (V_{Rk,cp} / \gamma_{Mp/Mc}) = k \cdot N_{Rd,c}$

* $N_{Rd,c}$: $= N_{Rk,c} / \gamma_{Mc}$

* $N_{Rk,c}$: characteristic tension resistance for concrete cone failure (see design concrete cone failure)

* γ_{Mc}: partial safety factor for concrete cone failure (see design concrete cone failure)

* **k**: influence of embedment strength

* Values given in the relevant ETA

Design concrete pryout resistance $V_{Rd,cp}$ for bonded anchors designed according EOTA TR 029

EOTA TR 029 and relevant ETA

$V_{Rd,c}$ = $(V_{Rk,cp} / \gamma_{Mp/Mc})$ = $k \cdot$ lower value of $N_{Rd,p}$ and $N_{Rd,c}$

$N_{Rd,p} = N_{Rk,p} / \gamma_{Mp}$

$N_{Rd,c} = N_{Rk,c} / \gamma_{Mc}$

$N_{Rd,p}$: characteristic tension resistance for combined pull-out and concrete cone failure (see design combined pull-out and concrete cone failure)

$N_{Rk,c}$: characteristic tension resistance for concrete cone failure (see design concrete cone failure)

* γ_{Mp}: partial safety factor for combined pull-out and concrete cone failure (see design combined pull-out and concrete cone failure)

* γ_{Mc}: partial safety factor for concrete cone failure (see design concrete cone failure)

k: influence of embedment depth

* Values given in the relevant ETA

Design concrete edge resistance $V_{Rd,c}$

Annex C of ETAG 001 / EOTA TR 029 and relevant ETA

$V_{Rd,c}$ = $(V^0_{Rk,c} / \gamma_{Mc}) \cdot (A_{c,V} / A^0_{c,V}) \cdot \psi_{s,V} \cdot \psi_{h,V} \cdot \psi_{\alpha,V} \cdot \psi_{ec,V} \cdot \psi_{re,V}$

where $V^0_{Rk,c} = k_1 \cdot d^{\alpha} \cdot h_{ef}^{\beta} \cdot f_{ck,cube}^{0,5} \cdot c_1^{1,5}$

$\alpha = 0,1 \cdot (h_{ef} / c_1)^{0,5}$

$\beta = 0,1 \cdot (d / c_1)^{0,2}$

* γ_{Mp}: partial safety factor for concrete edge failure

\+ $A^0_{c,V}$: area of concrete cone of an individual anchor at the lateral concrete surface not affected by edges (idealised)

\+ $A_{c,V}$: actual area of concrete cone of anchorage at the lateral concrete surface, limited by overlapping concrete cones of adjoining anchors, by edges of the concrete member and by member thickness

\+ $\psi_{s,V}$: influence of the disturbance of the distribution of stresses due to further edges

\+ $\psi_{h,V}$: takes account of the fact that the shear resistance does not decrease proportially to the memebr thickness as assumed by the idealised ratio $A_{c,V} / A^0_{c,V}$

++ $\psi_{\alpha,V}$: Influence of angle between load applied and the direction perpendicular to the free edge

++ $\psi_{ec,V}$: influence of excentricity

++ $\psi_{re,V}$: influence of reinforcement

k_1: = 1,7 for anchorages in cracked concrete
= 2,3 for anchorages in non-cracked concrete

* **d:** anchor diameter

$f_{ck,cube}$: concrete compressive strength

* c_1: edge distance

* Values given in the relevant ETA

\+ Values have to be calculated according data given in the relavant ETA (details of calculation see Annex C of ETAG 001 or EOTA TR 029)

++ Details see Annex C of ETAG 001 or EOTA TR 029

Combined tension and shear loading

The following equations must be satisfied

$ß_N \leq 1$

$ß_V \leq 1$

$ß_N + ß_V \leq 1{,}2$ or $ß_N^{\alpha} + ß_V^{\alpha} \leq 1$

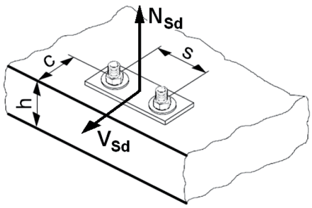
With

$ß_N = N_{Sd} / N_{Rd}$ and

$ß_V = V_{Sd} / V_{Rd}$

N_{Sd} (V_{Sd}) = **tension (shear) design action**

N_{Rd} (V_{Rd}) = **tension (shear) design resistance**



Annex C of ETAG 001

α = **2,0** if N_{Rd} and V_{Rd} are governed by steel failure

α = **1,5** for all other failure modes

Corrosion

1. What is corrosion?

Corrosion is understood to be the tendency of a metal to revert from its synthetically produced state to its natural state, i.e. from a high-energy pure form to the low energy but thermodynamically stable form of a metal oxide (ore). As a rule, an ore is the chemical compound of a metal with oxygen, hydrogen and possibly other elements. Corrosion is thus a natural process. In everyday usage, the word corrosion has many meanings.

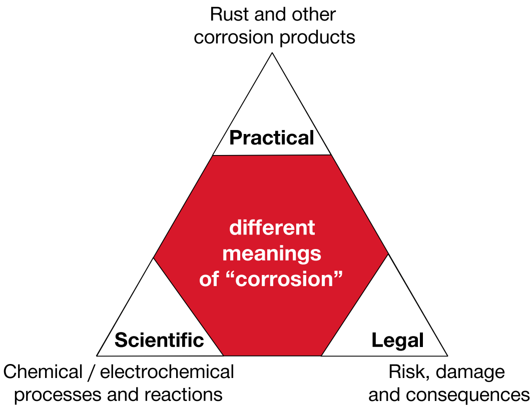


Fig. 1: Different meanings of corrosion.

With a view to achieving standardization when referring to and writing about this subject, the main terms have been defined, i.e. in ISO 8044. Accordingly, corrosion is a property of a system that is defined as follows.

Physicochemical interaction between a metal and its environment that results in changes in the properties of the metal, and which may lead to significant impairment of the function of the metal, the environment, or the technical system, of which these form a part [ISO 8044].

Material

The definition of material corrosion does not, actually, exclude the destruction of wood, ceramics, textiles, etc., but in practice the term applies primarily to metals and plastics, i.e. corrosion is directly associated with metals. Corrosion of materials is influenced by different processes, i.e. alloying, heat treatment, cold forming, etc.

Environment

The environment is characterized by temperature, humidity, pressure and composition/concentration of surrounding mediums (air, liquids and gases).

Design

Corrosion resistance is greatly affected by factors such as design, i.e. loads, ventilation, crevices etc.. The design of a part can have a significant influence on how specific areas of it are affected by its surroundings and the prevailing environmental conditions.

Reaction

Corrosion can be a chemical, electrochemical or a physicochemical reaction. Phase boundary reactions, reaction formulae and thermodynamics permit the processes taking place to be described. Generally, a distinction is made between types (the reaction between substances) and forms (the way the corrosion appears) of corrosion, which are explained in detail in this brochure.

2. When must corrosion be expected?

Corrosion must be expected when the properties of the metallic component or the entire structure (this includes the fastener, the base material and the fastened component) do not meet the requirements imposed by the surrounding conditions. To evaluate the risk of corrosion, it is essential that a profile of environmental conditions, specific materials or material combinations and design characteristics exists.

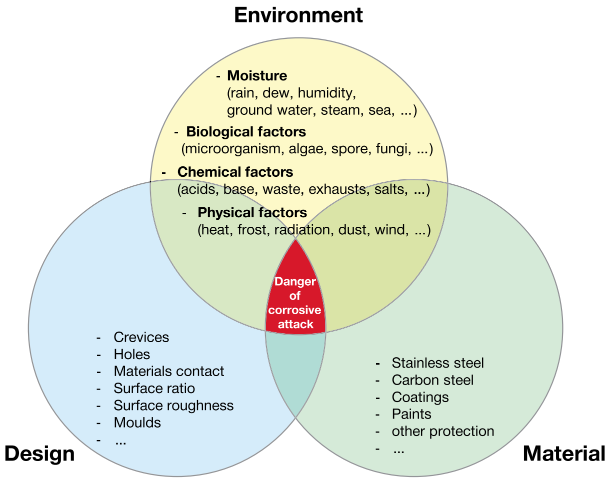


Fig. 2: Corrosion will occur only if more than one critical factor is present.

3. Corrosion protection

The aim of corrosion protection is to increase the components service life expectancy. A distinction is made between active and passive protection. Active corrosion protection is the measures, like advance planning and design, that take corrosion into account, e.g. galvanic separation, resistant materials, protective measures in the medium and protection by impressed current systems. Passive protection is regarded as all measures which affect the component directly and by which medium access is stopped or hindered. This can be, for example, metallic or non-metallic protective coatings.

3.1 Zinc-coated steel

The free corrosion potential of zinc is more negative than the free corrosion potential of steel. Zinc coatings on steel provide sacrificial cathodic protection against corrosion for the underlying steel surface even if the surface is damaged up to the ground material. In case of coating damage and under corrosive conditions, zinc donates its electrons to the steel. Due to this reaction, the steel will be protected. However, the zinc removal rate in regions close to the scratch will increase.

Generally, the rate of zinc corrosion is more or less linear with respect to time, depending on the atmosphere. Consequently, the duration of protection against corrosion is directly proportional to the plating thickness.

Atmosphere	Mean zinc plating surface removal per year
Rural	1 – 2 microns
Urban	3 – 5 microns
Industrial	6 – 10 microns
Coastal / marine	5 – 9 microns
Corrosion-resistant steels	Stainless steels, special alloys
Additional measures	Galvanic separation, etc.

Table 2
Rates of zinc removal in various surroundings as per Corrosion Handbook, Kreysa, Schütze, 9/2009.

Consequently, a doubling of the zinc thickness will lead to a doubling of duration of protection. The desired duration of protection thus governs selection of the zinc-plating process and thickness.

Zinc-coating processes used by Hilti

There are many different zinc plating processes. Which one is used depends on the application as well as on the shape and size of the product.

Process	Products
Electrochemical zinc plating	DX nails and threaded studs, anchors, MQ installation system
Sendzimir zinc plating	Anchor parts, MQ installation system
Sherardizing	Anchor
Hot-dip galvanizing	Anchors, MQ installation system
Others	Miscellaneous
Additional measures	Galvanic separation, etc.

Table 3
Zinc-coating processes used by Hilti

3.2 Electrochemical zinc plating (galvanizing)

During electrochemical zinc plating, pure zinc or zinc alloy is deposited on steel from a zinc salt solution by applying an electrical voltage. The adhesion of the layers is good. The achievable layer thicknesses are limited to approximately 25 microns. Typically, electrochemically zinc-plated fasteners have a zinc thickness of at least 5 to 13 microns and, with few exceptions, they have a blue passivation. This gives them adequate protection against corrosion for use in dry indoor rooms. If they are exposed to moisture though, the corrosion rate increases due to condensation from the surrounding air.

3.3 Sherardizing

Sherardizing is a method of galvanizing also called vapor galvanizing. It is a diffusion process. During this process, zinc powder diffuses into the surface of metal parts. In this drum process, temperatures between 320° and 420°C are usual. Even on complicated threaded parts, this process produces wear and temperature-resistant, uniform zinc coatings. These zinc coatings consist of layers of Zn/Fe alloys which offer very good protection against corrosion that can be compared with hot-dip galvanizing. The achievable coating thicknesses range up to 45 microns.

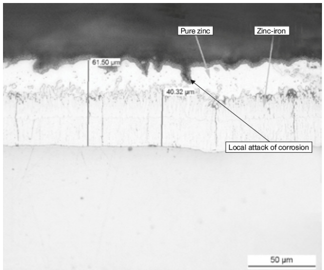
3.4 Hot-dip galvanizing

During the hot-dip galvanizing process, steel parts are dipped into a bath of molten zinc and are removed after a defined time. The thickness of the layer depends on the material thickness, the duration of dipping and other conditions. The typical thickness achieved are between 35 and 70 microns.

Coating composition after conventional, hot-dip galvanizing:

1. Layers of Zn/Fe alloys
2. Formation of a thin, overlying layer of pure zinc which gives the coated part abright appearance (zinc spangle). The formation of a pure zinc layer depends on the reactivity of the underlying steel.

A coating thickness between 45 and 60 microns can be achieved on threadedparts and anchors. Hot-dip galvanized parts with a well-developed layer of pure zinc first suffer white rusting, i.e. the product of corrosion of the pure zinc layer. After- wards, when the pure zinc layer has dissolved or broken down, brown rust appears, i.e. the product of corrosion of the Fe/Zn alloy layer. Brown rusting appears immediately on hot-dipped galvanized if the pure zinc layer is not present.



Micrograph of a hot-dip galvanized steel with local points of corrosion in the zinc layer (white rust)

3.5 Corrosion-resistant steels

Corrosion-resistant materials form a protective passivation layer on their surface. This reaction depends on the material and the specific surrounding medium. Under atmospheric conditions, materials such as aluminium and stainless steels are known as corrosion-resistant.

Stainless steels
In comparison to carbon steel, stainless steels have a chromium content of more than 12 wt%. A chromium oxide layer is formed as the result of a very short and intensive corrosion reaction. This invisible layer is very thin, less than 10 nm, with good adhe- sion properties and is normally without defects, resulting in very good corrosion protection.

After incurring damage, the oxide layer is reformed (repassivation) if oxygen and humidity are present. Under special circumstances, the passivation layer can be locally destroyed and repassivation is not possible. This leads to local corrosion, e.g. pitting corrosion.

Designations of stainless steels

A range of designations (standards) for stainless steels exist in industrial countries. The most important ones have been given here for the sake of a better understand- ing. The American Iron and Steel Institute (AISI) has a designation system that is used world wide. It consists of a number to which one of several letters are sometimes added.

200 – designates an austenitic steel containing chromium, nickel and manganese

300 – designates an austenitic steel containing chromium, nickel

400 – designates ferritic and martensitic chromium steels

The additional letters (some shown below) indicate the following:

L = lowcarbon

N = nitrogen

Se = selenium / easy machining Ti = titanium

F = easy machining

Nb = niobium

Similarly, the German system of numbering materials in accordance with DIN is used in several countries. Each number has five digits, such as 1. 4404.

The digit “1” stands for steel, the next two digits “44” stand for chemical-resistant steels containing Mo, but no Nb or Ti. The last two digits “04” designate the exact al- loy. In addition to the designation “44”, the following designations for stainless steel exist:

“40” = without Mo, Nb, Ti, Ni < 2.5 %

“41” = with Mo, without Nb and Ti, Ni < 2.5 %

“43” = without Mo, Nb and Ti, Ni ≥ 2.5%

“44” = with Mo, without Nb and Ti, Ni ≥ 2.5 %

“45” = with additional elements

In Germany and other European countries, an abbreviated form of designation ac- cording to the chemical analyses of materials is also in use (see DIN EN 10088.)

For example: X 2 Cr Ni Mo 17 12 2

X = High-alloy steel

2 = Carbon content in 1 / 100%, in this case: C= 0.02%

Cr = Chromium,inthiscase:17%

Ni = Nickel, in this case: 12%

Mo = Molybdenium, 2%

This steel corresponds to the AISI type 316 L and the DIN material no. 1.4404.

Designation V2A (A2) or V4A (A4):
In some countries (D, CH and A) the designation V2A (A2) or V4A (A4) has become accepted, especially in the construction industry. This designation can be traced back to the early days of stainless steel production. It is the brand designation used by a steel manufacturer. V2A steels are understood to be the group of austenitic CrNi steels without molybdenum, whereas austenitic steels of the V4A grade contain at least 2% molybdenum. Accordingly, this designation provides an initial indication of corrosion resistance.

The usual designations for fasteners made of austenitic stainless steels are explained in ISO 3506.

A4-70 as an example:

A = Austeniticstainlesssteel(alsopossible,F=ferritic,C=martensitic)

4 = Chromium-nickel-molybdenum steel

70 = Tensile strength of 700 N/mm2 (strain hardened)

According to German construction supervisory authority approval Z-30.3-6 dated April 20, 2009, corrosion-resistant steels are grouped in various corrosion resistance categories (WK = Widerstandsklasse, i.e. German for “resistance category”).

Material no.	Short designation	AISI	WK (DIbT Z.30.3-6)
1.4301	X5CrNi18-10	304	II
1.4401	X5CrNiMo17-12-2	316	III
1.4404	X2CrNiMo17-12-2	316L	III
1.4571	X6CrNiMoti17-12-2	316Ti	III
1.4362	X2CrNiN23-4	---	III
1.4462	X2CrNiMoN22-5-3	---	IV
1.4565	X2CrNiMnMoNbN25-18-5-4	---	IV
1.4529	X1NiCrMoCuN25-20-7	---	IV

Table 4
Stainless steels used by Hilti for most fasteners and connectors

Hilti HCR products (highly corrosion-resistant)
HCR products are made of 1.4529 material, which is recommended by Hilti for anchor fastenings in atmospheres containing chlorides (road tunnels, indoor swimming pools and in sea water) where high safety requirements must be met.

As a result of long-term field tests carried out by Hilti, the use of stainless steels other than HCR is not recommended for safety-relevant fastenings in the fields described above. More information about field tests in road tunnels is available in another Hilti brochure. Please ask your Hilti representative.

Hilti X-CR direct fastening products (corrosion-resistant)
X-CR material is a stainless steel of the WK4 category, and has a very high strength. It is used for direct fastening applications (i.e. threaded studs and nails driven by powder-actuated and gas-actuated tools). This material was developed jointly by Hilti and a steel manufacturer. X-CR has a higher chromium and molybdenum content than 1.4401, and therefore higher corrosion resistance according to PRE.

Table 5 shows the suitability of metals when in contact with each other.
It also shows which metal combinations are permitted in practice and which should be avoided.

	Fastener					
Fastened part	**Galvanized steel**	**Hot-dip galvanized**	**Aluminimum alloy**	**Structural steel**	**Stainless steel**	**Brass**
Galvanized steel	+	+	+	+	+	+
Hot-dip galvanized	+	+	+	+	+	+
Alluminum alloy	–	±	+	+	+	+
Structural steel	–	–	–	+	+	+
Cast steel	–	–	–	±	+	+
Chromium steel	–	–	–	–	+	±
CrNi(Mo) steel	–	–	–	–	+	–
Tin	–	–	–	–	+	±
Copper	–	–	–	–	+	±
Brass	–	–	–	–	+	±

+ slight or no corrosion of fastener
– heavy corrosion of fastener
± moderate corrosion of fastener

Table 5
Risk of bimetal corrosion under atmospheric conditions

4. How does Hilti solve the corrosion problem in practice?

The table 6 can be used to select the necessary corrosion protection system for the fastener and structure.materials or material combinations and design characteristics exists.

Impact	Exposure	Surroundings	Examples	Stainless steel WK				Carbon steel with zinc coating			Others
				I	II	III	IV	galv. Zinc 5)	HDG 6)	HDG plus 7)	Zinc flakes
Humidity, annual average value U	SF0	dry	U < 60%								
	SF1	rarely wet	60% < U < 80%								
	SF2	often wet	80% < U < 95%								
	SF3	mostly wet	95% < U							8)	
Chloride content of surroundings, distance M from sea, distance S from roads with high traffic volume and de-icing salt in use	SC0	low	countryside, town M > 10km, S > 0.1km								
	SC1	medium	Industrial zone, 10km > M > 1km, 0.1km > S > 0.01km								
	SC2	high	M < 1km S < 0.01km			1)					
	SC3	very high	indoor swimming pools, road tunnels				2)			8)	
Redox-effective Substances (SO_2, Cl_2, H_2O_2)	SR0	low	countryside, town								
	SR1	medium	Industrial zone			1)					
	SR2	high	indoor swimming pools, road tunnels				2)			8)	
pH-value at the surface	SH0	neutral	5 < pH < 9								
	SH1	alkaline (e.g. contact with concrete)	pH > 9					9)	9)	9)	9)
	SH2	slightly acidic (e.g. contact with wood)	3 < pH < 5					10)	10)	10)	10)
	SH3	acidic	pH < 3								
Exposure of the parts	SL0	indoor	heated and unheated rooms								
	SL1	outdoor, under roof	roofed structures		3) 4)						8)
	SL2	outdoor, exposed to weather	weathered structures		3) 4)						8)
	SL3	outdoor, concealed, may be affected by ambient air	ventilated facades			4)		11)	11)	8)	8)

Colored cells in the table: Material can be used.
Impact: The factors to be considered where highest corrosion resistance is required.
A combination of different impacting factors does not necessarily lead to higher demands.
Generally speaking, specific design features of relevant to corrosion and surface quality must be taken into consideration.
Please note that national or international standards may contradict information provided in this table.
Only structural aspects are taken into consideration. If decorative aspects are an issue, please ask your Hilti representative for further information.
Material selection here takes only external corrosion reactions into account. The risk of hydrogen embrittlement (materials with strength > 1000MPa] is not taken into consideration

1) A reduction of the WK is possible if the parts are accessible and frequently cleaned by hand or by rain.
2) Frequently cleaning of accessible parts may allow reduction of the WK.
3) If pitting corrosion up to 500µm is possible and lifetime is less than 20 years, WK I is possible.
4) If good visual appearance is required, a very smooth surface finish is necessary. It is not possible to use higher alloyed steels. In this case, ask your Hilti representative for further information.
5) The thickness of galvanized zinc layer is between 3 and 30µm (ISO 4042) or between 5 and 25µm (DIN 50961). The expected lifetime of an approx. 12µm zinc layer is more than 20 years if all exposure classes are O.
6) Hilti HDG provides a layer thickness of approx. 45µm. The expected lifetime of these products is more than 20 years if the materials selection table is used correctly.
7) Hilti HDG plus provides a layer thickness of approx. 60µm. The expected lifetime of these products is more than 20 years if the materials selection table is used correctly.
8) This system can be used if an additional organic coasting (ISO 12944) is applied. The expected lifetime depends on the coating system.
9) Contact with dry and carbonated concrete is not critical. Zinc is not corrosion resistant if in contact with (liquid) alkaline media. Zinc-coated steel parts can be used in alkaline concrete if the parts are completely embedded (in this case, no zinc layer is necessary).
10) Contact with dry wood is not critical. Zinc is not corrosion resistant if in contact with (liquid) acid media.
11) In Germany according to DIBt 2008: Galvanic coated screws for plastic frame anchoring can be used, if an additional bitumen-oil combinated coating is applied which protects the screws against rain and humidity.

Table 6
Selection aid for fasteners in different environments

Only common corrosion protection systems are shown in the table above. Hilti products are available with a number of other protection systems.

On the following pages you will find examples of how the above material selection table can be used.

Selection of corrosion protection for anchors

	Anchors	HSA HUS3 HST3 HAS-U	HUS3-HF	HSA-F HAS-U F	HSA-R2	HUS3-HR HSA-R HST3-R HAS-UR HIT-Z-R	HST3-HCR
	Coating/Material	Electro galvanize	Duplex coated carbon steel	HDG/ sherardized 45-50 µm	A2 AISI 304	A4 AISI 316	HCR, e.g. 1.4529
Environmental Conditions	**Fastened part**						
Dry indoor	Steel (zinc-coated, painted), aluminum, stainless steel	■	■	■	■	■	■
Indoor with temporary condensation	Steel (zinc-coated, painted), aluminum, stainless steel	-	■	■	■	■	■
	Stainless steel		-	-			
Outdoor with low pollution	Steel (zinc-coated, painted), aluminum, stainless steel	-	□ *	□ *	■ *	■	■
	Stainless steel		-	-			
1-10km Outdoor with moderate concentration of pollutants	Steel (zinc-coated, painted), aluminum, stainless steel	-	□ *	□ *	■ *	■	■
	Stainless steel		-	-			
0-1km Coastal areas	Steel (zinc-coated, painted), aluminum, stainless steel	-	-	-	-	■	■
Outdoor, areas with heavy industrial pollution	Steel (zinc-coated, painted), aluminum, stainless steel	-	-	-	-	■	■
Close proximity to roads treated with de-icing salts	Steel (zinc-coated, painted), aluminum, stainless steel	-	-	-	-	■	■
Special applications	-	Consult experts					■

■ = expected lifetime of anchors made from this material is typically satisfactory in the specified environment based on the typically expected lifetime of a building. The assumed service life in ETA approvals for powder-actuated and screw fasteners is 25 years, and for concrete anchors it is 50 years.

□ = a decrease in the expected lifetime of non-stainless fasteners in these atmospheres must be taken into account (≤ 25 years). Higher expected lifetime needs a specific assessment.

- = fasteners made from this material are not suitable in the specified environment. Exceptions need a specific assessment.

* From a technical point of view. HDG/duplex coatings and A2/304 material are suitable for outdoor environments with certain lifetime and application restrictions. This is based on longterm experience with these materials as reflected e.g. in the corrosion rates for Zn given in the ISO 9224:2012 (corrosivity categories, C-classes), the selection table for stainless steel grades given in the national technical approval issued by the DIBt Z.30.3-6 (April 2009) or the ICC-ES evaluation reports for our KB-TZ anchors for North America (e.g. ESR-1917, May 2013). The use of those materials in outdoor environments however is currently not covered by the European Technical Approval (ETA) of anchors, where it is stated that anchors made of galvanized carbon steel or stainless steel grade A2 may only be used in structures subject to dry indoor conditions, based on an assumed working life of the anchor of 50 years.

Environment categories

Applications can be classified into various environmental categories, by taking the following factors into account:

	Indoor applications
	Dry indoor environments
	(Heated or air-conditioning areas) without condensation, e.g. office buildings, schools
	Indoor environments with temporary condensation
	(Unheated areas without pollution) e.g. storage sheds

	Outdoor applications
	Outdoor, rural or urban environment with low population
	Large distance (> 10 km) from the sea
1-10km	**Outdoor, rural or urban environment with moderate concentration of pollutants and/or salt from sea water**
	Distance from the sea 1-10 km
0-1km	**Coastal areas**
	Distance from the sea < 1 km
	Outdoor areas with heavy industrial pollution
	Close to plants > 1 km (e.g. petrochemical, coal industry)
	Close proximity to roadways threated with de-icing salts
	Distance to roadways < 10 km

	Outdoor applications
	Special applications
	Areas with special corrosive conditions, e.g. road tunnels with de-icing salt, indoor swimming pools, special applications in the chemical industry (exceptions possible)

Important notes

The ultimate decision on the required corrosion protection must be made by the customer. Hilti accepts no responsibility regarding the suitability of a product for a specific application, even if informed of the application conditions.

The tables are based on an average service life for typical applications.

For metallic coatings, e.g. zinc layer systems, the end of lifetime is the point at which red rust is visible over a large fraction of the product and widespread structural deterioration can occur - the initial onset of rust may occur sooner.

National or international codes, standards or regulations, customer and/or industry specific guidelines must be independently considered and evaluated.

These guidelines apply to atmospheric corrosion only. Special types of corrosion, such as crevice corrosion or hydrogen assisted cracking must be independently evaluated.

The table published in this brochure describe only a general guideline for commonly accepted applications in typical atmospheric environments.

Suitability for a specific application can be significantly affected by localised conditions, including but not limit to:

Elevated temperatures and humidity; High levels of airborne pollutants; Direct contact with corrosive products, such as found in some types of chemically-treated wood, waste water, concrete additives,cleaning agents, etc.; Direct contact to soil, stagnant water; Electrical current; Contact with dissimilar metals; Confined areas, e.g. crevices; Physical damage or wear; Extreme corrosion due to combined effects of different influencing factors; Enrichment or pollutants on the product

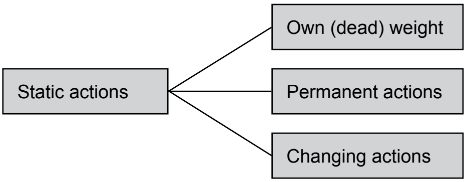
Dynamic

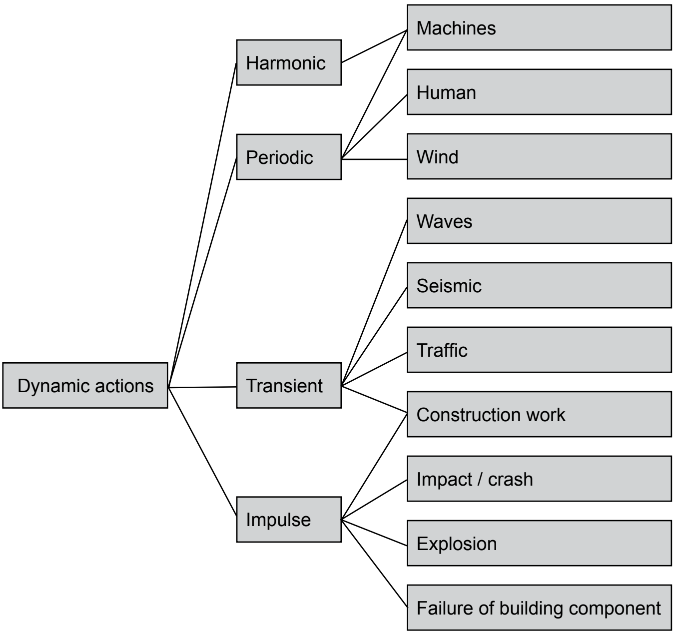
1. Impacts on Fasteners

Actions (loads)

Review of actions

Often, it is not possible to accurately determine the actions (loads) to which anchor / fasteners are subjected. In this case, it is possible to make it with estimates for which standards specify the minimum levels to be used for most modes of loading. The uncertainty in determining a action (load) is compensated by selecting suitably adapted safety factors.





Static loads

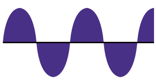
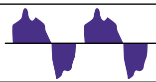
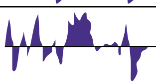
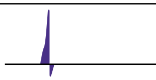
Static loads can be segregated as follows:

- Own (dead) weight
- Permanent actions
  Loads of non-loadbearing components, e.g. floor covering, screed, or from constraint (due to temperature change or sinking of supports / columns)
- Changing actions:
  Working loads (fitting / furnishing, machines, "normal" wear)
  Snow
  Wind
  Temperature

Static loads

The main difference between static and dynamic loads is the effectiveness of inertia and damping forces. These forces result from included acceleration and must be taken into account when determining section forces and anchoring forces.

Classification	Fatigue	Fatigue under few load cycles	Impact, impulse-like load
Frequency of occurence, number of load cycles	$10^4 < n \geq 10^8$	$10^1 < n < 10^4$	$1 < n < 20$
Rate of strain	$10^{-6} < n \geq 10^{-3}$	$10^{-6} < \varepsilon' > 10^{-2}$	$10^{-3} < \varepsilon' > 10^{-1}$
Example	Traffice loads, machines, wind, waves	Earthquakes / seismic, man-made earthquakes	Impact, explosion, sudden building component failure
	Fatigue	**Seismic**	**Shock**

Action	**Chronological sequence**		**Possible cause**
Harmonic (alternating load)		sinusoidal	Out of balance rotating machines
Harmonic (compressive / tensile pulsating load)		sinusoidal	Regularly impacting parts (punching machines)
Periodic		random, periodic	Earthquakes / seismic, rail and road traffic
Stochastic		random, non periodic	Earthquakes / seismic, rail and road traffic
Impace / Shock		random, of short duration	Impact / crash, explosion, rapidly closing valves

Behaviour of materials

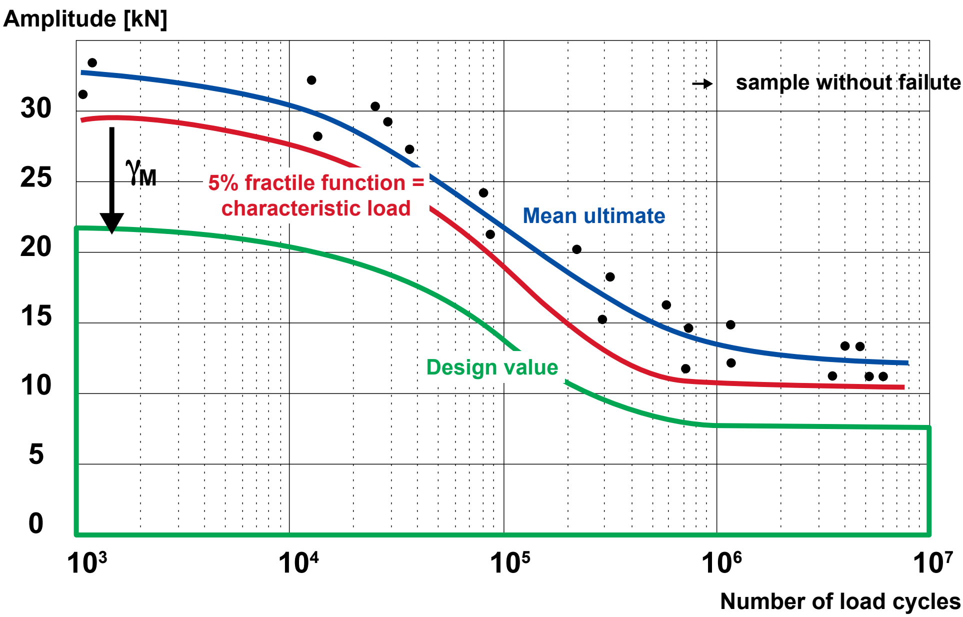
Material behaviour under static loading

The behaviour of material under static loading is described essentially by the strength (tensile and compressive) and the elastic-plastic behaviour of the material, e.g. modulus of elasticity, shear (lateral) strain under load, etc. These properties are generally determined by carrying out simple tests with specimens.

Fatigue behaviour

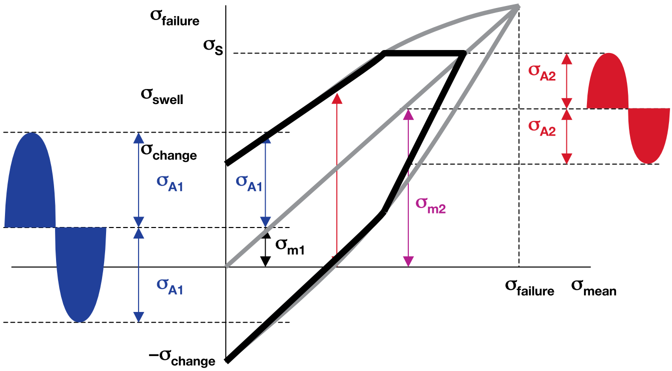
If a material is subjected to a sustained load that changes with respect to time, it can fail after a certain number of load cycles even though the upper limit of the load with- stood up to this time is clearly lower than the ultimate tensile strength under static loading. This loss of strength is referred to as material fatigue.

It is widespread practice to depict the fatigue behaviour of a material in the form of so-called S-N curves (also called Wöhler curves). They show the maximum load am- plitude that can be withstood at a given number of load cycles (for action with a sinu- soidal pattern). If a level of stress can be determined at which failure no longer occurs after any number of load cycles, reference is made to fatigue strength or short-term fatigue strength. Higher loads that can often only be withstood for a limited time, come within the low-cycle fatigue range or range of fatigue strength for finite life.



Fatigue behaviour of steel

The fatigue behaviour of various grades of steel is determined during fatigue (Wöhler) tests. If a series of fatigue tests is carried out using different mean stresses, many fatigue curves are obtained from which a decrease in the fatigue-resisting stress amplitude, σ_A, can be identified. The graphical depiction of the relationship between the mean stress, σ_m, and the fatigue-resisting stress amplitude, σ_A, in each case is called the stress-number (S-N) diagram. Smith's representation is mostly used today.



The grade of steel has a considerable influence on the alternating strength. In the case of structural and heat-treatable steels, it is approx. 40% of the static strength, but this, of course, is considerably reduced if there are any stress raisers (notch effects). The fatigue strength of actual building components is influenced by many factors:

- Stress raiser (notch effect)
- Type of loading (tensile, shear, bending)
- Dimensions
- Mean stress

Stainless steels as well as plastics do not have a pronounced fatigue durability (endurance) so that fatigue failure can even occur after load cycles of $>10^7$.

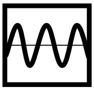
Fatigue behaviour of concrete

The failure pheonmenon of concrete under fatigue loading is the same as under static loading. In the non-loaded state, concrete already has micro-cracks in the zone of contact of the aggregates and the cement paste which are attributable to the aggregates hindering shrinkage of the cement paste. The fatigue strength of concrete is directly dependent on the grade of concrete. A concrete with a higher compressive strength also has higher fatigue strength. Concrete strength is reduced to about 60 – 65% of the initial strength after 2'000'000 load cycles.

2. Anchor Behaviour

Behaviour when subjected to dynamic action

In view of the fact that dynamic action can have very many different forms, only the basic information has been given in the following that is required to understand fastening behaviour.



Fatigue

Fatigue behaviour of single anchor in concrete

The fatigue behaviour of steel and concrete is described in chapter 1. When a large number of load cycles is involved, i.e. $n > 10^4$, it is always the anchor in single fasten- ings that is crucial (due to steel failure). The concrete can only fail when an anchor is at a reduced anchorage depth and subjected to tensile loading or an anchor is at a reduced distance from an edge and exposed to shear loading.

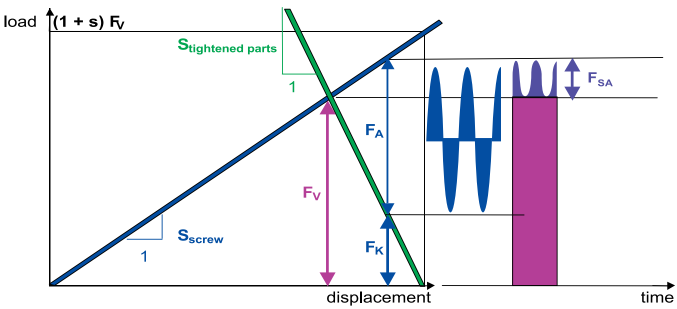
In the range of short-term strength, i.e. $n < 10^4$, the concrete can also be crucial. This is dependent very much on the cross-sectional area of the steel in relation to the anchorage depth, i.e. a large diameter combined with a small anchorage depth => concrete failure or a small diameter with a large anchorage depth => steel failure.

Multiple anchor fastenings

Individual anchors in a multiple-anchor fastening can have a different elastic stiffness and a displacement (slip) behaviour that differs from one anchor to another, e.g. if an anchor is set in a crack. This leads to a redistribution of the forces in the anchors during the appearance of the load cycles. Stiffer anchors are subjected to higher loads, whereas the loads in the less stiff anchors are reduced. Allowance is made for these two effects by using a reduction factor for multiple-anchor fastenings. It is determined during defined tests.

Influence of anchor pretensioning

The behaviour of anchors under dynamic loading is decisively improved by anchor pretensioning (preload). If an external working load, F_A, acts on a pretensioned anchor fastening, the fatigue-relevant share of the load cycle taken by the bolt is only the considerably smaller share of the force in the bolt, F_{SA}.



F_A: external working load
F_K: clamping force
F_{SA}: share relevant to fatigue
F_V: pretensioning force
S_{screw}: bolt stiffness
$S_{clamped\ parts}$:stiffness of clamped parts

Consequently, the existence of a pretensioning force is of crucial significance for the fatigue behaviour of an anchor (fastener). In the course of time, however, all anchors lose some of the pretensioning force. This loss is caused by creep of the concrete, primarily in the zone in which the load is transferred to the concrete, due to relative deformation in turns of the bolt thread and relaxation in the bolt shank.

Tests have shown that comparable losses of pretensioning force can be measured in anchors (fasteners) that have quite different anchoring mechanisms, such as cast-in headed studs, undercut anchors and expansion anchors. As a result, a residual pretensioning force of 30 to 50% the initial force must be expected after a considerable time if no counter-measures are taken.

Pretensioning force of anchor in a crack

If an anchor is set in a crack, the pretensioning force may decrease to zero and cannot, consequently, be taken into account for a fastening being designed to withstand fatigue.

Influence of pretensioning on anchors loaded in shear

The clamping force between the part fastened and the base material, as shown above, is directly dependent on the pretensioning force in the anchor. As a rule, the fatigue strength of steel under shear loading is not as high as under pure tensile load- ing. In view of this, an attempt should be made to transfer at least a part of the dy- namic shear force into the concrete by friction. Accordingly, if the pretensioning force is high, the share that the anchor must take up is smaller. This has a considerable in- fluence on the number and size of anchors required.

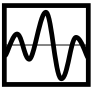
It is recommended that shear pins be provided to take up the dynamic shear forces. As a result, the anchors, provided that the through-hole has a suitable shape, can be designed for pure tensile loading.

Pretensioning force in stand-off fastenings

In stand-off fastenings, the section of the bolt above the concrete is not pretensioned. The type of threaded rod alone, i.e. rolled after heat treatment or tempered after heat treatment, thus determines the fatigue durability of the fastenings. The pretensioning force in anchors is, nevertheless, important to achieve a high level of fastening stiffness.

Influence of type of thread

How the thread is produced, has a decisive influence on the fatigue strength. A thread rolled after bolt heat treatment has a higher fatigue strength than a thread tempered after heat treatment. All threads of Hilti anchors are rolled after heat treatment. Similarly, the diameter of a thread has a decisive influence on the ultimate strength. This decreases with increasing diameter.



Earthquakes (seismic loading)

Load peaks caused by earthquakes

Anchor (fasteners) subjected to seismic loading can, under circumstances, be stressed far beyond their static loading capacity.

In view of this, the respective suitability tests are carried out using a level of action (loading) that is considerably higher than the working load level. The behaviour of anchors under seismic action depends on the magnitude of loading, the direction of loading, the base material and the type of anchor. After an earthquake, the loading capacity (ultimate state) of an anchor is considerably reduced (to 30 – 80% of the original resistance).

Anchor design as a part of the overall concept

When designing anchor fastenings, it is important to remember that they cannot be regarded as something isolated to take up seismic forces, but that they must be incorporated in the overall context of a design. As anchors are generally relatively short and thus also stiff items, the possibility of taking up energy in an anchor (fastener) is restricted. Other building components are usually more suitable for this purpose. It is also difficult to foresee what loads will actually be imposed.

Impact and shock-like loads

Load increase times in the range of milliseconds can be simulated during tests on servo-hydraulic testing equipment. The following main effects can then be observed:

- deformation is greater when the breaking load is reached.
- the energy absorbed by an anchor is also much higher.
- breaking loads are of roughly the same magnitude during static loading and shock-loading tests.

In this respect, more recent investigations show that the base material (cracked or non-cracked concrete), has no direct effect on the load bearing behaviour.

Suitability of anchors for dynamic loading

Suitability under fatigue loading

Both mechanical and chemical anchors are basically suitable for fastenings subjected to fatigue loading. As, first and foremost, the grade of steel is crucial, Hilti manufactures the HDA anchors of special grades of steel resistant to fatigue and has also subjected them to suitably tests. Where other anchors are concerned, global statements about ultimate strengths have to be relied on, e.g. those from mechanical engineering.

Suitability under seismic loading

Where fastenings subjected to seismic loading are concerned, chemical anchors take preference. There are, however, accompanying requirements to be met, such as behaviour in a fire or at high temperatures, i.e. load-displacement behaviour, which restrict the use of this type of anchor and make mechanical systems preferable.

Suitability under shock loading

To date, mechanical anchor systems have been used primarily for applications in civil defence installations. These mechanical anchors have had their suitability proofed when set in cracked concrete. Recently, adhesive systems suitable for use in cracked concrete have been developed, e.g. the HDA adhesive whose suitability for shock loading were also verified. For other shock-like loads, such as those acting on the fastenings of guide rail systems, both mechanical anchors and chemical systems can be considered.

Seismic anchor design

Background and recommendations

Influence of earthquake resulting cracks in concrete base material

Concrete should be assumed cracked

As a structure responds to earthquake ground motion it experiences displacement and consequently deformation of its individual members. This deformation leads to the formation and opening of cracks in members. Consequently all anchorages intended to transfer earthquake loads should be suitable for use in cracked concrete and their design should be closed for the duration of the ground motion.

Anchors not recommended in plastic hinges areas

Parts of the structures may be subjected to extreme inelastic deformation as exposed in Fig.1. In the reinforced areas yielding of the reinforcement and cycling of cracks may result in cracks width of several millimeters, particularly in regions of plastic hinges. Qualification procedures for anchors do not currently anticipate such large crack widths. For this reason, anchorages in this region where plastic hinging is expected to occur, such as the base of shear wall and joint regions of frames, should be avoided unless apposite design measures are taken.

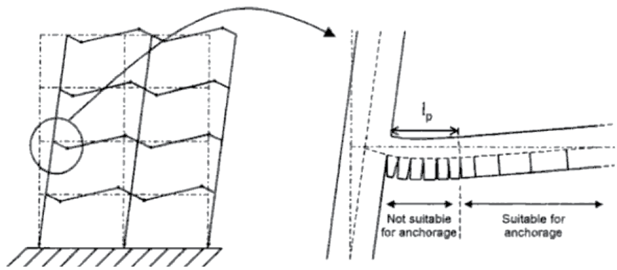


Fig.1 - Member cracking assuming a strong-column, weak girder design

Influence of earthquake resulting cracks in concrete base material

Specific testing programs are needed to asses anchors

An anchor suitable (approved) to perform in a commonly defined cracked concrete, about 0.3mm, is not consequently suitable to resist seismic actions, it's just a starting point.

During an earthquake cyclic loading of the structure and of the fastenings is induced simultaneously. Due to this the width of the cracks will vary between a minimum and a maximum value and the fastenings will be loaded cyclically. Specific testing programs and evaluation requirements are then necessary in order to evaluate the performance of an anchor subjected to seismic actions. Only the anchors approved after the mentioned procedure shall be specified for any safety relevant connection.

Anchors suitable to endure seismic loading

Anchors generally suitable for taking up seismic actions are those which can be given a controlled and sustained pre-tensioning force and are capable of re-expanding when cracking occurs. Also favorable are anchors which have an anchoring mechanism based on a keying (mechanical interlock) as it is the case for undercut anchors and concrete screws. Furthermore, some specific chemical anchors have also been recognized good performance to resist seismic actions.

Influence of an annular gap in the anchorage resistance under shear loading

Annular gap influence the anchors resistance

Under shear loading, if the force exceeds the friction between the concrete and the anchoring plate, the consequence will be slip of the fixture by an amount equal to the annual gap. The forces on the anchors are amplified due to a hammer effect on the anchor resulting from the sudden stop against the side of the hole (Fig.2a).

Moreover, where multiple-anchor fastenings are concerned, it must be assumed that due to play of the hole on the plate a shear load is not distributed among all anchors. In an unfavourable situation, when anchor fastenings are positioned near to the edge of a concrete member, only the anchors closest to the edge are loaded. This can result in failure of the concrete edge before the anchors furthest from the edge can also participate in the load transfer (Fig.2b). By eliminating the annular gap, filling the clearance hole with an adhesive mortar e.g. the effects mentioned above are controlled with great benefit to the anchorage performance.

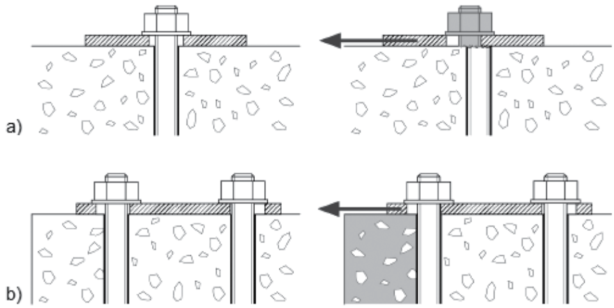


Fig.2 - Mains consequence possibility resulting from annular gaps

Recommended the use of Hilti Dynamic Set

As per the European seismic design guideline an annular gap between an anchor and its fixture should be avoided in seismic design situations. Moreover, loosening of the nut shall be prevented by appropriate measures. The use of Hilti Dynamic Set (Fig.3) will ensure a professional approach for controlled filling of the annual gaps as well as it will present the loosening of the nut since it also comprehends a lock nut.

Also according to the European guideline, in case it can be ensured that there is no hole clearance between the anchor and the fixture, the anchor seismic resistance for shear loading is doubled compared to connections with hole clearances.

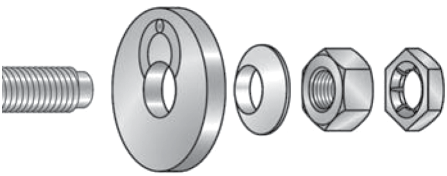


Fig.3 - Hilti Dynamic Set: Filling washer, conical washer nut and lock-nut

Seismic Fastening systems

Approved per new European regulations (ETAG 001 Annex E)

ETA seismic categories C1 and C2

Hilti HY 200 w / HIT-Z
- Fast-curing bonded anchor
- No cleaning required with the innovative HIT-Z ord

Hilti HST 3
- Medium-duty mechanical anchor
- Designed to excel in cracked concrete

Hilti HSL-3
- Sleeved heavy-duty expansion anchor
- Wide range of configuration for multi applications

Hilti HDA
- High-performance, self-undercutting
- Anchor for fast, reliable installation

Hilti HVU2 w / HAS-U
- Pre-dosed bonded anchor
- Ideal for system installations in variable locations

ETA seismic category C1

Hilti HY 200 w / HAS-U
- Fast-curing bonded anchor
- Auto-cleaning with Hilti hollow drill bit

Hilti HUS
- Highly efficient medium duty screw anchor
- Ideal for serial applications

Hilti HVU2 w / HAS-U
- Pre-dosed bonded anchor
- Ideal for system installations in variable locations

HEAVY / MEDIUM DUTY METAL ANCHORS

HDA Undercut anchor

Ultimate-performance undercut anchor for dynamic loads

Anchor version

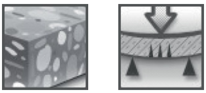
HDA-P
HDA-PR
HDA-PF
Anchor for pre-setting (M10-M20)

HDA-T
HDA-TR
HDA-TF
Anchor for through-fasting (M10-M20)

Benefits

- Self undercutting (without special undercutting tool)
- Low expansion force (small edge distance / spacing)
- Performance of a headed stud
- Complete system (anchor, stop drill bit, setting tool, drill hammer)
- Setting mark on anchor for installation control (easy and safe)
- Completely removable
- Suitable for all dynamic loads; seismic [a] C1 and C2, shock and fatigue

Base material

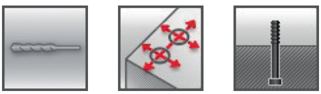


Non-cracked concrete | Cracked concrete (Tension zone)

Load conditions

Static/ quasi-static | Seismic ETA-C1, C2 | Fatigue | Shock | Fire resistance

Installation conditions



Hammer drilled holes | Small edge distance and spacing | Performance of a headed stud

Other information

European Technical Assessment | CE conformity | PROFIS Engineering Suite | Nuclear power plant approval | Corrosion resistance

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European Technical Assessment [b]	CSTB, Paris	ETA-99/0009 / 2015-01-06
ICC-ES report incl. seismic [c]	ICC evaluation service	ESR 1546 / 2020-01
Shockproof fastenings in civil defence installations	Federal Office for Civil Protection, Bern	BZS D 09-601 / 2009-10-21
Nuclear power plants	DIBt, Berlin	Z-21.1-1987 / 2015-03-02
Fatigue loading	DIBt, Berlin	Z-21.1-1693 / 2016-09-23
Fire test report	IBMB, Braunschweig	UB 3039/8151-CM / 2001-01-31
Assessment report (fire)	Warringtonfire	WF 327804/A / 2013-07-10

a) Please contact your Hilti representative for seismic resistance data
b) All data for HDA-P / HDA-PR / HDA-T / HDA-TR given in this section according ETA-99/0009 issue 2015-01-06. Sherardized versions HDA-PF / HDA-TF are not covered by the approvals.
c) Please contact your Hilti representative for more details on Technical Data according to ICC

Recommended general notes

* The below clauses based on Hilti product qualifications are for references only. Selection of clauses by the engineer shall be based on the specific application needs. Please contact Hilti's technical team for further details.

- Self-cutting undercut through-fastening and/or presetting anchor for use in cracked and un-cracked concrete
- The anchor shall have European Technical Assessment (ETA); evaluating performance in cracked and un-cracked concrete and seismic conditions
- Anchor shall conform to shock proof fastening according to Swiss Federal Office for Civil Protection (FOCP) or equivalent authority
- Anchor shall have corrosion resistance of min. 5µm galvanization
- Anchor shall have corrosion resistance of A4 stainless steel
- Anchor shall be installed as per the manufacturer's approved procedure and equipment
- Correct anchor setting should be verifiable with a "setting mark" through visual inspection after installation
- Anchor shall be completely removable using removal system provided by manufacturer.
- The recommended tension load of the anchor should not be not less than __kN in cracked concrete with concrete strength at 25N/mm² (including overall global safety factor=3)
- Effective anchorage depth of the anchor should not exceed __mm

Basic loading data (for a single anchor)

All data in this section applies to:
- Static and quasi-static loading
- Correct setting (see setting instruction)
- No edge distance and spacing influence
- *Steel* failure
- Minimum base material thickness
- Concrete C 20/25, $f_{ck,cube}$ = 25 N/mm². Concrete strength influence factor can be applied if concrete grade > C20/25, when steel failure does not govern.

Effective anchorage depth

Anchor size			M10	M12	M16	M20
Eff. Anchorage depth	h_{ef}	[mm]	100	125	190	250

Characteristic resistance

Anchor size			M10	M12	M16	M20 a)
Non-cracked concrete						
Tension N_{Rk}	HDA-P / HDA-T HDA-PF / HDA-TF b)	[kN]	*46*	*67*	*126*	*192*
	HDA-PR / HDA-TR	[kN]	*46*	*67*	*126*	-
Cracked concrete						
Tension N_{Rk}	HDA-P / HDA-T HDA-PF / HDA-TF b)	[kN]	25	35	75	95
	HDA-PR / HDA-TR	[kN]	25	35	75	-
Non-cracked and cracked concrete						
Shear V_{Rk}	HDA-P / HDA-PF b)	[kN]	*22*	*30*	*62*	*92*
	HDA-PR	[kN]	*23*	*34*	*63*	-

Shear V_{Rk} – HDA-T / HDA-TF b) (non-cracked and cracked concrete)

Anchor size	$t_{fix,min}$ [mm]	$t_{fix,max}$ [mm]	V_{Rk} [kN]
M10	10≤	<15	*65 c)*
M10	15≤	≤20	*70*
M12	10≤	<15	*80*
M12	15≤	<20	*80*
M12	20≤	≤50	*100*
M16	15≤	<20	*140c)*
M16	20≤	<25	*140*
M16	25≤	<30	*155*
M16	30≤	<35	*170*
M16	35≤	≤60	*190*
M20	20≤	<25	*205*
M20	25≤	<40	*205*
M20	40≤	<55	*235*
M20	55≤	≤100	*250*

Shear V_{Rk} – HDA-TR (non-cracked and cracked concrete)

Anchor size	$t_{fix,min}$ [mm]	$t_{fix,max}$ [mm]	V_{Rk} [kN]
M10	10≤	<15	*71 c)*
M10	15≤	≤20	*71*
M12	10≤	<15	*87*
M12	15≤	<20	*87*
M12	20≤	<30	*94*
M12	30≤	≤50	*109*
M16	15≤	<20	*152*
M16	20≤	<25	*152*
M16	25≤	<35	*158*
M16	35≤	≤60	*170*
M20	-	-	-

a) HDA M20 is only available in galvanized 5µm version.
b) HDA-PF and HDA-TF anchors are not covered by ETA-99/0009.
c) With use of centering washer (t=5mm) only.

Effective anchorage depth

Anchor size			M10	M12	M16	M20
Eff. Anchorage depth	h_{ef}	[mm]	100	125	190	250

Design resistance [a]

Anchor size			M10	M12	M16	M20 [b]
Non-cracked concrete						
Tension N_{Rk}	HDA-P / HDA-T HDA-PF / HDA-TF [c]	[kN]	30,7	44,7	84,0	128,0
	HDA-PR / HDA-TR	[kN]	28,8	41,9	78,8	-
Cracked concrete						
Tension N_{Rd}	HDA-P / HDA-T HDA-PF / HDA-TF [c]	[kN]	16,7	23,3	50,0	63,3
	HDA-PR / HDA-TR	[kN]	16,7	23,3	50,0	-
Non-cracked and cracked concrete						
Shear V_{Rk}	HDA-P / HDA-PF [c]	[kN]	17,6	24,0	49,6	73,6
	HDA-PR	[kN]	17,3	25,6	47,4	-

Non-cracked and cracked concrete – Shear V_{Rk}, HDA-T / HDA-TF [c]

		M10		M12			M16					M20 [b]			
$t_{fix,min}$	[mm]	10≤	15≤	10≤	15≤	20≤	15≤	20≤	25≤	30≤	35≤	20≤	25≤	40≤	55≤
$t_{fix,max}$	[mm]	<15	≤20	<15	<20	≤50	<20	<25	<30	<35	≤60	<25	<40	<55	≤100
V_{Rk}	[kN]	43,3[d]	46,7	53,3[d]	53,3	66,7	93,3[d]	93,3	103,3	113,3	126,7	136,7	136,7[d]	156,7	166,7

Non-cracked and cracked concrete – Shear V_{Rk}, HDA-TR

		M10		M12				M16				M20 [b]
$t_{fix,min}$	[mm]	10≤	15≤	10≤	15≤	20≤	30≤	15≤	20≤	25≤	35≤	-
$t_{fix,max}$	[mm]	<15	≤20	<15	<20	<30	≤50	<20	<25	<35	≤60	-
V_{Rk}	[kN]	53,4[d]	53,4	65,4[d]	65,4	70,7	82,0	114,3[d]	114,3	118,8	127,8	-

a) Includes material partial factor according to ETA-99/0009, issue 2015-01-06
b) HDA M20 is only available in galvanized 5µm version.
c) HDA-PF and HDA-TF anchors are not covered by ETA-99/0009.
d) With use of centering washer (t=5mm) only.

Effective anchorage depth

Anchor size			M10	M12	M16	M20
Eff. Anchorage depth	h_{ef}	[mm]	100	125	190	250

Recommended loads [a)]

Anchor size			M10	M12	M16	M20[b)]
Non-cracked concrete						
Tension N_{Rk}	HDA-P / HDA-T HDA-PF / HDA-TF [c)]	[kN]	15,3	22,3	42	64
	HDA-PR / HDA-TR	[kN]	15,3	22,3	42	-
Cracked concrete						
Tension N_{Rec}	HDA-P / HDA-T HDA-PF / HDA-TF [c)]	[kN]	8,3	11,7	25	31,7
	HDA-PR / HDA-TR	[kN]	8,3	11,7	25	-
Non-cracked and cracked concrete						
Shear V_{Rec}	HDA-P / HDA-PF [c)]	[kN]	7,3	10	20,7	30,7
	HDA-PR	[kN]	7,7	11,3	21	-

Shear V_{Rec}, HDA-T / HDA-TF [c)] (non-cracked and cracked concrete):

Anchor size	M10	M10	M12	M12	M12	M16	M16	M16	M16	M16	M20	M20	M20	M20
$t_{fix,min}$ [mm]	10≤	15≤	10≤	15≤	20≤	15≤	20≤	25≤	30≤	35≤	20≤	25≤	40≤	55≤
$t_{fix,max}$ [mm]	<15	≤20	<15	<20	≤50	<20	<25	<30	<35	≤60	<25	<40	<55	≤100
V_{Rk} [kN]	21,7[d)]	23,3	26,7	26,7	33,3	46,7[d)]	46,7	51,7	56,7	63,3	68,3	68,3	78,3	83,3

Shear V_{Rec}, HDA-TR (non-cracked and cracked concrete):

Anchor size	M10	M10	M12	M12	M12	M12	M16	M16	M16	M16	M20
$t_{fix,min}$ [mm]	10≤	15≤	10≤	15≤	20≤	30≤	15≤	20≤	25≤	35≤	-
$t_{fix,max}$ [mm]	<15	≤20	<15	<20	<30	≤50	<20	<25	<35	≤60	-
V_{Rk} [kN]	23,7[d)]	23,7	29	29	31,3	36,3	50,7	50,7	52,7	56,7	-

a) Includes global safety factor of 3.0
b) HDA M20 is only available in galvanized 5µm version.
c) HDA-PF and HDA-TF anchors are not covered by ETA-99/0009.
d) With use of centering washer (t=5mm) only.

Materials

Mechanical properties of HDA

Anchor size		HDA-P / HDA-PF / HDA-T / HDA-TF				HDA-PR / HDA-TR		
		M10	M12	M16	M20 [a)]	M10	M12	M16
Anchor bolt								
Nominal tensile strength f_{uk}	[N/mm²]	800	800	800	800	800	800	800
Yield strength f_{yk}	[N/mm²]	640	640	640	640	600	600	600
Stressed cross-section A_s	[mm²]	58,0	84,3	157	245	58,0	84,3	157
Moment of resistance W_{el}	[mm³]	62,3	109,2	277,5	540,9	62,3	109,2	277,5
Characteristic bending resistance without sleeve $M^0_{Rk,s}$ [b)]	[Nm]	60	105	266	519	60	105	266
Anchor sleeve								
Nominal tensile strength f_{uk}	[N/mm²]	850	850	700	550	850	850	700
Yield strength f_{yk}	[N/mm²]	600	600	600	450	600	600	600

a) HDA M20 is only available in galvanized 5µm version
b) The recommended bending moment of the HDA anchor bolt may be calculated from $M_{rec} = MR_{d,s} / \gamma_F = M_{Rk,s} / (\gamma_{Ms} \cdot \gamma_F) = (1,2 \cdot W_{el} \cdot f_{uk}) / (\gamma_{Ms} \cdot \gamma_F)$, where the partial safety factor for bolts of strength 8.8 is γ_{MS} = 1,25, for A4-80 equal to 1,33 and the partial safety factor for action may be taken as γ_F = 1,4. In case of HDA-T/-TR/-TF the bending capacity of the sleeve is neglected, only the capacity of the bolt is taken into account.

Material quality

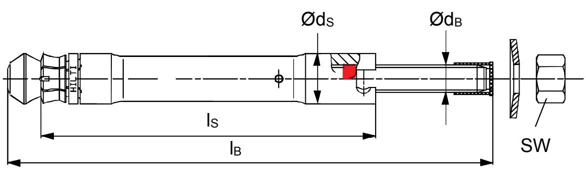
Part	Material
HDA-P / HDA-T	
Sleeve:	Machined steel with brazed tungsten carbide tips, galvanized to min. 5 µm
Bolt M10 - M16: Bolt M20:	Cold formed steel, strength 8.8, galvanized to min. 5 µm Cone machined, rod strength 8.8, galvanized to min. 5 µm
Washer M10-M16: Washer M20:	Spring washer, galvanized or coated Washer, galvanized
Centering washer	Machined steel
HDA-PR / HDA-TR	
Sleeve:	Machined stainless steel with brazed tungsten carbide tips
Bolt M10 - M16:	Cone/rod: machined stainless steel
Washer	Spring washer stainless steel
Centering washer	Machined steel
HDA-PF/-TF	
Sleeve:	Machined steel with brazed tungsten carbide tips, sherardized
Bolt M10 - M16:	Cold formed steel, strength 8.8, sherardized

Anchor dimensions [a)]

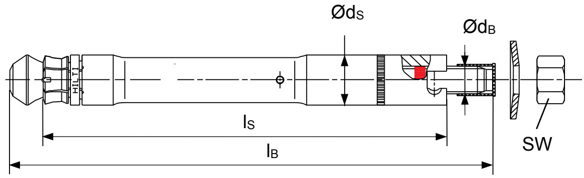
Anchor size			HDA -P / HDA-PR / HDA-T / HDA-TR / HDA-PF / HDA-TF						
			M10	M12		M16		M20	
			x100/20	x125/30	x125/50	x190/40	x190/60	x250/50	x250/100
Length code letter			I	L	N	R	S	V	X
Total length of bolt	l_B	[mm]	150	190	210	275	295	360	410
Diameter of bolt	dB	[mm]	10	12		16		20	
Anchor sleeve									
HDA-P	l_s	[mm]	100	125	125	190	190	250	250
HDA-T	l_s	[mm]	120	155	175	230	250	300	350
Max. diameter of sleeve	d_s	[mm]	19	21		29		35	
Washer diameter	d_w	[mm]	27,5	33,5		45,5		50	
Width across flats	S_w	[mm]	17	19		24		30	

a) Please refer to the product catalogue on the Hilti Hong Kong website for standard portfolio

HDA-P/-PR



HDA-T/-TR

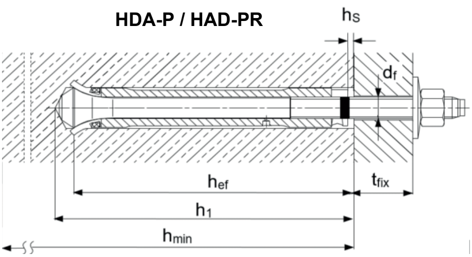


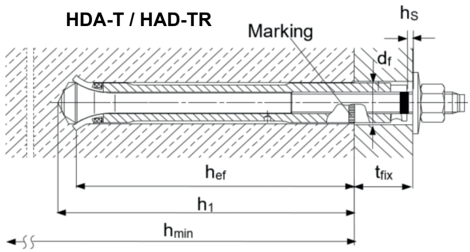
Setting information

Setting details

Anchor size			HDA-P / HDA-PR / HDA-T / HDA-TR						
			M10	M12		M16		M20	
			x100/20	x125/30	x125/50	x190/40	x190/60	x250/50	x250/100
Length code letter			I	L	N	R	S	V	X
Nominal drill bit diameter		[mm]	20	22		30		37	
Cutting diameter of drill bit	$d_{cut,min}$	[mm]	20,10	22,10		30,10		37,15	
	$d_{cut,max}$	[mm]	20,55	22,55		30,55		37,70	
Depth of drill hole	$h_1 \geq$	[mm]	107	133		203		266	
Anchorage depth	h_{ef}	[mm]	100	125		190		250	
Sleeve recess	$h_{s,min}$	[mm]	2	2		2		2	
	$h_{s,max}$	[mm]	6	7		8		8	
Torque moment	T_{inst}	[Nm]	50	80		120		300	
For HDA-P/-PR/-PF									
Clearance hole	d_f	[mm]	12	14		18		22	
Minimum base material thickness	h_{min}	[mm]	180	200		270		350	
Fixture thickness	$t_{fix,min}$	[mm]	0	0		0		0	
	$t_{fix,max}$	[mm]	20	30	50	40	60	50	100
For HDA-T/-TR/-TF									
Clearance hole	d_f	[mm]	21	23		32		40	
Minimum base material thickness	h_{min}	[mm]	200-t_{fix}	230-t_{fix}	250-t_{fix}	310-t_{fix}	330-t_{fix}	400-t_{fix}	450-t_{fix}
Min. fixture thickness									
Tension load only!	$t_{fix,min}$	[mm]	10	10		15		20	50
Shear load **without** use of centering washer	$t_{fix,min}$	[mm]	15	15		20		25	50
Shear load - **with** use of centering washer	$t_{fix,min}$ a)	[mm]	10	10		15		20	-
Max. fixture thickness	$t_{fix,max}$	[mm]	20	30	50	40	60	50	100

a) With use of centering washer (t=5mm) only



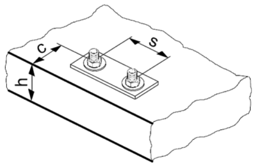


Setting parameters

Anchor size			HDA-P / HDA-PR / HDA-T / HDA-TR						
			M10	M12		M16		M20	
			x100/20	x125/30	x125/50	x190/40	x190/60	x250/50	x250/100
Minimum spacing	s_{min}	[mm]	100	125		190		250	
Minimum edge distance	c_{min}	[mm]	80	100		150		200	
Critical spacing for splitting failure	$s_{cr,sp}$	[mm]	300	375		570		750	
Critical edge distance for splitting failure	$c_{cr,sp}$	[mm]	150	190		285		375	
Critical spacing for concrete cone failure	$s_{cr,N}$	[mm]	300	375		570		750	
Critical edge distance for concrete cone failure	$c_{cr,N}$	[Nm]	150	190		285		375	

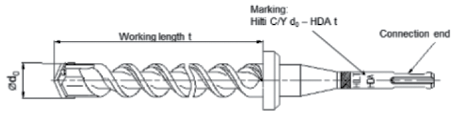
For spacing (edge distance) smaller than critical spacing (critical edge distance) the design loads have to be reduced.

Critical spacing and critical edge distance for splitting failure apply only for non-cracked concrete. For cracked concrete only the critical spacing and critical edge distance for concrete cone failure are decisive.



Stop drill bits for HDA

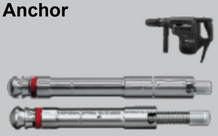
The stop drill is required in order to achieve the correct hole depth.
The setting system (tool and setting tool) is required for transferring the specific energy for the undercutting process.



Anchor	Stop drill bit with TE-C (SDS plus) connection end	Stop drill bit with TE-Y (SDS max) connection end	Nominal working length t [mm]	Drill bit diameter d_0 [mm]
HDA-P/ HDA-PF/ HDA-PR M10x100/20	TE-C-HDA-B 20x100	TE-Y-HDA-B 20x100	107	20
HDA-T/ HDA-TF/ HDA-TR M10x100/20	TE-C-HDA-B 20x120	TE-Y-HDA-B 20x120	127	20
HDA-P/ HDA-PF/ HDA-PR M12x125/30 HDA-P/ HDA-PF/ HDA-PR M12x125/50	TE-C HDA-B 22x125	TE-Y HDA-B 22x125	133	22
HDA-T/ HDA-TF/ HDA-TR M12x125/30	TE-C HDA-B 22x155	TE-Y HDA-B 22x155	163	22
HDA-T/ HDA-TF/ HDA-TR M12x125/50	TE-C HDA-B 22x175	TE-Y HDA-B 22x175	183	22
HDA-P/ HDA-PF/ HDA-PR M16 x190/40 HDA-P/ HDA-PF/ HDA-PR M16 x190/60		TE-Y HDA-B 30x190	203	30
HDA-T/ HDA-TF/ HDA-TR M16x190/40		TE-Y HDA-B 30x230	243	30
HDA-T/ HDA-TF/ HDA-TR M16x190/60		TE-Y HDA-B 30x250	263	30
HDA-P M20 x250/50 HDA-P M20 x250/100		TE-Y HDA-B 37x250	266	37
HDA-T M20x250/50		TE-Y HDA-B 37x300	316	37
HDA-T M20x250/100		TE-Y HDA-B 37x350	366	37

Stop drill bits for HDA

The setting system (tool and setting tool) is required for transferring the specific energy for the undercutting process.

Anchor 	TE 25 a) TE 24 a)	TE 30-A36	TE 35	TE 40 TE 40 AVR	TE 56 TE 56-ATC	TE 60 TE 60-ATC	TE 70 TE 70-ATC	TE 75	TE 76 TE 76-ATC	TE 80-ATC TE 80-ATC AVR	Setting tool 
HDA-P/ HDA-T M10x100/20	■	■		■							TE-C-HDA-ST 20 M10
					■	■					TE-Y-HDA-ST 20 M10
HDA-P/ HDA-T M12x125/30 HDA-P/ HDA-T M12x125/50	■	■		■							TE-C-HDA-ST 22 M12
					■	■					TE-Y-HDA-ST 22 M12
HDA-P/ HDA-T M16x190/40 HDA-P/ HDA-T M16x190/60							■	■	■	■	TE-Y-HDA-ST 30 M16
HDA-P/ HDA-T M20x250/50 HDA-P/ HDA-T M20x250/50							■		■	■	TE-Y-HDA-ST 37 M20

a) 1st gear

Anchor 	TE 25 a) TE 24 a)	TE 30-A36	TE 35	TE 40 TE 40 AVR	TE 56 TE 56-ATC	TE 60 TE 60-ATC	TE 70 TE 70-ATC	TE 75	TE 76 TE 76-ATC	TE 80-ATC TE 80-ATC AVR	Setting tool 
HDA-PR/ HDA-TR M10x100/20	■	■	■	■							TE-C-HDA-ST 20 M10
					■	■					TE-Y-HDA-ST 20 M10
HDA-PR/ HDA-TR M12x125/30 HDA-PR/ HDA-TR M12x125/50	■	■	■	■							TE-C-HDA-ST 22 M12
					■	■					TE-Y-HDA-ST 22 M12
HDA-PR/ HDA-TR M16x190/40 HDA-PR/ HDA-TR M16x190/60							■	■	■	■	TE-Y-HDA-ST 30 M16

a) 1st gear

Anchor 	TE 25 a) TE 24 a)	TE 30-A36	TE 35	TE 40 TE 40 AVR	TE 56 TE 56-ATC	TE 60 TE 60-ATC	TE 70 TE 70-ATC	TE 75	TE 76 TE 76-ATC	TE 80-ATC TE 80-ATC AVR	Setting tool 
HDA-PF/ HDA-TF M10x100/20		■	■	■		■					TE-C-HDA-ST 20 M10
HDA-PF/ HDA-TF M12x125/30 HDA-PF/ HDA-TF M12x125/50		■	■	■		■					TE-C-HDA-ST 22 M12
HDA-PF/ HDA-TF M16x190/40 HDA-PF/ HDA-TF M16x190/60							■	■	■	■	TE-Y-HDA-ST 30 M16

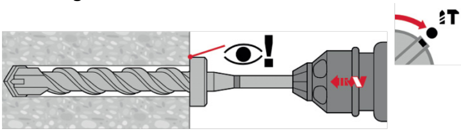
a) 1st gear

Setting instructions

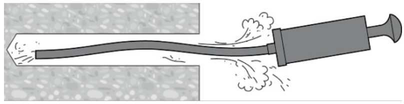
***For detailed information on installation see instruction for use given with the package of the product.**

HDA-P/-PR/-PF (prepositioning)

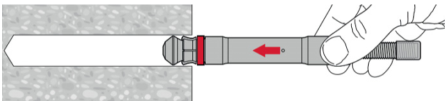
1. Drilling



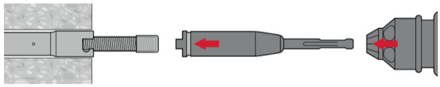
2. Cleaning



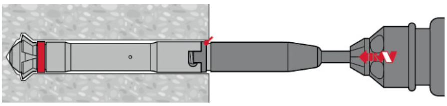
3. Inserting the anchor by hand



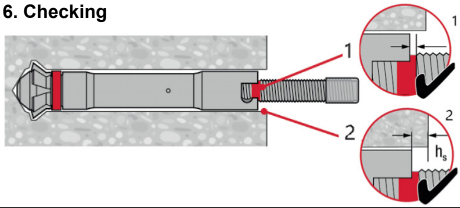
4. Applying hammerdrill



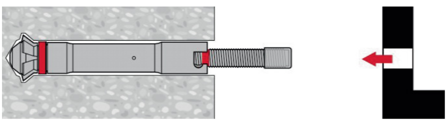
5. Applying hammer drill



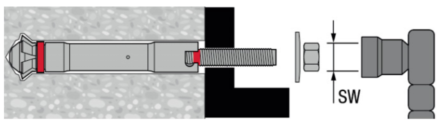
6. Checking



7. Attaching the fixture

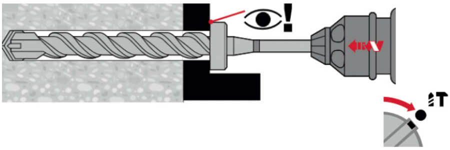


8. Attaching the belonging washer

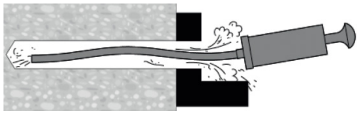


HDA-/-TR / -TF (post-positioning)

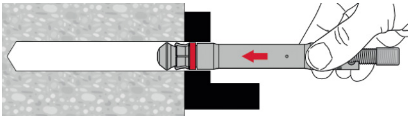
1. Drilling



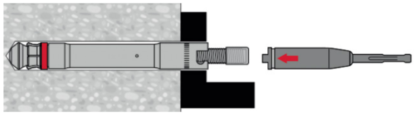
2. Cleaning



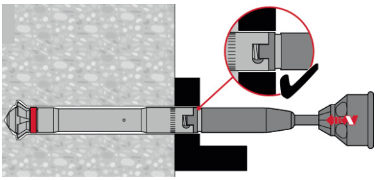
3. Inserting the anchor by hand



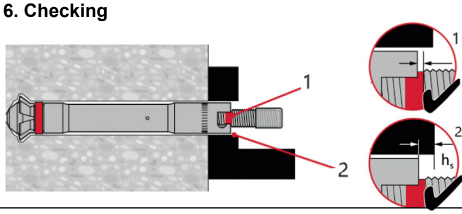
4. Applying hammerdrill



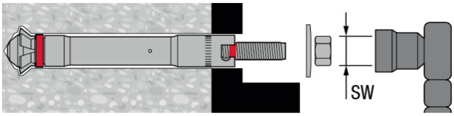
5. Checking



6. Checking



7. Attaching the belonging washer

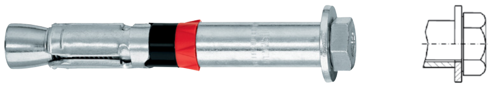


tracefast
http://hilti.to/traceable-fastener

HSL4 expansion anchor

Ultimate-performance heavy-duty expansion anchor

Anchor version



HSL4
Bolt version
(M8-M24)

HSL4-G
Threaded
rod version
(M8-M24)

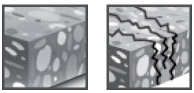
HSL4-B
Safety cap
version
(M12-M24)

HSL4-SK
Countersunk
version
(M8-M12)

Benefits

- Suitable for cracked concrete C20/25 to C50/60
- Suitable for seismic C1 and C2, shock, fire and fatigue
- Installation with hammer drilling, diamond drilling and hollow drill bit available for same performance
- Top shear performance due to high strength expansion and shear sleeves
- HSL4-B special safety cap ensures proper installation torque even without calibrated torque wrench
- Tracefast improves quality assurance of anchor installation by making every fastener uniquely identifiable and allowing easy documentation
- Easily removable for temporary and machine fastening applications or retrofit needs

Base material

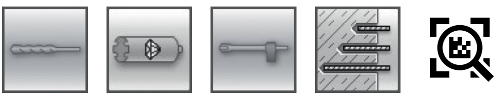


Non-cracked concrete | Cracked concrete

Load conditions

Static/ quasi-static | Seismic ETA-C1, C2 | Fatigue | Shock | Fire resistance

Installation conditions



Hammer drilled holes | Diamond drilled holes | Hollow drill-bit drilling | Variable embedment depth | Tracefast

Other information

European Technical Assessment | CE conformity | PROFIS Engineering Suite | Nuclear power plant approval

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European Technical Assessment [a)]	CSTB, Marne-la-Vallèe	ETA-19/0556 / 2020-01-20
Fire test report	CSTB, Marne-la-Vallèe	ETA-19/0556 / 2020-01-20
European Technical Assessment [b)]	CSTB, Marne-la-Vallèe	ETA-19/0858 / 2020-02-17
ICC-ES report incl. seismic [c)]	ICC evaluation service	ESR 4386 / 2020-03

a) All data for static or seismic load cases given in this section according to ETA-19/0556, issued 2020-01-20.
b) All data for fatigue relevant load cases given in this section according to ETA-19/0858, issued 2020-02-17.
c) For more details on Technical Data according to ICC please consult the relevant HNA FTM.

Static and quasi-static resistance (for a single anchor)

All data in this section applies to:
- Correct setting (see setting instruction)
- No edge distance and spacing influence
- *Steel* failure
- Minimum base material thickness
- Concrete C 20/25, f_c = 20 N/mm²

Effective anchorage depth [a)]

Anchor size			M8			M10			M12		
Eff. Anchorage depth	h_{ef}	[mm]	$h_{ef,1}$ [b)]	$h_{ef,2}$	$h_{ef,3}$	$h_{ef,1}$ [b)]	$h_{ef,2}$	$h_{ef,3}$	$h_{ef,1}$ [b)]	$h_{ef,2}$	$h_{ef,3}$
			60	80	100	70	90	110	80	105	130
Anchor size			**M16**			**M20**			**M24**		
Eff. Anchorage depth	h_{ef}	[mm]	$h_{ef,1}$	$h_{ef,2}$	$h_{ef,3}$	$h_{ef,1}$	$h_{ef,2}$	$h_{ef,3}$	$h_{ef,1}$	$h_{ef,2}$	$h_{ef,3}$
			100	125	150	125	155	185	150	180	210

a) HSL4-SK only available in sizes M8-M12, HSL4-B only available in sizes M12-M24.
b) HSL4-SK can only be set in position 1.

Characteristic resistance

Anchor size				M8			M10			M12		
Non-cracked concrete												
Tension N_{Rk}	HSL4 / HSL4-B HSL4-G HSL4-SK[a)]		[kN]	23,5	*29,3*	*29,3*	29,6	42,0	*46,4*	36,1	52,9	*67,4*
Shear V_{Rk}	HSL4 / HSL4-B		[kN]	*31,1*	*31,1*	*31,1*	*60,5*	*60,5*	*60,5*	*89,6*	*89,6*	*89,6*
	HSL4-G		[kN]	*26,1*	*26,1*	*26,1*	*41,8*	*41,8*	*41,8*	*59,3*	*59,3*	*59,3*
	HSL4-SK[a)]	t_{fix}	[mm]	≥11	-	-	≥11	-	-	≥13	-	-
		V_{Rk}	[kN]	*31,1*	-	-	*60,5*	-	-	*89,6*	-	-
		t_{fix}	[mm]	*<11*	-	-	<11	-	-	<13	-	-
		V_{Rk}	[kN]	*14,6*	-	-	*23,2*	-	-	33,7	-	-
Cracked concrete												
Tension N_{Rk}	HSL4 / HSL4-B HSL4-G HSL4-SK[a)]		[kN]	12,0	12,0	12,0	16,0	16,0	16,0	25,8	24,0	24,0
Shear V_{Rk}	HSL4 / HSL4-B		[kN]	*31,1*	*31,1*	*31,1*	54,8	*60,5*	*60,5*	69,6	*89,6*	*89,6*
	HSL4-G		[kN]	*26,1*	*26,1*	*26,1*	*41,8*	*41,8*	*41,8*	*59,3*	*59,3*	*59,3*
	HSL4-SK[a)]	t_{fix}	[mm]	≥11	-	-	≥11	-	-	≥13	-	-
		V_{Rk}	[kN]	*31,1*	-	-	54,8	-	-	69,6	-	-
		t_{fix}	[mm]	<11	-	-	<11	-	-	<13	-	-
		V_{Rk}	[kN]	*14,6*	-	-	*23,2*	-	-	*33,7*	-	-
Anchor size				**M16**			**M20**			**M24**		
Non-cracked concrete												
Tension N_{Rk}	HSL4 / HSL4-B HSL4-G		[kN]	50,5	65,0	65,0	70,6	95,0	95,0	92,8	100	100
Shear V_{Rk}	HSL4 / HSL4-B		[kN]	141	*159*	*159*	*186*	*186*	*186*	*205*	*205*	*205*
	HSL4-G		[kN]	*121*	*121*	*121*	*155*	*155*	*155*	*205*	*205*	*205*
Cracked concrete												
Tension N_{Rk}	HSL4 / HSL4-B HSL4-G		[kN]	36,0	36,0	36,0	50,3	50,0	50,0	66,1	65,0	65,0
Shear V_{Rk}	HSL4 / HSL4-B		[kN]	101	141	*159*	*186*	*186*	*186*	*205*	*205*	*205*
	HSL4-G		[kN]	101	*121*	*121*	*155*	*155*	*155*	*205*	*205*	*205*

a) HSL4-SK can only be set in position 1.

Design resistance

Anchor size				M8			M10			M12		
Non-cracked concrete												
Tension N_{Rd}	HSL4 / HSL4-B HSL4-G HSL4-SK[a]		[kN]	15,7	*19,5*	*19,5*	19,7	28,0	*30,9*	24,1	35,3	*45,0*
Shear V_{Rd}	HSL4 / HSL4-B		[kN]	*24,9*	*24,9*	*24,9*	*48,4*	*48,4*	*48,4*	*63,4*	*71,7*	*71,7*
	HSL4-G		[kN]	*20,9*	*20,9*	*20,9*	*33,4*	*33,4*	*33,4*	*47,4*	*47,4*	*47,4*
	HSL4-SK[a]	t_{fix}	[mm]	≥11	-	-	≥11	-	-	≥13	-	-
		V_{Rd}	[kN]	*24,9*	-	-	*48,4*	-	-	*63,4*	-	-
		t_{fix}	[mm]	<11	-	-	<11	-	-	<13	-	-
		V_{Rd}	[kN]	*11,7*	-	-	*18,6*	-	-	27,0	-	-
Cracked concrete												
Tension N_{Rd}	HSL4 / HSL4-B HSL4-G HSL4-SK[a]		[kN]	8,0	8,0	8,0	10,7	10,7	10,7	17,2	16,0	16,0
Shear V_{Rd}	HSL4 / HSL4-B		[kN]	*24,9*	*24,9*	*24,9*	36,5	*48,4*	*48,4*	46,4	66,7	*71,7*
	HSL4-G		[kN]	*20,9*	*20,9*	*20,9*	*33,4*	*33,4*	*33,4*	*47,4*	*47,4*	*47,4*
	HSL4-SK[a]	t_{fix}	[mm]	≥11	-	-	≥11	-	-	≥13	-	-
		V_{Rd}	[kN]	20,1	-	-	36,5	-	-	46,4	-	-
		t_{fix}	[mm]	<11	-	-	<11	-	-	<13	-	-
		V_{Rd}	[kN]	*11,7*	-	-	*18,6*	-	-	*27,0*	-	-
Anchor size				**M16**			**M20**			**M24**		
Non-cracked concrete												
Tension N_{Rd}	HSL4 / HSL4-B HSL4-G		[kN]	33,7	43,3	43,3	47,1	63,3	63,3	61,9	66,7	66,7
Shear V_{Rd}	HSL4 / HSL4-B		[kN]	94,3	*127*	*127*	*149*	*149*	*149*	*164*	*164*	*164*
	HSL4-G		[kN]	*96,5*	*96,5*	*96,5*	*124*	*124*	*124*	*164*	*164*	*164*
Cracked concrete												
Tension N_{Rd}	HSL4 / HSL4-B HSL4-G		[kN]	24,0	24,0	24,0	33,5	33,3	33,3	44,1	43,3	43,3
Shear V_{Rd}	HSL4 / HSL4-B		[kN]	67,3	94,0	118	124	*149*	*149*	*164*	*164*	*164*
	HSL4-G		[kN]	67,3	*96,5*	*96,5*	*124*	*124*	*124*	*164*	*164*	*164*

a) HSL4-SK can only be set in position 1.

Recommended loads b)

Anchor size				M8			M10			M12		
Non-cracked concrete												
Tension N_{Rec}	HSL4 / HSL4-B HSL4-G HSL4-SK a)		[kN]	7,8	*9,8*	*9,8*	9,9	14,4	*15,5*	12,0	18,1	*32,1*
Shear V_{Rec}	HSL4 / HSL4-B		[kN]	*10,4*	*10,4*	*10,4*	*20,2*	*20,2*	*20,2*	*29,9*	*29,9*	*29,9*
	HSL4-G		[kN]	*8,7*	*8,7*	*8,7*	*13,9*	*13,9*	*13,9*	*19,8*	*19,8*	*19,8*
	HSL4-SK a)	t_{fix}	[mm]	≥11	-	-	≥11	-	-	≥13	-	-
		V_{Rec}	[kN]	*10,4*	-	-	*20,2*	-	-	29,9	-	-
		t_{fix}	[mm]	<11	-	-	<11	-	-	<13	-	-
		V_{Rec}	[kN]	*4,9*	-	-	*7,7*	-	-	*11,2*	-	-
Cracked concrete												
Tension N_{Rec}	HSL4 / HSL4-B HSL4-G HSL4-SK a)		[kN]	4,0	4,0	4,0	5,3	5,3	5,3	8,6	8,0	8,0
Shear V_{Rec}	HSL4 / HSL4-B		[kN]	*10,4*	*10,4*	*10,4*	18,3	*20,2*	*20,2*	23,2	*29,9*	*29,9*
	HSL4-G		[kN]	*8,7*	*8,7*	*18,7*	*13,9*	*13,9*	*13,9*	*19,8*	*19,8*	*19,8*
	HSL4-SK a)	t_{fix}	[mm]	≥11	-	-	≥11	-	-	≥13	-	-
		V_{Rec}	[kN]	*10,4*	-	-	18,3	-	-	23,2	-	-
		t_{fix}	[mm]	<11	-	-	<11	-	-	<13	-	-
		V_{Rec}	[kN]	*4,9*	-	-	*7,7*	-	-	*11,2*	-	-
Anchor size				**M16**			**M20**			**M24**		
Non-cracked concrete												
Tension N_{Rec}	HSL4 / HSL4-B HSL4-G		[kN]	16,8	21,7	21,7	25,5	31,7	31,7	30,9	33,3	33,3
Shear V_{Rec}	HSL4 / HSL4-B		[kN]	47,1	*53,0*	*53,0*	*62,0*	*62,0*	*62,0*	*68,3*	*68,3*	*68,3*
	HSL4-G		[kN]	*40,3*	*40,3*	*40,3*	*51,7*	*51,7*	*51,7*	*68,3*	*68,3*	*68,3*
Cracked concrete												
Tension N_{Rec}	HSL4 / HSL4-B HSL4-G		[kN]	12,0	12,0	12,0	16,8	16,7	16,7	22,0	21,7	21,7
Shear V_{Rec}	HSL4 / HSL4-B		[kN]	33,7	47,0	53,0	62,0	*62,0*	*62,0*	*68,3*	*68,3*	*68,3*
	HSL4-G		[kN]	33,7	*40,3*	*40,3*	*51,7*	*51,7*	*51,7*	*68,3*	*68,3*	*68,3*

a) HSL4-SK only available in sizes M8-M12, HSL4-B only available in sizes M12-M24.

b) With overall partial safety factor for action γ = 1,4. The partial safety factors for action depend on the type of loading and shall be taken from national regulations.

Materials

Mechanical properties [a)]

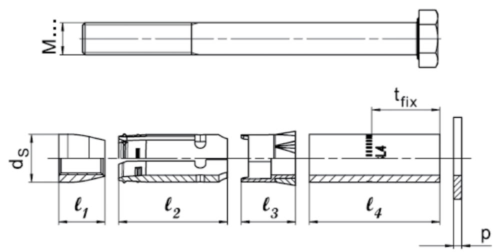
Anchor size		M8	M10	M12	M16	M20	M24
HSL4, HSL4-G, HSL4-B, HSL4-SK							
Nominal tensile strength f_{uk}	[N/mm²]	800	800	800	800	830	830
Yield strength f_{yk}	[N/mm²]	640	640	640	640	640	640
Stressed cross-section A_s	[mm²]	36,6	58,0	84,3	157	245	353
Moment of resistance W	[mm³]	31,3	62,5	109	277	541	935
Design bending resistance without sleeve $M_{Rk,s}$	[Nm]	24,0	48,0	84,0	213	415	718

Material quality

Part		Material
Carbon Steel		
HSL4 HSL4-G HSL4-B HSL4-SK	Cone	Carbon steel, galvanized to ≥ 5 µm
	Expansion sleeve	Carbon steel, galvanized to ≥ 5 µm
	Collapsible element	POM + TPE Plastic element
	Distance sleeve	Carbon steel, galvanized to ≥ 5 µm
HSL4	Washer	Carbon steel, galvanized to ≥ 5 µm
	Hexagonal bolt	Carbon steel, galvanized to ≥ 5 µm, rupture elongation ≥ 12%
HSL4-G	Hexagonal nut	Carbon steel, galvanized to ≥ 5 µm
	Threaded rod	Carbon steel, galvanized to ≥ 5 µm, rupture elongation ≥ 12%
HSL4-B	Hexagonal bolt with safety cap	Carbon steel, galvanized to ≥ 5 µm, rupture elongation ≥ 12%
HSL4-SK	Countersunk bolt	Carbon steel, galvanized to ≥ 5 µm, rupture elongation ≥ 12%
	Cup washer	Carbon steel, galvanized to ≥ 5 µm

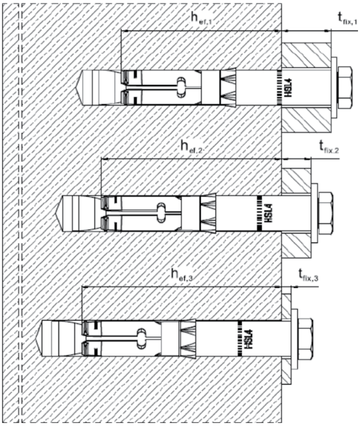
Anchor dimensions of HSL4, HSL4-G, HSL4-B, HSL4-SK

Anchor version	Thread size	t_{fix} [mm]		d_s [mm]	l_1 [mm]	l_2 [mm]	l_3 [mm]	l_4 [mm]		p [mm]
		min	max	d_s [mm]	l_1 [mm]	l_2 [mm]	l_3 [mm]	min	max	p [mm]
HSL4 HSL4-G	M8	5	200	11,9	12	32	15,2	19	214	2
	M10	5	200	14,8	14	36	17,2	23	218	3
HSL4 HSL4-G	M12	5	200	17,6	17	40	20	28	223	3
	M16	10	200	23,6	20	54,4	24,4	34,5	224,5	4
	M20	10	200	27,6	20	57	31,5	51	241	4
	M24	10	200	31,6	22	65	39	57	247	4
HSL4 HSL4-G	M8	6	20	11,9	12	32	15,2	18,2	28,2	2
	M10	6	20	14,8	14	36	17,2	32,2		3
	M12	8	25	17,6	17	40	20	40		3



Setting information

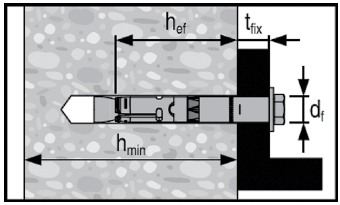
Setting positions [a)]



Setting position ①

Setting position ②

Setting position ③

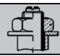


a) HSL4-SK can only be set in position 1.

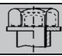
Setting details for HSL4

Anchor version			M8			M10			M12		
Nominal diameter of drill bit	d_0	[mm]	12			15			18		
Max. cutting diameter of drill bit	d_{cut}	[mm]	12,5			15,5			18,5		
Max. diameter of clearance hole in the fixture	d_f	[mm]	14			17			20		
Setting position	i		①	②	③	①	②	③	①	②	③
Fixture thickness	$t_{fix,1}$	[mm]	5-200								
Effective fixture thickness	$t_{fix,i}$		$tf_{ix,1}$[1)] - Δi								
Reduction of fixture thickness	Δi	[mm]	0	20	40	0	20	40	0	25	50
Effective anchorage depth	$h_{ef,i}$	[mm]	60	80	100	70	90	110	80	105	130
Min. depth of drill hole	$h_{1,i}$	[mm]	80	100	120	90	110	130	105	130	155
Min. thickness of concrete member	h_{min}	[mm]	120	170	195	140	195	215	160	225	250
Width across flats	SW	[mm]	13			17			19		
Installation torque	T_{inst}	[Nm]	25			25			60		
Anchor version			**M16**			**M20**			**M24**		
Nominal diameter of drill bit	d_0	[mm]	24			28			32		
Max. cutting diameter of drill bit	d_{cut}	[mm]	24,55			28,55			32,7		
Max. diameter of clearance hole in the fixture	d_f	[mm]	26			31			35		
Setting position	i		①	②	③	①	②	③	①	②	③
Fixture thickness	$t_{fix,1}$	[mm]	10-200								
Effective fixture thickness	$t_{fix,i}$		$tf_{ix,1}$[1)] - Δi								
Reduction of fixture thickness	Δi	[mm]	0	20	50	0	30	60	0	30	60
Effective anchorage depth	$h_{ef,i}$	[mm]	100	125	150	125	155	185	150	180	210
Min. depth of drill hole	$h_{1,i}$	[mm]	125	150	175	155	185	215	180	210	240
Min. thickness of concrete member	h_{min}	[mm]	200	275	300	250	380	410	300	405	435
Width across flats	SW	[mm]	24			30			36		
Installation torque	T_{inst}	[Nm]	75			145			210		

Setting details for HSL4-G

Anchor version 			M8			M10			M12		
Nominal diameter of drill bit	d_0	[mm]	12			15			18		
Max. cutting diameter of drill bit	d_{cut}	[mm]	12,5			15,5			18,5		
Max. diameter of clearance hole in the fixture	d_f	[mm]	14			17			20		
Setting position	i		①	②	③	①	②	③	①	②	③
Fixture thickness	$t_{fix,1}$	[mm]	5-200								
Effective fixture thickness	$t_{fix,i}$		$tf_{ix,1}$ [1)] - Δi								
Reduction of fixture thickness	Δi	[mm]	0	20	40	0	20	40	0	25	50
Effective anchorage depth	$h_{ef,i}$	[mm]	60	80	100	70	90	110	80	105	130
Min. depth of drill hole	$h_{1,i}$	[mm]	80	100	120	90	110	130	105	130	155
Min. thickness of concrete member	h_{min}	[mm]	120	170	195	140	195	215	160	225	250
Width across flats	SW	[mm]	13			17			19		
Installation torque	T_{inst}	[Nm]	25			27			60		
Anchor version			**M16**			**M20**			**M24**		
Nominal diameter of drill bit	d_0	[mm]	24			28			32		
Max. cutting diameter of drill bit	d_{cut}	[mm]	24,55			28,55			32,7		
Max. diameter of clearance hole in the fixture	d_f	[mm]	26			31			35		
Setting position	i		①	②	③	①	②	③	①	②	③
Fixture thickness	$t_{fix,1}$	[mm]	10-200								
Effective fixture thickness	$t_{fix,i}$		$tf_{ix,1}$ [1)] - Δi								
Reduction of fixture thickness	Δi	[mm]	0	20	50	0	30	60	0	30	60
Effective anchorage depth	$h_{ef,i}$	[mm]	100	125	150	125	155	185	150	180	210
Min. depth of drill hole	$h_{1,i}$	[mm]	125	150	175	155	185	215	180	210	240
Min. thickness of concrete member	h_{min}	[mm]	200	275	300	250	380	410	300	405	435
Width across flats	SW	[mm]	24			30			36		
Installation torque	T_{inst}	[Nm]	75			105			180		

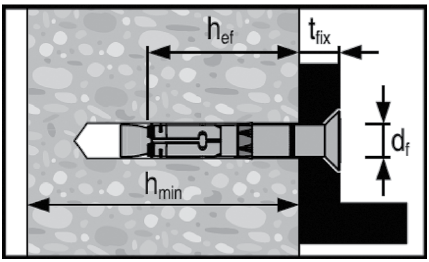
Setting details for HSL4-B

Anchor version 			M12			M16			M20			M24		
Nominal diameter of drill bit	d_0	[mm]	18			24			28			32		
Max. cutting diameter of drill bit	d_{cut}	[mm]	18,5			24,55			28,55			32,7		
Max. diameter of clearance hole in the fixture	d_f	[mm]	20			26			31			35		
Setting position	i		①	②	③	①	②	③	①	②	③	①	②	③
Fixture thickness	$t_{fix,1}$	[mm]	5-200			10-200								
Effective fixture thickness	$t_{fix,i}$		$tf_{ix,1}$ [1)] - Δi											
Reduction of fixture thickness	Δi	[mm]	0	25	50	0	25	50	0	30	60	0	30	60
Effective anchorage depth	$h_{ef,i}$	[mm]	80	105	130	100	125	150	125	155	185	150	180	210
Min. depth of drill hole	$h_{1,i}$	[mm]	105	130	155	125	150	175	155	185	215	180	210	240
Min. thickness of concrete member	h_{min}	[mm]	160	225	250	200	275	300	250	380	410	300	405	435
Width across flats	SW	[mm]	19			24			30			36		
Installation torque	T_{inst}	[Nm]	The torque moment is controlled by the safety cap											

Setting details for HSL4-SK [a)]

Anchor version			M8	M10	M12
Nominal diameter of drill bit	d_0	[mm]	12	15	18
Max. cutting diameter of drill bit	d_{cut}	[mm]	12,5	15,5	18,5
Max. diameter of clearance hole in the fixture	d_f	[mm]	14	17	20
Top diameter of countersunk head in the fixture	d_h	[mm]	22,5	25,5	32,9
Bottom diameter of countersunk head in the fixture	d_h	[mm]	11,4	14,4	17,4
Height of the countersunk head in the fixture	h_{cs}	[mm]	5,8	5,8	8,0
Min. Fixture thickness	$t_{=fix,min}$ [b)]	[mm]	6	6	8
Effective anchorage depth	h_{ef}	[mm]	60	70	80
Min. depth of drill hole	h_1	[mm]	80	90	105
Min. thickness of concrete member	h_{min}	[mm]	120	140	160
Width across flats	SW	[mm]	5	6	8
Installation torque	T_{inst}	[Nm]	20	32	65

a) HSL4-SK can only be set in position 1.
b) The influence of the thickness of fixture to the characteristic resistance for shear loads, steel failure without lever arm is taken into account.



Installation equipment

Anchor size	M8	M10	M12	M16	M20	M24
Rotary hammer	TE 2 – TE 30			TE 40 – TE 80		
Diamond coring	DD 30-W or DD-EC-1 + SPX-T DD 110 / 150 + SPX-L handheld		DD 30-W or DD-EC-1 + SPX-T DD 110 / 150 + SPX-L handheld DD 120 / 160 / 150 + SPX-L		DD 30-W or DD-EC-1 + SPX-T DD 110 / 150 + SPX-L handheld DD 120 / 160 / 150 / 200 / 250 + SPX-L	
Other tools	blow out pump, hammer, torque wrench [1)]					

1) HSL4-B only requires a regular wrench as it automatically ensures correct torque is applied.

Setting parameters for HSL4, HSL4-G, HSL4-B, HSL4-SK a)

Anchor size			M8			M10			M12		
Setting position b)	i		①	②	③	①	②	③	①	②	③
Minimum base material thickness	h_{min}	[mm]	120	170	190	140	195	215	160	225	250
Uncracked concrete											
Minimum spacing	s_{min}	[mm]	60			70			80		
	for c ≥	[mm]	100			100			160		
Minimum edge distance	c_{min}	[mm]	60			70			80		
	for c ≥	[mm]	100			160			240		
Cracked concrete											
Minimum spacing	s_{min}	[mm]	50			70			70		
	for c ≥	[mm]	80			100			140		
Minimum edge distance	c_{min}	[mm]	60			70			70		
	for c ≥	[mm]	80			120			160		
Anchor size			**M16**			**M20**			**M24**		
Setting position b)	i		①	②	③	①	②	③	①	②	③
Minimum base material thickness	h_{min}	[mm]	200	275	300	250	380	410	300	405	435
Uncracked concrete											
Minimum spacing	s_{min}	[mm]	100			125			150		
	for c ≥	[mm]	240			300			300		
Minimum edge distance	c_{min}	[mm]	100			150			150		
	for c ≥	[mm]	240			300			300		
Cracked concrete											
Minimum spacing	s_{min}	[mm]	80			120			120		
	for c ≥	[mm]	180			220			260		
Minimum edge distance	c_{min}	[mm]	100			120			120		
	for c ≥	[mm]	200			220			280		

a) HSL4-SK only available in sizes M8-M12, HSL4-B only available in sizes M12-M24.
b) HSL4-SK can only be set in position 1.

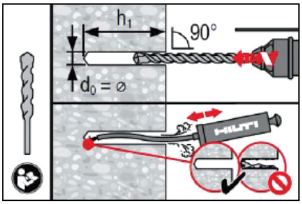
Setting instructions

*** For detailed information on installation of each specific HSL4 version, see instruction for use given with the package of the product.**

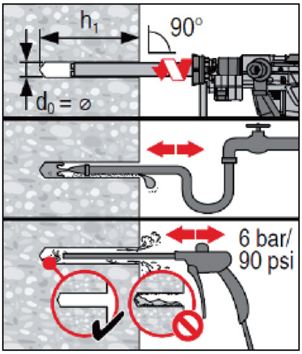
Setting instruction

Hole drilling and cleaning

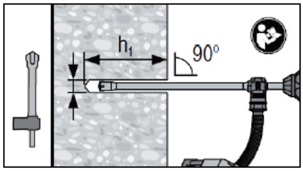
a) Hammer drilling (HD) with manual cleaning (MC)



b) Diamond coring (DD) with flushing and blowing

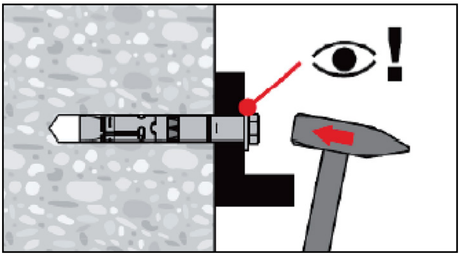


c) Hammer drilling (HD) with hollow drill bit (HDB)



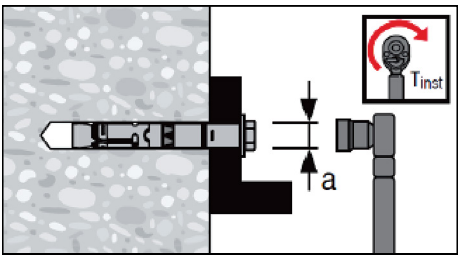
Anchor setting

Hammer setting, check setting

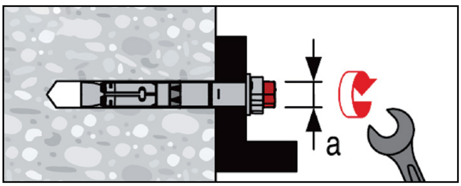


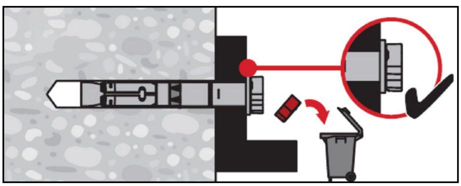
Anchor torqueing for HSL4, HSL4-G, HSL-4-SK

Use torque wrench



HSL4-B Safety cap



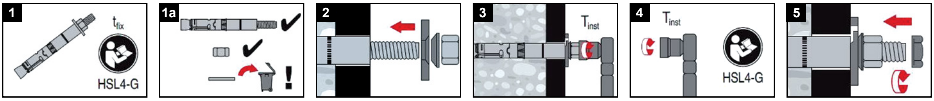


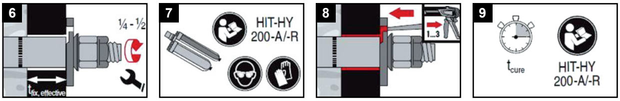
Setting instructions

*** For detailed information on installation of HSL4-G version, see instruction for use given with the package of the product**

Installation instructions for the filling set

HSL4-G



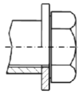


Size	$t_{fix, effective}$ [mm]
M16	10 ... 200
M20	10 ... 200

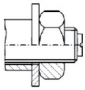
HSL-3-R Stainless Steel Expansion anchor

Ultimate-performance heavy-duty expansion anchor

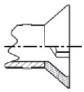
Anchor versions

HSL-3-R
Bolt/Hex version
(M8-M20) [a)]

HSL-3-GR
Threaded rod version
(M8-M20) [a)]

HSL-3-SKR
Countersunk version
(M8-M12) [a)]

Benefits

- Suitable for cracked concrete C20/25 to C50/60
- Suitable for all dynamic loads: seismic [b)] C1 and C2 [c)], shock and fatigue
- Can be installed with hammer or diamond drilling [c)] for same performance
- Top shear performance due to high strength expansion and shear sleeves
- Length can be customized to a specific project need
- Easily removable for temporary fastening or retrofit

Base material

Non-cracked concrete

Cracked concrete (Tension zone)

Load conditions

Static/ quasi-static

Seismic [b)] ETA-C1, C2 [c)]

Fatigue

Shock

Fire resistance

Installation conditions

Hammer drilled holes

Variable embedment depth

Other information

European Technical Assessment

CE conformity

PROFIS Engineering Suite

Corrosion resistance

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European technical assessment [c)]	CSTB, Marne-la-Vallèe	ETA-02/0042 / 2017-11-22
Fire test report	CSTB, Marne-la-Vallèe	ETA-02/0042 / 2017-11-22
ICC-ES report incl. seismic [d) e)]	ICC evaluation service	ESR 1545 / 2020-01

a) Please refer to the product catalogue on the Hilti Hong Kong website for standard portfolio
b) Please contact your Hilti representative for seismic resistance data
d) All data given in this section according to ETA-02/0042 issue 2017-11-22
e) For more details on technical data according to ICC, please contact your Hilti representative

Recommended general notes

* The below clauses based on Hilti product qualifications are for references only. Selection of clauses by the engineer shall be based on the specific application needs. Please contact Hilti's technical team for further details.

- Torque controlled expansion anchor with distance sleeve, single-piece-four section expansion sleeve with two-level cutting and collapsible element, approved for use in cracked and un-cracked concrete
- The anchor must have European Technical Assessment (ETA); evaluating performance in cracked and un-cracked concrete and seismic conditions
- Anchor shall be partially removable
- Anchor must conform to shock proof fastening according to Swiss Federal Office for Civil Protection (FOCP) or equivalent authority
- Anchor shall be installed as per the manufacturer's approved procedure and equipment
- The recommended tension load of the anchor should not be not less than __kN in cracked concrete with concrete strength at 25N/mm² (including overall global safety factor=3)
- Effective anchorage depth of the anchor should not exceed __mm

For HSL-3-R
- Anchor shall be approved for installation in 3 embedment depths or setting positions
- Anchor must have corrosion resistance of A4 stainless steel
- Anchor shall have identification marks on the bolt head that can be used to verify the material type and anchor length during inspection

For HSL-3-GR
- Anchor shall be approved for installation in 3 embedment depths or setting positions
- Anchor shall have corrosion resistance of A4 stainless steel

For HSL-3-SKR
Anchor head finish to be a countersunk type with integrated washer
- Anchor must have corrosion resistance of A4 stainless steel
- Anchor shall have identification marks on the bolt head that can be used to verify the material type and anchor length during inspection

Basic loading data (for a single anchor)

All data in this section applies to:
- Static and quasi-static loading
- Correct setting (see setting instruction)
- No edge distance and spacing influence
- *Steel* failure
- Minimum base material thickness
- Concrete C 20/25, $f_{ck,cube}$ = 25 N/mm². Concrete strength influence factor can be applied if concrete grade > C20/25, when steel failure does not govern.
- Values for HSL-3-R, HSL-3-SKR and HSL-3-GR only applicable for hammer drilling.

Characteristic resistance

Anchor size [a)]			M8			M10			M12		
Eff. Anchorage depth	h_{ef}	[mm]	$h_{ef,1}$ [b) c)]	$h_{ef,2}$	$h_{ef,3}$	$h_{ef,1}$ [b) c)]	$h_{ef,2}$	$h_{ef,3}$	$h_{ef,1}$ [b) c)]	$h_{ef,2}$	$h_{ef,3}$
			60	80	100	70	90	110	80	105	130
Non-cracked concrete											
Tension N_{Rk}	HSL-3-R / HSL-3-SKR [b)] HSL-3-GR	[kN]	20,0	20,0	20,0	29,6	*40,6*	*40,6*	36,1	50,0	50,0
Shear V_{Rk}	HSL-3-R, HSL-3-SKR [b)]	[kN]	46,9	*50,9*	*50,9*	59,2	*62,7*	*62,7*	72,3	*82,8*	*82,8*
	HSL-3-GR		*40,3*	*40,3*	*40,3*	*58,9*	*58,9*	*58,9*	72,3	*78,7*	*78,7*
Cracked concrete											
Tension N_{Rk}	HSL-3-R / HSL-3-SKR [b)] HSL-3-GR	[kN]	12,0	12,0	12,0	16,0	16,0	16,0	25,8	24,0	24,0
Shear V_{Rk}	HSL-3-R, HSL-3-SKR [b)]	[kN]	33,5	*50,9*	*50,9*	42,2	61,5	*62,7*	51,5	77,5	*82,8*
	HSL-3-GR		33,5	*40,3*	*40,3*	42,2	*58,9*	*58,9*	51,5	77,5	*78,7*

Anchor size [a)]			M16			M20		
Eff. Anchorage depth	h_{ef}	[mm]	$h_{ef,1}$ [b)]	$h_{ef,2}$	$h_{ef,3}$	$h_{ef,1}$ [b)]	$h_{ef,2}$	$h_{ef,3}$
			100	125	150	125	155	185
Non-cracked concrete								
Tension N_{Rk}	HSL-3-R HSL-3-GR	[kN]	50,5	65,0	65,0	70,6	95,0	95,0
Shear V_{Rk}	HSL-3-R	[kN]	101,0	*127,7*	*127,7*	141,2	*154,8*	*154,8*
	HSL-3-GR		101,0	*129,5*	*129,5*	141,2	*151,9*	*151,9*
Cracked concrete								
Tension N_{Rk}	HSL-3-R HSL-3-GR	[kN]	36,0	36,0	36,0	50,3	50,0	50,0
Shear V_{Rk}	HSL-3-R	[kN]	72,0	100,6	*127,7*	100,6	138,9	*154,8*
	HSL-3-GR		72,0	100,6	*129,5*	100,6	138,9	*151,9*

a) Please refer to the product catalogue on the Hilti website for standard portfolio
b) HSL-3-SK and HSL-3-SKR only available in sizes M8-M12
c) Standard embedment depth up to anchor marking

Design resistance [a]

Anchor size [b]			**M8**			**M10**			**M12**		
Eff. Anchorage depth	h_{ef}	[mm]	$h_{ef,1}$ [b) c)]	$h_{ef,2}$	$h_{ef,3}$	$h_{ef,1}$ [b) c)]	$h_{ef,2}$	$h_{ef,3}$	$h_{ef,1}$ [b) c)]	$h_{ef,2}$	$h_{ef,3}$
			60	80	100	70	90	110	80	105	130
Non-cracked concrete											
Tension N_{Rk}	HSL-3-R / HSL-3-SKR [c)] HSL-3-GR	[kN]	13,3	13,3	13,3	19,7	*21,7*	*21,7*	24,1	*31,6*	*31,6*
Shear V_{Rk}	HSL-3-R, HSL-3-SKR	[kN]	31,3	*40,7*	*40,7*	39,4	*41,8*	*41,8*	48,2	*53,1*	*53,1*
	HSL-3-GR		31,3	32,2	32,2	39,4	*47,1*	*47,1*	48,2	*63,0*	*63,0*
Cracked concrete											
Tension N_{Rk}	HSL-3-R / HSL-3-SKR [c)] HSL-3-GR	[kN]	8,0	8,0	8,0	10,7	10,7	10,7	17,2	16,0	16,0
Shear V_{Rk}	HSL-3-R, HSL-3-SKR [c)]	[kN]	22,3	34,4	*40,7*	28,1	*41,0*	*41,8*	34,3	51,6	*53,1*
	HSL-3-GR		22,3	32,2	32,2	28,1	41,0	47,1	34,3	51,6	63,0

Anchor size [b]			**M16**			**M20**		
Eff. Anchorage depth	h_{ef}	[mm]	$h_{ef,1}$ [b)]	$h_{ef,2}$	$h_{ef,3}$	$h_{ef,1}$ [b)]	$h_{ef,2}$	$h_{ef,3}$
			100	125	150	125	155	185
Non-cracked concrete								
Tension N_{Rk}	HSL-3-R HSL-3-GR	[kN]	33,7	43,3	43,3	47,1	63,3	63,3
Shear V_{Rk}	HSL-3-R	[kN]	67,3	*81,9*	*81,9*	94,1	*99,2*	*99,2*
	HSL-3-GR		67,3	94,1	103,6	94,1	121,5	121,5
Cracked concrete								
Tension N_{Rk}	HSL-3-R HSL-3-GR	[kN]	24,0	24,0	24,0	33,5	33,3	33,3
Shear V_{Rk}	HSL-3-R	[kN]	48,0	67,1	*81,9*	67,1	92,6	*99,2*
	HSL-3-GR		48,0	67,1	88,2	67,1	92,6	120,8

a) Includes material partial factor according to ETA-02/0042 issue 2017-11-22
b) Please refer to the product catalogue on the Hilti Hong Kong website for standard portfolio
c) Standard embedment depth up to anchor marking

Recommended loads [a)]

Anchor size [b)]			M8			M10			M12		
Eff. Anchorage depth	h_{ef}	[mm]	$h_{ef,1}$ [b) d)]	$h_{ef,2}$	$h_{ef,3}$	$h_{ef,1}$ [b) d)]	$h_{ef,2}$	$h_{ef,3}$	$h_{ef,1}$ [b) d)]	$h_{ef,2}$	$h_{ef,3}$
			60	80	100	70	90	110	80	105	130
Non-cracked concrete											
Tension N_{Rec}	HSL-3-R / HSL-3-SKR [c)] HSL-3-GR	[kN]	6,7	6,7	6,7	9,9	13,5	13,5	12,0	16,7	16,7
Shear V_{Rec}	HSL-3-R, HSL-3-SKR [c)]	[kN]	15,6	17,0	17,0	19,7	20,9	20,9	24,1	27,6	27,6
	HSL-3-GR	[kN]	13,4	13,4	13,4	19,6	19,6	19,6	24,1	26,2	26,2
Cracked concrete											
Tension N_{Rec}	HSL-3-R / HSL-3-SKR [c)] HSL-3-GR	[kN]	4,0	4,0	4,0	5,3	5,3	5,3	8,6	8,0	8,0
Shear V_{Rec}	HSL-3-R, HSL-3-SKR [c)]	[kN]	11,2	17,0	17,0	14,1	20,5	20,9	17,2	25,8	27,6
	HSL-3-GR	[kN]	11,2	13,4	13,4	14,1	19,6	19,6	17,2	25,8	26,2

Anchor size [b)]			M16			M20		
Eff. Anchorage depth	h_{ef}	[mm]	$h_{ef,1}$ [b)]	$h_{ef,2}$	$h_{ef,3}$	$h_{ef,1}$ [b)]	$h_{ef,2}$	$h_{ef,3}$
			100	125	150	125	155	185
Non-cracked concrete								
Tension N_{Rec}	HSL-3-R HSL-3-GR	[kN]	16,8	21,7	21,7	23,5	31,7	31,7
Shear V_{Rec}	HSL-3-R	[kN]	33,7	42,6	42,6	47,1	51,6	51,6
	HSL-3-GR	[kN]	33,7	43,2	43,2	47,1	50,6	50,6
Cracked concrete								
Tension N_{Rec}	HSL-3-R HSL-3-GR	[kN]	12,0	12,0	12,0	16,8	16,7	16,7
Shear V_{Rec}	HSL-3-R	[kN]	24,0	33,5	42,6	33,5	46,3	51,6
	HSL-3-GR	[kN]	24,0	33,5	43,2	33,5	46,3	50,6

a) Includes global safety factor of 3.0
b) Please refer to the product catalogue on the Hilti Hong Kong website for standard portfolio
c) HSL-3-SK and HSL-3-SKR only available in sizes M8-M12 and can only be set in position 1
d) Standard embedment depth up to anchor marking

Materials

Mechanical properties

Anchor size			M8	M10	M12	M16	M20
HSL-3-R, HSL-3-GR, HSL-3-SKR							
Nominal tensile strength f_{uk}		[N/mm²]	700	700	700	700	700
Yield strength f_{yk}	HSL-3-R HSL-3-SKR	[N/mm²]	560	450	450	450	450
	HSL-3-GR		560	560	560	560	560
Stressed cross-section A_s		[mm²]	36,6	58,0	84,3	157	245
Moment of resistance W		[mm³]	31,3	62,5	109,4	277,1	540,6
Design bending resistance without sleeve $M^0_{Rk,s}$		[Nm]	16,8	33,5	58,8	149,4	291,3

Material quality

Part		Material
Stainless steel		
HSL-3-R HSL-3-GR HSL-3-SKR	Cone	Stainless steel A4, coated
	Expansion sleeve	Stainless steel A4
	Collapsible element	Plastic element
	Distance sleeve	Stainless steel A4
HSL-3-R	Washer	Stainless steel A4, coated
	Hexagonal bolt	Stainless steel A4, coated, rupture elongation ≥ 12%
HSL-3-GR	Hexagonal nut	Stainless steel A4, coated
	Threaded rod	Stainless steel A4, coated, rupture elongation ≥ 12%
HSL-3-SKR	Countersunk bolt	Stainless steel A4, coated, rupture elongation ≥ 12%
	Cup washer	Stainless steel A4, coated

Letter code for anchor length and maximum thickness of the fixture t_{fix}

Type	HSL-3-R, HSL-GR				
Size / Letter	M8 $t_{fix,1}/t_{fix,2}/t_{fix,3}$	M10 $t_{fix,1}/t_{fix,2}/t_{fix,3}$	M12 $t_{fix,1}/t_{fix,2}/t_{fix,3}$	M16 $t_{fix,1}/t_{fix,2}/t_{fix,3}$	M20 $t_{fix,1}/t_{fix,2}/t_{fix,3}$
y	20/-/- [1) 2)]	20/-/- [1)2)]	[3)]	[3)]	[3)]
x	[1)]	[3)]	25/-/- [1) 2)]	25/-/- [1) 2)]	[3)]
w	[3)]	[3)]	[3)]	[3)]	30/-/- [1) 2)]
c	40/20/- [1) 2)]	40/20/- [1)] 100/80/60 [2)]	[3)]	[3)]	[3)]
b	[3)]	[3)]	50/25/- [1)] 100/75/50 [2)]	50/25/- [1)] 100/75/50 [2)]	[3)]
a	100/80/60 [2)]	[3)]	[3)]	[3)]	60/30/- [1)] 100/70/40 [2)]

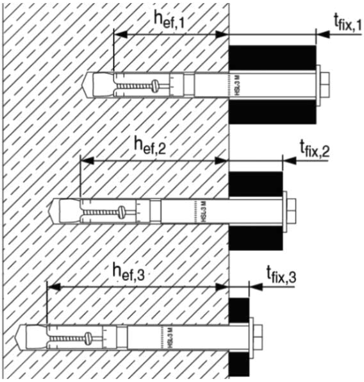
1) HSL-3-R standard items
2) HSL-3-GR standard items
3) There is no available standard item, check availability of special items

Type	HSL-3-SKR		
Size / Letter	M8 $t_{fix,1}$	M10 $t_{fix,1}$	M12 $t_{fix,1}$
z	10	[1)]	[1)]
y	20	20	[1)]
x	[1)]	[1)]	25

1) There is no available standard item, check availability of special items

Setting information

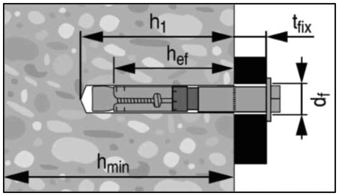
Setting positions a)



Setting position ①

Setting position ②

Setting position ③



a) HSL-3-SK and HSL-3-SKR can only be set in position 1.

Setting details for HSL-3-R

Anchor version			M8			M10			M12		
Nominal diameter of drill bit	d_0	[mm]	12			15			18		
Max. cutting diameter of drill bit	d_{cut}	[mm]	12,5			15,5			18,5		
Max. diameter of clearance hole in the fixture	d_f	[mm]	14			17			20		
Anchorage depth	h_{nom}	[mm]	78	88	118	90	110	130	106	131	156
Fixture thickness a)	$t_{fix,1}$	[mm]	5-200								
Effective fixture thickness	$t_{fix,i}$		Anchor length - h_{nom}								
Effective anchorage depth	$h_{ef,i}$	[mm]	60	80	100	70	90	110	80	105	130
Min. depth of drill hole	$h_{1,i}$	[mm]	80	100	120	90	110	130	105	130	155
Min. thickness of concrete member	$h_{min,i}$	[mm]	120	170	195	140	195	215	160	225	250
Width across flats	SW	[mm]	13			17			19		
Installation torque c)	T_{inst}	[Nm]	25			35			80		

Anchor version			M16			M20		
Nominal diameter of drill bit	d_0	[mm]	24			28		
Max. cutting diameter of drill bit	d_{cut}	[mm]	24,55			28,55		
Max. diameter of clearance hole in the fixture	d_f	[mm]	26			31		
Anchorage depth	h_{nom}	[mm]	128	153	178	153	183	213
Fixture thickness a)	$t_{fix,1}$	[mm]	10-200					
Effective fixture thickness	$t_{fix,i}$		Anchor length - h_{nom}					
Effective anchorage depth	$h_{ef,i}$	[mm]	100	125	150	125	155	185
Min. depth of drill hole	$h_{1,i}$	[mm]	125	150	175	155	185	215
Min. thickness of concrete member	$h_{min,i}$	[mm]	200	275	300	250	380	410
Width across flats	SW	[mm]	24			30		
Installation torque	T_{inst}	[Nm]	120			200		

a) Please refer to the product catalogue on the Hilti website for standard portfolio

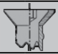
Setting details for HSL-3-GR

Anchor version			M8			M10			M12		
Nominal diameter of drill bit	d_0	[mm]	12			15			18		
Max. cutting diameter of drill bit	d_{cut}	[mm]	12,5			15,5			18,5		
Max. diameter of clearance hole in the fixture	d_f	[mm]	14			17			20		
Anchorage depth	h_{nom}	[mm]	78	88	118	90	110	130	106	131	156
Fixture thickness [a)]	$t_{fix,1}$	[mm]	5-200								
Effective fixture thickness	$t_{fix,i}$		Anchor length - h_{nom}								
Effective anchorage depth	$h_{ef,i}$	[mm]	60	80	100	70	90	110	80	105	130
Min. depth of drill hole	$h_{1,i}$	[mm]	80	100	120	90	110	130	105	130	155
Min. thickness of concrete member [c)]	$h_{min,i}$	[mm]	120	170	195 (195)	140	195	215	160	225	250
Width across flats	SW	[mm]	13			17			19		
Installation torque [c)]	T_{inst}	[Nm]	30			50			80		

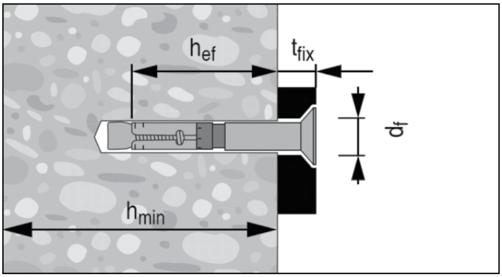
Anchor version			M16			M20		
Nominal diameter of drill bit	d_0	[mm]	24			28		
Max. cutting diameter of drill bit	d_{cut}	[mm]	24,55			28,55		
Max. diameter of clearance hole in the fixture	d_f	[mm]	26			31		
Anchorage depth	h_{nom}	[mm]	128	153	178	153	183	213
Fixture thickness [a)]	$t_{fix,1}$	[mm]	10-200					
Effective fixture thickness	$t_{fix,i}$		Anchor length - h_{nom}					
Effective anchorage depth	$h_{ef,i}$	[mm]	100	125	150	125	155	185
Min. depth of drill hole	$h_{1,i}$	[mm]	125	150	175	155	185	215
Min. thickness of concrete member	$h_{min,i}$	[mm]	200	275	300	250	380	410
Width across flats	SW	[mm]	24			30		
Installation torque	T_{inst}	[Nm]	120			200		

a) Please refer to the product catalogue on the Hilti website for standard portfolio

Setting details for HSL-3-SKR [a)]

Anchor version 			M8	M10	M12
Nominal diameter of drill bit	d_0	[mm]	12	15	18
Max. cutting diameter of drill bit	d_{cut}	[mm]	12,5	15,5	18,5
Max. diameter of clearance hole in the fixture	d_f	[mm]	14	17	20
Top diameter of countersunk head in the fixture	d_h	[mm]	22,5	25,5	32,9
Bottom diameter of countersunk head in the fixture	d_h	[mm]	11,4	14,4	17,4
Height of the countersunk head in the fixture	h_{cs}	[mm]	5,8	6,0	8,0
Fixture thickness	t_{fix}	[mm]	10 – 20	20	25
Effective anchorage depth	h_{ef}	[mm]	60	70	80
Min. depth of drill hole	h_1	[mm]	80	90	105
Min. thickness of concrete member	h_{min}	[mm]	120	140	160
Width across flats	SW	[mm]	5	6	8
Installation torque	T_{inst}	[Nm]	18	50	80

a) HSL-3-SKR can only be set in position 1



Installation equipment

Anchor size	M8	M10	M12	M16	M20
Rotary hammer	TE 2 – TE 30			TE 40 – TE 80	
Other tools	blow out pump, hammer, torque wrench [1)]				

1) HSL-3-B only requires a regular wrench as it automatically ensures correct torque is applied

Setting parameters for HSL-3R, HSL-3-GR, HSL-3-SKR

Anchor size [a)]			M8			M10			M12			M16			M20		
Setting position	i		①	②	③	①	②	③	①	②	③	①	②	③	①	②	③
Eff. Anchorage depth	h_{ef}	[mm]	$h_{ef,1}$ [b)]	$h_{ef,2}$	$h_{ef,3}$	$h_{ef,1}$ [b)]	$h_{ef,2}$	$h_{ef,3}$	$h_{ef,1}$ [b)]	$h_{ef,2}$	$h_{ef,3}$	$h_{ef,1}$ [b)]	$h_{ef,2}$	$h_{ef,3}$	$h_{ef,1}$ [b)]	$h_{ef,2}$	$h_{ef,3}$
			60	80	100	70	90	110	80	105	130	100	125	150	125	155	185
Minimum base material thickness	h_{min}	[mm]	120	170	195	140	195	215	160	225	250	200	275	300	250	380	410
Critical spacing for concrete cone failure	$s_{cr,N}$	[mm]	180	240	300	210	270	330	240	315	390	300	375	450	375	465	555
Critical edge distance for concrete cone failure	$c_{cr,N}$	[mm]	90	120	150	105	135	165	120	158	195	150	188	225	188	233	278
Critical spacing for splitting failure	$s_{cr,sp}$	[mm]	340	350	350	440	540	660	530	530	530	480	570	660	670	880	1110
Critical edge distance for splitting failure	$c_{cr,sp}$		170	175	175	220	270	330	265	265	265	240	285	330	335	440	555
Non-cracked concrete																	
Minimum spacing	s_{min}	[mm]	70			70			80			100			125		
	for c ≥	[mm]	100			100			170			240			300		
Minimum edge distance	c_{min}	[mm]	70			120			80			100			150		
	for s ≥	[mm]	140			160			240			240			300		
Cracked concrete																	
Minimum spacing	s_{min}	[mm]	70			70			80			100			125		
	for c ≥	[mm]	100			100			160			240			300		
Minimum edge distance	c_{min}	[mm]	70			80			80			100			150		
	for s ≥	[mm]	140			160			240			240			300		

a) Please refer to the product catalogue on the Hilti website for standard portfolio

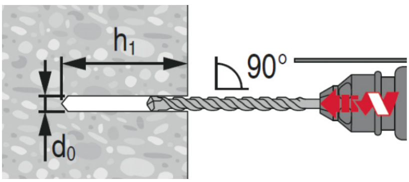
Setting instructions

*** For detailed information on installation of each specific HSL-3 versions see instruction for use given with the package of the product.**

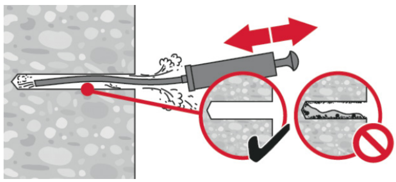
Setting instruction

Hammer drilling

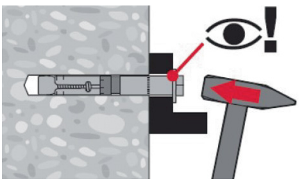
1. Drilling



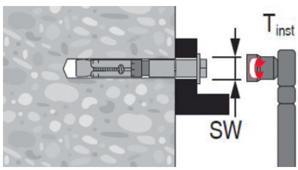
2. Cleaning



3. Installation



4. Applying tightening torque

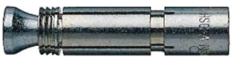


HSC Undercut anchor

Ultimate-performance undercut anchor for shallow embedment depth

Anchor version

HSC-A
HSC-AR
(M8-M12)



HSC-I
HSC-IR
(M6-M12)

Benefits

- The perfect solution for small edge distances and spacing
- Suitable for thin concrete blocks due to low embedment depth
- Suitable for cracked concrete
- Self-cutting undercut anchor
- Available as bolt version for through applications
- Available in stainless steel for external applications

Base material

Non-cracked concrete

Cracked concrete (Tension zone)

Load conditions

Static/ quasi-static

Shock

Fire resistance

Installation conditions

Hammer drilled holes

Other information

European Technical Assessment

CE conformity

PROFIS Engineering Suite

A4 316
Corrosion resistance

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European Technical Assessment [a)]	CSTB, Marne-la-Vallèe	ETA-02/0027 / 2018-07-04
Shockproof fastenings in civil defence installations	Federal Office for Civil Protection, Bern	BZS D 06-601 / 2016-07-04
Fire test report	IBMB, Braunschweig	UB 3177/1722-1 / 2006-06-28
Fire performance	Exova Warringtonfire	WF 327804/A / 2013-07-10

a) All data given in this section according to ETA-02/0027 issue 2018-07-04

Recommended general notes

* The below clauses based on Hilti product qualifications are for references only. Selection of clauses by the engineer shall be based on the specific application needs. Please contact Hilti's technical team for further details.

- Self-cutting undercut anchor available in externally threaded and/or internally threaded head for for use in cracked and un-cracked concrete
- The anchor shall have European Technical Assessment (ETA); evaluating performance in cracked and un-cracked concrete
- Anchor shall conform to shock proof fastening according to Swiss Federal Office for Civil Protection (FOCP) or equivalent authority
- Anchor shall have corrosion resistance of min. 5µm galvanization
- Anchor shall have corrosion resistance of A4 stainless steel
- Anchor shall be installed as per the manufacturer's approved procedure and equipment
- The recommended tension load of the anchor should not be not less than __kN in cracked concrete with concrete strength at 25N/mm2 (including overall global safety factor=3)
- Effective anchorage depth of the anchor should not exceed __mm

Basic loading data (for a single anchor)

All data in this section applies to:
- Static and quasi-static loading
- Correct setting (See setting instruction)
- No edge distance and spacing influence
- *Steel* failure
- Minimum base material thickness
- Concrete C 20/25, $f_{ck,cube}$=25 N/mm². Concrete strength influence factor can be applied when concrete grade > C20/25, when steel failure does not govern.

HSC-A/-AR

Effective anchorage depth of HSC-A/-AR

Anchor size			M8	M8	M10	M12
Eff. Anchorage depth range	h_{ef}	[mm]	40	50	40	60

Characteristic resistance of HSC-A/-AR

Anchor size			M8 x 40	M8 x 50	M10 x 40	M12 x 60
Non-cracked concrete						
Tension N_{Rk}	HSC-A, HSC-AR	[kN]	12,8	17,8	12,8	23,4
Shear V_{Rk}	HSC-A	[kN]	*14,6*	*14,6*	*23,2*	*33,7*
	HSC-AR		*12,8*	*12,8*	*20,3*	*29,5*
Cracked concrete						
Tension N_{Rk}	HSC-A, HSC-AR	[kN]	9,1	12,7	9,1	16,7
Shear V_{Rk}	HSC-A	[kN]	*14,6*	*14,6*	18,2	33,5
	HSC-AR		*12,8*	*12,8*	18,2	*29,5*

Design resistance of HSC-A/-AR a)

Anchor size			M8 x 40	M8 x 50	M10 x 40	M12 x 60
Non-cracked concrete						
Tension N_{Rk}	HSC-A, HSC-AR	[kN]	8,5	11,9	8,5	15,6
Shear V_{Rk}	HSC-A	[kN]	*11,7*	*11,7*	17,0	*27,0*
	HSC-AR		*8,2*	*8,2*	*13,0*	*18,9*
Cracked concrete						
Tension N_{Rk}	HSC-A, HSC-AR	[kN]	6,1	8,5	6,1	11,2
Shear V_{Rk}	HSC-A	[kN]	*11,7*	*11,7*	12,1	22,3
	HSC-AR		*8,2*	*8,2*	12,1	*18,9*

a) Includes material partial factor according to ETA-02/0027 issue 2018-07-04

Recommended loads of HSC-A/-AR [a)]

Anchor size			M8 x 40	M8 x 50	M10 x 40	M12 x 60
Non-cracked concrete						
Tension N_{Rk}	HSC-A, HSC-AR	[kN]	4,3	5,9	4,3	7,8
Shear V_{Rk}	HSC-A	[kN]	*4,8*	*4,8*	*7,7*	*11,2*
	HSC-AR		*4,3*	*4,3*	*6,8*	*9,8*
Cracked concrete						
Tension N_{Rk}	HSC-A, HSC-AR	[kN]	3,0	4,2	3,0	5,6
Shear V_{Rk}	HSC-A	[kN]	*4,9*	*4,9*	6,1	11,2
	HSC-AR		*4,3*	*4,3*	6,1	*9,8*

a) Includes global safety factor of 3

HSC-I/-IR

Effective anchorage depth of HSC-I/-IR

Anchor size			M6	M8	M10	M10	M12
Eff. Anchorage depth range	h_{ef}	[mm]	40	40	50	60	60

Characteristic resistance of HSC-I/-IR

Anchor size			M6 x 40	M8 x 40	M10 x 50	M10 x 60	M12 x 60
Non-cracked concrete							
Tension N_{Rk}	HSC-I, HSC-IR	[kN]	12,8	12,8	17,8	23,4	23,4
Shear V_{Rk}	HSC-I	[kN]	*8,0*	*12,2*	*15,2*	*15,2*	*18,2*
	HSC-IR		*7,0*	*10,7*	*13,3*	*13,3*	*16,0*
Cracked concrete							
Tension N_{Rk}	HSC-I, HSC-IR	[kN]	9,1	9,1	12,7	12,7	16,7
Shear V_{Rk}	HSC-I	[kN]	*8,0*	*12,2*	*15,2*	*15,2*	*18,2*
	HSC-IR		*7,0*	*10,7*	*13,3*	*13,3*	*16,0*

Design resistance of HSC-I/-IR [a)]

Anchor size			M6 x 40	M8 x 40	M10 x 50	M10 x 60	M12 x 60
Non-cracked concrete							
Tension N_{Rk}	HSC-I	[kN]	8,5	8,5	11,9	15,6	15,6
	HSC-IR		*7,5*	8,5	11,9	*14,2*	15,6
Shear V_{Rk}	HSC-I	[kN]	*4,6*	*11,7*	17,0	*11,7*	*27,0*
	HSC-IR		*4,5*	8,2	*13,0*	8,2	*18,9*
Cracked concrete							
Tension N_{Rk}	HSC-I, HSC-IR	[kN]	4,3	4,3	6,1	8,0	8,0
Shear V_{Rk}	HSC-I	[kN]	4,6	7,0	8,7	8,7	10,4
	HSC-IR		3,2	4,9	6,1	6,1	7,3

a) Includes material partial factor according to ETA-02/0027 issue 2018-07-04

Recommended loads of HSC-I/-IR [a)]

Anchor size			M6 x 40	M8 x 40	M10 x 50	M10 x 60	M12 x 60
Non-cracked concrete							
Tension N_{Rk}	HSC-I, HSC-IR	[kN]	4,3	4,3	5,9	7,8	7,8
Shear V_{Rk}	HSC-I	[kN]	*2,7*	*4,1*	*5,1*	*5,1*	*6,1*
	HSC-IR		*2,3*	*3,6*	*4,4*	*4,4*	*5,3*
Cracked concrete							
Tension N_{Rk}	HSC-I, HSC-IR	[kN]	3,0	3,0	4,2	4,2	5,6
Shear V_{Rk}	HSC-I	[kN]	*2,7*	*4,1*	*5,1*	*5,1*	*6,1*
	HSC-IR		*2,3*	*3,6*	*4,4*	*4,4*	*5,3*

a) Includes global factor of 3.0

Materials

Mechanical properties of HSC-A/ HSC-AR

Anchor size			HSC	M8 x 40	M10 x 40	M10 x 40	M8 x 50
Nominal tensile strength	f_{uk}	[N/mm²]	-A	800	800	800	800
			-AR	700	700	700	700
Yield strength	f_{yk}	[N/mm²]	-A	640	640	640	640
			-AR	450	450	450	450
Stressed cross-section for bolt version	$A_{s,A}$	[mm²]	-A, -AR	36,6	36,6	58,0	84,3
Moment of resistance	W	[mm³]	-A, -AR	31,2	31,2	62,3	109,2
Design bending resistance Without sleeve	$M_{Rd,s}$	[Nm]	-A	24	24	48	84
			-AR	16,7	16,7	33,3	59,0

Mechanical properties of HSC-I/ HSC-IR

Anchor size			HSC	M6	M8	M10	M10	M12
Nominal tensile strength	f_{uk}	[N/mm²]	-I	800	800	800	800	800
			-IR	700	700	700	700	700
Yield strength	f_{yk}	[N/mm²]	-I	640	640	640	640	640
			-IR	355	355	350	350	340
Stressed cross-section for bolt version	$A_{s,A}$	[mm²]	-I, -IR	22,0	28,3	34,6	34,6	40,8
Stressed cross-section for bolt version	$A_{s,A}$	[mm²]	-I, -IR	20,1	36,6	58,0	58,0	84,3
Moment of resistance	W	[mm³]	-I, -IR	12,7	31,2	62,3	62,3	109,2
Design bending resistance without sleeve	$M_{Rd,s}$	[Nm]	-I, -IR	9,6	24	48	48	84
				7,1	16,7	33,3	33,3	59,0

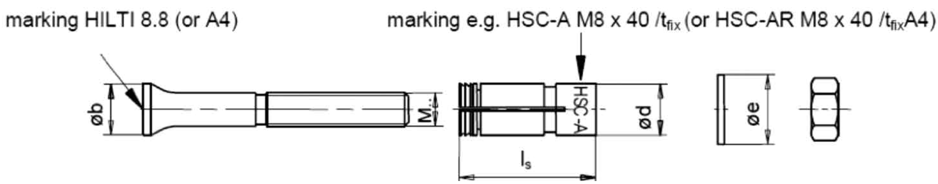
Material quality

Part	Material
HSC-A / HSC-I Carbon steel	
Cone bolt with internal thread	Carbon steel strength 8.8, galvanized to min. 5 µm
Cone bolt with external thread	
Expansion sleeve and washer	Galvanized to min. 5 µm
Hexagon nut	Grade 8
HSC-AR / HSC-IR Stainless steel	
Cone bolt with internal thread	Steel grade 1.4401, 1.4571 A4-70
Cone bolt with internal thread	
Expansion sleeve and washer	Steel grade 1.4401, 1.4571
Hexagon nut	Steel grade 1.4401, 1.4571 A4-70

Anchor dimension of HSC-A/ HSC-AR [a)]

Anchor size			M8 x 40	M8 x 50	M8 x 50	M12 x 60
Diameter of cone bolt	b	[mm]	13,5	13,5	15,5	17,5
Length of expansion sleeve	l_s	[mm]	40,8	50,8	40,8	60,8
Diameter of expansion sleeve	d	[mm]	13,5	13,5	15,5	17,5
Diameter of washer	e	[mm]	16	16	20	24

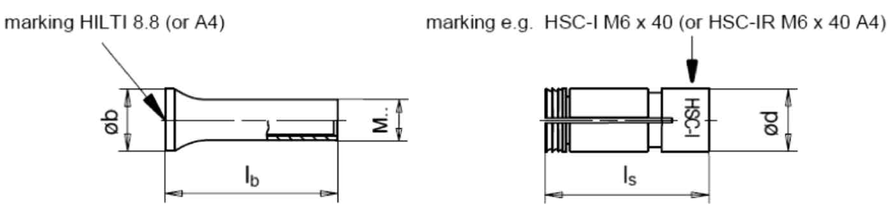
a) Please refer to the product catalogue on the Hilti website for standard portfolio



Anchor dimension of HSC-I/ HSC-IR [a)]

Anchor size			M6	M8	M10	M10	M12
Length of cone bolt	l_b	[mm]	43,8	43,8	54,8	64,8	64,8
Diameter of cone bolt	b	[mm]	43,8	13,5	15,5	13,5	17,5
Length of expansion sleeve	l_s	[mm]	40,8	40,8	50,8	50,8	60,8
Diameter of expansion sleeve	d	[mm]	13,5	15,5	17,5	17,5	19,5

a) Please refer to the product catalogue on the Hilti website for standard portfolio



Setting information

Setting details of HSC-A/ HSC-AR

Anchor size			M8 x 40	M8 x 50	M8 x 50	M12 x 60
Effective anchorage depth	h_{ef}	[mm]	40	50	40	60
Nominal Diameter of drill bit	d_0	[mm]	14	14	16	18
Cutting diameter of drill bit [1]	$d_{cut} \leq$	[mm]	14,5	14,5	16,5	18,5
Maximum fastening thickness	t_{fix}	[mm]	15	15	20	20
Depth of drill hole	h_1	[mm]	46	56	46,5	68
Diameter of clearance hole in the fixture	$d_f \leq$	[mm]	9	9	12	14
Torque moment	T_{inst}	[Nm]	10	10	20	30
Width across nut flats	SW	[mm]	13	13	17	19

Setting details of HSC-I/ HSC-IR

Anchor size			M6	M8	M10	M10	M12
Effective anchorage depth	h_{ef}	[mm]	40	40	50	60	60
Nominal Diameter of drill bit	d_0	[mm]	14	16	18	18	20
Cutting diameter of drill bit [1]	$d_{cut} \leq$	[mm]	14,5	16,5	18,5	18,5	20,5
Depth of drill hole	$h_1 =$	[mm]	46	46,5	56	68	68,5
Diameter of clearance hole in the fixture	$d_f \leq$	[mm]	7	9	12	12	14
Torque moment	T_{inst}	[Nm]	10	10	20	30	30
Width across nut flats	SW	[mm]	10	13	17	17	19
Screwing depth	min s	[mm]	6	8	10	10	12
	max s	[mm]	16	22	28	28	30

Installation equipment for HSC-A/ HSC-AR

Anchor size		M8 x 40	M8 x 50	M10 x 40	M12 x 60
Rotary hammer for setting		TE 7-C; TE 7-A; TE 16; TE 16-C; TE 16-M; TE 25; TE 30; TE 35		TE 7-C; TE 7-A; TE 25; TE 35	TE 16; TE 16-C; TE 16-M; TE 25; TE 30; TE 35; TE 40; TE 40-AVR
Stepped drill bit	TE-C-HSC-B	14x40	14x50	16x40	18x60
Setting tool	TE-C-HSC-MW	14	14	16	18

Installation equipment for HSC-I/ HSC-IR

Anchor size		M6 x 40	M8 x 40	M10 x 50	M10 x 60	M12 x 60
Rotary hammer for setting		TE 7-C; TE 7-A; TE 16; TE 16-C; TE 16-M; TE 25; TE 30; TE 35				TE 16; TE 16-C; TE 16-M; TE 25; TE 30; TE 35; TE 40; TE 40-AVR
Stepped drill bit	TE-C-HSC-B	14x40	16x40	18x50	18x60	20x60
Setting tool	TE-C-HSC-MW	14	16	18	18	20
Insert tool	TE-C-HSC-EW	14	16	18	18	20

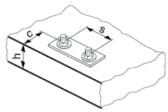
Setting parameters for HSC-A/ HSC-AR

Anchor size			M8 x 40	M10 x 40	M8 x 50	M12 x 60
Effective anchorage depth	h_{ef}	[mm]	40	40	50	60
Minimum base material thickness	$h_{min} \geq$	[mm]	100	100	100	130
Minimum spacing	$s_{min} \geq$	[mm]	40	40	50	60
Minimum edge distance	$c_{min} \geq$	[mm]	40	40	50	60
Critical spacing for splitting failure	$s_{cr,sp}$	[mm]	130	120	170	180
Critical edge distance for splitting failure	$c_{cr,sp}$	[mm]	65	60	85	90
Critical spacing for concrete cone failure	$s_{cr,N}$	[mm]	120	120	150	180
Critical edge distance for concrete cone failure	$c_{cr,N}$	[mm]	60	60	75	90

Setting details of HSC-I/ HSC-IR

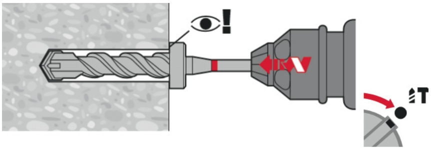
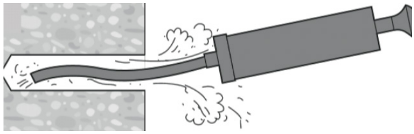
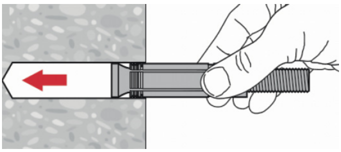
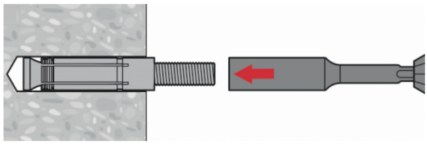
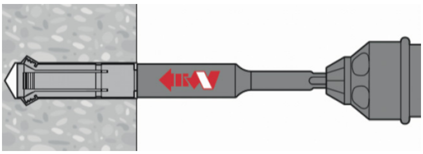
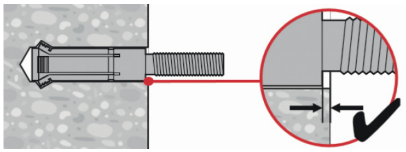
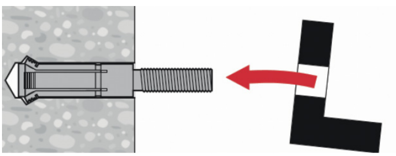
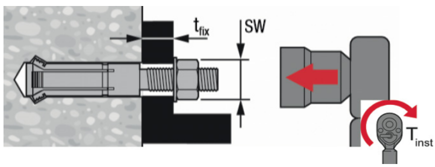
Anchor size			M6 x 40	M8 x 40	M10 x 50	M10 x 60	M12 x 60
Effective anchorage depth	h_{ef}	[mm]	40	40	50	60	60
Minimum base material thickness	$h_{min} \geq$	[mm]	100	100	100	100	130
Minimum spacing	$s_{min} \geq$	[mm]	40	40	40	50	60
Minimum edge distance	$c_{min} \geq$	[mm]	40	40	50	60	60
Critical spacing for splitting failure	$s_{cr,sp}$	[mm]	130	120	170	180	180
Critical edge distance for splitting failure	$c_{cr,sp}$	[mm]	65	60	85	90	90
Critical spacing for concrete cone failure	$s_{cr,N}$	[mm]	120	120	150	180	180
Critical edge distance for concrete cone failure	$c_{cr,N}$	[mm]	60	60	75	90	90

In case of smaller edge distance and spacing than $c_{cr,sp}$, $s_{cr,sp}$, $c_{cr,N}$ and $s_{cr,N}$ the load values shall be reduced according ETAG 001, Annex C
Critical spacing and critical edge distance for splitting failure apply only for non-cracked concrete.
For cracked concrete only the critical spacing and critical edge distance for concrete cone failure are decisive.



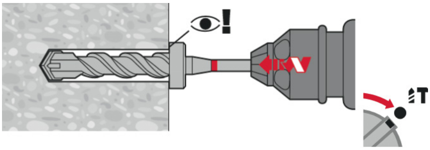
Setting instructions

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

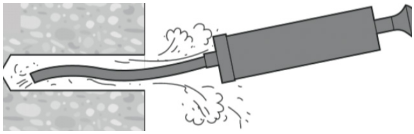
Setting instruction for HSC-A (R)	
1. Drilling 	**2. Cleaning** 
3. Inserting the anchor by hand 	**4. Applying hammer drill** 
5. Applying hammer drill 	**6. Checking** 
7. Attaching the fixture 	**8. Attaching the belonging washer** 

Setting instruction for HSC-A (R)

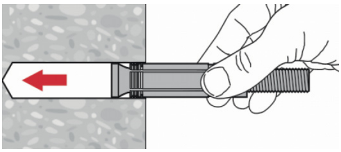
1. Drilling



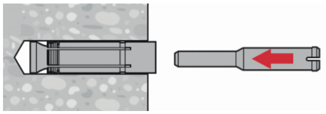
2. Cleaning



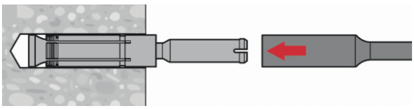
3. Inserting the anchor by hand



4. Inserting the tool HSC-EW14

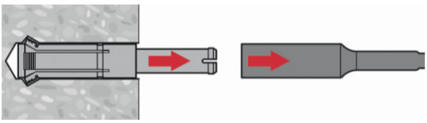


5. Applying hammer drill

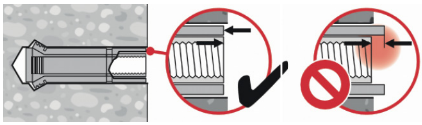


6. Applying hammer drill

7. Applying hammer drill

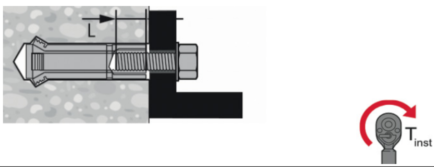


8. Checking

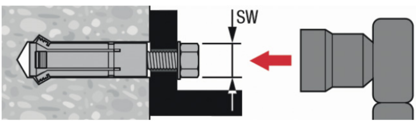


9. Attaching the fixture

10. Attaching the belonging washer



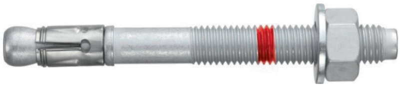
11.



Anchor technology & design
Heavy / medium duty metal anchors
Plastic / light duty / other metal anchors
Chemical anchors

HST3 Expansion anchor

Ultimate-performance expansion anchor for cracked concrete and seismic

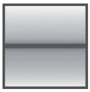
Anchor versions		Benefits
	HST3 HST3-R (M8-M24)	- Highest resistance for reduced member thickness, short spacing and edge distances - Increased undercut percentage in combination with optimized coating - Suitable for non-cracked and cracked concrete C 12/15 to C 80/95 - Highly reliable and safe anchor for structural seismic [a] design with ETA C1/C2 approval - Flexibility with two embedment depths included in the ETA - Product and length identification mark facilitates quality control and inspection

Base material


Non-cracked concrete


Cracked concrete (Tension zone)

Load conditions

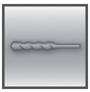

Static/ quasi-static

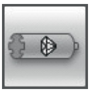

Seismic ETA-C1, C2

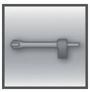

Shock


Fire resistance

Installation conditions


Hammer drilled holes


Diamond cored holes [c]


Hollow drill-bit drilling

Other information

European Technical Assessment

CE conformity

PROFIS Engineering Suite

FM approved

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European technical assessment [b]	DIBt, Berlin	ETA-98/0001 / 2019-10-02
Fire test report	DIBt, Berlin	ETA-98/0001 / 2019-10-02
Shock approval	FOCP, Zurich	BZS D 08-602 / 2016-08-17

a) Please contact your Hilti representative for seismic resistance data

b) All data given in this section according to ETA-98/0001 issue 2019-10-02

Recommended general notes

* The below clauses based on Hilti product qualifications are for references only. Selection of clauses by the engineer shall be based on the specific application needs. Please contact Hilti's technical team for further details.

- Torque controlled expansion anchor, approved for use in cracked and un-cracked concrete
- The anchor shall have European Technical Assessment (ETA); evaluating performance in cracked and un-cracked concrete and seismic conditions
- The anchor shall be assessed for use in cracked and uncracked concrete of strength class C12/15 minimum to C80/95 maximum.
- Anchor shall conform to shock proof fastening according to Swiss Federal Office for Civil Protection (FOCP) or equivalent authority
- Anchor shall have corrosion resistance of min. 5μm galvanization
- Anchor shall have corrosion resistance of A4 stainless steel
- Anchor shall be installed as per the manufacturer's approved procedure and equipment
- Anchor shall have identification marks on the bolt head that can be used to verify the anchor material and length during inspection
- The recommended tension load of the anchor should not be not less than __kN in cracked concrete with concrete strength at 25N/mm² (including overall global safety factor=3)
- Effective anchorage depth of the anchor should not exceed __mm

For HST3/HST3-R M10, M12 and M16

- Anchor must be approved for installation in 2 embedment depths or setting positions

Basic loading data (for a single anchor)

All data in this section applies to:

- Static and quasi-static loading
- Correct setting (See setting instruction)
- No edge distance and spacing influence
- *Steel* failure
- Minimum base material thickness
- Concrete C 20/25, $f_{ck,cube}$=25 N/mm² . Concrete strength influence factor can be applied when concrete grade > C20/25, when steel failure does not govern.

Effective anchorage depth

Anchor size			M8	M10		M12		M16		M20	M24
Eff. Anchorage depth range	h_{ef}	[mm]	47	40	60 a)	50	70 a)	65	85 a)	101	125

Characteristic resistance

Anchor size			M8	M10		M12		M16		M20	M24
Non-cracked concrete											
Tension N_{Rk}	HST3	[kN]	12,0	12,8	22,0	17,9	25,0	26,5	39,6	51,3	60,0
	HST3-R		12,0	12,8	22,0	17,9	25,0	26,5	39,6	51,3	60,0
Shear V_{Rk}	HST3	[kN]	*13,8*	*21,9*	*23,6*	*34,0*	*35,4*	*54,5*	*55,3*	*83,9*	*94,0*
	HST3-R		*15,7*	*25,6*	*25,3*	*31,1*	*36,7*	*48,6*	*63,6*	*97,2*	*115,0*
Cracked concrete											
Tension N_{Rk}	HST3	[kN]	8,0	9,1	15,0	12,7	20,0	18,9	28,2	36,5	40,0
	HST3-R		8,5	9,1	15,0	12,7	20,0	18,9	28,2	36,5	40,0
Shear V_{Rk}	HST3	[kN]	*13,8*	*21,9*	*23,6*	*34,0*	*35,4*	*54,5*	*55,3*	*83,9*	*94,0*
	HST3-R		*15,7*	*24,3*	*25,3*	*31,1*	*36,7*	*48,6*	*63,6*	*97,2*	*115,0*

a) Standard embedment depth up to anchor marking

Effective anchorage depth

Anchor size			M8	M10		M12		M16		M20	M24
Eff. Anchorage depth range	h_{ef}	[mm]	47	40	60 b)	50	70 b)	65	85 b)	101	125

Design resistance a)

Anchor size			M8	M10		M12		M16		M20	M24
Non-cracked concrete											
Tension N_{Rd}	HST3	[kN]	8,0	8,5	14,7	11,9	16,7	17,6	26,4	34,2	40,0
	HST3-R		8,0	8,5	14,7	11,9	16,7	17,6	26,4	34,2	40,0
Shear V_{Rd}	HST3	[kN]	*11,0*	*17,5*	*18,9*	*27,2*	*28,3*	*43,6*	*44,2*	*67,1*	62,7
	HST3-R		*12,6*	*20,5*	*20,2*	*24,9*	*29,4*	*38,9*	*50,9*	*77,8*	88,5
Cracked concrete											
Tension N_{Rd}	HST3	[kN]	5,3	6,1	10,0	8,5	13,3	12,6	18,8	24,4	26,7
	HST3-R		5,7	6,1	10,0	8,5	13,3	12,6	18,8	24,4	26,7
Shear V_{Rd}	HST3	[kN]	*11,0*	*16,2*	18,9	*23,6*	28,3	*42,9*	44,2	67,1	*62,7*
	HST3-R		*12,6*	*16,2*	20,2	*23,6*	29,4	38,9	50,9	77,8	*83,9*

a) Includes material partial factor according to ETA-98/0001 issue 2019-10-02
b) Standard embedment depth up to anchor marking

Recommended loads a)

Anchor size			M8	M10		M12		M16		M20	M24
Non-cracked concrete											
Tension N_{Rec}	HST3	[kN]	4,0	4,3	7,3	6,0	8,3	8,8	13,2	17,1	20,0
	HST3-R		4,0	4,3	7,3	6,0	8,3	8,8	13,2	17,1	20,0
Shear V_{Rec}	HST3	[kN]	*4,6*	*7,3*	*7,9*	*11,3*	*11,8*	*18,2*	*18,4*	*28,0*	*31,3*
	HST3-R		*5,2*	*8,5*	*8,4*	*10,4*	*12,2*	*16,2*	*21,2*	*32,4*	*38,3*
Cracked concrete											
Tension N_{Rec}	HST3	[kN]	2,7	3,0	5,0	4,2	6,7	6,3	9,4	12,2	13,3
	HST3-R		2,8	3,0	5,0	4,2	6,7	6,3	9,4	12,2	13,3
Shear V_{Rec}	HST3	[kN]	*4,6*	*7,3*	*7,9*	*11,3*	*11,8*	*18,2*	*18,4*	*28,0*	*31,3*
	HST3-R		*5,2*	8,1	*8,4*	*10,4*	*12,2*	*16,2*	*21,2*	*32,4*	*38,3*

a) Includes global safety factor of 3.0
b) Standard embedment depth up to anchor marking

Materials

Mechanical properties

Anchor size			M8	M10	M12	M16	M20	M24
Nominal tensile strength $f_{uk,thread}$	HST3	[N/mm²]	800	800	800	720	700	530
	HST3-R		720	710	710	650	650	650
Yield strength $f_{yk,thread}$	HST3	[N/mm²]	640	640	640	576	560	450
	HST3-R		576	568	568	520	520	500
Stressed cross-section A_s		[mm²]	36,6	58,0	84,3	157	245	353
Moment of resistance W		[mm³]	31,2	62,3	109	277	541	935
Char, bending resistance $M^0_{Rk,s}$	HST3	[Nm]	30	60	105	240	457	595
	HST3-R		27	53	93	216	425	730

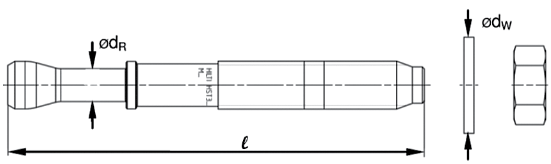
Material quality

Part		Material
Expansion sleeve	HST3	M10, M16: Galvanized or Stainless steel M8, M12, M20, M24: Stainless steel
	HST3-R	Stainless steel A4
Bolt	HST3	Carbon steel, galvanized, coated (transparent)
	HST3-R	Stainless steel A4, cone coated (transparent)
Washer	HST3	Galvanized
	HST3-R	Stainless steel A4
Hexagon nut	HST3	Strength class 8
	HST3-R	Stainless steel A4, coated

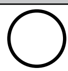
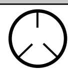
Anchor dimensions

Anchor size			M8	M10	M12	M16	M20	M24
Maximum length of anchor	$l_{max} \leq$	[mm]	260	280	350	475	450	500
Shaft diameter at the cone	d_R		5,60	6,94	8,22	11,00	14,62	17,4
Length of expansion sleeve	l_s	[mm]	13,6	16,0	20,0	25,0	28,3	36,0
Diameter of washer	$d_w \geq$		15,57	19,48	23,48	29,48	36,38	43,38

a) Please refer to our product catalogue for our standard portfolio



Material code for identification of different materials

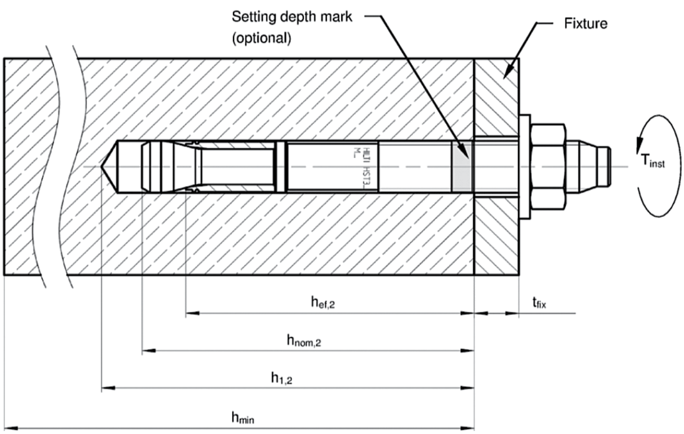
Type	HST3	HST3-R
Material Code		

Setting information

Setting details

Anchor size			M8	M10	M12	M16	M20	M24
Nominal diameter of drill bit	d_o	[mm]	8	10	12	16	20	24
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	8,45	10,45	12,5	16,5	20,55	24,55
Effective embedment depth	$h_{ef,1}$	[mm]	-	40	50	65	-	-
	$h_{ef,2}$	[mm]	47	60	70	85	101	125
Drill hole depth[1)]	$h_{1,1} \geq$	[mm]	-	53	68	86	-	-
	$h_{1,2} \geq$	[mm]	59	73	88	106	124	151
Thread engagement length	$h_{nom,1}$	[mm]	-	48	60	78	-	-
	$h_{nom,2}$	[mm]	54	68	80	98	116	143
Maximum diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18	22	26
Torque moment	T_{inst}	[Nm]	20	45	60	110	180	300
Maximum thickness of fixture	$t_{fix,max}$	[mm]	195	220	270	370	310	330
Width across	SW	[mm]	13	17	19	24	30	36

a) In case of diamond drilling +5 mm for M8 to M10 and +2 mm for M12 to M24.



Installation equipment

Anchor size	M8	M10	M12	M16	M20	M24
Rotary hammer	TE2(-A) – TE30(-A)				TE40 – TE80	
Diamond coring tool	DD-30W, DD-EC1					
Setting tool	Hilti S7W 6AT 22A – SI-AT-A22			-		
Hollow drill bit	-		TE-CD, TE-YD			
Other tools	hammer, torque wrench, blow out pump					

Setting parameters of HST3 / HST3-R for M8 and M10

Anchor size			M8			M10			
Concrete class			C20/25 to C50/60 a) C55/67 to C80/95 b)		C12/15 b) C16/20 b)	C12/15 to C16/20 a)	C20/25 to C50/60 a) C55/67 to C80/95 b)		C12/15 b) C16/20 b)
Effective anchorage depth	h_{ef}	[mm]	47		47	40	60		60
Minimum base material thickness	h_{min}	[mm]	80	100	100	80	100	120	120
Minimum spacing in *non-cracked* concrete	s_{min}	[mm]	35	35	35	50	40	40	70
	for c ≥	[mm]	55	50	65	95	100	60	90
Minimum spacing in *cracked* concrete	s_{min}	[mm]	35	35	35	40	40	40	45
	for c ≥	[mm]	50	50	55	90	100	55	85
Minimum edge distance in *non-cracked* concrete	c_{min}	[mm]	40	40	50	50	60	50	80
	for s ≥	[mm]	50	50	80	190	90	90	120
Minimum edge distance in *cracked* concrete	c_{min}	[mm]	40	40	40	45	60	45	70
	for s ≥	[mm]	50	50	75	180	90	80	120
Critical spacing for splitting failure and concrete cone failure	$s_{cr,sp}$	[mm]	141		188	168	180		240
	$s_{cr,N}$	[mm]	141		141	120	180		180
Critical spacing for splitting failure and concrete cone failure	$c_{cr,sp}$	[mm]	71		94	84	90		120
	$c_{cr,N}$	[mm]	71		71	60	90		90

a) Data covered by by ETA-98/0001 issue 2019-10-02
b) Data covered by Hilti Technical Data

Setting parameters of HST3 / HST3-R for M12 and M16

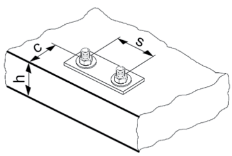
Anchor size			M12				M16			
Concrete class			C20/25 to C50/60 a)	C20/25 to C50/60 a) C55/67 to C80/95 b)		C12/15 b) C16/20 b)	C20/25 to C50/20 a)	C20/25 to C50/60 a) C55/67 to C80/95 b)		C12/15 b) C16/20 b)
Effective anchorage	h_{ef}	[mm]	50	70		70	65	85		85
Minimum base material	h_{min}	[mm]	100	120	140	140	120	140	160	160
Minimum spacing in *non-cracked* concrete	s_{min}	[mm]	55	50	60	110	75	80	65	90
	for c ≥	[mm]	110	100	70	140	140	130	95	145
Minimum spacing in *cracked* concrete	s_{min}	[mm]	50	50	50	80	65	80	65	70
	for c ≥	[mm]	105	90	70	120	130	130	95	125
Minimum edge distance in *non-cracked* concrete	c_{min}	[mm]	60	60	55	90	65	65	65	110
	for s ≥	[mm]	210	120	110	190	240	180	150	170
Minimum edge distance in *cracked* concrete	c_{min}	[mm]	55	60	55	80	65	65	65	90
	for s ≥	[mm]	210	120	110	170	240	180	150	165
Critical spacing for splitting failure and concrete cone failure	$s_{cr,sp}$	[mm]	180	120		280	208	255		340
	$s_{cr,N}$	[mm]	150	120		210	195	255		255
Critical spacing for splitting failure and concrete cone failure	$c_{cr,sp}$	[mm]	90	105		140	104	128		170
	$c_{cr,N}$	[mm]	75	105		105	98	128		128

a) Data covered by by ETA-98/0001 issue 2019-10-02
b) Data covered by Hilti Technical Data

Setting parameters of HST3 / HST3-R for M20 and M24

Anchor size				M20			M24	
Concrete class				C20/25 to C50/60 a) C55/67 to C80/95 b)		C12/15 b) C16/20 b)	C20/25 to C50/60 a) C55/67 to C80/95 b)	C12/15 b) C16/20 b)
Effective anchorage		h_{ef}	[mm]	101		101	125	125
Minimum base material		h_{min}	[mm]	160	200	200	250	250
Minimum spacing in non-cracked concrete	HST3	s_{min}	[mm]	120	90	90	125	180
		for c ≥	[mm]	180	130	165	255	375
	HST3-R	s_{min}	[mm]	120	90	90	125	180
		for c ≥	[mm]	180	130	165	205	375
Minimum spacing in cracked concrete	HST3	s_{min}	[mm]	120	90	90	125	140
		for c ≥	[mm]	180	130	165	180	325
	HST3-R	s_{min}	[mm]	120	90	90	125	140
		for c ≥	[mm]	180	130	140	130	325
Min. edge distance in non-cracked concrete	HST3	c_{min}	[mm]	120	80	90	170	260
		for s ≥	[mm]	180	180	140	295	400
	HST3-R	c_{min}	[mm]	120	80	120	150	260
		for s ≥	[mm]	180	180	270	235	400
Min. edge distance in cracked concrete	HST3	c_{min}	[mm]	120	80	100	125	230
		for s ≥	[mm]	180	180	240	240	295
	HST3-R	c_{min}	[mm]	120	80	100	125	230
		for s ≥	[mm]	180	180	240	140	295
Critical spacing for splitting failure and concrete cone failure		$s_{cr,sp}$	[mm]	384		404	375	500
		$s_{cr,N}$	[mm]	303		303	375	375
Critical spacing for splitting failure and concrete cone failure		$c_{cr,sp}$	[mm]	192		202	188	250
		$c_{cr,N}$	[mm]	152		152	188	188

a) Data covered by by ETA-98/0001 issue 2019-10-02
b) Data covered by Hilti Technical Data
For spacing (edge distance) smaller than critical spacing (critical edge distance) the design loads have to be reduced.



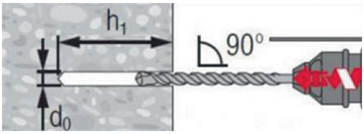
Setting instructions

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

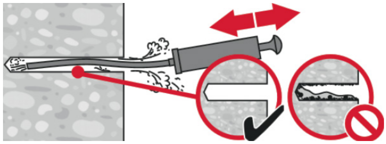
Setting instruction for HST3, HST3-R

Hammer drilling (M8, M10, M12, M16, M20, M24)

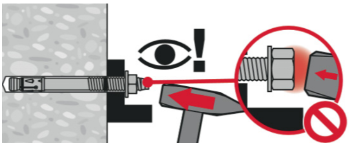
1. Drill the hole



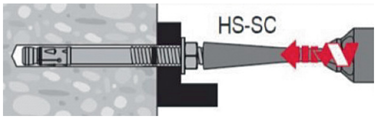
2. Clean the hole



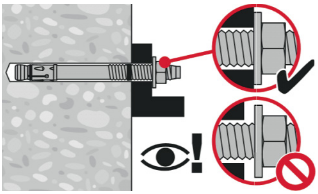
3.a Insert the anchor



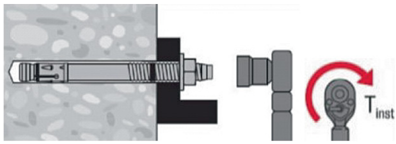
3.b Use a setting tool HS-SC



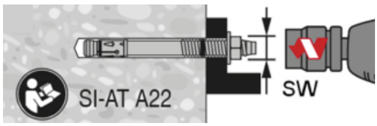
4. Checking



5.a Attach the belonging washer

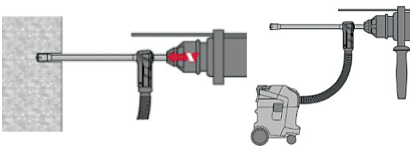


5.b Attach the belonging washer with screw driver (M8, M10, M12)

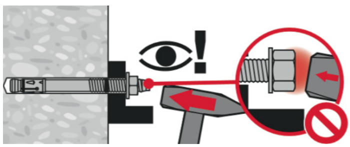


Hammer drilling (M8, M10, M12, M16, M20, M24)

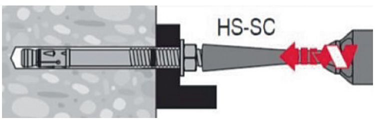
1. Drill the hole with the Hollow drill bit



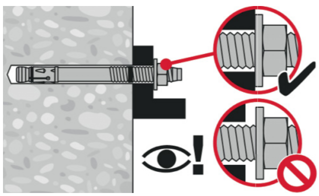
2. Insert the anchor



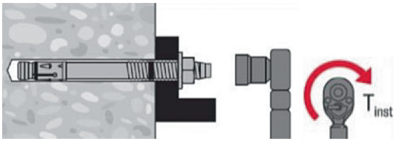
3. Use a setting tool HS-SC



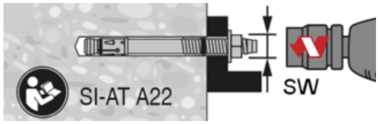
4. Checking



5.a Attach the belonging washer

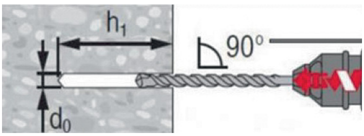


5.b Attach the belonging washer with screw driver (M8, M10, M12)

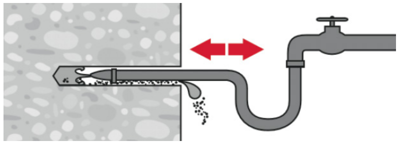


Diamond coring (M8, M10, M12, M16, M20, M24)

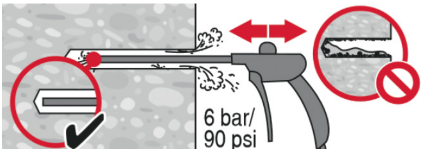
1. Core the hole



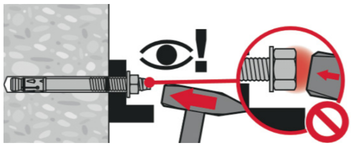
2. Flushing



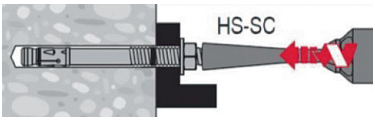
3. Clean the hole



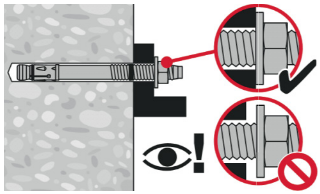
4. Insert the anchor



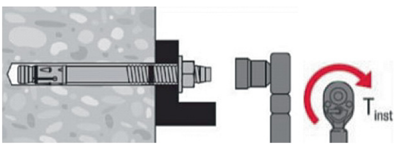
5. Use a setting tool HS-SC



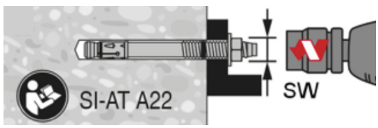
6. Checking



7.a Attach the belonging washer



7.b Attach the belonging washer with screw driver (M8, M10, M12)



HSA Expansion anchor

Everyday standard expansion anchor for uncracked concrete

Anchor version

HSA
HSA-F
HSA-R
HSA-R2
(M6-M20)

Benefits

- Small edge and spacing distances
- Three embedment depths for maximal design flexibility
- Fast & convenient setting including approval to torque using impact wrench with torque bar for torque control

Base material

Non-cracked concrete

Load conditions

Static/ quasi-static

Fire resistance

Installation conditions

Hammer drilled holes

Diamond drilled holes

Hollow drill-bit drilling

Small edge distance and spacing

Variable embedment depth

Other information

European Technical Assessment

CE conformity

PROFIS Engineering Suite

A4 316
Corrosion resistance

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European technical assessment [a)]	DIBt, Berlin	ETA-11/0374 / 2016-08-08
Fire performance	Exova Warringtonfire	WF 327804/A / 2013-07-10

a) All data given in this section according to ETA-11/0374 issue 2016-08-08

Recommended general notes

* The below clauses based on Hilti product qualifications are for references only. Selection of clauses by the engineer shall be based on the specific application needs. Please contact Hilti's technical team for further details.

- Torque controlled expansion anchor, approved for use in un-cracked concrete
- Anchor shall be approved for installation in 3 embedment depths or setting positions
- The anchor must have European Technical Assessment (ETA); evaluating performance in un-cracked concrete
- Anchor shall have corrosion resistance of min. 5µm galvanization
- Anchor shall have corrosion resistance of A4 stainless steel
- Anchor shall be installed as per the manufacturer's approved procedure and equipment
- Anchor shall be approved for installation using manufacturer approved impact wrench with torque bar
- Anchor shall have identification marks on the bolt head that can be used to verify the anchor material and length during inspection
- The recommended tension load of the anchor should not be not less than __kN in un-cracked concrete with concrete strength at 25N/mm² (including overall global safety factor=3)
- Effective anchorage depth of the anchor should not exceed __mm

Basic loading data (for a single anchor)

All data in this section applies to:

- Static and quasi-static loading
- Correct setting (see setting instruction)
- No edge distance and spacing influence
- *Steel* failure
- Minimum base material thickness
- Concrete C 20/25, $f_{ck,cube}$ = 25 N/mm². Concrete strength influence factor can be applied when concrete grade > C20/25, when steel failure does not govern.

Effective anchorage depth

Anchor size			M6			M8			M10		
Eff. Anchorage depth	h_{ef}	[mm]	30	40 [b]	60	30	40 [b]	70	40	50 [b]	80
Anchor size			**M12**			**M16**			**M20**		
Eff. Anchorage depth	h_{ef}	[mm]	50	65 [b]	100	65	80 [b]	120	75	100 [b]	115

Characteristic resistance

Anchor size			M6			M8			M10		
Eff. Anchorage depth	h_{ef}	[mm]	30	40	60	30	40	70	40	50	80
Tension N_{Rk}	HSA, HSA-F [a]	[kN]	6,0	7,5	*9,0*	8,3	12,8	16,0	12,8	17,9	25,0
	HSA-R2, HSA-R		6,0	7,5	9,0	8,3	12,8	16,0	12,8	17,9	25,0
Shear V_{Rk}	HSA, HSA-F [a]	[kN]	*6,5*	*6,5*	*6,5*	8,3	*10,6*	*10,6*	*18,9*	*18,9*	*18,9*
	HSA-R2, HSA-R		*7,2*	*7,2*	*7,2*	8,3	*12,3*	*12,3*	*22,6*	*22,6*	*22,6*
Anchor size			**M12**			**M16**			**M20**		
Eff. Anchorage depth	h_{ef}	[mm]	50	65	100	65	80	120	75	100	115
Tension N_{Rk}	HSA, HSA-F [a]	[kN]	17,9	26,5	35,0	26,5	36,1	50,0	32,8 [a]	50,5 [a]	62,3 [a]
	HSA-R2, HSA-R		17,9	26,5	35,0	26,5	36,1	50,0	32,8	50,5	62,3
Shear V_{Rk}	HSA, HSA-F [a]	[kN]	*29,5*	*29,5*	*29,5*	*51,0*	*51,0*	*51,0*	65,6 [a]	*85,8* [a]	*85,8* [a]
	HSA-R2, HSA-R		*29,3*	*29,3*	*29,3*	*56,5*	*56,5*	*56,5*	65,6	*91,9*	*91,9*

a) Data for HSA-F covered by Hilti Technical Data.
b) Standard embedment depth up to anchor marking

Design resistance [a]

Anchor size			M6			M8			M10		
Eff. Anchorage depth	h_{ef}	[mm]	30	40 [c]	60	30	40 [c]	70	40	50 [c]	80
Tension N_{Rd}	HSA, HSA-F [b]	[kN]	4,0	5,0	*6,0*	5,5	8,5	10,7	8,5	11,9	16,7
	HSA-R2, HSA-R		4,0	5,0	6,0	5,5	8,5	10,7	8,5	11,9	16,7
Shear V_{Rd}	HSA, HSA-F [b]	[kN]	*5,2*	*5,2*	*5,2*	*5,5*	*8,5*	*8,5*	*15,1*	*15,1*	*15,1*
	HSA-R2, HSA-R		*5,5*	*5,8*	*5,8*	5,5	*9,8*	*9,8*	*18,1*	*18,1*	*18,1*
Anchor size			**M12**			**M16**			**M20**		
Eff. Anchorage depth	h_{ef}	[mm]	50	65 [c]	100	65	80 [c]	120	75	100 [c]	115
Tension N_{Rd}	HSA, HSA-F [b]	[kN]	11,9	17,6	23,3	17,6	24,1	33,3	21,9 [b]	33,7 [b]	41,5 [b]
	HSA-R2, HSA-R		11,9	17,6	23,3	17,6	24,1	33,3	21,9	33,7	41,5
Shear V_{Rd}	HSA, HSA-F [b]	[kN]	*23,6*	*23,6*	*23,6*	*40,8*	*40,8*	*40,8*	*43,7* [b]	*68,6* [b]	*68,6* [b]
	HSA-R2, HSA-R		*23,4*	*23,4*	*23,4*	*45,2*	*45,2*	*45,2*	*43,7*	*73,5*	*73,5*

a) Includes material partial factor according to ETA-11/0374, issue 2016-08-08
b) Data for HSA-F covered by Hilti Technical Data.
c) Standard embedment depth up to anchor marking

Recommended loads [a]

Anchor size			M6			M8			M10		
Eff. Anchorage depth	h_{ef}	[mm]	30	40 [c]	60	30	40 [c]	70	40	50 [c]	80
Tension N_{Rec}	HSA, HSA-F [b]	[kN]	2,0	2,5	*3,0*	2,8	4,3	5,3	4,4	6,0	8,3
	HSA-R2, HSA-R		2,0	2,5	3,0	2,8	4,3	5,3	4,4	6,0	8,3
Shear V_{Rec}	HSA, HSA-F [b]	[kN]	2,2	2,2	2,2	2,8	3,5	3,5	6,3	6,3	6,3
	HSA-R2, HSA-R		2,4	2,4	2,4	2,8	4,1	4,1	7,5	7,5	7,5
Anchor size			**M12**			**M16**			**M20**		
Eff. Anchorage depth	h_{ef}	[mm]	50	65 [c]	100	65	80 [c]	120	75	100 [c]	115
Tension N_{Rec}	HSA, HSA-F [b]	[kN]	6,0	8,8	11,7	8,8	12,0	16,7	11,0	16,8	20,8
	HSA-R2, HSA-R		6,0	8,8	11,7	8,8	12,0	16,7	11,0	16,8	20,8
Shear V_{Rec}	HSA, HSA-F [b]	[kN]	*9,8*	*9,8*	*9,8*	*17,0*	*17,0*	*17,0*	21,9	*28,6*	*28,6*
	HSA-R2, HSA-R		*9,8*	*9,8*	*9,8*	*18,8*	*18,8*	*18,8*	21,9	*30,6*	*30,6*

a) Includes global safety factor of 3.0
b) Data for HSA-F covered by Hilti Technical Data.
c) Standard embedment depth up to anchor marking

Materials

Mechanical properties

Anchor size			M6	M8	M10	M12	M16	M20
Nominal tensile strength $f_{uk,thread}$	HSA, HSA-F	[N/mm²]	650	580	650	700	650	700
	HSA-R2, HSA-R		650	560	650	580	600	625
Yield strength $f_{yk,thread}$	HSA, HSA-F	[N/mm²]	520	464	520	560	520	560
	HSA-R2, HSA-R		520	448	520	464	480	500
Stressed cross-section A_s		[mm²]	20,1	36,6	58	84,3	157	245
Moment of resistance W		[mm³]	12,7	31,2	62,3	109,2	277,5	540,9
Char, bending resistance $M^0_{Rk,s}$	HSA, HSA-F	[Nm]	9,9	21,7	48,6	91,7	216,4	454,4
	HSA-R2, HSA-R		9,9	21	48,6	76	199,8	405,7

Material quality

Part		Material
HSA (Carbon steel)	Bolt	Galvanized (≥5 µm)
	Sleeve	Galvanized (≥5 µm)
	Washer	Galvanized (≥5 µm)
	Hexagon nut	Strength class 8 / Galvanized (≥5 µm)
HSA-R2 (Stainless steel)	Bolt	Stainless steel A2, 1.4301 or 1.4162; M6-M20 coated
	Sleeve	Stainless steel A2, 1.4301 or 1.4404
	Washer	Stainless steel A2
	Hexagon nut	Stainless steel A2; / M6-M20 coated
HSA-R (Stainless steel)	Bolt	Stainless steel A4, 1.4301 or 1.4162 / M6-M20 coated
	Sleeve	Stainless steel A2, 1.4301 or 1.4404
	Washer	Stainless steel A4
	Hexagon nut	Stainless steel A4; / M6-M20 coated
HSA-F (Carbon steel)	Bolt	Stainless steel A2, 1.4301; Rupture elongation A_5 >8%; Hot-dip galvanized (≥42 µm)
	Sleeve	Stainless steel A2, 1.4301 / Hot-dip galvanized (≥42 µm)
	Washer	Hot-dip galvanized (≥42 µm)
	Hexagon nut	Strength class 8 / Hot-dip galvanized (≥42 µm)

Material code for identification of different materials

Type	HSA, HSA-F (carbon steel)	HSA-R2 (Stainless steel grade A2)	HSA-R (stainless steel grade A4)
Material code			
	Letter code without mark	Letter code with two marks	Letter code with three marks

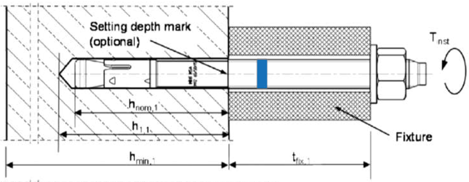
Letter code for anchor length and maximum thickness of the fixture t_{fix} a)

Type	HSA, HSA-BW, HSA-R2, HSA-R, HSA-F					
Size	M6	M8	M10	M12	M16	M20
h_{nom} [mm]	37 / 47 / 67	39 / 49 / 79	50 / 60 / 90	64 / 79 / 114	77 / 92 / 132	90 / 115 / 130
Letter \ t_{fix}	$t_{fix,1}/t_{fix,2}/t_{fix,3}$	$t_{fix,1}/t_{fix,2}/t_{fix,3}$	$t_{fix,1}/t_{fix,2}/t_{fix,3}$	$t_{fix,1}/t_{fix,2}/t_{fix,3}$	$t_{fix,1}/t_{fix,2}/t_{fix,3}$	$t_{fix,1}/t_{fix,2}/t_{fix,3}$
z	**5/-/-**	**5/-/-**	**5/-/-**	**5/ -/-**	**5/-/-**	5/-/-
y	10/-/-	10/-/-	10/-/-	10/-/-	10/-/-	**10/-/-**
x	15/5/-	15/5/-	15/5/-	15/-/-	15/-/-	15/-/-
w	**20/10/-**	**20/10/-**	**20/10/-**	**20/5/-**	**20/5/-**	20/-/-
v	25/15/-	25/15/-	25/15	25/10/-	25/10/-	25/-/-
U	30/20/-	30/20/-	30/20/-	30/15/-	30/15/-	30/5/-
T	35/25/5	**35/25/-**	**35/25/-**	**35/20/-**	35/20/-	35/10/-
s	**40/30/10**	40/30/-	40/30/-	40/25/-	**40/25/-**	40/15/-
r	45/35/15	45/35/5	45/35/5	45/30/-	45/30/-	45/20/5
q	50/40/20	50/40/10	**50/40/10**	50/35/-	50/35/-	50/25/10
p	**55/45/25**	**55/45/15**	55/45/15	55/40/5	55/40/-	**55/30/15**
o	60/50/30	60/50/20	60/50/20	60/45/10	60/45/5	60/35/20
n	65/55/35	65/55/25	65/55/25	**65/50/15**	65/50/10	65/40/25
m	70/60/40	70/60/30	**70/60/30**	70/55/20	70/55/15	70/45/30
l	75/65/45	75/65/35	75/65/35	75/60/25	75/60/20	75/50/35
k	80/70/50	**80/70/40**	80/70/40	80/65/30	80/65/25	80/55/40
j	85/75/55	85/75/45	85/75/45	85/70/35	**85/70/30**	85/60/45
i	90/80/60	90/80/50	**90/80/50**	90/75/40	90/75/35	90/65/50
h	95/85/65	95/85/55	95/85/55	**95/80/45**	95/80/40	95/70/55
g	100/90/70	100/90/60	100/90/60	100/85/50	100/85/45	100/75/60
f	105/95/75	105/95/65	**105/95/65**	105/90/55	105/90/50	105/80/65
e	110/100/80	110/100/70	110/100/70	110/95/60	110/95/55	110/85/70
d	115/105/85	115/105/75	115/105/75	115/100/65	115/100/60	115/90/75
c	120/110/90	120/110/80	120/110/80	**125/110/75**	120/105/65	120/95/80
b	125/115/95	125/115/85	125/115/85	135/120/85	125/110/70	125/100/85
a	130/120/100	130/120/90	130/120/90	**145/130/95**	**135/120/80**	130/105/90

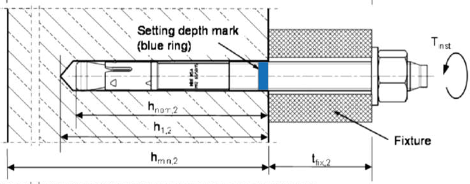
a) Please refer to the product catalogue on the Hilti website for standard portfolio. Anchor length in bold type are standard items, for selection of other anchor length, check availability of the items

Setting information

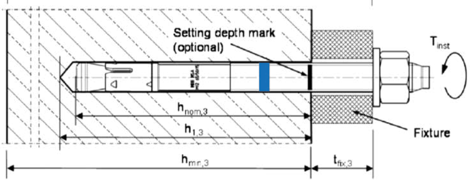
Setting position ①



Setting position ②



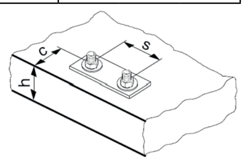
Setting position ③



Setting details

Anchor size			M6			M8			M10		
Nominal anchorage depth	h_{nom}	[mm]	37	47	67	39	49	79	50	60	90
Minimum base material thickness	h_{min}	[mm]	100	100	120	100	100	120	100	120	160
Minimun spacing	s_{min}	[mm]	35	35	35	35	35	35	50	50	50
Minimum edge distance	c_{min}	[mm]	35	35	35	40	35	35	50	40	40
Nominal diameter of drill bit	d_0	[mm]	6			8			10		
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	6,4			8,45			10,45		
Depth of drill hole	$h_1 \geq$	[mm]	42	52	72	44	54	84	55	65	95
Diameter of clearance hole in the fixture	$d_f \leq$	[mm]	7			9			12		
Torque moment	T_{inst}	[Nm]	5			15			25		
Width across	SW	[mm]	10			13			17		
Anchor size			**M12**			**M16**			**M20**		
Nominal anchorage depth	h_{nom}	[mm]	64	79	114	77	92	132	90	115	130
Minimum base material thickness	h_{min}	[mm]	100	140	180	140	160	180	160	220	220
Minimun spacing	s_{min}	[mm]	70	70	70	90	90	90	195	175	175
Minimum edge distance	c_{min}	[mm]	70	65	55	80	75	70	130	120	120
Nominal diameter of drill bit	d_0	[mm]	12			16			20		
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	12,5			16,5			20,55		
Depth of drill hole	$h_1 \geq$	[mm]	72	87	122	85	100	140	98	123	138
Diameter of clearance hole in the fixture	$d_f \leq$	[mm]	14			18			22		
Torque moment	T_{inst}	[Nm]	50			80			200		
Width across	SW	[mm]	19			24			30		

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



Installation equipment

Anchor size		M6	M8	M10	M12	M16	M20
Rotary hammer		TE2 – TE16					TE40 – TE80
Other tools		hammer, torque wrench, blow out pump					
Machine tightening							
Setting tool		-	S-TB HSA				-
Impact screw driver		-	Hilti S/W 14-A Hilti S/W 22-A			Hilti S/W 22T-A	-
Speed	HAS, HAS-BW, HAS-F	-	1		3	- [a]	-
	HAS-R2, HAS-R	-	3				-
Setting time t_{set} [sec]		-	4				-

a) The impact screw driver operates with a fixed speed

Setting parameters

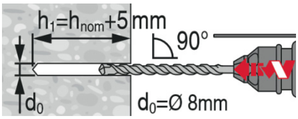
Anchor size			M6			M8			M10		
Nominal anchorage depth	h_{nom}	[mm]	37	47	67	39	49	79	50	60	90
Effective anchorage depth	h_{ef}	[mm]	30	40	60	30	40	70	40	50	80
Critical spacing for splitting failure	$s_{cr,sp}$	[mm]	100	120	130	130	180	200	190	210	290
Critical edge distance for splitting failure	$c_{cr,sp}$	[mm]	50	60	65	65	90	100	95	105	145
Critical spacing for concrete cone failure	$s_{cr,N}$	[mm]	90	120	180	90	120	210	120	150	240
Critical edge distance for concrete cone failure	$c_{cr,N}$	[mm]	45	60	90	45	60	105	60	75	120
Anchor size			**M12**			**M16**			**M20**		
Nominal anchorage depth	h_{nom}	[mm]	64	79	114	77	92	132	90	115	130
Effective anchorage depth	h_{ef}	[mm]	50	65	100	65	80	120	75	100	115
Critical spacing for splitting failure	$s_{cr,sp}$	[mm]	200	250	310	230	280	380	260	370	400
Critical edge distance for splitting failure	$c_{cr,sp}$	[mm]	100	125	155	115	140	190	130	185	200
Critical spacing for concrete cone failure	$s_{cr,N}$	[mm]	150	195	300	195	240	360	225	300	345
Critical edge distance for concrete cone failure	$c_{cr,N}$	[mm]	75	97,5	150	97,5	120	180	112,5	150	172,5

Setting instructions

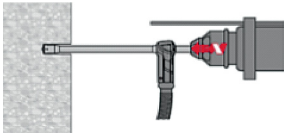
*** For detailed information on installation see instruction for use given with the package of the product**

1. Hole drilling

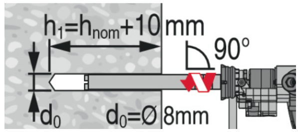
Hammer drilling (HD): M6-M20



Hammer drilling with Hilti hollow drill bit (HDB): M12-M20

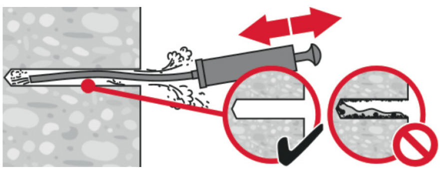


Diamond drilling (DD): M10-M20

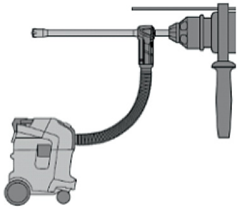


2. Cleaning

Manual cleaning (MC): M6-M20

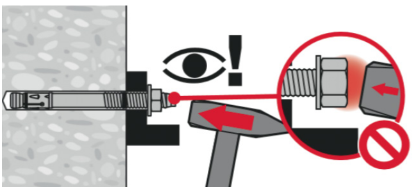


Automatic cleaning (AC): M12-M20

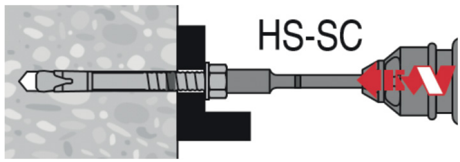


3. Anchor setting

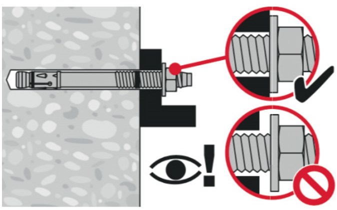
Manual cleaning (MC): M6-M20



Machine setting (impact screw driver with setting tool): M8-M16

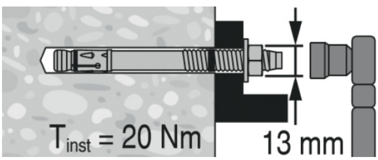


4. Check setting

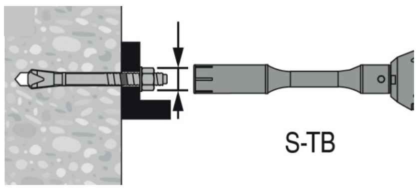


5. Anchor torqueing

Manual cleaning (MC): M6-M20



Impact screw driver with setting tool: M8-M16



HUS3 Screw anchor

Ultimate performance screw anchor

Anchor version

HUS3-H
(M6, M8, M10, M14)

HUS3-C
(M6, M8, M10, M14)

HUS3-A
(M6)

HUS3-P
(M6)

HUS3-I
(M6)

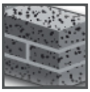
Benefits

- High productivity - less drilling and fewer operations compared to conventional anchors
- ETA approval for cracked and non-cracked concrete
- ETA approval for Seismic C1 and C2 [a)]
- ETA approval for adjustability (unscrew-rescrew)
- High loads
- Small edge and spacing distance
- abZ (DIBt) approval for reusability in fresh concrete ($f_{ck, cube}$ = 10/15/20 Nmm2) for temporary applications
- Three embedment depths for maximum design flexibility
- Forged-on washer and hexagon head with no protruding thread
- Through fastening

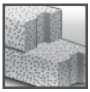
Base material

Non-cracked concrete

Cracked concrete (Tension zone)

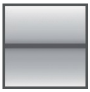


Solid brick



Autoclaved aerated concrete

Load conditions

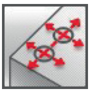


Static/ quasi-static

Seismic ETA-C1,C2

Fire resistance

Installation conditions



Small edge distance and spacing

Other information

European Technical Assessment

CE conformity

PROFIS Engineering Suite

DIBt Approval Reusability

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European Technical Assessment [b)]	DIBt, Berlin	ETA-13/1038 / 2016-12-08
Fire test report	DIBt, Berlin	ETA-13/1038 / 2016-12-08

a) Please contact your Hilti representative for seismic resistance data

b) All data given in this section according ETA-13/1038 issue 2016-12-08

Recommended general notes

* The below clauses based on Hilti product qualifications are for references only. Selection of clauses by the engineer shall be based on the specific application needs. Please contact Hilti's technical team for further details.

- Anchor shall be made of galvanised steel of sizes 6/8/10/14, which when screwed into a predrilled cylindrical drill hole cuts an internal thread into the member while setting, creating a mechanical interlock with the base material and the thread.
- The anchor must have European Technical Assessment (ETA); evaluating performance in cracked and un-cracked concrete and seismic conditions
- Anchor shall be installed as per the manufacturer's approved procedure and equipment
- Anchor shall have identification marks on the bolt head that can be used to verify the anchor type and length during inspection
- The recommended tension load of the anchor should not be not less than __kN in cracked concrete with concrete strength at 25N/mm2 (including overall global safety factor=3)
- Effective anchorage depth of the anchor should not exceed __mm

For HUS3-H/-C* and 10
- Anchor must be approved ofr adjustability as per the manufacturer's approved procedure and equipment

Basic loading data (for a single anchor)

All data in this section applies to:
- Static and quasi-static loading
- Correct setting (See setting instruction)
- No edge distance and spacing influence
- *Steel* failure
- Minimum base material thickness
- Concrete C 20/25, fck,cube=25 N/mm². Concrete strength influence factor can be applied when concrete grade > C20/25, when steel failure does not govern.

Anchorage depth

Anchor size		M6		M8			M10			M14		
Type	HUS3-	H,C, A,I	P	H,C			H,C			H		
Nominal embedment depth	h_{nom} [mm]	h_{nom1}		h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
		55		50	60	70	55	75	85	65	85	115

Characteristic resistance

Anchor size		M6		M8			M10			M14		
Type	HUS3-	H,C, A,I	P	H,C			H,C			H		
Non-cracked concrete												
Tension N_{Rk}	[kN]	9,0	7,5	9,0	12,0	16,0	12,0	20,0	27,8	17,5	27,3	44,4
Shear V_{Rk}	[kN]	*12,5*	*12,5*	12,8	19,0	22,0	13,5	30,0	34,0	35,0	54,5	62,0
Cracked concrete												
Tension N_{Rk}	[kN]	6,0	6,0	6,0	9,0	12,0	9,7	16,2	19,8	12,5	19,4	31,7
Shear V_{Rk}	[kN]	*12,5*	*12,5*	9,1	19,0	22,0	9,7	30,0	34,0	24,9	38,9	62,0

HILTI

Anchorage depth

Anchor size		M6		M8			M10			M14		
Type	HUS3-	H,C,A,I	P	H,C			H,C			H		
Nominal embedment depth	h_{nom} [mm]	h_{nom1}		h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
		55		50	60	70	55	75	85	65	85	115

Design resistance a)

Anchor size		M6		M8			M10			M14		
Type	HUS3-	H,C,A,I	P	H,C			H,C			H		
Non-cracked concrete												
Tension N_{Rd}	[kN]	5,0	4,2	6,0	8,0	10,7	8,0	13,3	18,5	11,7	18,2	29,6
Shear V_{Rd}	[kN]	*8,3*	*8,3*	8,5	12,7	14,7	9,0	20,0	22,7	23,3	36,3	41,3
Cracked concrete												
Tension N_{Rd}	[kN]	3,3	3,3	4,0	6,0	8,0	6,4	10,8	13,2	8,3	13,0	21,1
Shear V_{Rd}	[kN]	*8,3*	*8,3*	6,1	12,7	14,7	6,4	20,0	22,7	16,6	25,9	41,3

a) Includes material partial factor according to ETA-13/1038 issue 2016-12-08

Recommended loads a)

Anchor size		M6		M8			M10			M14		
Type	HUS3-	H,C,A,I	P	H,C			H,C			H		
Non-cracked concrete												
Tension N_{Rec}	[kN]	3,0	2,5	3,0	4,0	5,3	4,0	6,7	9,3	5,8	9,1	14,8
Shear V_{Rec}	[kN]	*4,2*	*4,2*	4,3	6,3	7,3	4,5	10,0	11,3	11,7	18,2	20,7
Cracked concrete												
Tension N_{Rec}	[kN]	2,0	2,0	2,0	3,0	4,0	3,2	5,4	6,6	4,2	6,5	10,6
Shear V_{Rec}	[kN]	*4,2*	*4,2*	3,0	6,3	7,3	3,2	10,0	11,3	8,3	13,0	20,7

a) Includes global safety factor of 3.0

Materials

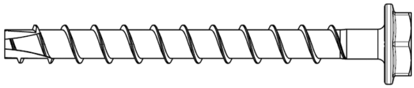
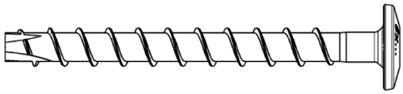
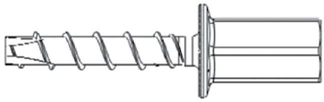
Mechanical properties

Anchor size		M6	M8	M10	M14
Type	HUS3-	H,C,A,I,P	H,C	H,C	H
Nominal tensile strength f_{uk}	[N/mm²]	930	810	805	730
Yield strength f_{yk}	[N/mm²]	745	695	690	630
Stressed cross-section A_s	[mm²]	26,9	48,4	77,0	131,7
Moment of resistance W	[mm³]	19,6	47	95	213
Design bending resistance $M^0_{Rd,s}$	[Nm]	21	46	92	187

Material quality

Type	Material
HUS3 - H,A,C,P,I	Carbon steel, galvanized

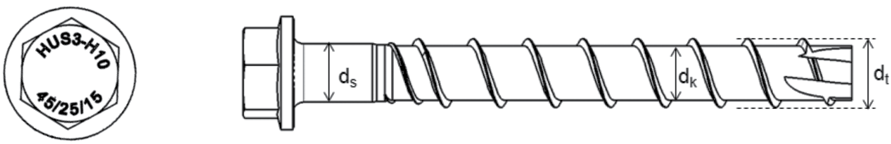
Material quality

Type	Part		
HUS3-H	Hexagonal head		
HUS3-C	Countersunk head		
HUS3-A	External thread		
HUS3-P	Pan head		
HUS3-I	Internal thread		

Anchor dimensions a)

Anchor size			M6	M8	M10	M14
Type		**HUS3-**	**H,C,A,I,P**	**H,C**	**H,C**	**H**
Threaded outer diameter	d_t	[mm]	7,85	10,30	12,40	16,85
Core diameter	d_k	[mm]	5,85	7,85	9,90	12,95
Shaft diameter	d_s	[mm]	6,15	8,45	10,55	13,80
Stressed section	A_s	[mm^2]	26,9	48,4	77,0	131,7

a) Please refer to the product catalogue on the Hilti website for standard portfolio



HUS3: Hilti Universal Screw 3rd generation
H: Hexagonal head
10: Screw diameter
45/25/15: Maximum thickness fixture t_{fix1}/ t_{fix2}/ t_{fix3} related to the embedment depth h_{nom1}/h_{nom2}/h_{nom3} (see Annex B3).

Screw length and thickness of fixture for HUS3-H/-C/-A/-I/-P a)

Anchor size		M6					
Nominal embedmenth depth [mm]		h_{nom1}					
		55					
Thickness of fixture		t_{fix1}	t_{fix2}	t_{fix1}	t_{fix2}	t_{fix1}	t_{fix2}
Length of screw [mm]	55	-	-	0	0	-	-
	60	5	5	-	-	5	5
	70	-	15	-	-	-	-
	80	25	-	-	-	25	-
	100	45	-	-	-	-	-
	120	65	-	-	-	-	-
	135	-	-	80	-	-	-
	155	-	-	100	-	-	-
	175	-	-	120	-	-	-
	195	-	-	140	-	-	-

a) Please refer to the production catalogue on the Hilti website for standard portfolio

Screw length and thickness of fixture for HUS3-C

Anchor size		M8			M10		
Nominal embedmenth depth [mm]		h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
		50	60	70	55	75	85
Thickness of fixture		t_{fix1}	t_{fix2}	t_{fix3}	t_{fix2}	t_{fix1}	t_{fix3}
Length of screw [mm]	65	15	5	-	-	-	-
	70	-	-	-	15	-	-
	75	25	15	-	-	-	-
	85	35	25	15	-	-	-
	90	-	-	-	35	15	-
	100	-	-	-	45	25	15

a) Please refer to the production catalogue on the Hilti website for standard portfolio

Screw length and thickness of fixture for HUS3-H

Anchor size		M8			M10			M14		
Nominal embedmenth depth [mm]		h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
		50	60	70	55	75	85	65	85	115
Thickness of fixture		t_{fix1}	t_{fix2}	t_{fix3}	t_{fix1}	t_{fix2}	t_{fix3}	t_{fix1}	t_{fix2}	t_{fix3}
Length of screw [mm]	55	5	-	-	-	-	-	-	-	-
	60	-	-	-	5	-	-	-	-	-
	65	15	5	-	-	-	-	-	-	-
	70	-	-	-	15	-	-	-	-	-
	75	25	15	5	-	-	-	10	-	-
	80	-	-	-	25	5	-	-	-	-
	85	35	25	15	-	-	-	-	-	-
	90	-	-	-	35	15	5	-	-	-
	100	50	40	30	45	25	15	35	15	
	110	-	-	-	55	35	25	-	-	-
	120	70	60	50	-	-	-	-	-	-
	130	-	-	-	75	55	45	65	45	15
	150	100	90	80	95	75	65	85	65	35

a) Please refer to the production catalogue on the Hilti website for standard portfolio

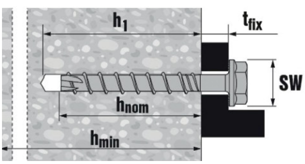
Setting information

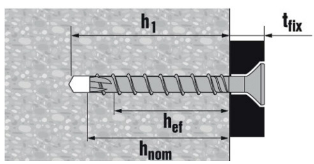
Setting details

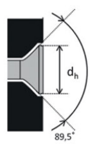
Anchor size			M6				
Type		HUS3-	H	C	A	P	I
Nominal embedmenth depth		[mm]	h_{nom1}				
			55				
Nominal diameter of drill bit	d_0	[mm]	6				
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	6,4				
Clearance hole diameter	$d_f \leq$	[mm]	9				
Wrench size	SW	[mm]	13	-	13	-	13
Countersunk head diameter	d_h	[mm]	-	11,5	-		
Torx size	TX	[mm]	-	30	-	30	-
Depth of drill hole in floor/wall position	$h_1 \geq$	[mm]	65				
Depth of drill hole in ceiling position	$h_1 \geq$	[mm]	58				
Installation Torque	T_{inst}	[mm]	25				

Setting details

Anchor size			M8			M10			M14		
Type		HUS3-	H , C			H, C			H		
Nominal embedmenth depth		[mm]	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
			50	60	70	55	75	85	65	85	115
Nominal diameter of drill bit	d_0	[mm]	8			10			14		
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	8,45			10,45			14,50		
Clearance hole diameter	$d_f \leq$	[mm]	12			14			18		
Wrench size	SW	[mm]	13			15			21		
Countersunk head diameter	d_h	[mm]	18			21			-		
Torx size	TX	[mm]	45			50			-		
Depth of drill hole in floor/wall position	$h_1 \geq$	[mm]	60	70	80	65	85	95	75	95	125
Depth of drill hole in ceiling position	$h_1 \geq$	[mm]	-	80	90	-	95	105	-		







Installation equipment

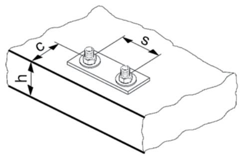
Anchor size		M6	M8	M10	M14
Type	**HUS3-**	**H,C,A,I,P**	**H,C**	**H,C**	**H**
Rotary hammer		TE 2 -TE 7	TE 2 – TE 30		
Drill bit for concrete, solid clay brick and solid sand-lime brick		CX 6	CX 8	CX 10	CX 14
Drill bit for aerated concrete		CX 5	CX 6	CX 8	-
Socket wrench insert		S-NSD 13 ½”	SI-S ½” 13S	SI-S ½” 15S	SI-S ½” 21S
Torx		TX30	S-SY TX45	S-SY TX50	-
Tube for temporary application [a)]		-	HRG 8	HRG 10	HRG 14
Setting tool for solid brick and aerated concrete		-	SFH 22 A		
Setting tool for hollow core slab		SIW 14 A SIW 22 A	SIW 22 A		

a) Only for HUS3-H

Setting details

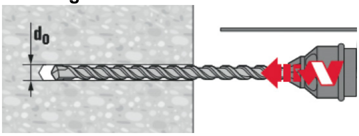
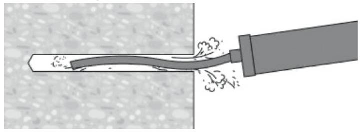
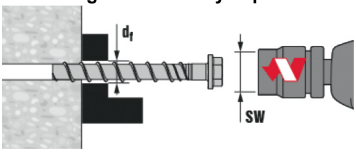
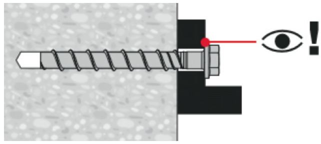
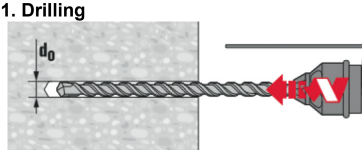
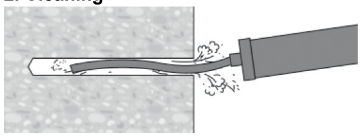
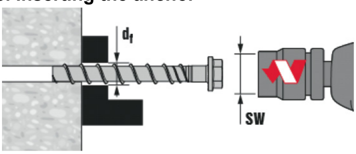
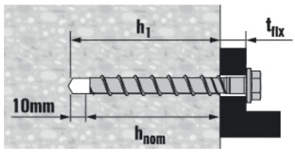
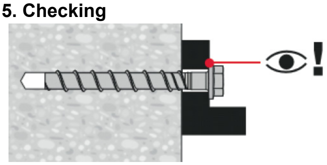
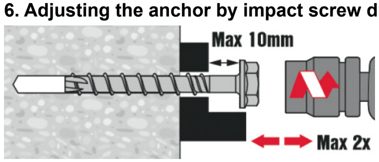
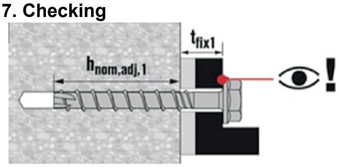
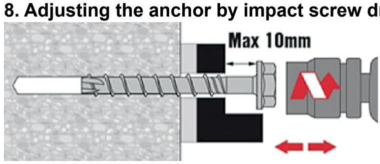
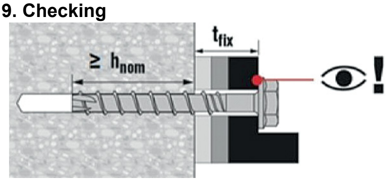
Anchor size			M6	M8			M10			M14		
Type		**HUS3-**										
Nominal embedment depth	d_0	[mm]	55	50	60	70	55	75	85	65	85	115
Minimum base material thickness	d_{cut} ≤	[mm]	100	100	100	120	100	130	140	120	160	200
Minimum spacing	d_f ≤	[mm]	35	40	50	50	50	50	60	60	75	75
Minimum edge distance	SW	[mm]	35	50	50	50	50	50	60	60	75	75
Critical spacing for splitting failure	d_h	[mm]	126	120	140	170	130	180	220	170	200	280
Critical edge distance for splitting failure	TX	[mm]	63	60	70	85	65	90	110	85	100	140
Critical spacing for concrete cone failure	h_1≥	[mm]	$3\ h_{ef}$									
Critical edge distance for concrete cone failure	h_1≥	[mm]	$1{,}5\ h_{ef}$									

For spacing (edge distance) smaller than critical spacing (critical edge distance) the design loads have to be reduced (see system design resistance).
Critical spacing and critical edge distance for splitting failure apply only for non-cracked concrete. For cracked concrete only the critical spacing and critical edge distance for concrete cone failure are decidive.



Setting instructions

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

Setting instruction without adjustment	
1. Drilling  	**2. Cleaning** 
3. Installing the anchor by impact screw driver  	**4. Checking** 
Setting instruction with adjustment	
1. Drilling  	**2. Cleaning** 
3. Inserting the anchor  	**4. Anchor installed** 
5. Checking 	**6. Adjusting the anchor by impact screw driver** 
7. Checking  	**8. Adjusting the anchor by impact screw driver** 
9. Checking  	

The anchor can be adjusted max. two times.
The total allowed thickness of shims added during the adjustment process is 10 mm.
The final embedment depth after adjustment process must be larger or equal than h_{nom2} or h_{nom3}.

Basic loading data (for a single anchor) in solid masonry units

All data in this section applies to:
- Load values valid for holes drilled with TE rotary hammers in hammering mode
- Correct anchor setting (see instruction for use, setting details)
- The core/material ratio may not exceed 15 % of a bed joint area
- The brim area around holes must be at least 70mm
- Edge distances, spacing and other influences, see below
- All data given in this section according to Hilti Technical Data

Nominal embedmenth depth

Anchor size			M6	M8	M10
Nominal embedment depth	h_{nom}	[mm]	55	60	75

Recommended loads for HUS3

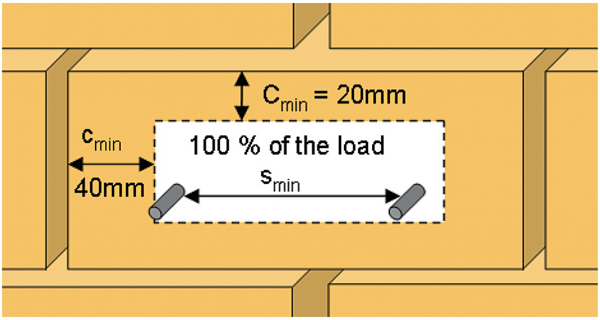
Anchor size			M6	M8	M10
			A, H, I, C, P	H, C	H, C
		Compressive strength class [N/mm²]	F_{rec} Tensile and shear loads		
	Solid clay brick Mz 12/2,0 DIN 105 / EN 771-1	≥ 8	0,6	-	-
		≥ 10	0,7	-	-
		≥ 12	0,8	1,1	1,4
		≥ 16	0,9	-	-
		≥ 20	0,9	1,6	2,0
	Solid clay brick Mz 12/2,0 DIN 105 / EN 771-1	≥ 8	0,8	-	-
		≥ 10	0,9	-	-
		≥ 12	1,0	1,3	1,4
		≥ 16	1,1	-	-
		≥ 20	1,2	1,7	2,1
	Aerated concrete PPW 6-0,4 DIN 4165/ EN 771-4	≥ 6	0,4	0,7	0,9

Permissible anchor location in brick and block walls

Edge distance and spacing influence
- The technical data for HUS3 anchors are reference loads for MZ 12, KS 12 and PPW 6. Due to the large variation of natural stone slid bricks, on site anchor testing is recommended to validate technical data
- The HUS3 anchor was installed and tested in center of solid bricks as shown. The HUS3 anchor was not tested in the mortar joint between solid bricks or in hollow bricks, however a load reduction is expected
- For brick walls where anchor position in brick can not be determined, 100 % anchor testing is recommended
- Distance to free edge free edge to solid masonry (Mz and KS) units ≥ 200mm
- Distance to free edge free edge to solid masonry (autoclaved aerated gas concrete) units ≥ 170mm
- The minimum distance to horizontal and vertical mortar joint (c_{min}) is started in drawing below
- Minimum anchor spacing (s_{min}) in one brick/block is ≥ 80 mm

Limits

- All data is for multiple use for non-structural applications
- Plaster, graveling, lining or levelling courses are regarded as non-bearing and may not be taken into account for the calculation of embedment depth
- The decisive resistance to tension loads is the lower value of N_{rec} (brick breakout, pull out) and N_{max},pb (pull out of one brick)



Basic loading data for single anchor in hollow core slab

Basic loading data

All data in this section applies to

- Correct setting (See setting instruction)
- No edge distance and spacing influence
- Ratio core width / web thickness w/e ≤ 4,2
- Concrete C 30/37 to C 50/60

Characteristic resistance

Anchor size			M8	M10
Type		HUS3	C, H	C, H
Bottom flange thickness	d_b ≥	[mm]	30	30
All load directions	F_{Rk}	[kN]	2,0	2,0

Design resistance

Anchor size			M8	M10
Type		HUS3	C, H	C, H
Bottom flange thickness	d_b ≥	[mm]	30	30
All load directions	F_{Rk}	[kN]	1,3	1,3

Recommended loads

Anchor size			M8	M10
Type		HUS3	C, H	C, H
Bottom flange thickness	d_b ≥	[mm]	30	30
All load directions [a]	F_{Rk}	[kN]	0,95	0,95

a) With overall partial safety factor for action γ = 1,4. The partial safety factors for action depend on the type of loading and shall be taken from national regulations.

Requirements for redundant fastening

The definition of redundant fastening according to Member States is given in the ETAG 001 Part six, Annex 1, In Absence of a definition by a Member State the following default values may be taken		
Minimum number of fixing points	**Minimum number of anchors per fixing point**	**Maximum design load of action NSd per fixing point** [a)]
3	1	2 kN
4	1	3 kN

a) The value for maximum design load of actions per fastening point NSd is valid in general that means all fastening points are considered in the design of the redundant structural system. The value N_{Sd} may be increased if the failure of one (= most unfavourable) fixing point is taken into account in the design (serviceability and ultimate limit state) of the structural system e.g. suspended ceiling.

Setting

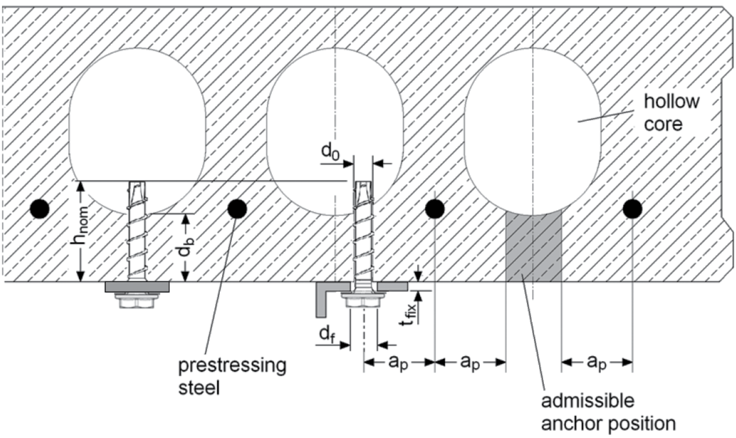
Anchor size	**8**	**10**
Type **HUS3**	**C, H**	**C, H**
Rotary hammer	Hilti TE 6 / TE 7	
drill bit	TE-CX 4	
Impact screw driver	SIW 22 A, 1^{st} or 2^{nd} gear	

Setting details

Anchor size			**8**	**10**
Type		**HUS3**	**C, H**	**C, H**
Nominal embedment depth	$h_{nom} \geq$	[mm]	40	45
Bottom flange thickness	$d_b \geq$	[mm]	30	30
Nominal diameter of drill bit	d_o	[mm]	8	10
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	8,45	10,45
Nominal depth of drill hole a)	$h_1 \geq$	[mm]	40	40
Diameter of clearance hole in the fixture	$d_f \leq$	[mm]	12	14
Nominal effective anchorage depth	h_{ef}	[mm]	30	30
Distance between anchor position and prestressing steel	$a_p \geq$	[mm]	50	50

a) Nominal depth of drill hole may be deeper than bottom flange thickness

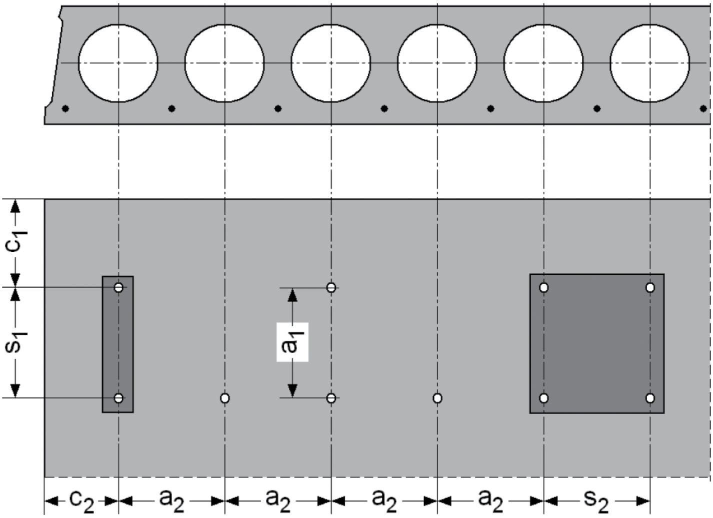
Anchor Type	Size	Length	d_b=30 [mm]		d_b=35 [mm]		d_b=40 [mm]		d_b=50 [mm]	
	[mm]	[mm]	$t_{fix,min}$ [mm]	$t_{fix,max}$ [mm]	$t_{fix,min}$ [mm]	$t_{fix,max}$ [mm]	$t_{fix,min}$ [mm]	$t_{fix,max}$ [mm]	$t_{fix,min}$ [mm]	$t_{fix,max}$ [mm]
HUS3-H	8	55	5	15	5	10	5	5	5	5
		65	5	25	5	20	5	15	5	5
		75	5	35	5	30	5	25	5	15
		85	15	45	15	40	15	35	15	25
		100	30	60	30	55	30	50	30	40
		120	50	80	50	75	50	70	50	60
		150	80	110	80	105	80	100	80	90
HUS3-C	8	65	15	25	15	20	15	15	15	5
		75	15	35	15	30	15	25	15	15
		85	15	45	15	40	15	35	15	25
HUS3-H	10	60	5	15	5	10	5	5	5	5
		70	15	25	15	20	15	15	15	5
		80	5	35	5	30	5	25	5	15
		90	5	45	5	40	5	35	5	25
		100	15	55	15	50	15	45	15	35
		110	25	65	25	60	25	55	25	45
		130	45	85	45	80	45	75	45	65
		150	65	105	65	100	65	95	65	85
HUS3-C	10	70	15	25	15	20	15	15	15	10
		90	15	45	15	40	15	35	15	25
		100	15	55	15	50	15	45	15	35



Anchor technology & design
Heavy / medium duty metal anchors
Plastic / light duty / other metal anchors
Chemical anchors

Anchor spacing and edge distance

Anchor size				8	10
Type			**HUS3**	**C, H**	**C, H**
Minimum edge distance	$c_{min} \geq$		[mm]	100	
Minimum anchor spacing	$s_{min} \geq$		[mm]	100	
Minimum distance between anchor groups	$a_{min} \geq$		[mm]	100	

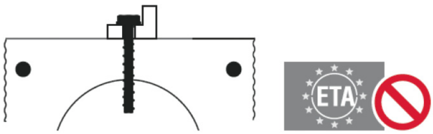


Setting instructions

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

Installation in hollow core slabs

1. Checking the anchor with tube Hilti HSB

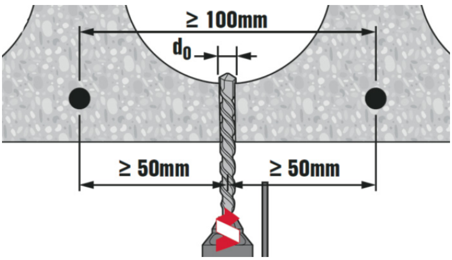


2. Positioning pre-stressed steel

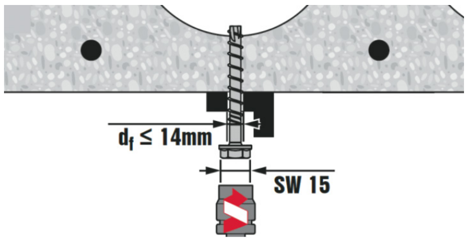
3. Marking pre-stressed steel position

4. Marking pre-stressed steel position

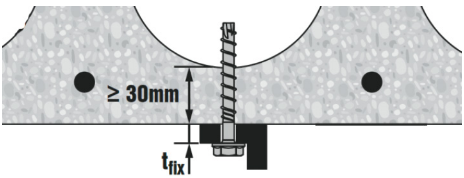
5. Drilling



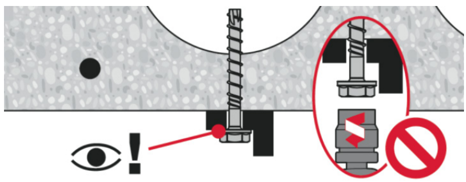
6. Setting the anchor



7. Setting the anchor



8. Checking



HUS-HR / HUS-CR Screw anchor

Ultimate performance screw anchor

Anchor version

HUS-HR
(M6, M8, M10, M14)

HUS-CR
(M8, M10, M14)

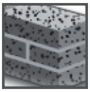
Benefits

- High productivity- less drilling and fewer operations than with conventional anchors
- ETA approval for cracked and non-cracked concrete
- ETA approval for Seismic C1 [a)]
- Technical data for reusability in fresh concrete ($f_{ck,cube}$ = 10/15/20 Nmm²) for temporary applicationS

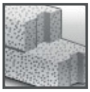
Base material

Non-cracked concrete

Cracked concrete (Tension zone)

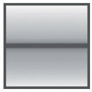


Solid brick



Autoclaved aerated concrete

Load conditions

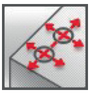


Static/ quasi-static

Seismic ETA-C1

Fire resistance

Installation conditions



Small edge distance and spacing

Other information

European Technical Assessment

CE conformity

Corrosion resistance

PROFIS Engineering Suite

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European Technical Assessment [b)]	DIBt, Berlin	ETA-08/0307 / 2015-08-27
Fire test report	DIBt, Berlin	ETA-08/0307 / 2015-08-27
Fire test report ZTV – Tunel (EBA)	MFPA, Leipzig	PB III / 08-354 / 2008-11-27

a) Please contact your Hilti representative for seismic resistance data
b) All data given in this section according ETA-08/0307 issue 2015-08-27

Recommended general notes

* The below clauses based on Hilti product qualifications are for references only. Selection of clauses by the engineer shall be based on the specific application needs. Please contact Hilti's technical team for further details.

- Anchor shall be made of stainless steel of sizes 6/8/10/14, which when screwed into a predrilled cylindrical drill hole cuts an internal thread into the member while setting, creating a mechanical interlock with the base material and the thread.
- The anchor must have European Technical Assessment (ETA); evaluating performance in cracked and un-cracked concrete and seismic conditions
- Anchor shall be installed as per the manufacturer's approved procedure and equipment
- Anchor shall have identification marks on the bolt head that can be used to verify the anchor type and length during inspection
- Anchor must have corrosion resistance of A4 stainless steel
- The recommended tension load of the anchor should not be not less than __kN in cracked concrete with concrete strength at 25N/mm^2 (including overall global safety factor=3)
- Effective anchorage depth of the anchor should not exceed __mm

Basic loading data (for a single anchor)

All data in this section applies to:

- Static and quasi-static loading
- Correct setting (See setting instruction)
- No edge distance and spacing influence
- *Steel* failure
- Minimum base material thickness
- Concrete C 20/25, $f_{ck,cube}$ = 25 N/mm^2. Concrete strength influence factor can be applied if concrete grade > C20/25, when steel failure does not govern.

Effective anchorage depth

Anchor size	M6		M8			M10			M14		
Type HUS-	HR		HR, CR			HR, CR			HR		
Nominal embedment h_{ef} [mm]	30	55	50 a)	60 b)	80 c)	60 a)	70 b)	90 c)	-	70 b)	110 c)

a) Extra reduced embedment (Hilti Technical Data)
b) Reduced embedment depth according to ETA-08/0307 issue 2015-08-27
c) Standard embedment depth according to ETA-08/0307 issue 2015-08-27

Characteristic resistance

Anchor size	M6		M8			M10			M14		
Type HUS-	HR		HR, CR			HR, CR			HR		
Non-cracked concrete											
Tension N_{Rk} [kN]	_ a) b)	9,0	9,0 a)	12,0	16,0	12,0 a)	16,0	25,0	-	18,9	40,2
Shear V_{Rk} [kN]	_ a) b)	17,0	23,6 a)	*26,0*	*26,0*	31,4 a)	*33,0*	*33,0*	-	37,8	*77,0*
Cracked concrete											
Tension N_{Rk} [kN]	_ a) b)	5,0	5,0 a)	6,0	12,0	7,5 a)	9,0	16,0	-	12,0	25,0
Shear V_{Rk} [kN]	_ a) b)	16,3	16,9 a)	23,2	*26,0*	22,5 a)	28,6	*33,0*	-	27,0	57,4

a) Hilti Technical Data
b) Please refer to resistance table in all directions for multiple use fastenings for HUS3 6 screw anchor for redundant fastenings

Effective anchorage depth

Anchor size	M6		M8			M10			M14		
Type HUS-	HR		HR, CR			HR, CR			HR		
Nominal embedment h_{ef} [mm]	30	55	50 a)	60 b)	80 c)	60 a)	70 b)	90 c)	-	70 b)	110 c)

a) Extra reduced embedment (Hilti Technical Data)
b) Reduced embedment depth according to ETA-08/0307.
c) Standard embedment depth according to ETA-08/0307.

Design resistance a)

Anchor size	M6		M8			M10			M14		
Type HUS-	HR		HR, CR			HR, CR			HR		
Non-cracked concrete											
Tension N_{Rd} [kN]	_ b) c)	4,3	5,0 b)	6,7	8,9	6,7 b)	8,9	13,9	-	10,5	22,3
Shear V_{Rd} [kN]	_ b) c)	11,3	15,7 b)	*17,3*	*17,3*	21,0 b)	*22,0*	*22,0*	-	25,2	*51,3*
Cracked concrete											
Tension N_{Rd} [kN]	_ b) c)	2,4	2,8 b)	3,3	6,7	4,2 b)	5,0	8,9	-	6,7	13,9
Shear V_{Rd} [kN]	_ b) c)	10,9	11,2 b)	15,5	*17,3*	15,0 b)	19,0	*22,0*	-	18,0	38,3

a) Includes material partial factor according to ETA-08/0307 issue 2015-08-27
b) Hilti Technical Data
c) Please refer to resistance table in all directions for multiple use fastenings for HUS3 6 screw anchor for redundant fastenings

Recommended loads a)

Anchor size	M6		M8			M10			M14		
Type HUS-	HR		HR, CR			HR, CR			HR		
Non-cracked concrete											
Tension N_{Rec} [kN]	_ b) c)	3,0	3,0 b)	4,0	5,3	4,0 b)	5,3	8,3	-	6,3	13,4
Shear V_{Rec} [kN]	_ b) c)	5,7	7,9 b)	*8,7*	*8,7*	10,5 b)	11,0	*11,0*	-	12,6	*25,7*
Cracked concrete											
Tension N_{Rec} [kN]	_ b) c)	1,7	1,7 b)	2,0	4,0	2,5 b)	3,0	5,3	-	4,0	8,3
Shear V_{Rec} [kN]	_ b) c)	5,4	5,6 b)	7,7	8,7	7,5 b)	9,5	*11,0*	-	9,0	19,1

a) Includes global safety factor of 3.0
b) Hilti Technical Data
c) Please refer to resistance table in all directions for multiple use fastenings for HUS3 6 screw anchor for redundant fastening

Materials

Mechanical properties

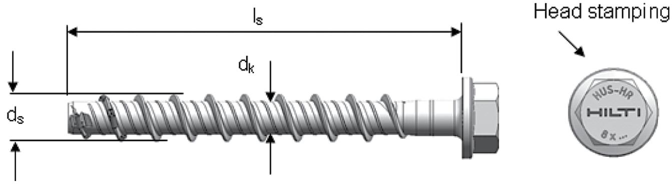
Anchor size		M6	M8	M10	M14
Type	HUS3	HR	HR, CR	HR, CR	HR
Nominal tensile strength f_{uk}	[N/mm²]	1050	870	950	690
Yield strength f_{yk}	[N/mm²]	900	745	815	590
Stressed cross-section A_s	[mm²]	22,9	39	55,4	143,1
Moment of resistance W	[mm³]	15	34	58	255
Design bending resistance $M^0_{Rd,s}$	[Nm]	19	36	66	193

Material quality

Type	Material
Hexagonal head concrete screw	Stainless steel (grade A4)

Anchor dimensions

Anchor size			6	8	10	12
Type		**HUS-**	**HR**	**HR, CR**	**HR, CR**	**HR**
Core diameter	d_k	[N/mm²]	5,4	7,05	8,4	12,6
Shaft diameter	d_s	[mm²]	7,6	10,1	12,3	16,6
Stressed section	A_s	[mm³]	22,9	39,0	55,4	143,1



Screw length and thickness of fixture for HUS-HR [a)]

Anchor size		6		8		10		14	
Embedment depth h_{nom1}, h_{nom2} [mm]		**30**	**55**	**60**	**80**	**70**	**90**	**70**	**110**
Thickness of fixture		t_{fix1}	t_{fix2}	t_{fix1}	t_{fix2}	t_{fix1}	t_{fix2}	t_{fix1}	t_{fix2}
Length of screw [mm]	35	5	-	-	-	-	-	-	-
	45	15	-	-	-	-	-	-	-
	60	30	5	-	-	-	-	-	-
	65	-	-	5	-	-	-	-	-
	75	40	15	15	-	5	5	10	-
	80	-	-	-	-	-	-	-	-
	85	-	-	25	5	15	-	-	-
	90	-	-	-	-	-	-	-	-
	95	-	-	35	15	25	5	-	-
	100	-	-	-	-	-	-	-	-
	105	-	-	45	25	35	15	-	-
	110	-	-	-	-	-	-	-	-
	115	-	-	-	-	45	25	-	-
	120	-	-	-	-	-	-	50	10
	130	-	-	-	-	-	-	-	-
	135	-	-	-	-	-	-	65	25

a) Please refer to the product catalogue on the Hilti website for standard portfolio

Screw length and thickness of fixture for HUS-CR [a)]

Anchor size		8		10	
Embedment depth h_{nom1}, h_{nom2} [mm]		**60**	**80**	**70**	**90**
Thickness of fixture		t_{fix1}	t_{fix2}	t_{fix1}	t_{fix2}
Length of screw [mm]	75	15	-	-	5
	80	-	-	-	-
	85	-	-	15	-
	90	-	-	-	-
	95	35	15	-	-
	100	-	-	-	-
	105	45	25	35	15

a) Please refer to the product catalogue on the Hilti website for standard portfolio

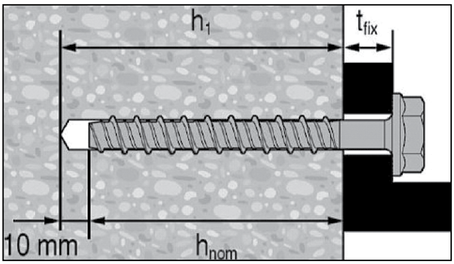
Setting information

Setting details

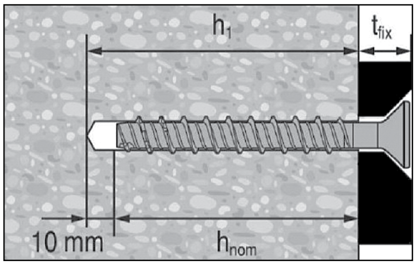
Anchor size			6		8			10			14	
Type		HUS-	HR		HR, CR a)			HR, CR a)			HR	
Non-cracked concrete												
Nominal anchorage depth	h_{nom}	[mm]	30	55	50	60	80	60	70	90	70	110
Efective anchorage depth	h_{ef}	[mm]	23	45	38	47	64	46	54	71	52	86
Nominal diameter of drill bit	d_0	[mm]	6		8			10			14	
Cutting diameter of drill bit	d_{cut}	[mm]	6,4		8,45			10,45			14,5	
Clearance hole diameter	d_f	[mm]	9		12			14			18	
Depth of drill hole	h_1	[mm]	40	65	60	70	90	70	80	100	80	120
Wrench size	SW	[mm]	13		13			15			21	
Diameter of countersunk head(CR)	d_h	[mm]	-		-			21			-	
Installation torque: Concrete	T_{inst}	[Nm]	20	- a)	35	- a)	- a)	45 c)			65	
Installation torque: Solid m, Mz 12	T_{inst}	[Nm]	- b)	10	- b)	16	16	- b)	20	20	- b)	- b)
Installation torque: Solid m, KS 12	T_{inst}	[Nm]	- b)	10	- b)	16	16	- b)	20	20	- b)	- b)
Installation torque: Aerated concrete	T_{inst}	[Nm]	- b)	4	- b)	8	8	- b)	10	10	- b)	- b)

a) Hand setting in concrete base material not allowed (machine setting only)
b) Hilti does not recommend this setting process for this application.
c) Installation torque refer to HUS-HR only

HUS-HR (hexagonal head)
M6, M8, M10 and M14



HUS-CR (countersunk)
M8 and M10



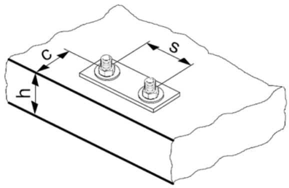
Installation equipment

Anchor size		M6	M8	M10	M14
Type	HUS-	HR	HR, CR	HR, CR	HR
Rotary hammer		TE 2 – TE 30			
Drill bit		TE-C3X 6/17	TE-C3X 8/17	TE-C3X 10/22	TE-C3X 14/22
Socket wrench insert		S-NSD 13 ½ (L)		S-NSD 15 ½ (L)	S-NSD 21 ½ (L)
Torx (CR type only)		-	S-SY TX 45	S-SY TX 50	-
Impact screw driver		Hilti SIW 14-A,22-A	Hilti SIW 22 T-A		

Setting parameters

Anchor size			M6		M8			M10			M14	
Type		**HUS-**	**HR**		**HR, CR**			**HR, CR**			**HR**	
Nominal anchorage depth	h_{nom}	[mm]	30	55	50	60	80	60	70	90	70	110
Minimum base material thickness	h_{min}	[mm]	100	100	100	100	120	120	120	140	140	160
Minimum spacing	s_{min}	[mm]	35	35	45	45	50	50	50	50	50	60
Minimum edge distance	c_{min}	[mm]	35	35	45	45	50	50	50	50	50	60
Critical spacing for splitting failure	$s_{cr,sp}$	[mm]	69	135	114	114	192	166	194	256	187	310
Critical edge distance for splitting failure	$c_{cr,sp}$	[mm]	35	68	57	71	96	83	97	128	94	155
Critical spacing for concrete cone failure	$s_{cr,N}$	[mm]	69	135	114	114	192	166	194	256	187	310
Critical edge distance for concrete cone failure	$c_{cr,N}$	[mm]	35	68	57	71	96	83	97	128	94	155

For spacing (edge distance) smaller than critical spacing (critical edge distance) the design loads have to be reduced (see system design resistance).
Critical spacing and critical edge distance for splitting failure apply only for non-cracked concrete. For cracked concrete only the critical spacing and critical edge distance for concrete cone failure are decidive.

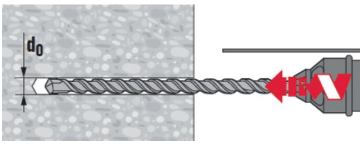


Setting instructions

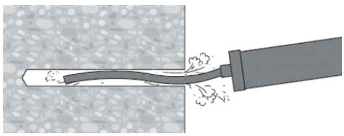
*** For detailed information on installation see instruction for use given with the package of the product.**

Setting instruction

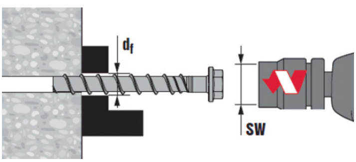
1. Make a cylinder hole



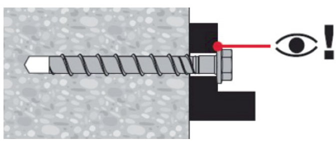
2. Clean the borehole



3. Install the screw anchor by impact screw driver



4. Ensure that the fixture is caught



Basic loading data (for a single anchor) in solid masonry units

All data in this section applies to:
- Load values valid for holes drilled with TE rotary hammers in hammering mod
- Correct anchor setting (see instruction for use, setting details)
- The core/material ratio may not exceed 15 % of a bed joint area
- The brim area around holes must be at least 70mm
- Edge distances, spacing and other influences, see below
- All data given in this section according to Hilti Technical Data

Nominal embedmenth depth

Anchor size			M8	M10
Nominal embedment depth	h_{nom}	[mm]	60	70

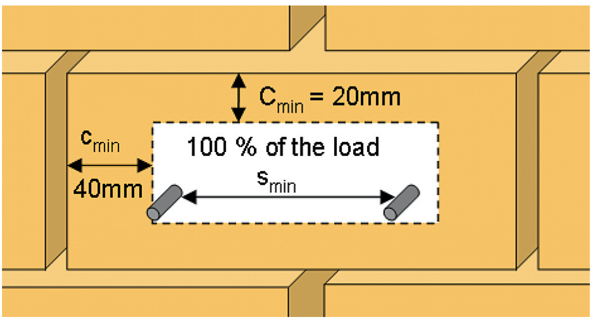
Recommended loads for HUS-HR / HUS-CR

Anchor size				M8	M10
	Solid clay brick Mz 12/2,0 DIN 105 / EN 771-1 f_b a) ≥ 12 N/mm²	Tension N_{Rec}	[kN]	1,0	1,1
		Shear V_{Rec}	[kN]	2,0	2,3
	Solid sand-lime brick Mz 12/2,0 DIN 106/EN 771-2 f_b a) ≥ 12 N/mm²	Tension N_{Rec}	[kN]	0,6	1,0
		Shear V_{Rec}	[kN]	1,1	1,7
	Aerated concrete PPW 6-0,4 DIN 4165/EN 771-4 f_b a) ≥ 6 N/mm²	Tension N_{Rec}	[kN]	0,2	0,4
		Shear V_{Rec}	[kN]	0,4	0,9

Permissible anchor location in brick and block walls

Edge distance and spacing influence
- The technical data for HUS-HR anchors are reference loads for MZ 12 and KS 12. Due to the large variation of natural stone slid bricks, on site anchor testing is recommended to validate technical data
- The HUS-HR anchor was installed and tested in center of solid bricks as shown. The HUS-HR anchor was not tested in the mortar joint between solid bricks or in hollow bricks, however a load reduction is expected
- For brick walls where anchor position in brick can not be determined, 100 % anchor testing is recommended
- Distance to free edge free edge to solid masonry (Mz and KS) units ≥ 170mm
- Distance to free edge free edge to solid masonry (autoclaved aerated gas concrete) units ≥ 170mm
- The minimum distance to horizontal and vertical mortar joint (c_{min}) is started in drawing below
- Minimum anchor spacing (s_{min}) in one brick/block is ≥ 2*c_{min}

Limits
- Applied load to individual bricks may not exceed 1,0 kN without compression or 1,4 kN with compression
- All data is for multiple use for non-structural applications
- Plaster, graveling, lining or levelling courses are regarded as non-bearing and may not be taken into account for the calculation of embedment depth



HKD Flush anchor

Everyday standard set flush anchor

Anchor version

HKD
(M6-M20)

HKD-SR
(M6-M20)

HKD-ER
(M6-M20)

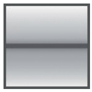
Benefits

- Simple and well proven
- Approved and tested
- Reliable setting with simple visual check
- Versatile
- For medium-duty fastening with bolts or threaded rods
- Available in various materials and sizes for maximized coverage of possible applications

Base material

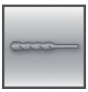
Non-cracked concrete

Load conditions



Static/ quasi-static

Installation conditions



Hammer drilled holes

Other information

European Technical Assessment

CE conformity

PROFIS Engineering Suite

A4 316

Corrosion resistance

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European Technical Assessment [a)]	CSTB, Marne-la-Vallèe	ETA-02/0032 / 2015-01-07

a) All data given in this section according to ETA-02/0032 issue 2015-01-07

Recommended general notes

* The below clauses based on Hilti product qualifications are for references only. Selection of clauses by the engineer shall be based on the specific application needs. Please contact Hilti's technical team for further details.

- Push-in anchor which is placed into a drill hole and anchored by deformation controlled expansion, approved for use in un-cracked concrete.
- The anchor shall have European Technical Assessment (ETA); evaluating performance in un-cracked concrete
- Anchor shall be installed as per the manufacturer's approved procedure and equipment
- Anchor shall have corrosion resistance of min. 5µm galvanization
- Anchor shall be approved for installation using machine setting tools recommended by the manufacturer
- The recommended tension load of the anchor should not be not less than __kN in cracked concrete with concrete strength at 25N/mm² (including overall global safety factor=3)
- Effective anchorage depth of the anchor should not exceed __mm
- Anchor shall be approved for proper setting verification through visual inspection ("4 marks") when set with a manual tool or machine tool followed by manual tool recommended by the manufacturer

Basic loading data (for a single anchor)

All data in this section applies to:

- Static and quasi-static loading
- Correct setting (See setting instruction)
- No edge distance and spacing influence
- Concrete as specified in the table
- *Steel* failure
- Minimum base material thickness
- Concrete C 20/25, $f_{ck, cube}$=25 N/mm². Concrete strength influence factor can be applied when concrete grade > C20/25, when steel failure does not govern.
- Screw or rod with steel grade 5.8 (carboon steel) and / or A4-70 (stainless steel)

Characteristic resistance a)

Anchor size			M6x25 b) (1/4"x25)	M8x30 (5/16"x30)	M10x40 (3/8"x40)	M12x50 (1/2"x50)	M16x65 (5/8"x65)	M20x80
Tension N_{Rk}	HKD	[kN]	6,3	8,3	12,8	17,8	26,4	36,1
	HKD-SR, HKD-ER		6,3	8,3	12,8	17,8	26,4	36,1
Shear N_{Rk}	HKD	[kN]	*5,0*	*8,6*	*11,0*	*18,3*	*33,8*	*49,0*
	HKD-SR, HKD-ER		*6,2*	*8,4*	*10,5*	*18,7*	*32,1*	*51,0*

a) Includes material partial factor according to ETA-02/0032 issue 2015-01-07
b) Hilti Technical Data

Design resistance a)

Anchor size			M6x25 b) (1/4"x25)	M8x30 (5/16"x30)	M10x40 (3/8"x40)	M12x50 (1/2"x50)	M16x65 (5/8"x65)	M20x80
Tension N_{Rd}	HKD	[kN]	4,2	5,5	8,5	11,9	17,6	24,0
	HKD-SR, HKD-ER		3,0	4,6	7,1	9,9	17,6	24,0
Shear N_{Rd}	HKD	[kN]	*4,0*	*6,9*	*8,8*	*14,6*	*27,0*	*39,4*
	HKD-SR, HKD-ER		*4,1*	*5,5*	*6,9*	*12,3*	*21,1*	*33,6*

a) Includes material partial factor according to ETA-02/0032 issue 2015-01-07
b) Hilti Technical Data

Recommended loads [a]

Anchor size			M6x25 [b] (1/4"x25)	M8x30 (5/16"x30)	M10x40 (3/8"x40)	M12x50 (1/2"x50)	M16x65 (5/8"x65)	M20x80
Tension N_{Rrec}	HKD	[kN]	2,1	2,8	4,3	5,9	8,8	12,0
	HKD-SR, HKD-ER		2,1	2,8	4,3	5,9	8,8	12,0
Shear N_{Rec}	HKD	[kN]	*1,7*	*2,1*	*3,7*	*6,1*	*11,3*	*16,3*
	HKD-SR, HKD-ER		*2,1*	*2,8*	*3,5*	*6,2*	*10,7*	*17,0*

a) Includes global safety factor of 3.0
b) Hilti Technical Data

Materials

Mechanical properties

Anchor size				M6	M8	M10	M10	M12	M16
Nominal tensile strength	f_{uk}	HKD	[N/mm²]	570	570	570	570	640	590
		HKD-SR, HKD-ER		540	540	540	540	-	540
Yield strength	f_{yk}	HKD	[N/mm²]	460	460	460	480	510	470
		HKD-SR, HKD-ER		355	355	355	355	-	355
Stressed cross-section	A_s	HKD	[mm²]	20,7	26,7	32,7	60,1	105	167
		HKD-SR, HKD-ER		20,9	26,1	28,8	58,7	-	163
Moment of resistance	W	HKD	[mm³]	32,3	54,6	82,9	184	431	850
		HKD-SR, HKD-ER		50	79	110	264	602	1191
Char. bending resistance for rod or bolt	$M^0_{Rk,s}$	With 5.8 Gr. Steel	[Nm]	7,6	18,7	37,4	65,5	167	325
		HKD-SR HKD-ER with A4-70		11	26	52	92	187	454

Material quality

Part		Material
Anchor body	HKD	Cold formed steel / galvanized to min. 5 µm
	HKD-SR, HKD-ER	Stainless steel, 1.4401, 1.4404, 1.4571
Expansion plug	HKD	Cold formed steel
	HKD-SR, HKD-ER	Stainless steel, 1.4401, 1.4404, 1.4571

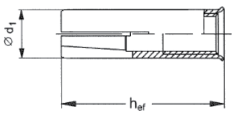
Anchor dimensions of HKD, HKD-SR, HKD-ER [a)]

Anchor size			M6x25 [b)] (1/4"x25)	M8x30 (5/16"x30)	M10x40 (3/8"x40)	M12x50 (1/2"x50)	M16x65 (5/8"x65)	M20x80
Eff. anchorage depth	h_{ef}	[mm]	25	30	40	50	65	80
Anchor diameter	d_1	[mm]	7,9	10	12	14,9	19,8	24,8
Plug diameter	d_2	[mm]	5,1	6,5	8,2	10,3	13,8	16,4
Plug length	l_1	[mm]	10	12	16	20	29	30

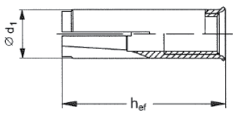
a) Please refer to the product catalogue on the Hilti Hong Kong website for standard portfolio
b) Hilti Technical Data

Anchor body

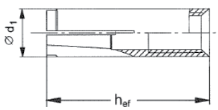
HKD



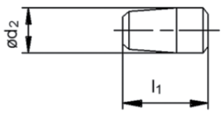
HKD-SR

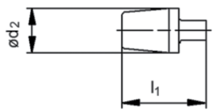


HKD-ER



Expansion plugs

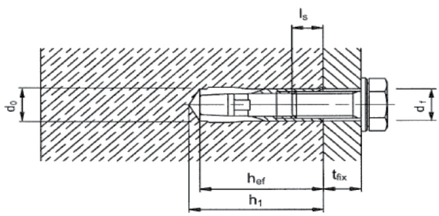




Setting information

Setting details

Anchor size			M6x25 (1/4"x25)	M8x30 (5/16"x30)	M10x40 (3/8"x40)	M12x50 (1/2"x50)	M16x65 (5/8"x65)	M20x80
Effective embedment depth	h_{ef}	[mm]	25	30	40	50	65	80
Nominal diameter of drill bit	d_o	[mm]	8	10	12	15	20	25
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	8,45	10,5	12,5	15,5	20,5	25,5
Depth of drill hole	$h_1 \geq$	[mm]	27	33	43	54	70	85
Screwing depth	$l_{s,min}$		6	8	10	12	16	20
Thread engagement depth	$l_{s,max}$		12	14,5	18	23,5	30,5	42
Diameter of clearance hole in the fixture	$d_f \leq$		7	9	12	14	18	22
Max. torque moment	T_{ins}		4	8	15	35	60	100



Installation equipment

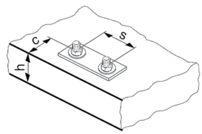
Part		M6	M8	M10	M12	M16	M20
Rotary hammer for setting		TE 2 – TE 16				TE 16 – TE 50	
Machine setting tool	HSD-M HSD-TE CX	6x25/30	8x25/30	10x40	12x50	16x65	20x80
Expansion plug	HSD-G	6x25/30	8x25/30	10x40	12x50	16x65	20x80
Other tools		hammer, torque wrench, blow up pump					

Setting parameters a)

Anchor size			M6x25 a) (1/4"x25)	M8x30 (5/16"x30)	M10x40 (3/8"x40)	M12x50 (1/2"x50)	M16x65 (5/8"x65)	M20x80
Minimum base material thickness	h_{min}	[mm]	100	100	100	100	130	160
Minimum spacing and minimum edge distance HKD-SR/ HKD-ER	s_{min}	[mm]	60	60	80	125	130	160
	c_{min}	[mm]	88	105	140	175	230	280
Minimum spacing HKD	s_{min}	[mm]	80	60	80	125	130	160
	$c \geq$	[mm]	140	105	140	175	230	280
Minimum edge distance HKD	c_{min}	[mm]	100	80	140	175	230	280
	$s \geq$	[mm]	150	120	80	125	130	160
Critical spacing and edge distance for splitting failure HKD	$s_{cr,sp}$	[mm]	200	210	280	350	455	560
	$c_{cr,N}$	[mm]	100	105	140	175	227	280
Critical spacing and edge distance for splitting failure HKD-SR / HKD-ER	$s_{cr,sp}$	[mm]	176	210	280	350	455	560
	$c_{cr,N}$	[mm]	88	105	140	175	227	280
Critical spacing and edge distance for concrete cone failure HKD / HKD-SR / HKD-ER	$s_{cr,N}$	[mm]	80	90	120	150	195	240
	$c_{cr,N}$	[mm]	40	45	60	75	97	120

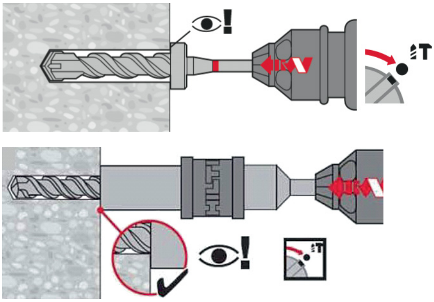
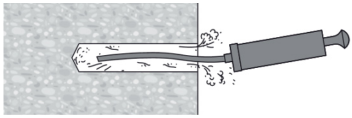
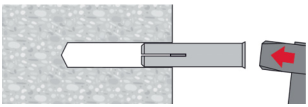
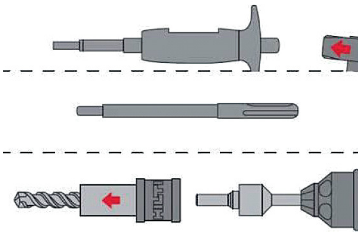
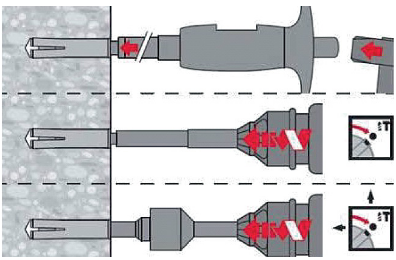
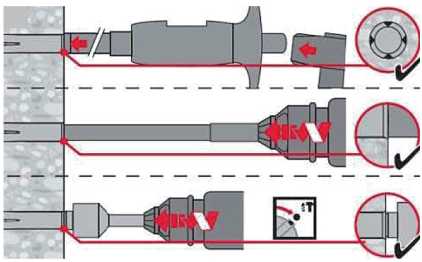
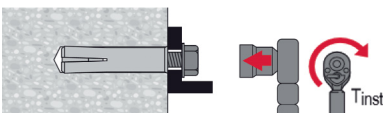
a) Hilti Technical Data

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



Setting instructions

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

Setting instruction	
1. Drilling 	**2. Cleaning** 
3. Inserting the anchor 	**4. Setting tools** 
5. Inserting the tools 	**6. Inserting the tools** 
7. Attaching the belonging washer 	

HKV Flush anchor

Economical flush anchor

Anchor version

HKV
(M6-M16)

HKV-R2
(M8-M12)

Benefits

- Simple and well proven
- Reliable setting thanks to simple visual check
- Versatile
- For medium-duty fastening with bolts or threaded rods

Base material

Non-cracked
concrete

Recommended general notes

* The below clauses based on Hilti product qualifications are for references only. Selection of clauses by the engineer shall be based on the specific application needs. Please contact Hilti's technical team for further details.

- Push-in anchor which is placed into a drill hole and anchored by deformation controlled expansion for use in un-cracked concrete.
- Anchor shall be installed as per the manufacturer's approved procedure and equipment
- Anchor must have corrosion resistance of min. 5µm galvanization
- Anchor must have corrosion resistance of A2 stainless steel
- The recommended tension load of the anchor should not be not less than __kN in cracked concrete with concrete strength at 25N/mm^2 (including overall global safety factor=3)
- Effective anchorage depth of the anchor should not exceed __mm
- Anchor shall be approved for proper setting verification through visual inspection ("4 marks") when set with a manual tool or machine tool followed by manual tool recommended by the manufacturer

Basic loading data (for a single anchor)

All data in this section applies to:

- Correct setting (See setting instruction)
- No edge distance and spacing influence
- Concrete as specified in the table
- Minimum base material thickness
- Concrete C 20/25, $f_{ck, cube}$=25 N/mm^2. Concrete strength influence factor can be applied when concrete grade > C20/25, when steel failure does not govern.
- Screw or rod with steel grade 5.8 (carboon steel) and / or A4-70 (stainless steel)

Characteristic resistance

Anchor size		M6x25 (1/4”x25)	M8x30 (5/16”x30)	M10x30 (3/8”x30)	M10x40 (3/8”x40)	M12x50 (1/2”x50)	M16x65 (5/8”x65)
Tension N_{Rk}	[kN]	4,2	5,9	5,9	9,1	12,7	26,5
Shear N_{Rk}	[kN]	5,0	8,6	10,0	10,0	18,3	33,8

Design resistance

Anchor size		M6x25 (1/4”x25)	M8x30 (5/16”x30)	M10x30 (3/8”x30)	M10x40 (3/8”x40)	M12x50 (1/2”x50)	M16x65 (5/8”x65)
Tension N_{Rd}	[kN]	2,8	3,9	3,9	6,1	8,5	17,6
Shear N_{Rd}	[kN]	4,0	6,9	8,0	8,0	14,6	27,0

Recommended loads [a)]

Anchor size		M6x25 (1/4”x25)	M8x30 (5/16”x30)	M10x30 (3/8”x30)	M10x40 (3/8”x40)	M12x50 (1/2”x50)	M16x65 (5/8”x65)
Tension N_{Rec}	[kN]	1,4	2,0	2,0	3,0	4,2	8,8
Shear N_{Rec}	[kN]	1,7	2,9	3,3	3,3	6,1	11.3

a) Includes global safety factor of 3.0

Materials

Mechanical properties

Anchor size			M6x25	M8x30	M10x30	M10x40 (3/8”x40)	M12x50 (1/2”x50)	M16x65 (5/8”x65)
Nominal tensile strength	f_{uk}	[N/mm²]	570	570	570	570	570	640
Yield strength	f_{yk}	[N/mm²]	460	460	460	460	460	510
Stressed cross-section	A_s	[mm²]	20,7	26,7	32,7	32,7	60,1	105
			17,3	27,46	39,9	39,9	70,6	-
Moment of resistance	W	[mm³]	32,3	54,6	82,9	82,9	184	431
			28,2	55,8	97,4	97,4	229,8	-
Char. bending resistance for rod or bolt with 5.8 steel grade	$M^0_{Rk,s}$	[Nm]	7,6	18,7	37,4	37,4	65,5	167
			10,4	16,5	23,9	24,5	42,4	-

Material quality

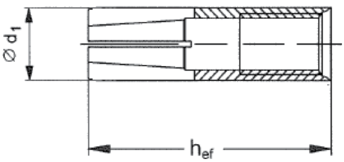
Part		Material
Anchor body	HKV	Steel Fe/Zn5 galvanized to min. 5 µm
	HKV-R2	Stainless steel, A2
Expansion plug	HKV	Steel material
	HKV-R2	Stainless steel, A2

Anchor dimension [a)]

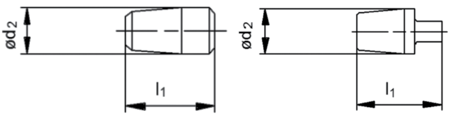
Anchor size			M6x25 (1/4”x25)	M8x30 (5/16”x30)	M10x30 (3/8”x30)	M10x40 (3/8”x40)	M12x50 (1/2”x50)	M16x65 (5/8”x65)
Effective anchorage depth	h_{ef}	[mm]	25	30	30	40	50	65
Anchor diameter	d_1	[mm]	7,9	9,95 (9,9)	11,8 (11,9)	11,95	14,9 (15,85)	19,75
				-	-		-	-
Diameter of cone bolt	d_2	[mm]	5,1	6,5 (6,35)	8,2	8,2 (7,86)	10,3 (10,2)	13,8
				-		-	-	-
Length of expansion sleeve	l_1	[mm]	10	12	12	16 (16,2)	20	29
						-		-

a) Please refer to the product catalogue on the Hilti website for standard portfolio

Anchor body



Expansion plugs

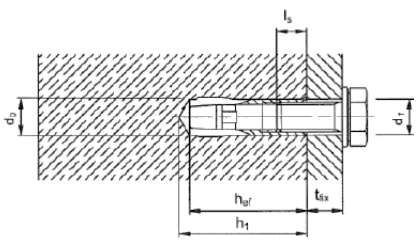


Setting information

Setting details

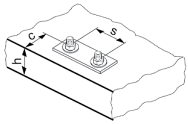
Anchor size			M6x25 (1/4”x25)	M8x30 (5/16”x30)	M10x30 (3/8”x30)	M10x40 (3/8”x40)	M12x50 (1/2”x50)	M16x65 (5/8”x65)
Effective anchorage depth	h_{ef}	[mm]	25	30	30	40	50	65
Nominal diameter of drill bit	d_0	[mm]	8	10	12	12	15 (16) [a)]	20
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	8,45	10,5	13 (12,5) [a)]	12,5	15,5 (16,5)[a)]	20,5
Depth of drill hole	$h_1 \geq$	[mm]	27	33	33	43	54	70
Diameter of clearance hole in the fixture	$d_f \leq$	[mm]	7	9	12	12	14	18
Torque moment	T_{inst}	[Nm]	4	8	15	15	35	60
Screwing depth	$l_{s,min}$	[mm]	6	8	10	10	12	16
	$l_{s,max}$ [a)]	[mm]	10	12	10,5	15,5	20,0	25,5

a) Drill bit diameter for metric/fractional



Setting parameters

Anchor size			M6x25 (1/4"x25)	M8x30 (5/16"x30)	M10x30 (3/8"x30)	M10x40 (3/8"x40)	M12x50 (1/2"x50)	M16x65 (5/8"x65)
Minimum base material thickness	$h_{min} \geq$	[mm]	100	100	100	100	100	130
Minimum spacing	$s_{min} \geq$	[mm]	200	200	200	200	200	260
Minimum edge distance	$c_{min} \geq$		150	150	150	150	150	195



Installation equipment

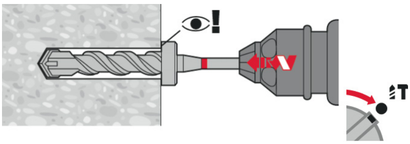
Anchor size		M6x25 (1/4"x25)	M8x30 (5/16"x30)	M10x30 (3/8"x30)	M10x40 (3/8"x40)	M12x50 (1/2"x50)	M16x65 (5/8"x65)
Rotary hammer for setting		TE 2 – TE 30				TE 16 – TE 50	
		TE 1 – TE 30					-
Machine setting tool	HSD-M	6x25/30	8x25/30	10x25/30	10x40	12x50	16x65
Hand setting tool	HSD-G						
Other tools		hammer, torque wrench, blow up pump					

Setting instructions

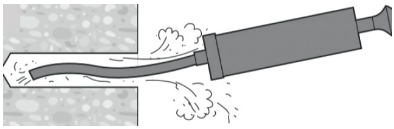
*** For detailed information on installation see instruction for use given with the package of the product.**

Setting instruction

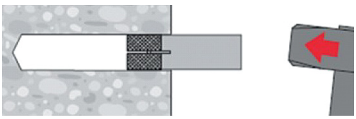
1. Drilling



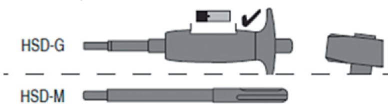
2. Cleaning



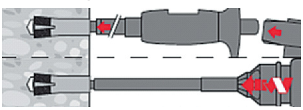
3. Inserting the anchor



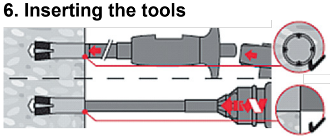
4. Setting tools



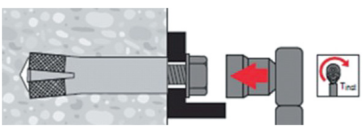
5. Inserting the tools



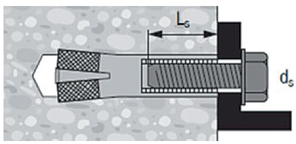
6. Inserting the tools



7. Attaching the belonging washer



8.



HAP 1.15 Hoist anchor plate

Proven solution for hoisting applications

Anchor version

Benefits

- No limitation in load direction, hook (shackle) can rotate and swivel, symmetric design of base plate with 4 anchors
- Design fits application requirements of vibratory dynamic loads from motorized hoisting with dynamic safety factor of 1.8
- Anchorage of hoist point can be designed with PROFIS Anchor software, cracked and un-cracked concrete, ≥ C20/25
- Recommended anchor HST3 M12 (h_{ef}=70mm)
- Two or more HAP 1.15 can be combined to increase total WLL
- Delivered pre-assembled (one piece), no need for assembly
- Compact design, only 155 x 155 x 52 mm (when shackle is folded to plate)
- Global safety factor of 4 for all steel connections

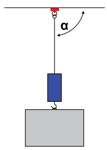
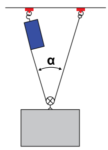
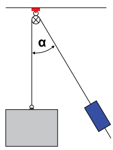
Applications

The HAP 1.15 is designed for temporary and permanent application under dry indoor conditions, to be used as post installed "master hoist point" for installation and/or maintenance in elevator shafts. It can be used with manual or motor hoists and bears a working load up to 1.15 metric tons in variable directions.

Basic loading data (for a single anchor)

Data for WLL_{total} applies to

- Correct design of anchorage (see "design of anchorage")
- Correct setting of anchors
- No edge distance influence
- Cracked concrete, C20/25, $f_{ck,cube}$ = 25 N/mm²
- Cracked concrete, ACI 318-14 design (cylindrical test method): f'_c = 2500 psi
- No shock loading; vibratory dynamic safety factor γ_{dyn} up to 1.8

			Single point	Single pulley	Fixed motor hoist
					
α < 20°	WLL total	[metric ton]	1,15	2,25	0,55
20° < α < 45°	WLL total	[metric ton]	1,15	2,10	0,50
45° < α < 60°	WLL total	[metric ton]	1,15	2,00	0,45
60° < α < 90°	WLL total	[metric ton]	1,15	1,60	0,40
90° < α < 120°	WLL total	[metric ton]	Not applicable	1,15	Not applicable

a) Keep distance of min. 4 x hef between anchors of the two HAP's

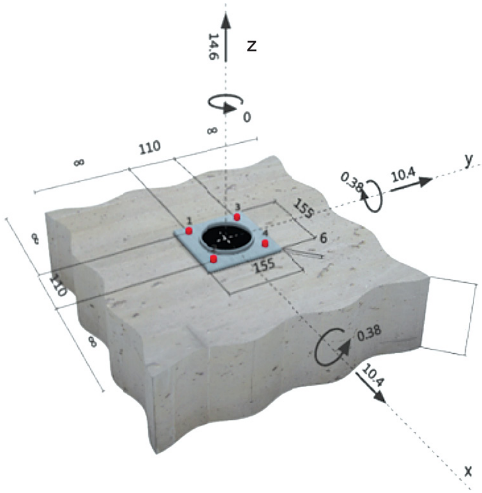
Design of anchorage

HAP 1.15 is designed to be used as hoist point for lifting loads under variable directions in elevator installation or maintenance.

The design of an anchorage for the HAP 1.15 must account for varying load conditions (varying directions, dynamic effects, etc.) For this the anchorage for HAP 1.15 has to be designed according to extreme load cases: A concrete anchor can only be considered as suitable for use with the HAP 1.15 hoist point if the approved anchor satisfies ALL of the following load scenarios (e.g. by PROFIS calculation1) with ETAG or ICC calculation method:

ETA Design

- Base material: acc. to onsite conditions
- Cracked or un-cracked concrete
- Slab thickness: onsite slab thickness[2]
- Dimensions of baseplate see picture
- Partial safety factor for load γ_L= 1.8



Load scenario 1 (pure tension):

F_z	20.7	kN

Load scenario 2 (diagonal 45°):

F_z	14.6	kN
F_x	10.4	kN
F_y	10.4	kN
M_x	0.38	kNm
M_y	0.38	kNm

Load scenario 3 (diagonal shear):

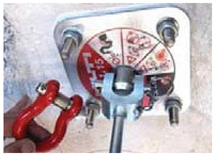
F_x	14.6	kN
F_y	14.6	kN
M_x	0.54	kN
M_y	0.54	kNm

For use of HAP 1.15 as ETAG approved anchorage, Hilti recommends use of HST3 M12

[1] Free download of PROFIS Anchor design software from www.hilti.com Service & Support
[2] Minimum slab thickness according to tech. data of applied anchors

Onsite qualification

1. Make sure anchors for the HAP 1.15 are correctly installed. Make sure shackle is not attached (de-install shackle if necessary). Connect ring bolt adapter of HAT 30 to center bolt.

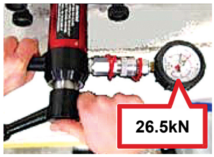


2. Connect HAT 30 with ring bolt adapter and position the tester with edges of tester baseplate parallel to edges of HAP plate.

   Turn crank in clockwise direction until legs are in contact with the base material. Check that pullout force acts parallel to the axis of the anchors and parallel to the legs of the HAT 30 and HAP 1.15 is centered with HAT 30.

3. Set the red hand of the gauge to zero.

4. Hold the HAT 30 by the grip while increasing the load on the HAP 1.15 by turning the crank in a clockwise direction. Increase the load until proof load of 26.5 kN is attained.



5. Keep the proof load on HAP 1.15 for at least 5 minutes.

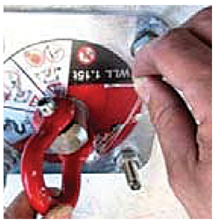
6. Check the load on the HAT 30 after 5 minutes (black hand) and note down the difference to the initially applied proof load (red hand).

   Release the load by turning the crank counterclockwise.

7. Remove HAT 30 and ring bolt adapter.

   Perform visual check on HAP 1.15 and base material (damages, deformations, cracks).

   The Hoist Anchor Kit has passed the test and can be loaded with a maximal working load of 1.15 metric tons if the following requirements are met:
   - The applied proof load of 26.5 kN decreased less than 10% during the 5 minutes test duration
   - No damage or deformation of the HAP 1.15
   - No damage (e.g. cracks) in the base material



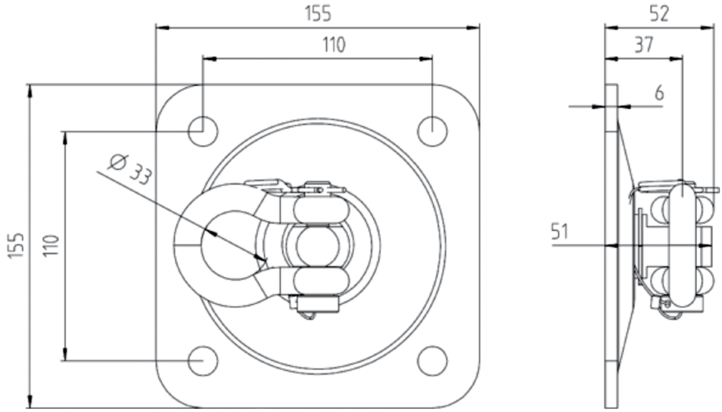
8. Install the shackle and plug in the safety pin, optional is to mark or label the HAP 1.15 with date of proof loading, name of testing person

Materials

Material quality

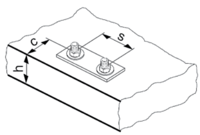
Part	Material / Mechanical properties or standard
Shackle axis	Galvanized steel R_m > 550N/mm²
Shackle (U-bolt)	Material, functional dimensions and mech. properties acc. to EN 13889, coated with 100my powder laque
Eye Bolt	Galvanized steel R_m > 550N/mm²
Base plate	Galvanized steel R_m > 355N/mm²

Setting information



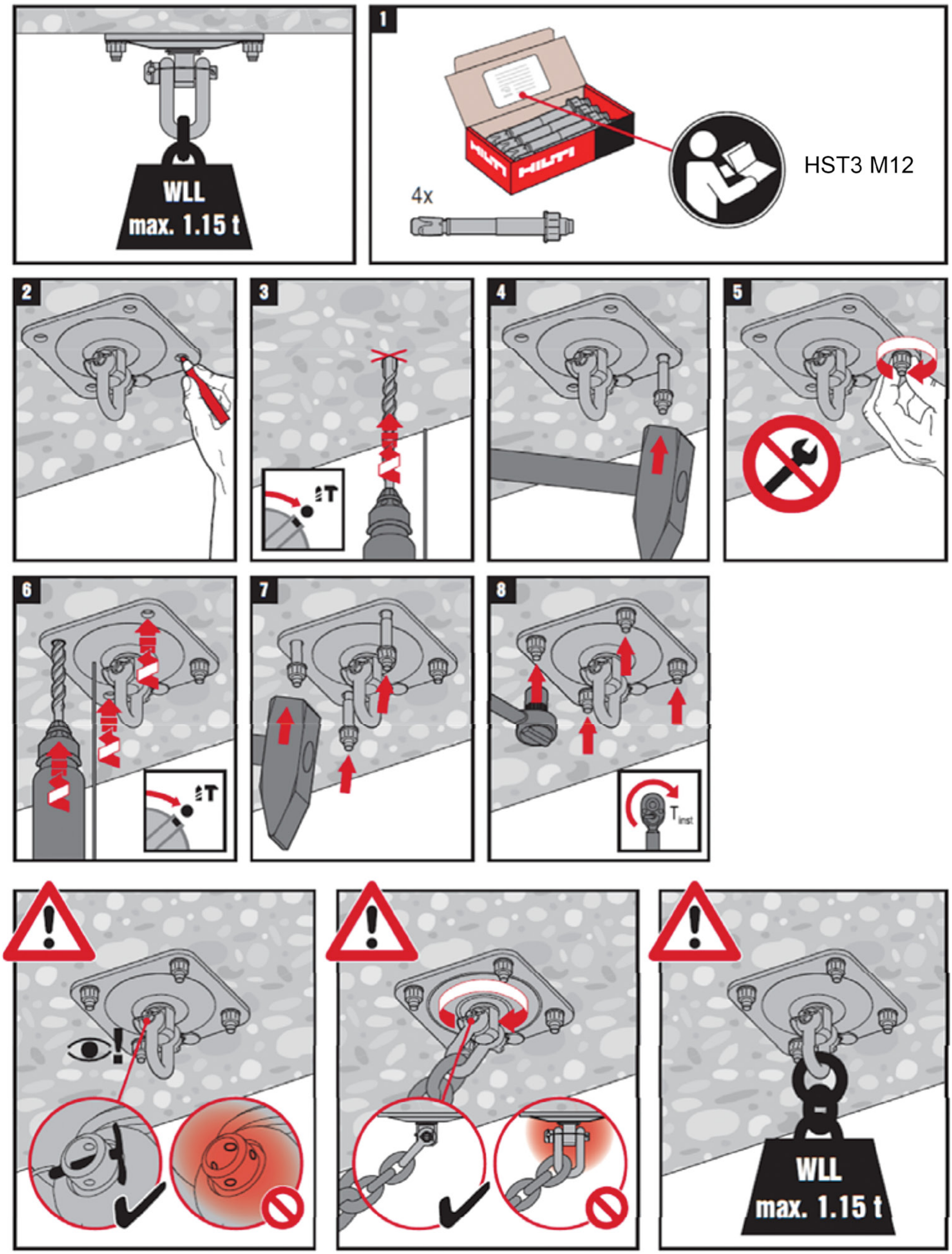
HAP 1.15			
Minimum base material thickness	h_{min}	[mm]	according to technical data of applied anchors
Spacing (Hoist Anchor Plate)	s	[mm]	110
Edge distance	c		according to technical data of applied anchors [a)]

a) For smaller edge distances the design loads have to be reduced (see ETAG 001, Annex C).



Setting instructions

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



PLASTIC / LIGHT DUTY / OTHER METAL ANCHORS

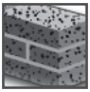
HRD Plastic frame anchor

Everyday standard plastic frame anchor suitable for wide range of base materials

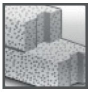
Anchor version		Benefits
	HRD-C HRD-CR (M8)	- Innovative screw design for better hold - Suitable on practically all base materials - Flexible embedment depth (approved at 50mm and 70mm) - Suitable for fastening thicknesses up to 260mm - Pre-assembled for optimum handling and fastening quality
	HRD-C HRD-CR (M10)	

Base material


Non-cracked concrete


Solid brick


Hollow brick


Autoclaved aerated concrete


Drywall


Prestressed hollow core slabs


Window frame

Load conditions


Tension zone a)


Fire resistance

a) Redundant fastening for non-structural fixing only

Other information

European Technical Assessment

CE conformity

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European Technical Assessment a)	DIBt, Berlin	ETA-07/2019 / 2018-06-28
Fire test report	MFPA, Leipzig	GS 3.2/10-157-1/ 2010-09-02
Window frame report b)	Ift, Rosenheim	Ift report 105 33035 / 2007-07-09

a) All data given in this section according ETA-07/0219 issue 2018-06-28. The anchor is to be used only for redundant fastening for non-structural applications

b) Only available for HRD 8

Recommended general notes

* The below clauses based on Hilti product qualifications are for references only. Selection of clauses by the engineer shall be based on the specific application needs. Please contact Hilti's technical team for further details.

- Plastic anchor with ribbed surface for toggling in hollow material, made of polyamide PA6 and an accompanying specific screw of galvanized steel or stainless steel; for use in concrete, solid brick, hollow brick, aerated concrete and drywall.
- Anchor shall be installed as per the manufacturer's approved procedure and equipment

Basic loading data

All data in this section applies to:
- Correct setting (See setting instruction)
- No edge distance and spacing influence
- Base material as specified in the table
- Minimum base material thickness
- Steel failure
- Shear without lever arm
- Anchor in redundant fastening
- The additional Hilti recommended data, not part of the approval

Characteristic resistance

Anchor size			HRD 8	HRD 10		
	h_{nom}	[mm]	50	50	70	90
Concrete C12/15	F_{Rk}	[kN]	2,0	3,0	6,0	-
	V_{Rk}	[kN]	6,9 / 6,6 a)	10,6 / 10,1 a) / 11,1 b)		-
Concrete C16/20 – C50/60	F_{Rk}	[kN]	3,0	4,5	8,5	-
	V_{Rk}	[kN]	6,9 / 6,6 a)	10,6 / 10,1 a) / 11,1 b)		-

a) Values for hot-dipped galvanized carbon steel
b) Values for stainless steel

Design resistance

Anchor size			HRD 8	HRD 10		
	h_{nom}	[mm]	50	50	70	90
Concrete C12/15	N_{Rd}	[kN]	1,1	1,7	3,3	-
	V_{Rd}	[kN]	5,5 / 5,2 a)	8,5 / 8,1 a) / 8,5 b)		-
Concrete C16/20 – C50/60	N_{Rd}	[kN]	1,7	2,5	4,7	-
	V_{Rd}	[kN]	5,5 / 5,2 a)	8,5 / 8,1 a) / 8,5 b)		-

a) Values for hot-dipped galvanized carbon steel
b) Values for stainless steel

Recommended loads a)

Anchor size			HRD 8	HRD 10		
	h_{nom}	[mm]	50	50	70	90
Concrete C12/15	N_{Rec}	[kN]	0,8	1,2	2,4	-
	V_{Rec}	[kN]	3,9 / 3,7 b)	6,1 / 5,8 b) / 6,1 c)		-
Concrete C16/20 – C50/60	N_{Rec}	[kN]	1,2	1,8	3,4	-
	V_{Rec}	[kN]	3,9 / 3,7 b)	6,1 / 5,8 b) / 6,1 c)		-

a) With overall partial safety factor for action γ = 1,4. The partial safety factors for action depend on the type of loading and shall be taken from national regulations
b) Values for hot-dipped galvanized carbon steel
c) Values for stainless steel

Characteristic resistance for pull-out failure (plastic sleeve) for use in concrete

Anchor size					HRD 8	HRD 10	
In standard concrete slabs							
Embedment depth			$h_{nom} \geq$	[mm]	50	50	70
Characteristic resistance		≥C16/20	$N_{Rk,p}$	[kN]	3,0	4,5	8,5
		C12/15	$N_{Rk,p}$	[kN]	2,0	3,0	6,0
Partial safety factor			γ_{Mc} a)		1,8		
In thin skins (weather resistant skins of external wall panels)							
Embedment depth			$h_{nom} \geq$	[mm]	-	50	-
Characteristic resistance	h=100mm to 400mm	≥C16/20	$N_{Rk,p}$	[kN]	-	3,5	-
		C12/15	$N_{Rk,p}$	[kN]	-	2,5	-
Partial safety factor			γ_{Mc} a)		1,8		
In precast prestressed hollow cored slabs							
Embedment depth			$h_{nom} \geq$	[mm]	-	50	-
Characteristic resistance	$d_b \geq 25$mm	≥C16/20	$N_{Rk,p}$	[kN]	-	0,6	-
	$d_b \geq 30$mm	≥C16/20	$N_{Rk,p}$	[kN]	-	1,5	-
	$d_b \geq 35$mm	≥C16/20	$N_{Rk,p}$	[kN]	-	2,5	-
	$d_b \geq 40$mm	≥C16/20	$N_{Rk,p}$	[kN]	-	3,5	-
Partial safety factor			γ_{Mc} a)		1,8		

a) In absence of other regulations

Requirements for redundant fastening

The definition of redundant fastening according to Member States is given in ETAG 020. In Absence of a definition by a Member State the following default values may be taken		
Maximum number of fixing points	**Minimum number of anchors per fixing point**	**Maximum design load of action N_{Sd} per fixing point a)**
3	1	3 [kN]
4	1	4,5 [kN]

Materials

Mechanical properties

Anchor size		HRD 8		HRD 10		
		Galvanized steel	Stainless steel	Galvanized steel	Hot-deep galvanized	Stainless steel
Nominal tensile strength f_{uk}	[N/mm²]	600	580	600	600	630
Yield strength f_{yk}	[N/mm²]	480	450	480	480	480
Stressed cross-section A_s	[mm²]	22,9	22,9	35,3	33,7	35,3
Moment of resistance W	[mm³]	15,5	15,5	29,5	27,6	29,5
Char. bending resistance $M^0_{Rk,s}$	[Nm]	11,1	10,8	21,3	19,9	22,3

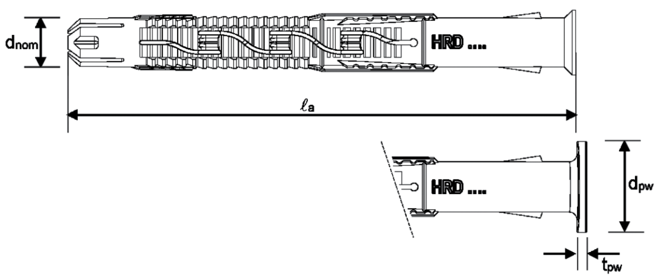
Material quality

Part		Material
Sleeve		Polyamide, colour red
Screw	HRD-C, -H, -K, -P	Carbon steel, galvanized to min.5 µm
	HRD-HF	Carbon steel, hot-dip galvanized to min. 65 µm
	HRD-CR2, -HR2, -KR2, -PR2	Stainless steel, corrosion class II: 1.4301 / 1.4567 i.e. A2 acc. to ISO3506
	HRD-CR, -HR, -KR, -PR	Stainless steel, corrosion class III: 1.4362/1.4401/1.4404/1.4571/ 1.4578 i.e. A4 acc. to ISO3506

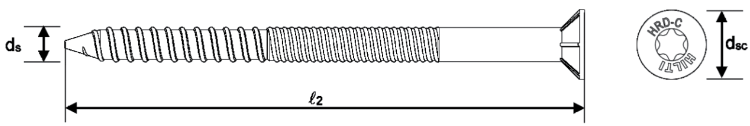
Anchor dimension

Anchor size			HRD 8	HRD 10
Minimum thickness of fixture	$t_{fix,min}$	[mm]	0	0
Maximum thickness of fixture	$t_{fix,max}$	[mm]	90	260
Diameter of the sleeve	d_{nom}	[mm]	8	10
Minimum length of the sleeve	$l_{1,min}$	[mm]	60	60
Maximum length of the sleeve	$l_{1,max}$	[mm]	140	310
Diameter of plastic washer	d_{pw}	[mm]	-	17,5
Thickness of plastic washer	t_{pw}	[mm]	-	2
Diameter of the screw	d_S	[mm]	6	7
Minimum length of the screw	$l_{2,min}$	[mm]	65	65
Maximum length of the screw	$l_{2,max}$	[mm]	145	315
Head diameter of countersunk screw	d_{sc}	[mm]	11	14
Head diameter of hexhead screw	d_{sw}	[mm]	-	17,5

Anchor sleeve



Special screw



Setting information

Installation temperature
-10°C to +40°C

Service temperature range
Hilti HRD frame anchors may be applied in the temperature range given below.

Temperature range	Base material temperature	Max. long term base material temperature	Max. short term base material temperature
Temperature range	-40 °C to +80 °C	+50 °C	+80 °C

Max short term base material temperature
Short-term elevated base material temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Max long term base material temperature
Long-term elevated base material temperatures are roughly constant over significant periods of time.

Setting details

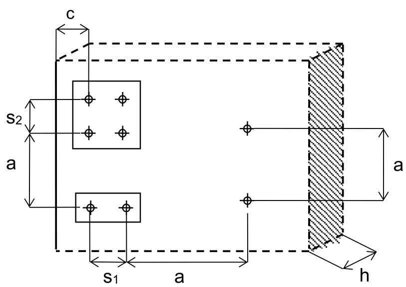
Anchor size				HRD 8	HRD 10
Drill hole diameter		d_o	[mm]	8	10
Cutting diameter of drill bit		$d_{cut} \leq$	[mm]	8,45	10,45
Depth of drilled hole to deepest point		$h_{1,1} \geq$	[mm]	60	60
		$h_{1,2} \geq$	[mm]	-	80
		$h_{1,3} \geq$	[mm]	-	100 [a)]
Overall plastic anchor embedment depth in base material		$h_{nom,1} \geq$	[mm]	50	50
		$h_{nom,2} \geq$	[mm]	-	70
		$h_{nom,3} \geq$	[mm]	-	90 [a)]
Diameter of clearance hole in the fixture	Countersunk screw	$d_f \leq$	[mm]	8,5	11
	Hexhead screw	$d_f \leq$	[mm]	-	12

a) For use in AAC

Setting parameters

Anchor size				HRD 8	HRD 10	
		h_{nom}	[mm]	**50**	**50**	**70**
Minimum base material thickness	Concrete	h_{min}	[mm]	100	100	120
	Concrete thin skin	h_{min}	[mm]	-	40	-
Minimum spacing	Concrete ≥C16/20	s_{min}	[mm]	100	50	
		for c ≥	[mm]	50	100 c)	
	Concrete C12/15	s_{min}	[mm]	140	70	
		for c ≥	[mm]	70	140 c)	
Minimum edge distance	Concrete ≥C16/20	c_{min}	[mm]	50	50	
		for s ≥	[mm]	100	150 c)	
	Concrete C12/15	c_{min}	[mm]	70	70	
		for s ≥	[mm]	140	210 c)	
Critical spacing in concrete a)	Concrete ≥C16/20	$s_{cr,N}$	[mm]	62	80	125
	Concrete C12/15	$s_{cr,N}$	[mm]	68	90	135
Critical edge distance in concrete b)	Concrete ≥C16/20	$c_{cr,N}$	[mm]	100	100	
	Concrete C12/15	$c_{cr,N}$	[mm]	140	140	

a) For spacing larger than the critical spacing each anchor in a group can be considered in design
b) For edge distance smaller than critical edge distance the design loads
c) Linear interpolation allowed



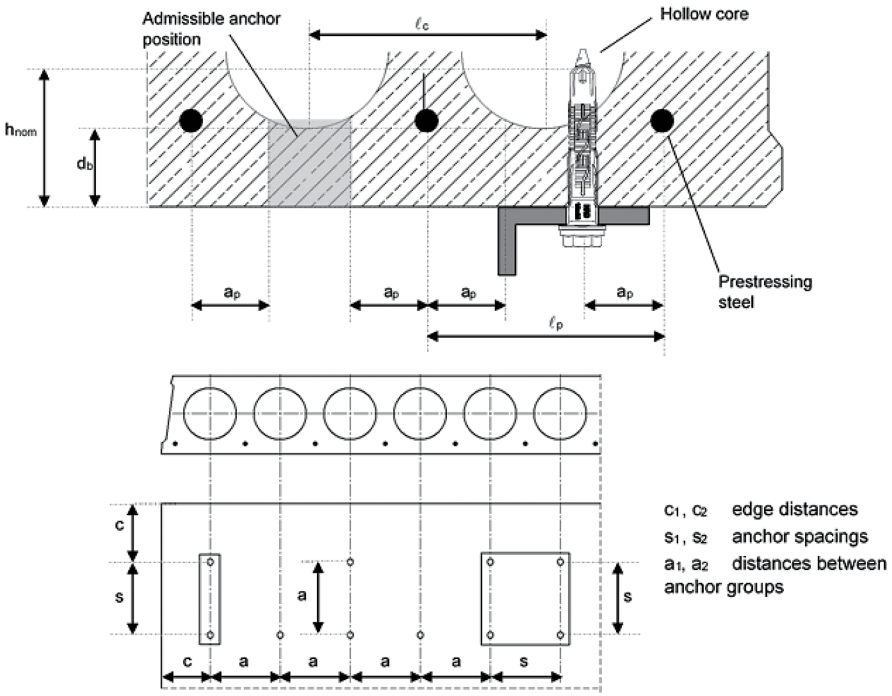
Installation equipment

Anchor size	HRD 8	HRD 10
Rotary hammer	TE 2- TE16	
Other tools	Hammer, Screwdriver	

Admissible anchor positons, min. spacing and edge distance of anchors and distance between anchor groups in precast pre-stressed hollow core slabs

Anchor size			HRD 8	HRD 10
Overall plasic anchor embedment depth in the base material	$h_{nom} \geq$	[mm]	-	50
Bottom flange thickness	$d_b \geq$	[mm]	-	25
Core distance	$\ell_c \geq$	[mm]	-	100
Prestressing steel distance	$\ell_p \geq$	[mm]	-	100
Distance between anchor position and prestressing steel	$a_p \geq$	[mm]	-	50
Minimum edge distance	$c_{min} \geq$	[mm]	-	100
Minimum anchor spacing	$s_{min} \geq$	[mm]	-	100
Minimum distance between anchor groups	$a_{min} \geq$	[mm]	-	100

Schemes of distances and spacing

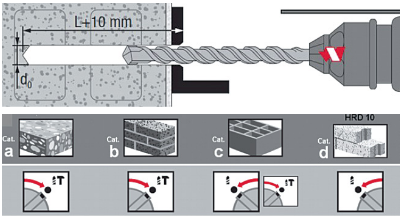


Setting instructions

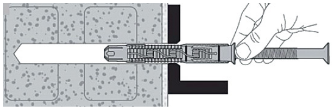
*** For detailed information on installation see instruction for use given with the package of the product.**

Setting instruction for HRD

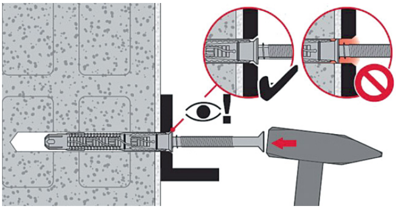
1. Drilling



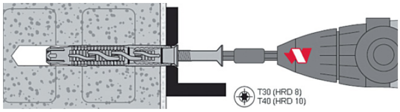
2. Cleaning the hole and inserting the anchor



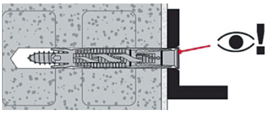
3. Inserting the anchor



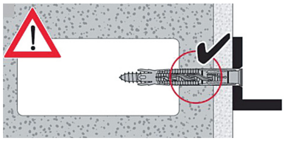
4. Setting tools



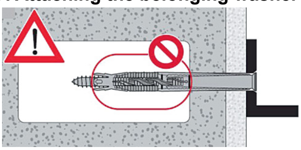
5. Checking



6. Attaching the belonging washer



7. Attaching the belonging washer

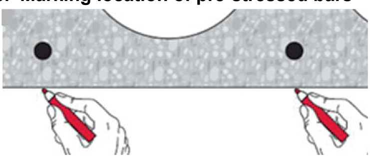


Additional preparation in case of application in precast prestressed hollow core slabs

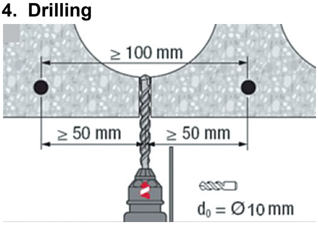
1. Location of pre-stressed bars

2. Marking location of pre-stressed bars

3. Marking location of pre-stressed bars



4. Drilling



HPS-1 Plastic anchor

Economical plastic impact anchor

Anchor version

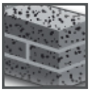
HPS-1
(M4-M8)

Benefits

- Impact anchor for light frames, battens and profiles
- Impact and temperature resistant
- High quality plastic

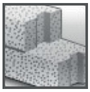
Base material

Non-cracked concrete



Solid brick

Hollow brick



Autoclaved aerated concrete

Basic loading data

All data in this section applies to:
- Correct setting (See setting instruction)
- No edge distance and spacing influence
- Base material as specified in the table
- Minimum base material thickness
- Loads shall be reduced if the temperature sustains above 40°C

Recommended loads a)

Anchor size			4/0	5/0	5/5-5/15	6/0-6/25	6/30-6/40	8/0	8/10-8/40	8/60-8/100
Concrete ≥ C16/20	N_{Rd}	[kN]	0,05	0,10	0,15	0,25	0,25	0,30	0,40	0,40
	V_{Rd}	[kN]	0,15	0,30	0,35	0,55	0,35	0,50	0,90	0,50

a) With overall global safety factor γ = 5 to the characteristic loads and a partial safety factor of γ = 1,4 to the design values

Materials

Material quality

Part	Material
Sleeve	Polyamide 6.6
Screw	Carbon steel, galvanised to min. 5µm
	Stainless steel, grade A2
	Stainless steel, grade A2, copper-plated

Setting information

Installation temperature
-10°C to +40°C

Service temperature range
Hilti HPS-1 impact anchor may be applied in the temperature range below.

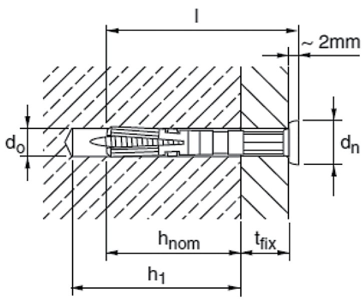
Temperature range	Base material temperature	Max. long term base material temperature	Max. short term base material temperature
Temperature range	-40 °C to +80 °C	+50 °C	+80 °C

Max short term base material temperature
Short-term elevated base material temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Max long term base material temperature
Long-term elevated base material temperatures are roughly constant over significant periods of time.

Setting details

Anchor			HPS-1 4	HPS-1 5	HPS-1 6	HPS-1 8
Nominal diameter of drill bit	d_o	[mm]	4	5	6	8
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	4,35	5,35	6,4	8,45
Depth of drill hole	$h_1 \geq$	[mm]	25	30	40	50
Effective anchorage depth	h_{nom}	[mm]	20	20	25	30
Anchor length	l	[mm]	21,5	22 - 37	27 - 67	28,5 - 132,5
Max fixture thickness	t_{fix}	[mm]	2	15	40	100

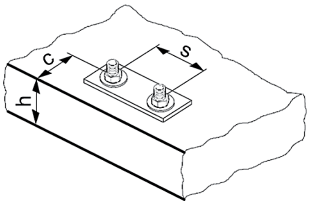


Installation equipment

Anchor	HPS-1 4	HPS-1 5	HPS-1 6	HPS-1 8
Rotary hammer	TE2 - TE16			
Other tools	Screwdriver			

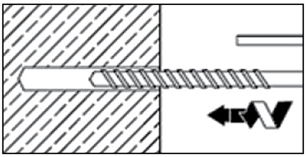
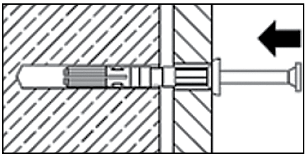
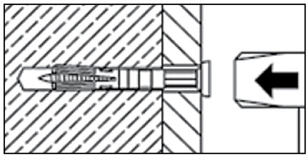
Setting parameters HPS-1

Anchor			HPS-1 4	HPS-1 5	HPS-1 6	HPS-1 8
Spacing	s	[mm]	20	25	30	35
Edge distance	c	[mm]	20	25	30	35



Setting instructions

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

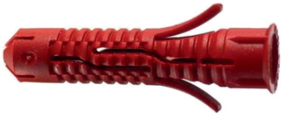
Setting instructions		
1. Drill hole with drill bit	2. Install anchor	3.Hammer in anchor
		

HUD-2 / HUD-1 Plastic Anchor

Economical universal plastic anchor

Anchor version

HUD-2
(5, 6, 8)



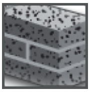
HUD-1
(10, 12, 14)

Benefits

- Flat setting
- Flexibility of screw length
- Suitable for use in a wide range of base materials

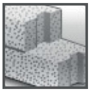
Base material

Non-cracked concrete



Solid brick

Hollow brick



Autoclaved aerated concrete

Drywall

Recommended general notes

* The below clauses based on Hilti product qualifications are for references only. Selection of clauses by the engineer shall be based on the specific application needs. Please contact Hilti's technical team for further details.

- Plastic anchor with ribbed surface for toggling in hollow material and fins (to prevent the anchor turning in the hole), made of polyamide PA6, for use in concrete, solid brick, hollow brick, aerated concrete and drywall.
- Plastic anchor shall have manufacturer information on volatile organic compunds (VOC) content.
- Anchor shall be installed as per the manufacturer's approved procedure and equipment

Basic loading data

All data in this section applies to:

- Correct setting (See setting instruction)
- Load data are only valid for the specified woodscrew type
- No edge distance and spacing influence
- Base material as specified in the table.
- Minimum base material thickness

Characteristic resistance

Anchor size			HUD-2			HUD-1		
			5x25	6x30	8x40	10x50	12x60	14x70
Screw type a)			C	C	C	W	W	W
Concrete ≥ C16/20	N_{Rk}	[kN]	0,60	1,2	2,5	7	10	15
	V_{Rk}	[kN]	-	-	-	11	15	28

a) Screw type: W: Wood-screw C: Chipboard screw. Load data are valid for the mentioned woodscrew type, if other types or different screws are used the load capacity may decrease.

Design resistance

Anchor size			HUD-2			HUD-1		
			5x25	6x30	8x40	10x50	12x60	14x70
Screw type a)			C	C	C	W	W	W
Concrete ≥ C16/20	N_{Rd}	[kN]	0,17	0,34	0,70	1,96	2,80	4,20
	V_{Rd}	[kN]	-	-	-	3,08	4,20	7,84

a) Screw type: W: Wood-screw C: Chipboard screw. Load data are valid for the mentioned woodscrew type, if other types or different screws are used the load capacity may decrease.

Recommended loads b)

Anchor size			HUD-2			HUD-1		
			5x25	6x30	8x40	10x50	12x60	14x70
Screw type a)			C	C	C	W	W	W
Concrete ≥ C16/20	N_{Rec}	[kN]	0,12	0,24	0,5	1,4	2	3
	V_{Rec}	[kN]	-	-	-	2,2	3	5,6

a) Screw type: W: Wood-screw C: Chipboard screw. Load data are valid for the mentioned woodscrew type, if other types or different screws are used the load capacity may decrease.
b) With overall global safety factor γ = 5 to the characteristic loads and a partial safety factor of γ = 1,4 to the design values.
c) chipboard screw 4x40: outer diameter 3,9 mm, core diameter 2,4 mm
chipboard screw 5x50: outer diameter 4,8 mm, core diameter 2,9 mm
chipboard screw 6x50: outer diameter 5,8 mm, core diameter 3,8 mm

Materials

Material quality

Part	Material
Plastic sleeve	Polyamide 6

Setting information

Service temperature range

Hilti HUD-1 universal anchor may be applied in the temperature range given below.

Temperature range	Base material temperature	Max. long term base material temperature	Max. short term base material temperature
Temperature range	-40 °C to +80 °C	+50 °C	+80 °C

Max short term base material temperature

Short-term elevated base material temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

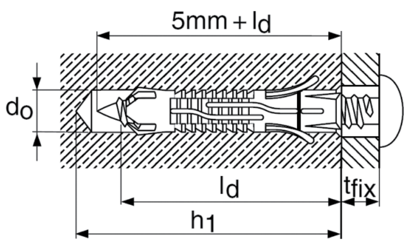
Max long term base material temperature

Long-term elevated base material temperatures are roughly constant over significant periods of time.

Setting details

Anchor size			5x25	6x30	8x40	10x50	12x60	14x70
Nominal diameter of drill bit	d_o	[mm]	5	6	8	10	12	14
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	5,35	6,4	8,45	10,45	12,5	14,5
Depth of drill hole	$h_1 \geq$	[mm]	30	35	45	65	80	90
Effective anchorage depth	h_{nom}	[mm]	25	30	40	50	60	70
Anchor length	l	[mm]	25	30	40	50	60	70
Max fixture thickness	t_{fix}	[mm]	Depending on screw length					
Installation temperature		[°C]	-10 to +40					
Woodscrew diameter [a)]	d	[mm]	3,5 - **4**	4,5 - **5**	5 - **6**	7 - **8**	8 - **10**	10 - **12**

a) The basic loading data are depending on the woodscrew diameters, if other types or different screws are used the load capacity may decrease. Highlighted diameters refer to basic loading data table, except footnotes [a), b), c)] of basic loading data tables.

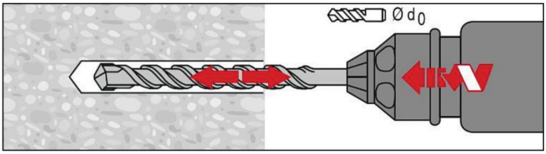
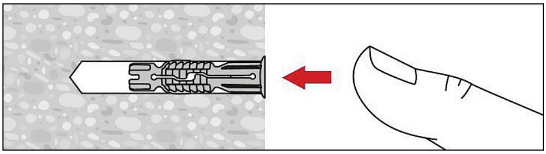
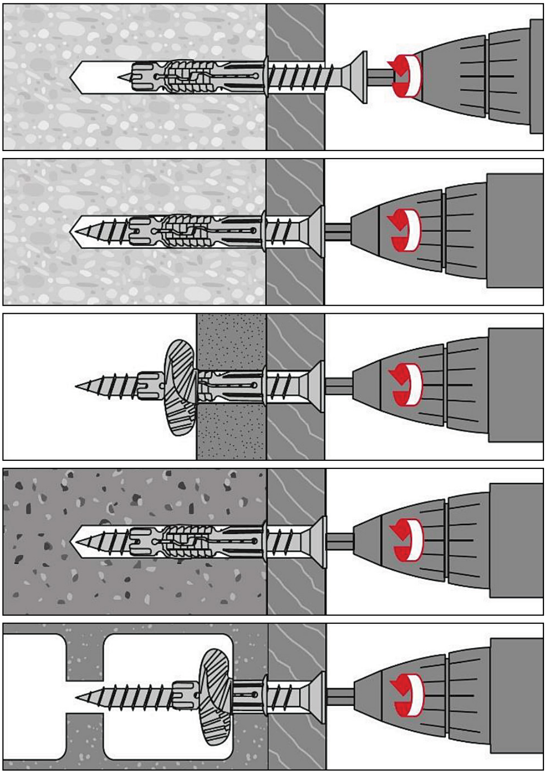


Installation equipment

Anchor size	5x25	6x30	8x40	10x50	12x60	14x70	5x25
Rotary hammer	TE 2- TE16						
Other tools	Screwdriver						

Setting instructions [a)]

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

Setting instructions	
	**1. Drill hole with drill bit**
	**2. Install anchor**
	**3. Drive screw into anchor**

a) Use only for wall and floor applications. Not applicable for ceiling and façade applications.

HUD-L Plastic anchor

Economical universal long plastic anchor

Anchor version

HUD-L
(M6-M8)

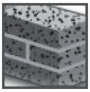
HUD-L
(M10)

Benefits

- Universal plastic anchor applicable in a wide range of base materials
- Daily application
- Excellent setting behaviour

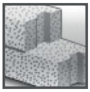
Base material

Non-cracked concrete



Solid brick

Hollow brick



Autoclaved aerated concrete

Drywall

Recommended general notes

* The below clauses based on Hilti product qualifications are for references only. Selection of clauses by the engineer shall be based on the specific application needs. Please contact Hilti's technical team for further details.

- Plastic anchor with ribbed surface for toggling in hollow material, made of polyamide PA6, for use in concrete, solid brick, hollow brick, aerated concrete and drywall.
- Plastic anchor shall have manufacturer information on volatile organic compounds (VOC) content.
- Anchor shall be installed as per the manufacturer's approved procedure and equipment
- The recommended tension load of the anchor should not be not less than __kN (including overall global safety factor γ = 5)

Basic loading data

All data in this section applies to:

- Correct setting (See setting instruction)
- Load data are only valid for the specified woodscrew type
- Load data given in the tables is independent of load direction
- No edge distance and spacing influence
- Base material as specified in the table
- Minimum base material thickness

Characteristic resistance

Anchor size		6x50	8x60	10x70
Screw type [a) b)]		W	W	W
Size		4,5x80	5x90	8
DIN		96	96	571
Concrete ≥ C16/20	F_{Rk} [kN]	1,15	1,4	9,0

a) Load data are valid for the mentioned woodscrew type, if other types or different screws are used the load capacity may decrease.
b) Screw type: W: Wood-screw

Design resistance

Anchor size		6x50	8x60	10x70
Screw type [a) b)]		W	W	W
Size		4,5x80	5x90	8
DIN		96	96	571
Concrete ≥ C16/20	F_{Rd} [kN]	0,32	0,39	2,52

a) Load data are valid for the mentioned woodscrew type, if other types or different screws are used the load capacity may decrease.
b) Screw type: W: Wood-screw

Recommended loads [c)]

Anchor size		6x50	8x60	10x70
Screw type [a) b)]		W	W	W
Size		4,5x80	5x90	8
DIN		96	96	571
Concrete ≥ C16/20	F_{Rec} [kN]	0,23	0,28	1,8
Solid clay brick Mz 12	F_{Rd} [kN]	0,24	0,28	-

a) Load data are valid for the mentioned woodscrew type, if other types or different screws are used the load capacity may decrease.
b) Screw type: W: Wood-screw
c) With overall global safety factor γ = 5 to the characteristic loads and a partial safety factor of γ = 1,4 to the design values.

Materials

Material quality

Part	Material
Plastic sleeve	Polyamide 6

Setting information

Installation temperature

-10°C to +40°C

Service temperature range

Hilti HUD-L universal anchor may be applied in the temperature range given below.

Temperature range	Base material temperature	Max. long term base material temperature	Max. short term base material temperature
Temperature range	-40 °C to +80 °C	+50 °C	+80 °C

Max short term base material temperature

Short-term elevated base material temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

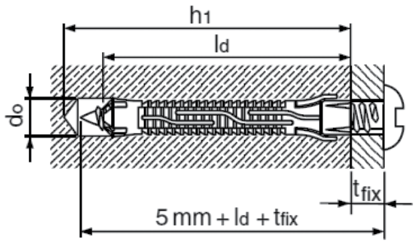
Max long term base material temperature

Long-term elevated base material temperatures are roughly constant over significant periods of time.

Setting details

Anchor size			6x50	8x60	10x70
Nominal diameter of drill bit	d_o	[mm]	6	8	10
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	6,4	8,45	10,45
Depth of drill hole	$h_1 \geq$	[mm]	70	80	90
Effective anchorage depth	h_{nom}	[mm]	47	57	70
Anchor length	l	[mm]	47	57	70
Max fixture thickness	t_{fix}	[mm]	Depending on screw length		
Recommended length of screw in base material	l_d	[mm]	55	65	75
Woodscrew diameter [a)]	d	[mm]	**4,5** - 5	**5** - 6	7 - **8**

a) The basic loading data are depending on the woodscrew diameters, if other types or different screws are used the load capacity may decrease. Highlighted diameters refer to basic loading data table, except footnotes [a), b), c)] of basic loading data tables.

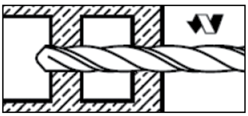
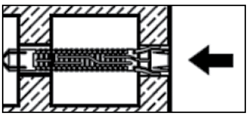
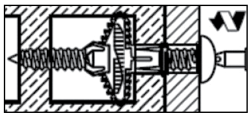
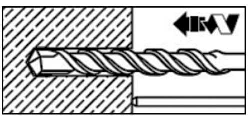
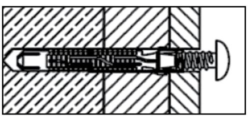
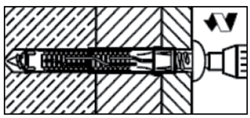


Installation equipment

Anchor size	6x50	8x60	10x70
Rotary hammer	TE 2- TE16		
Other tools	Screwdriver		

Setting instructions [a)]

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

Setting instructions		
1. Drill hole with drill bit 	**2. Install anchor** 	**3. Put part being fastened in place and drive screw into anchor.** 
4. Drill hole with drill bit 	**5. Put part being fastened in place and install anchor** 	**6. Drive screw into anchor** 

a) Use only for wall and floor applications. Not applicable for ceiling and façade applications.

HLD Plastic anchor

Economical plastic anchor for drywall

Anchor version		Benefits
	HLD (M10)	- Plastic undercut anchor - Simple setting - Drywall application

Base material

Drywall

Basic loading data

All data in this section applies to:
- Correct setting (See setting instruction)
- No edge distance and spacing influence
- Base material as specified in the table
- Load data given in the tables is independent of load direction

Characteristic resistance

Anchor size				HLD 2	HLD 3	HLD 4
	Anchoring principle a)					
Gypsum board Thickness 12,5mm	B	F_{Rk}	[kN]	0,4	0,4	0,4
Fibre reinforced gypsum board Thickness 12,5mm	A	F_{Rk}	[kN]	0,3	-	-
Fibre reinforced gypsum board Thickness 2x12,5mm	A	F_{Rk}	[kN]	-	0,6	-
Hollow clay brick	A / B	F_{Rk}	[kN]	0,75	0,75	
Concrete ≥ C16/20	C	F_{Rk}	[kN]	1,25	2	2,5

a) See setting details

Design resistance

Anchor size			HLD 2	HLD 3	HLD 4
	Anchoring principle [a]				
Gypsum board Thickness 12,5mm	B	F_{Rd} [kN]	0,11	0,11	0,11
Fibre reinforced gypsum board Thickness 12,5mm	A	F_{Rd} [kN]	0,08	-	-
Fibre reinforced gypsum board Thickness 2x12,5mm	A	F_{Rd} [kN]	-	0,17	-
Hollow clay brick	A / B	F_{Rd} [kN]	0,21	0,21	-
Concrete ≥ C16/20	C	F_{Rd} [kN]	0,35	0,56	0,70

a) See setting details

Recommended loads [b]

Anchor size			HLD 2	HLD 3	HLD 4
	Anchoring principle [a]				
Gypsum board Thickness 12,5mm	B	F_{Rec} [kN]	0,08	0,08	0,08
Fibre reinforced gypsum board Thickness 12,5mm	A	F_{Rec} [kN]	0,06	-	-
Fibre reinforced gypsum board Thickness 2x12,5mm	A	F_{Rec} [kN]	-	0,12	-
Hollow clay brick	A / B	F_{Rec} [kN]	0,15	0,15	
Concrete ≥ C16/20	C	F_{Rec} [kN]	0,25	0,4	0,5

a) See setting details
b) With overall global safety factor γ = 5 to the characteristic loads and a partial safety factor of γ = 1,4 to the design value.

Materials

Material quality

Part	Material
Sleeve	Polyamide PA 6

Setting information

Installation temperature
-10°C to +40°C

Service temperature range
Hilti HLD universal anchor may be applied in the temperature range given below.

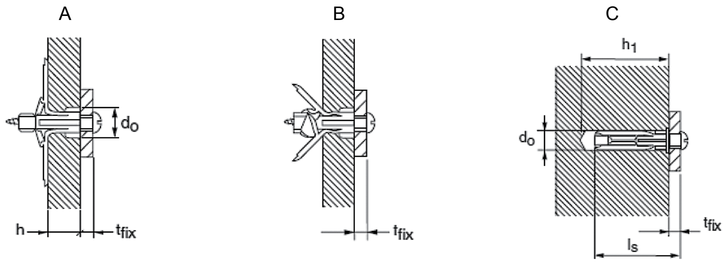
Temperature range	Base material temperature	Max. long term base material temperature	Max. short term base material temperature
Temperature range	-40 °C to +80 °C	+50 °C	+80 °C

Max short term base material temperature
Short-term elevated base material temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Max long term base material temperature
Long-term elevated base material temperatures are roughly constant over significant periods of time.

Setting details

Anchor size				HLD 2	HLD 3	HLD 4
Nominal diameter of drill bit		d_o	[mm]	10		
Depth of drill hole	(only anchoring principle C)	$h_1 \geq$	[mm]	50	56	66
Screw length	(anchoring principle A/B)	l_s	[mm]	$33 + t_{fix}$	$40 + t_{fix}$	$49 + t_{fix}$
	(anchoring principle C)	l_s	[mm]	$40 + t_{fix}$	$46 + t_{fix}$	$56 + t_{fix}$
Screw diameter	(anchoring principle A/B)	d_s	[mm]	4 - 5		
	(anchoring principle C)	d_s	[mm]	5 - 6		
Wall / panel thickness	(anchoring principle A)	h	[mm]	4 – 12	15 – 19	24 - 28
	(anchoring principle B)	h	[mm]	12 – 16	19 – 25	28 - 32
	(anchoring principle C)	h		35	42	50



Installation equipment

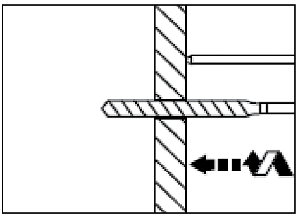
Anchor size	HLD 2	HLD 3	HLD 4
Rotary hammer	TE 2- TE16		
Other tools	Screwdriver		

Setting instruction

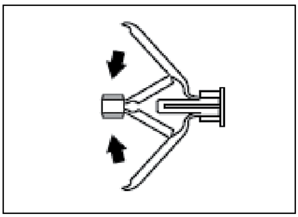
*** For detailed information on installation see instruction for use given with the package of the product.**

Setting instruction

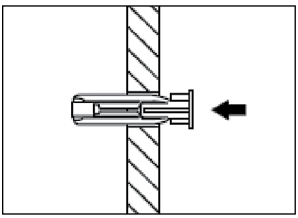
1. Drill hole with drill bit



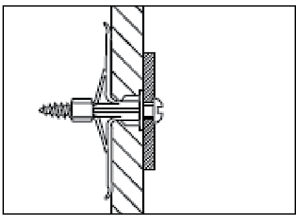
2. Install anchor



3. Install anchor

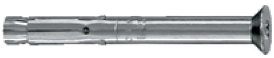
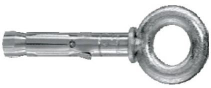


4. Drive in the screw



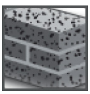
HLC Light duty metal anchor

Economical sleeve anchor

Anchor version			Benefits
	HLC (M5-M16)	Hex head nut with pressed-on washer	- Various head shapes and fastenings thickness
	HLC-H (M5-M16)	Bolt version with washer	
	HLC-L (M5-M16)	Torx round head	
	HLC-SK (M5-M16)	Torx counter sunk head	
	HLC-EC (M5-M16)	Loop-hanger head, eyebolt closed	
	HLC-EO (M5-M16)	Loop-hanger head, eyebolt open	
	HLC-T (M5-M16)	Ceiling hanger	

Base material


Non-cracked concrete


Solid brick

Load condition


Fire resistance

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
Fire test report	IBMB, Braunschweig	PB 3093/517/07-CM / 2007-09-10
Assessment report (fire)	Warringtonfire	WF 327804/A / 2013-07-10

Basic loading data (for a single anchor)

All data in this section is Hilti technical data and applies to:
- Correct setting (See setting instruction)
- No edge distance and spacing influence
- Concrete as specified in the table
- *Steel* failure
- Minimum base material thickness
- Concrete C 20/25, $f_{ck,cube}$=25 N/mm²

Effective anchorage depth

Anchor size		M5	M6	M8	M10	M12	M16
Nominal embedment depth	h_{ef} [mm]	16	26	31	33	41	41

Characteristic resistance

Anchor size		M5	M6	M8	M10	M12	M16
Tension N_{Rk}	[kN]	2,1	3,5	4,5	7,2	10,0	13,2
Shear V_{Rk}	[kN]	3,2	7,0	8,8	14,4	20,0	20,0

Design resistance

Anchor size		M5	M6	M8	M10	M12	M16
Tension N_{Rd}	[kN]	1,2	2,0	2,5	4,0	5,6	7,4
Shear V_{Rd}	[kN]	1,8	3,9	4,9	8,0	11,1	11,1

Recommended loads [a)]

Anchor size		M5	M6	M8	M10	M12	M16
Tension N_{Rec}	[kN]	0,7	1,2	1,5	2,4	3,3	4,4
Shear V_{Rec}	[kN]	1,1	2,3	2,9	4,8	6,7	6,7

a) Includes global safety factor of 3.0

Materials

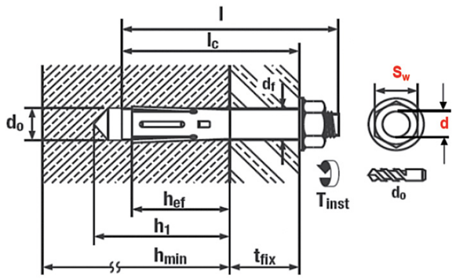
Material quality

Part		Material
Anchor	HLC HLC-EC HLC-EO	Carbon steel tensile strength 500 MPa galvanized to min. 5 µm
	HLC-H HLC-L HLC-SK HLC-T	Steel Bolt Strength 8.8, galvanized to min 5 µm

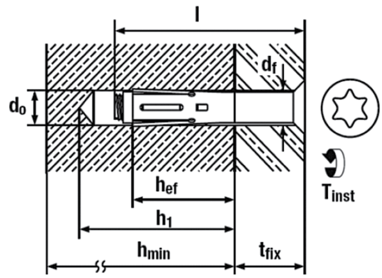
Anchor dimensions

Anchor version	Thread size	h_{ef} [mm]	d [mm]	l [mm]	l_c [mm]	t_{fix} [mm]
HLC, HLC-H, HLC-EC/EO carbon steel anchors	6,5 x 25/5	16	M5	30	25	5
	6,5 x 40/20			45	40	20
	6,5 x 60/40			65	60	40
	8 x 40/10	26	M6	46	40	10
	8 x 55/25			61	55	20
	8 x 70/40			76	70	40
	8 x 85/55			91	85	55
	10 x 40/5	31	M8	48	40	5
	10 x 50/15			58	50	15
	10 x 60/25			68	60	25
	10 x 80/45			88	80	45
	10 x 100/65			108	100	65
	12 x 55/15	33	M10	65	55	15
	12 x 75/35			85	75	35
	12 x 100/60			110	100	60
	16 x 60/10	41	M12	72	60	10
	16 x 100/50			112	100	60
	16 x 140/90			152	140	95
	20 x 80/25	41	M16	95	80	25
	20 x 115/60			130	115	60
	20 x 150/95			165	150	95
HLC-SK carbon steel anchors	6,5 x 45/20	16	M5	45	-	20
	6,5 x 65/40			65		40
	6,5 x 85/60			85		60
	8 x 60/25	26	M6	60	-	25
	8 x 75/40			75		40
	8 x 90/55			90		55
	10 x 45/5	31	M8	45	-	5
	10 x 85/45			85		45
	10 x 105/65			105		65
	10 x 130/95			130		95
	12 x 55/15	33	M10	80	-	35

HLC, HLC-H, HLC-EC/EO, HLC-L



HLC-SK



Setting information

Setting details HLV

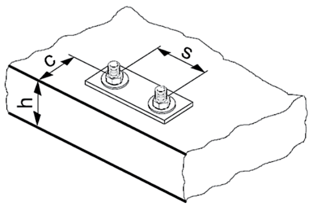
<table>
<tr><th colspan="4">Anchor size</th><th>M5</th><th>M6</th><th>M8</th><th>M10</th><th>M12</th><th>M16</th></tr>
<tr><td colspan="2">Nominal diameter of drill bit</td><td>d_0</td><td>[mm]</td><td>6,5</td><td>8</td><td>10</td><td>12</td><td>16</td><td>20</td></tr>
<tr><td colspan="2">Cutting diameter of drill bit</td><td>$d_{cut} \leq$</td><td>[mm]</td><td>6,4</td><td>8,45</td><td>10,45</td><td>12,5</td><td>16,5</td><td>20,55</td></tr>
<tr><td colspan="2">Depth of drill hole</td><td>$h_1 \geq$</td><td>[mm]</td><td>30</td><td>40</td><td>50</td><td>65</td><td>75</td><td>85</td></tr>
<tr><td rowspan="3">Width across nut flats</td><td>HLC</td><td>SW</td><td>[mm]</td><td rowspan="2">8</td><td rowspan="2">10</td><td rowspan="2">13</td><td>15</td><td rowspan="2">19</td><td rowspan="2">24</td></tr>
<tr><td>HLC-H</td><td>SW</td><td>[mm]</td><td>17</td></tr>
<tr><td>HLS-SK</td><td colspan="2">Driver</td><td>PZ 3</td><td>T 30</td><td>T 40</td><td>T 40</td><td>-</td><td>-</td></tr>
<tr><td colspan="2">Diameter of clearance hole in the fixture</td><td>$d_f \leq$</td><td>[mm]</td><td>7</td><td>10</td><td>12</td><td>14</td><td>18</td><td>21</td></tr>
<tr><td colspan="2">Effective anchorage depth</td><td>h_{ef}</td><td>[mm]</td><td>16</td><td>26</td><td>31</td><td>33</td><td>41</td><td>41</td></tr>
<tr><td colspan="2">Max. torque moment concrete</td><td>T_{inst}</td><td>[Nm]</td><td>5</td><td>8</td><td>25</td><td>40</td><td>50</td><td>80</td></tr>
<tr><td colspan="2">Max. torque moment masonry</td><td>T_{inst}</td><td>[Nm]</td><td>2,5</td><td>4</td><td>13</td><td>20</td><td>25</td><td>-</td></tr>
</table>

Installation equipment

<table>
<tr><th>Anchor size</th><th>M5</th><th>M6</th><th>M8</th><th>M10</th><th>M12</th></tr>
<tr><td>Rotary hammer for setting</td><td colspan="5">TE 2 – TE 16</td></tr>
<tr><td>Other tools</td><td colspan="5">hammer, torque wrench, blow up pump</td></tr>
</table>

Setting parameters

Anchor size			M6	M8	M10	M10	M12	M16
Minimum base material thickness	h_{min}	[mm]	60	70	80	100	100	120
Critical spacing for splitting failure and concrete cone failure	s_{cr}	[mm]	60	100	120	130	160	160
Critical edge distance for splitting failure and concrete cone failure	c_{cr}	[mm]	30	50	60	65	80	80

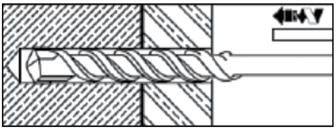


Setting instruction

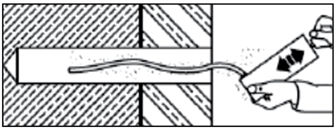
*** For detailed information on installation see instruction for use given with the package of the product.**

Setting instruction for HLC

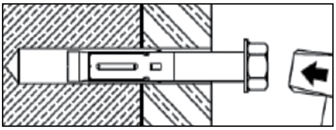
1. Drill hole with drill bit



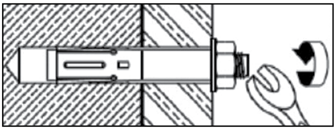
2. Blow out dust and fragments



3. Install anchor



4. Apply torque



Basic loading data (for a single anchor) in solid masonry units

All data in this section applies to

- Load values valid for holes drilled with TE rotary hammers in hammering mode
- Correct anchor setting (see instruction for use, setting details)
- The core / material ratio may not exceed 15% of a bed joint area.
- The brim area around holes must be at least 70mm
- Edge distances, spacing and other influences, see below

Anchorage depth

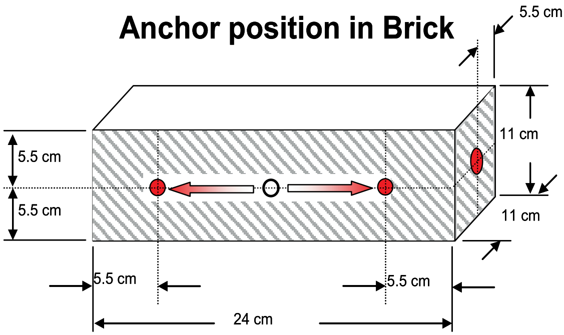
Anchor size			M5	M6	M8	M10	M12
Nominal anchorage depth	h_{nom}	[mm]	16	26	31	33	41

Recommended loads [a)]

Anchor size				M5	M6	M8	M10	M12
Solid clay brick Mz12/2,0 (Germany, Austria, Switzerland)								
	DIN 105/ EN 771-1 f_b [b)] ≥ 12 N/mm²	Tension N_{Rec} [c)]	[kN]	0,3	0,5	0,6	0,7	0,8
		Shear V_{Rec} [c)]	[kN]	0,45	1,0	1,2	1,4	1,6
Solid clay brick Mz12/2,0 (Germany, Austria, Switzerland)								
	DIN 106/ EN 771-2 f_b [b)] ≥ 12 N/mm²	Tension N_{Rec} [d)]	[kN]	0,4	0,5	0,6	0,8	0,8
		Shear V_{Rec} [d)]	[kN]	0,65	1,0	1,2	1,6	1,6

a) Recommended load values for German base materials are based on national regulations.
b) f_b=brick strength
c) Values only valid for M_z(DIN 105) with brick strength ≥ 19 N/mm², density 2,0 kg/dm³, min. brick size NF (24,0 cm x 11,5 cm x 11,5 cm)
d) Values only valid for K_s(DIN 106) with brick strength ≥ 29 N/mm², density 2,0 kg/dm³, min. brick size NF (24,0 cm x 11,5 cm x 11,5 cm)

Permissible anchor location in brick and block walls



Edge distance and spacing influences

- The technical data for the HLC sleeve anchors are reference loads for MZ 12 and KS 12. Due to the large variation of natural stone solid bricks, on site anchor testing is recommended to validate technical data.
- The HLC anchor was installed and tested in the centre of solid bricks as shown. The HLC anchor was not tested in the mortar joint between solid bricks or in hollow bricks, however a load reduction is expected.
- For brick walls where anchor position in brick cannot be determined, 100% anchor testing is recommended.
- Distance to free edge free edge to solid masonry (Mz and KS) units ≥ 300 mm
- The minimum distance to horizontal and vertical mortar joint (c_{min}) is stated in the drawing above.
- Minimum anchor spacing (s_{min}) in one brick/block is ≥ $2*c_{min}$

Limits

- Applied load to individual bricks may not exceed 1,0 kN without compression or 1,4 kN with compression
- All data is for multiple use for non-structural applications

Plaster, graveling, lining or levelling courses are regarded as non-bearing and may not be taken into account for the calculation of embedment depth.

HHD-S Light duty metal anchor

Economical cavity anchor

Anchor version

HHD-S
(M4-M8)

Benefits

- Metal undercut anchor with metric screw for drywall
- Metal to metal fastening
- Reliable undercut

Base material

Drywall

Basic loading data (for a single anchor)

All data in this section applies to:
- Correct setting (See setting instruction)
- No edge distance and spacing influence
- Base material as specified in the table
- Borehole drilling without hammering

Recommended loads [a)]

Anchor size			M4	M5	M6	M8
Hollow brick web thickness 20mm	N_{Rd}	[kN]	0,1	-	-	-
	V_{Rd}	[kN]	0,3	-	-	-
Gypsum board Thickness 10mm	N_{Rd}	[kN]	0,2	0,2	0,2	0,2
	V_{Rd}	[kN]	0,5	0,5	0,5	0,5
Gypsum board Thickness 12,5mm	N_{Rd}	[kN]	0,2	0,2	0,2	0,2
	V_{Rd}	[kN]	0,5	0,5	0,5	0,5
Gypsum board Thickness 2x12,5mm	N_{Rd}	[kN]	-	0,4	0,3	0,4
	V_{Rd}	[kN]	-	1	0,9	1
Fibre reinforced gypsum board Thickness 10mm	N_{Rd}	[kN]	0,2	0,3	0,25	0,4
	V_{Rd}	[kN]	0,5	0,6	0,8	0,9
Fibre reinforced gypsum board Thickness 12,5mm	N_{Rd}	[kN]	0,3	0,5	0,3	0,6
	V_{Rd}	[kN]	0,6	1	1	1,2
Fibre reinforced gypsum board Thickness 2x12,5mm	N_{Rd}	[kN]	-	0,9	0,8	0,9
	V_{Rd}	[kN]	-	1,1	1,8	1,7

a) With overall global safety factor γ = 3.0 to the characteristic loads and a partial safety factor of γ = 1,4 to the design values.

Materials

Material quality

Part	Material
Plastic sleeve	Carbon steel, galvanised
Screw	Carbon steel, galvanised

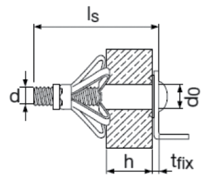
Setting information

Setting details HHD-S

Anchor			M4x4	M4x6	M4x12	M4x19	M5x8	M5x12	M5x25
Nominal diameter of drill bit	d_o	[mm]	8	8	8	8	10	10	10
Anchor length	l	[mm]	20	32	38	45	38	52	65
Anchor neck length	h	[mm]	4	6	12,5	19	8	12,5	25
Screw length	$l_S \geq$	[mm]	25	39	45	52	45	58	71
Screw diameter	d	[mm]	M4	M4	M4	M4	M5	M5	M5
Panel thickness	$h_{min,max}$	[mm]	3 - 4	6 - 7	10 - 13	18 - 20	6 - 8	11 - 13	23 - 25
Max. fixable thickness for pre-setting	t_{fix}	[mm]	15	25	25	25	25	30	30

Setting details HHD-S

Anchor			M6x9	M6x12	M6x24	M6x40	M8x12	M8x24	M8x40
Nominal diameter of drill bit	d_o	[mm]	12	12	12	12	12	12	12
Anchor length	l	[mm]	38	52	65	80	54	66	83
Anchor neck length	h	[mm]	9	12,5	25	40	12,5	25	40
Screw length	$l_S \geq$	[mm]	45	58	71	88	60	72	90
Screw diameter	d	[mm]	M6	M6	M6	M6	M8	M8	M8
Panel thickness	$h_{min,max}$	[mm]	7 - 9	11 - 13	23 - 25	38 - 40	11 - 13	23 - 25	38 - 40
Max. fixable thickness for pre-setting	t_{fix}	[mm]	20	30	30	30	30	30	35



Installation equipment

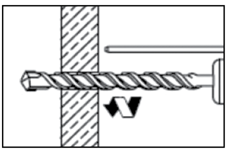
Anchor	M4	M5	M6	M8
Rotary hammer	TE2 - TE16			
Other tools	Screwdriver, HHD-SZ2 expansion tool			

Setting instruction

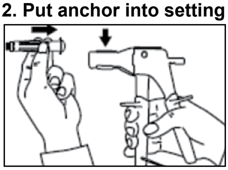
*** For detailed information on installation see instruction for use given with the package of the product.**

Setting instructions

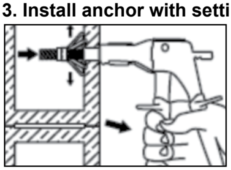
1. Drill hole with drill bit



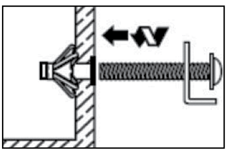
2. Put anchor into setting tool

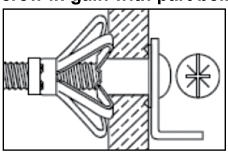


3. Install anchor with setting tool



4. Remove screw from anchor and screw in gain with part being fastened attached

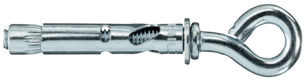




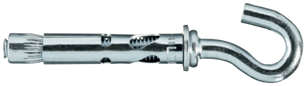
HA 8 NG Light duty metal anchor

Hook and ring anchor

Anchor version



HA 8 NG R1



HA 8 NG H1

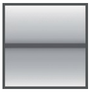
Benefits

- Well proven
- Easy-setting
- Follow-up expansion
- Hook and ring head available

Base material

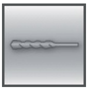
Non-cracked concrete

Load conditions



Static/ quasi-static

Installation conditions



Hammer drilled holes

Basic loading data (for a single anchor)

All data in this section applies to:

- Correct setting (See setting instruction)
- No edge distance and spacing influence
- Values are only valid for tensile loading
- Concrete C20/25 to C50/60

Recommended loads

Concrete		Non-cracked
Tensile N_{rec}	[kN]	0,8

Materials

Mechanical properties

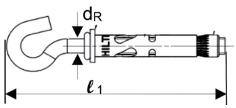
Anchor size			HA 8 NG bolt
Nominal tensile strength	f_{uk}	[N/mm²]	520
Yield strength	f_{yk}	[N/mm²]	450

Material quality

Part	Material
Expansion sleeve	Carbon steel, galvanized to min. 5 µm
Bolt	Carbon steel, galvanized to min. 5 µm

Anchor dimensions

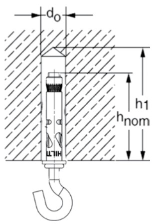
Anchor size			HA 8 NG
Bolt diameter	d_R	[mm]	5,4
Length of the anchor	l_1	[mm]	76



Setting information

Setting details

Anchor size			HA 8 NG
Nominal diameter of drill bit	d_o	[mm]	8
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	8,45
Depth of drill hole	$h_1 \geq$	[mm]	55
Effective anchorage depth	h_{ef}	[mm]	35

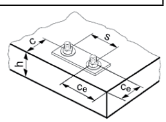


Installation equipment

Anchor size	HA 8 NG
Rotary hammer	TE2 – TE16
Other tools	Hammer, blow out pump

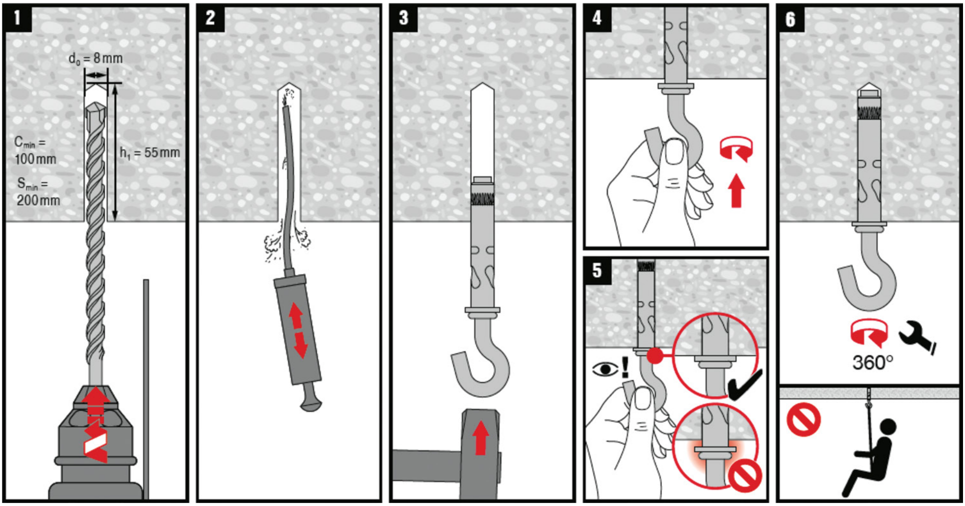
Setting parameters

Anchor size			HA 8 NG
Minimum base material thickness	h_{min}	[mm]	100
Minimum spacing	s	[mm]	200
Minimum edge distance	c	[mm]	100
Minimum edge distance at the corner	c_e	[mm]	150



Setting instruction

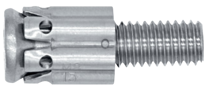
*** For detailed information on installation see instruction for use given with the package of the product.**



HSU-R Stone undercut anchor

Stone undercut anchor for fastening of stone panels

Anchor version



HSU-R
(M6-M8)

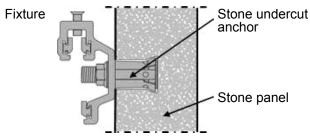
Benefits

- Setting mark to verify undercut completion
- Optimized sleeve size reduces the possibility of sleeve spinning
- Performance assessed by European Approval body per the latest standard

Base material

Natural stone

Application



Fastening stone panel

Other information

European Technical Assessment

A4 316

Corrosion resistance

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European technical approval [a)]	DIBt, Berlin	ETA-16/0784 / 2018-01-16

a) Data given in this section according ETA-16/0784 issue 2018-01-16

Recommended general notes

* The below clauses based on Hilti product qualifications are for references only. Selection of clauses by the engineer shall be based on the specific application needs. Please contact Hilti's technical team for further details.

- Anchor shall have European Technical Assessment (ETA)
- Anchor shall have a corrosion resistance of A4 stainless steel
- Drill hole for anchor shall be checked by designated/approved hole checking gauge according to the manufacturer's recommendation
- Anchor shall have head mark for identification upon installation
- Anchor shall be tightened as per the manufacturer's recommendation
- Anchor shall have a mechanical locking device to prevent rotation during tightening
- Anchor shall have setting indication to verify the correct setting after installation
- Anchor shall be installed as per the manufacturer's approved procedure and equipment

Basic loading data (single anchor)

All data in this section applies to:

- Correct anchor setting (see instruction for use, setting parameters)
- The resistance of steel failure provided by this technical data manual may not be lowest resistance for all failure modes of a stone undercut installed in natural stone.
- The resistance in natural stone provided by this technical data manual are valid only for the exact same natural stone panels or for those panels with equal or higher flexural strength, equal or larger edge distances and thicknesses.
- The resistance of the stone panel shall be verified in addition to the anchor resistance.
- For natural stone panels, tests and evaluation shall be used by responsible engineer to define the final resistance.

Characteristic resistance under tension and shear load – steel resistance

Anchor size		M6	M8
$N_{Rk,s}$	[kN]	16,1	29,3
$V_{Rk,s}$	[kN]	8,0	14,6

Characteristic resistance – in natural stone panels

- Please request reference test reports from your Hilti representative
- The resistance of the stone panel shall be verified in addition to the anchor resistance

Materials

Mechanical properties

Anchor size			M6	M8
Nominal tensile strength	$f_{uk,\ thread}$	[N/mm^2]	800	800
Stressed cross-section	A_s	[mm^2]	20.1	36.6

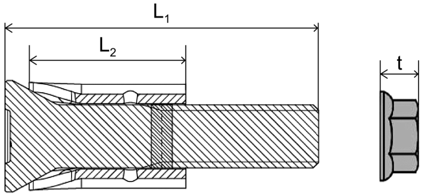
Material quality

Part	Material
Cone bolt with expansion sleeve	Stainless steel A4 according to EN 10 088: 2014
Serrated flange nut	Stainless steel A4 according to EN 10 088: 2014

Anchor dimensions [a)]

Anchor size			**M6**	**M8**
Minimum length of the anchor	$L_{1, min}$	[mm]	24	28
Maximum length of the anchor	$L_{1, max}$	[mm]	32	38
Length of expansion sleeve	L_2	[mm]	13/15	15/21
Serrated flange nut	t	[mm]	7	9

a) Please refer to Hilti Hong Kong website or contact your Hilti representative for the catalogue for standard portfolio

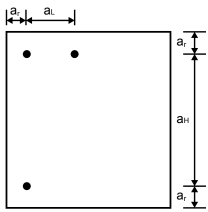


Setting information

Setting details applicable to natural stone type

Stone group [a)]			**I / II**	**III / IV**
Panel thickness	h	[mm]	$20 \le h_s + 5mm \le 70$	$30 \le h_s + 10mm \le 70$
Recommended min. edge distance [b)]	a_R	[mm]	50	
Recommended min. edge distance [b)]	a_L & a_H	[mm]	$8 \cdot h_s$	

a) Refer to below stone classification for information on stone group
b) For small fitting or fill-in pieces the minimum edge distance or spacing shall be chosen per the geometrical boundary conditions. Testing can be done to verify smaller edge distances and spacing



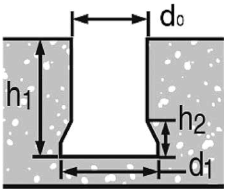
Stone group [a)]		**Natural stone type**
I	High-quality intrusive rocks (plutonic rocks)	Granite, granitite, tonalite, diorite, monzonite, gabbro, other magmatic plutonic rocks
II	Metamorphic rocks with “hard stone characteristics” [b)]	quarzite, granulite, gneiss, migmatite
III	High-quality extrusive rocks (volcanic rocks)	Basalt and basalt lava without harmful ingredients [c)] (e.g. sun burner basalt)
IV	Sedimentary rocks with “hard stone characteristics” [b)]	Sandstone, limestone and marble [c)]

a) Stone group to be determined based on petrographic information provided by the stone supplier
b) For façade panels made of natural stones with planes of anisotropies, the difference between the flexural strength determined parallel to the planes of anisotropy and perpendicular to the edges of the planes of anisotropy shall not be more than 50%.
c) For design based on EOTA Technical Report, refer to ETA 16/0784 for applicable boundary conditions

Setting parameters [a)]

Size			M6	M8
Setting depth	h_s	[mm]	$(10 \le h_s \le 25)$ + 0,4/-0,1	
Drill hole depth	h_1	[mm]	h_s + 0,5	
Diameter of drill hole	d_0	[mm]	11 + 0,4/-0,2	13 + 0,4/-0,2
Diameter of undercut	d_1	[mm]	13,5 ± 0,3	15,5 ± 0,3
Height of undercut	h_2	[mm]	4,5 ± 0,5	4,5 ± 0,5
Installation torque moment	T_{inst}	[Nm]	6	10
Width across flats	SW	[mm]	10	13
Max. diameter of clearance hole in fixture	d_f	[mm]	7	9
Max. fixture thickness	t_{fix}	[mm]	10	8

a) Refer to *Instruction for use* (IFU) for specific anchor installation parameters



Installation equipment

Anchor size	M6	M8
Diamond coring	HSU ADT G 220V	
	HSU CDB 11/13.5	HSU CDB 13/15.5
Hole inspection gauge	HSU IG M6	HSU IG M8
Setting tool	HSU ST-G M6 manual	HSU ST-G M8 manual
Other tools	Hammer, toque wrench	

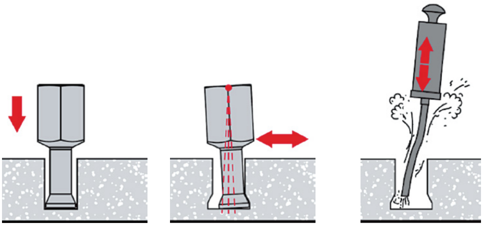
Setting instructions

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

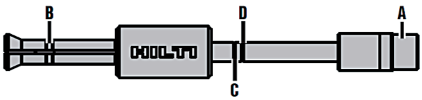
Safety regulations.

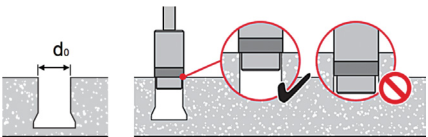
Review the Material Safety Data Sheet (MSDS) before use for proper and safe handling! Wear well-fitting protective goggles and protective gloves when working with Hilti HSU-R.

Drilling and cleaning of the undercut drill hole

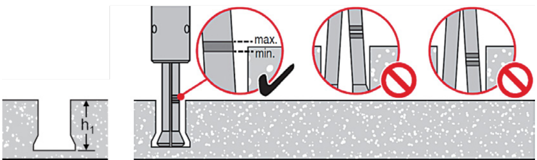


Checking dimensions of drill hole with gauge

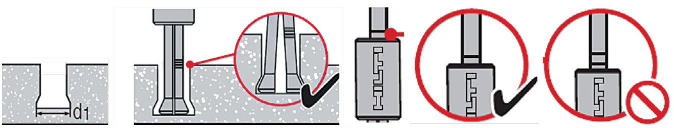




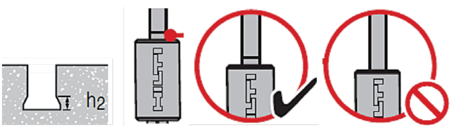
A) Drill hole diameter d_0



B) Drill hole depth h_1

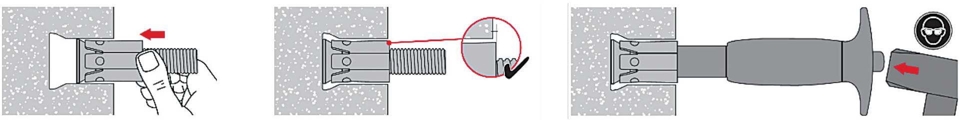


C) Diameter of the undercut d_1

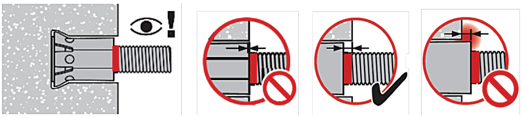


D) H eight of the undercut h_2

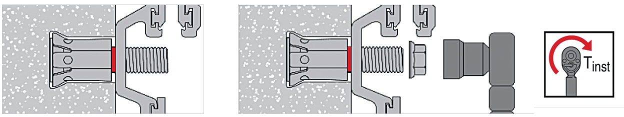
Installation of the undercut anchor



Checking of the setting depth



Installation of the fixture



CHEMICAL ANCHORS

IMPROVE WORKMANSHIP BY SAFESET SYSTEM

Hilti SafeSet Technology

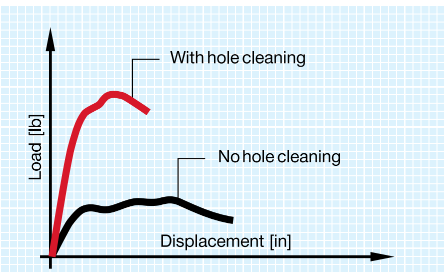
Now you can design post-installed rebar connections with more confidence. Inadequately cleaning holes during installation can reduce the performance of conventional chemical anchor systems significantly. Hilti SafeSet technology eliminates this factor almost entirely - in both cracked or uncracked concrete.

Cleaning while drilling.

Hollow drill bits + HIT-HY 200-R / HIT-RE 100/ HIT-RE 500-V3

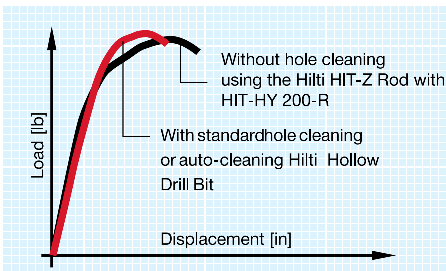
Hilti TE-CD and TE-YD hollow drill bits, in conjunction with HIT-HY 200-R, HIT-RE 100 or HIT-RE 500-V3, make subsequent hole cleaning completely unnecessary. Dust is removed by the Hilti vacuum system while drilling is in progress for faster drilling and a virtually dustless working environment.

Potential effects of no hole cleaning



The loading performance of a threaded rod or rebar with conventional injection adhesive may be very low if the hole is inadequately cleaned after drilling. The Hilti SafeSet system eliminates a cleaning step while still providing excellent load values.

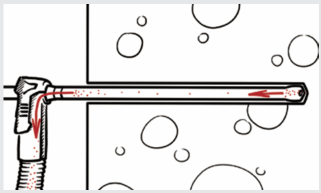
Hilti adhesive with SafeSet Technology

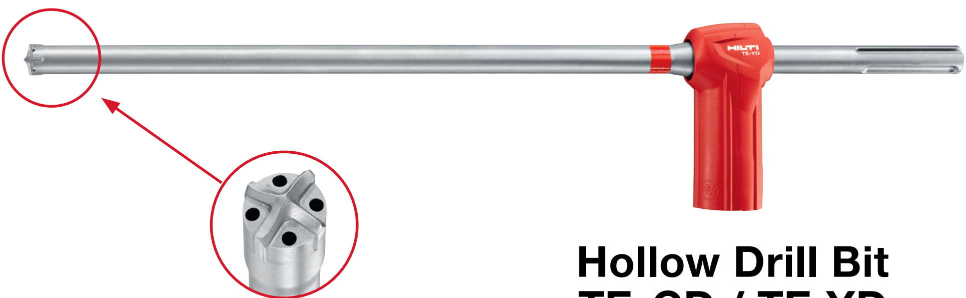


The new SafeSet system featuring HIT-HY 200-R allows a fastening point to take high loads, as if the hole were cleaned using standard hole cleaning methods.

Technical data

Rebar diameter range	Y8 to Y25
Threaded rod diameters	M10 to M30
Embedment depth	Up to 1000 mm
Concrete compressive strengths	C20/25 to C50/60
Installation temperature range	-10 °C to 40 °C





Hollow Drill Bit TE-CD / TE-YD

Hilti HIT-HY 200-R mortar for concrete

Ultimate performance hybrid mortar for heavy anchoring in concrete

Injection mortar system

Hilti HIT- HY 200-R

500 ml foil pack
(also available as
330 ml foil pack)

Anchor rods:
HIT-Z
HIT-Z-F
HIT-Z-R
(M8-M20)

Internally threaded
sleeves:
HIS-N
HIS-RN
(M8-M20)

Anchor rod:
HAS-U
HDG
HAS-U A4
HAS-U HCR
AM 8.8 (HDG)
(M8-M39)

Benefits

- Maximum load performance in cracked concrete and non-cracked concrete
- SafeSet technology: drilling and borehole cleaning in one step with Hilti hollow drill bit
- Small edge distance and anchor spacing possible
- ETA Approved for seismic performance category C1, C2 [a)]

a) Please contact your Hilti representative for seismic resistance data

Base material

Non-cracked concrete

Cracked concrete (Tension zone)

Installation conditions

Hammer drilled holes

Diamond drilled holes [c)]

SAFESET

Hilti SafeSet technology

Variable embedment depth

Small edge distance and spacing

Load conditions

Static/ quasi-static

Seismic, ETA-C1, C2 [a)]

Fire resistance

Other information

European Technical Assessment

CE conformity

A4 316

Corrosion resistance [b)]

HCR highMo

High corrosion resistance [b)]

PROFIS Engineering Suite

a) HIS-N internally threaded sleeves not approved for Seismic category C2.
b) High Corrosion resistant rods available only for HIT-V. Corrosion resistant rods available for HIT-V and HIS-N
c) Diamond drilling only covered for HIT-Z rods

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European technical Assessment [a)]	DIBt, Berlin	ETA-12/0084 / 2017-07-28 (HY200 R)
European technical Assessment [a)]	DIBt, Berlin	ETA-12/0028 / 2017-05-30 (HY200 R)
Fire test report	IBMB, Brunswick	3501/676/13 / 2012-08-03

a) All data given in this section according to ETA-11/0493 issue 2017-07-28, ETA-12/0006 issue 2017-05-30, ETA-12/0084 issue 2017-07-28 and ETA-12/0028 issue 2017-05-30

Recommended general notes

* The below clauses based on Hilti product qualifications are for references only. Selection of clauses by the engineer shall be based on the specific application needs. Please contact Hilti's technical team for further details.

- Fast cure adhesive mortar for anchor fastenings in uncracked and cracked concrete
- HIT-Z application: Adhesive anchors system shall be bonded expansion anchor type to cracked and uncracked concrete.
- HIT-Z application: Anchor shall be approved for use in diamond cored holes.
- Anchor shall be approved for overhead installation.
- For overhead or deep embedment depth (>250mm) installation, specialized accessories shall be applied to ensure drill hole is fully grouted with no voids.
- Borehole drilled and cleaned in one step with Hilti hollow drill bit is recommended to reduce installation error.
- Anchors shall obtain the European Technical Assessment (ETA) report.
- The anchor bolt design shall be done either according to "ETAG001 Annex C Design Method" issued by EOTA or "Guides on design of post-installed anchor bolt systems in Hong Kong" issued by HKISC.
- Anchors shall be tested in accordance to either ETAG-001 Annex A or ACI 355.2 by accredited laboratories under HOKLAS Mutual Recognition Arrangement (MRA) Partners.
- Anchor to be approved by WRAS and NSF for use in contact with drinking water.

Static and quasi-static resistance (for a single anchor)

All data in this section applies to:

- Correct setting (See setting instruction)
- No edge distance and spacing influence
- *Steel* failure
- Minimum base material thickness
- One typical embedment depth, as specified in the table
- One anchor material, as specified in the tables
- Concrete C 20/25, $f_{ck,cube}$ = 25 N/mm²
- Temperature range I (min. base material temp. -40°C, max. long/short term base material temp.: +24°C/40°C)

For hammer drilled holes, hammer drilled holes with Hilti hollow drill bit:

Anchorage depth [a)]

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
HAS-U										
Embedment depth	$h_{ef}=h_{nom,min}$	[mm]	80	90	110	125	170	210	240	270
Base material thickness		[mm]	110	120	140	160	220	270	300	340
HIS-N										
Embedment depth	$h_{ef}=h_{nom,min}$	[mm]	90	110	125	170	205	-	-	-
Base material thickness		[mm]	120	150	170	230	270	-	-	-
HIT-Z										
Effective anchorage depth [b)]	$h_{ef}=l_{Helix}$	[mm]	50	60	60	96	100	-	-	-
Effective embedment depth [c)]	$h_{ef}=h_{nom,min}$	[mm]	70	90	110	145	180	-	-	-
Base material thickness		[mm]	130	150	170	245	280	-	-	-

a) The allowed range of embedment depth is shown in the setting details
b) For combined pull-out and concrete cone failure
c) For concrete cone failure

Characteristic resistance

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete										
Tension N_{Rk}	HAS-U 5.8	[kN]	*18,0*	*29,0*	*42,0*	70,6	109	150	183	218
	HAS-U 8.8		*29,0*	42,0	56,8	68,7	109	150	183	218
	HAS-U A4		*26,0*	*41,0*	56,8	68,7	109	150	183	218
	HAS-U HCR		*29,0*	42,0	56,8	68,7	109	150	183	218
	HIS-N 8.8		*25,0*	*46,0*	*67,0*	109	*116*	-	-	-
	HIT-Z a)		*24,0*	*38,0*	54,3	*96,0*	133	-	-	-
Shear V_{Rk}	HAS-U 5.8	[kN]	*9,0*	*15,0*	*21,0*	*39,0*	*61,0*	*88,0*	*115*	*140*
	HAS-U 8.8		*15,0*	*23,0*	*34,0*	*63,0*	*98,0*	*141*	*184*	*224*
	HAS-U A4		*13,0*	*20,0*	*30,0*	*55,0*	*86,0*	*124*	*115*	*140*
	HAS-U HCR		*15,0*	*23,0*	*34,0*	*63,0*	*98,0*	*124*	*161*	*196*
	HIS-N 8.8		*13,0*	*23,0*	*34,0*	*63,0*	*58,0*	-	-	-
	HIT-Z a)		*12,0*	*19,0*	*27,0*	*48,0*	*73,0*	-	-	-
Cracked concrete										
Tension N_{Rk}	HAS-U 5.8	[kN]	15,1	21,2	35,2	48,1	76,3	105	128	153
	HAS-U 8.8		15,1	21,2	35,2	48,1	76,3	105	128	153
	HAS-U A4		15,1	21,2	35,2	48,1	76,3	105	128	153
	HAS-U HCR		15,1	21,2	35,2	48,1	76,3	105	128	153
	HIS-N 8.8		24,7	39,7	48,1	76,3	101	-	-	-
	HIT-Z a)		22,5	32,9	44,4	67,2	93,0	-	-	-
Shear V_{Rk}	HAS-U 5.8	[kN]	*9,0*	*15,0*	*21,0*	*39,0*	*61,0*	*88,0*	*115*	*140*
	HAS-U 8.8		*15,0*	*23,0*	*34,0*	*63,0*	*98,0*	*141*	*184*	*224*
	HAS-U A4		*13,0*	*20,0*	*30,0*	*55,0*	*86,0*	*124*	*115*	*140*
	HAS-U HCR		*15,0*	*23,0*	*34,0*	*63,0*	*98,0*	*124*	*161*	*196*
	HIS-N 8.8		*13,0*	*23,0*	*34,0*	*63,0*	*58,0*	-	-	-
	HIT-Z a)		*12,0*	*19,0*	*27,0*	*48,0*	*73,0*	-	-	-

a) Hilti anchor rod HIT-Z-F: M16 and M20

Design resistance

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete										
Tension N_{Rd}	HAS-U 5.8	[kN]	*12,0*	*19,3*	*28,0*	45,8	72,7	99,8	122	146
	HAS-U 8.8		*19,3*	28,0	37,8	45,8	72,7	99,8	122	146
	HAS-U A4		*13,9*	*21,9*	*31,6*	45,8	72,7	99,8	*80,4*	*98,3*
	HAS-U HCR		*19,3*	28,0	37,8	45,8	72,7	99,8	122	146
	HIS-N 8.8		16,7	30,7	44,7	72,7	77,3	-	-	-
	HIT-Z a)		16,0	25,3	36,2	57,3	79,2	-	-	-
Shear V_{Rd}	HAS-U 5.8	[kN]	*7,2*	*12,0*	*16,8*	*31,2*	*48,8*	*70,4*	*92,0*	*112*
	HAS-U 8.8		*12,0*	*18,4*	*27,2*	*50,4*	*78,4*	*113*	*147*	*179*
	HAS-U A4		*8,3*	*12,8*	*19,2*	*35,3*	*55,1*	*79,5*	*48,3*	*58,8*
	HAS-U HCR		*12,0*	*18,4*	*27,2*	*50,4*	*78,4*	*70,9*	*92,0*	*112*
	HIS-N 8.8		10,4	18,4	27,2	50,4	46,4	-	-	-
	HIT-Z a)		9,6	15,2	21,6	38,4	58,4	-	-	-
Cracked concrete										
Tension N_{Rd}	HAS-U 5.8	[kN]	10,1	14,1	23,5	32,1	50,9	69,9	85,4	102
	HAS-U 8.8		10,1	14,1	23,5	32,1	50,9	69,9	85,4	102
	HAS-U A4		10,1	14,1	23,5	32,1	50,9	69,9	*80,4*	*98,3*
	HAS-U HCR		10,1	14,1	23,5	32,1	50,9	69,9	85,4	102
	HIS-N 8.8		16,5	26,5	32,1	50,9	67,4	-	-	-
	HIT-Z a)		13,4	19,6	26,5	40,1	55,4	-	-	-
Shear V_{Rd}	HAS-U 5.8	[kN]	*7,2*	*12,0*	*16,8*	*31,2*	*48,8*	*70,4*	*92,0*	*112*
	HAS-U 8.8		*12,0*	*18,4*	*27,2*	*50,4*	*78,4*	*113*	*147*	*179*
	HAS-U A4		*8,3*	*12,8*	*19,2*	*35,3*	*55,1*	*79,5*	*48,3*	*58,8*
	HAS-U HCR		*12,0*	*18,4*	*27,2*	*50,4*	*78,4*	*70,9*	*92,0*	*112*
	HIS-N 8.8		10,4	18,4	27,2	50,4	46,4	-	-	-
	HIT-Z a)		9,6	15,2	21,6	38,4	58,4	-	-	-

a) Hilti anchor rod HIT-Z-F: M16 and M20

Recommended loads [b)]

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete										
Tension N_{Rk}	HAS-U 5.8	[kN]	6,0	9,7	14,0	22,9	36,3	50,0	61,0	72,7
	HAS-U 8.8		9,7	14,0	18,9	22,9	36,3	50,0	61,0	72,7
	HAS-U A4		8,6	13,7	18,9	22,9	36,3	50,0	61,0	72,7
	HAS-U HCR		9,7	14,0	18,9	22,9	36,3	50,0	61,0	72,7
	HIS-N 8.8		8,3	15,3	22,3	36,3	38,7	-	-	-
	HIT-Z [a)]		8,0	12,7	18,1	32,0	44,3	-	-	-
Shear V_{Rk}	HAS-U 5.8	[kN]	3,0	5,0	7,0	13,0	20,3	29,3	38,3	46,7
	HAS-U 8.8		5,0	7,7	11,3	21,0	32,7	47,0	61,3	74,7
	HAS-U A4		4,3	6,7	10,0	18,3	28,7	41,3	38,3	46,7
	HAS-U HCR		5,0	7,7	11,3	21,0	32,7	41,3	53,7	65,3
	HIS-N 8.8		4,3	7,7	11,3	21,0	19,3	-	-	-
	HIT-Z [a)]		4,0	6,3	9,0	16,0	24,3	-	-	-
Cracked concrete										
Tension N_{Rk}	HAS-U 5.8	[kN]	5,0	7,1	11,7	16,0	25,4	35,0	42,7	51,5
	HAS-U 8.8		5,0	7,1	11,7	16,0	25,4	35,0	42,7	51,5
	HAS-U A4		5,0	7,1	11,7	16,0	25,4	35,0	42,7	51,5
	HAS-U HCR		5,0	7,1	11,7	16,0	25,4	35,0	42,7	51,5
	HIS-N 8.8		8,2	13,2	16,0	25,4	33,7	-	-	-
	HIT-Z [a)]		7,5	11,0	14,8	22,4	31,0	-	-	-
Shear V_{Rk}	HAS-U 5.8	[kN]	3,0	5,0	7,0	13,0	20,3	29,3	38,3	46,7
	HAS-U 8.8		5,0	7,7	11,3	21,0	32,7	47,0	61,3	74,7
	HAS-U A4		4,3	6,7	10,0	18,3	28,7	41,3	38,3	46,7
	HAS-U HCR		5,0	7,7	11,3	21,0	32,7	41,3	53,7	65,3
	HIS-N 8.8		4,3	7,7	11,3	21,0	19,3	-	-	-
	HIT-Z [a)]		4,0	6,3	9,0	16,0	24,3	-	-	-

a) Hilti anchor rod HIT-Z-F: M16 and M20

b) With overall partial safety factor for action γ = 3.0. The recommended loads vary according to the safety factor requirement from national regulations

Materials

Materials properties for HAS-U

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Nominal tensile strength f_{uk}	HAS-U 5.8 (HDG)	[N/mm²]	500	500	500	500	500	500	-	-
	HAS-U 8.8 (HDG) AM 8.8 (HDG)		800	800	800	800	800	800	800	800
	HAS-U A4		700	700	700	700	700	700	500	500
	HAS-U HCR		800	800	800	800	800	700	-	-
Yield strength f_{yk}	HAS-U 5.8 (HDG)	[N/mm²]	440	440	440	440	400	400	-	-
	HAS-U 8.8 (HDG) AM 8.8 (HDG)		640	640	640	640	640	640	640	640
	HAS-U A4		450	450	450	450	450	450	210	210
	HAS-U HCR		640	640	640	640	640	400	-	-
Stressed cross-section A_s	HAS-U	[mm²]	36,6	58,0	84,3	157	245	353	459	561
Moment of resistance W	HAS-U	[mm³]	31,2	62,3	109	277	541	935	1387	1874

Mechanical properties for HIS-N

Anchor size			M8	M10	M12	M16	M20
Nominal tensile strength f_{uk}	HIS-N	[N/mm²]	490	490	490	490	490
	Screw 8.8		800	800	800	800	800
	HIS-RN		700	700	700	700	700
	Screw A4-70		700	700	700	700	700
Yield strength f_{yk}	HIS-N	[N/mm²]	390	390	390	390	390
	Screw 8.8		640	640	640	640	640
	HIS-RN		350	350	350	350	350
	Screw A4-70		450	450	450	450	450
Stressed cross-section A_s	HIS-(R)N	[mm²]	51,5	108	169	256	238
	Screw		36,6	58	84,3	157	245
Moment of resistance W	HIS-(R)N	[mm³]	145	430	840	1595	1543
	Screw		31,2	62,3	109	277	541

Mechanical properties for HIT-Z

Anchor size			M8	M10	M12	M16	M20
Nominal tensile strength f_{uk}	HIT-Z(-F) a)	[N/mm²]	650	650	650	610	595
	HIT-Z-R		650	650	650	610	595
Yield strength f_{yk}	HIT-Z(-F) a)	[N/mm²]	520	520	520	490	480
	HIT-Z-R		520	520	520	490	480
Stressed cross-section of thread A_s	HIT-Z(-F) a) HIT-Z-R	[mm²]	36,6	58,0	84,3	157	245
Moment of resistance W	HIT-Z(-F) a) HIT-Z-R	[mm³]	31,9	62,5	109,7	278	542

a) Hilti anchor rod HIT-Z-F: M16 and M20

Material quality for HAS-U

Part	Material
Zinc coated steel	
Threaded rod, HAS-U 5.8 (HDG)	Strength class 5.8; Elongation at fracture A5 > 8% ductile Electroplated zinc coated ≥ 5µm; (HDG) hot dip galvanized ≥ 45 µm
Threaded rod, HAS-U 8.8 (HDG)	Strength class 8.8; Elongation at fracture A5 > 12% ductile Electroplated zinc coated ≥ 5µm; (HDG) hot dip galvanized ≥ 45 µm
Hilti Meter rod, AM 8.8 (HDG)	Strength class 8.8; Elongation at fracture A5 > 12% ductile Electroplated zinc coated ≥ 5µm (HDG) hot dip galvanized ≥ 45 µm
Washer	Electroplated zinc coated ≥ 5 µm, (HDG) hot dip galvanized ≥ 45 µm
Nut	Strength class of nut adapted to strength class of threaded rod. Electroplated zinc coated ≥ 5µm, hot dip galvanized ≥ 45 µm
Hilti Filling set (F)	Filling washer: Electroplated zinc coated ≥ 5 µm / (HDG) hot dip galvanized ≥ 45 µm
	Spherical washer: Electroplated zinc coated ≥ 5 µm / (HDG) hot dip galvanized ≥ 45 µm
	Lock nut: Electroplated zinc coated ≥ 5 µm / (HDG) hot dip galvanized ≥ 45 µm
Stainless Steel	
Threaded rod, HAS-U A4	Strength class 70 for ≤ M24 and strength class 50 for > M24; Elongation at fracture A5 > 8% ductile Stainless steel 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 EN 10088-1:2014
Washer	Stainless steel 1.4401, 1.4404, 1.4578, 1.4571, 1.4439, 1.4362 EN 10088-1:2014
Nut	Stainless steel 1.4401, 1.4404, 1.4578, 1.4571, 1.4439, 1.4362 EN 10088-1:2014
High corrosion resistant steel	
Threaded rod, HAS-U HCR	Strength class 80 for ≤ M20 and class 70 for > M20, Elongation at fracture A5 > 8% ductile High corrosion resistant steel 1.4529; 1.4565 EN 10088-1:2014
Washer	High corrosion resistant steel 1.4529, 1.4565 EN 10088-1:2014
Nut	High corrosion resistant steel 1.4529, 1.4565 EN 10088-1:2014

Material quality for HIS-N

Part		Material
HIS-N	Int. threaded sleeve	Electroplated zinc coated ≥ 5 µm
	Screw 8.8	Strength class 8.8, A5 > 8 % Ductile; Steel galvanized ≥ 5 µm
HIS-RN	Int. threaded sleeve	Stainless steel 1.4401,1.4571
	Screw 70	Strength class 70, A5 > 8 % Ductile; Stainless steel 1.4401; 1.4404, 1.4578; 1.4571; 1.4439; 1.4362

Material quality for HIT-Z

Part	Material
Threaded rod HIT-Z	Elongation at fracture > 8% ductile; Electroplated zinc coated ≥ 5 µm
Washer	Electroplated zinc coated ≥ 5 µm
Nut	Strength class of nut adapted to strength class of anchor rod. Electroplated zinc coated ≥ 5 µm
HIT-Z-F	Elongation at fracture > 8% ductile Multilayer coating, ZnNi-galvanized according to DIN 50979:2008-07
Washer	Multilayer coating, ZnNi-galvanized according to DIN 50979:2008-07
Nut	Multilayer coating, ZnNi-galvanized according to DIN 50979:2008-07
HIT-Z-R	Elongation at fracture > 8% ductile; Stainless steel 1.4401, 1.4404 EN 10088-1:2014
Washer	Stainless steel A4 according to EN 10088-1:2014
Nut	Strength class of nut adapted to strength class of anchor rod. Stainless steel 1.4401, 1.4404 EN 10088-1:2014

Setting information

In service temperature range

Hilti HIT-HY 200-R injection mortar with anchor rod HAS-U / HIS-(R)N may be applied in the temperature ranges given below. An elevated base material temperature leads to a reduction of the design bond resistance.

Temperature in the base material

Temperature range	Base material temperature	Max. long term base material temperature	Max. short term base material temperature
Temperature range I	-40 °C to +40 °C	+24 °C	+40 °C
Temperature range II	-40 °C to +80 °C	+50 °C	+80 °C
Temperature range III	-40 °C to +120 °C	+72 °C	+120 °C

Max short term base material temperature

Short-term elevated base material temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Max long term base material temperature

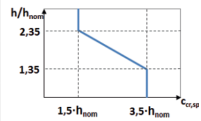
Long-term elevated base material temperatures are roughly constant over significant periods of time.

Curing and working time

Temperature of the base material	HIT-HY 200-R	
	Maximum working time t_{work}	Minimum curing time t_{cure}
- 10°C > T_{BM} ≥ - 5°C	3 h	20 h
- 5°C > T_{BM} ≥ 0°C	2 h	8 h
0°C > T_{BM} ≥ 5°C	1 h	4 h
5°C > T_{BM} ≥ 10°C	40 min	2,5 h
10°C > T_{BM} ≥ 20°C	15 min	1,5 h
20°C > T_{BM} ≥ 30°C	9 min	1 h
30°C > T_{BM} ≥ 40°C	6 min	1 h

Setting details for HAS-U

Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Nominal diameter of drill bit	d_0	[mm]	10	12	14	18	22	28	30	35
Eff. embedment depth and drill hole depth a)	$h_{ef,min}$	[mm]	60	60	70	80	90	96	108	120
	$h_{ef,max}$	[mm]	160	200	240	320	400	480	540	600
Minimum base material thickness	h_{min}	[mm]	h_{ef} + 30 mm ≥100 mm			$h_{ef} + 2\ d_0$				
Maximum diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18	22	26	30	33
Thickness of Hilti filling set	h_{fs}	[mm]	-	-	-	11	13	15	-	-
Effective fixture thickness with Hilti filling set	$t_{fix,eff}$	[mm]	$t_{fix,eff} - h_{fs}$							
Max. torque moment b)	T_{max}	[Nm]	10	20	40	80	150	200	270	300
Minimum spacing	s_{min}	[mm]	40	50	60	75	90	115	120	140
Minimum edge distance	c_{min}	[mm]	40	45	45	50	55	60	75	80
Critical spacing for splitting failure	$s_{cr,sp}$	[mm]	$2\ c_{cr,sp}$							
Critical edge distance for splitting failure c)	$c_{cr,sp}$	[mm]	**$1{,}0 \cdot h_{ef}$**		for $h / h_{ef} \geq 2{,}00$					
			$4{,}6\ h_{ef} - 1{,}8\ h$		for $2{,}00 > h / h_{ef} > 1{,}3$					
			$2{,}26\ h_{ef}$		for $h / h_{ef} \leq 1{,}3$					
Critical spacing for concrete cone failure	$s_{cr,N}$	[mm]	$2\ C_{cr,sp}$							
Critical edge distance for concrete cone failure d)	$c_{cr,N}$	[mm]	$1{,}5\ h_{ef}$							



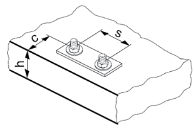
For spacing (edge distance) smaller than critical spacing (critical edge distance) the design loads have to be reduced.

a) $h_{ef,min} \leq h_{ef} \leq h_{ef,max}$ (h_{ef}: embedment depth)

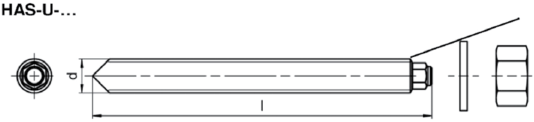
b) Maximum recommended torque moment to avoid splitting failure during installation with minimum spacing and edge distance

c) h: base material thickness ($h \geq h_{min}$)

d) The critical edge distance for concrete cone failure depends on the embedment depth h_{ef} and the design bond resistance. The simplified formula given in this table is on the save side



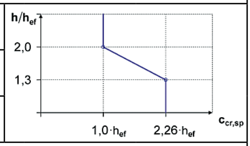
HAS-U-...



Marking:

Steel grade number and length identification letter: e.g. 8L

Setting details for HIS-N

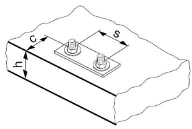
Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**
Nominal diameter of drill bit	d_0	[mm]	14	18	22	28	32
Diameter of element	d	[mm]	12,5	16,5	20,5	25,4	27,6
Effective anchorage and drill hole depth	h_{ef}	[mm]	90	110	125	170	205
Minimum base material thickness	h_{min}	[mm]	120	150	170	230	270
Diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18	22
Thread engagement length; min - max	h_s	[mm]	8-20	10-25	12-30	16-40	20-50
Minimum spacing	s_{min}	[mm]	60	75	90	115	130
Minimum edge distance	c_{min}	[mm]	40	45	55	65	90
Critical spacing for splitting failure	$s_{cr,sp}$	[mm]	$2\ c_{cr,sp}$				
Critical edge distance for splitting failure b)	$c_{cr,sp}$	[mm]	**1,0 · hef**	for $h / h_{ef} \geq 2{,}00$			
			$4{,}6\ h_{ef} - 1{,}8\ h$	for $2{,}00 > h / h_{ef} > 1{,}3$			
			$2{,}26\ h_{ef}$	for $h / h_{ef} \leq 1{,}3$			
Critical spacing for concrete cone failure	$s_{cr,N}$	[mm]	$2\ c_{cr,N}$				
Critical edge distance for concrete cone failure c)	$c_{cr,N}$	[mm]	$1{,}5\ _{hef}$				
Max. torque moment a)	T_{max}	[Nm]	10	20	40	80	150

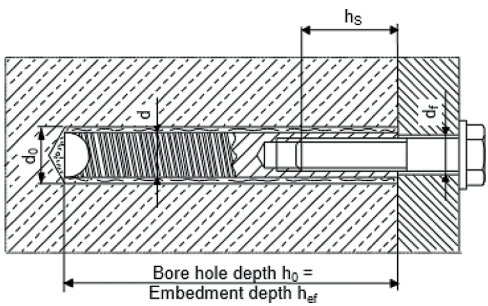
For spacing (edge distance) smaller than critical spacing (critical edge distance) the design loads have to be reduced.

a) Max. recommended torque moment to avoid splitting failure during Instalation with minimum spacing and edge distance

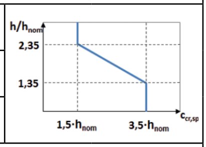
b) h: base material thickness ($h \geq h_{min}$)

c) The critical edge distance for concrete cone failure depends on the embedment depth h_{ef} and the design bond resistance. The simplified formula given in this table is on the save side





Settings details HIT-Z, HIT-Z-F and HIT-Z-R

Anchor size			M8	M10	M12	M16	M20
Nominal diameter of drill bit	d_0	[mm]	10	12	14	18	22
Length of anchor	min l	[mm]	80	95	105	155	215
	max l	[mm]	120	160	196	420	450
Nominal embedment depth range a)	$h_{nom,min}$	[mm]	60	60	60	96	100
	$h_{nom,max}$	[mm]	100	120	144	192	220
Borehole condition 1 Min. base material thickness	h_{min}	[mm]	h_{nom} + 60 mm			h_{nom} + 100 mm	
Borehole condition 2 Min. base material thickness	h_{min}	[mm]	h_{nom} + 30 mm ≥100 mm			h_{nom} + 45 mm ≥45 mm	
Maximum depth of drill hole	h_0	[mm]	h – 30 mm			h – 2 d_0	
Pre-setting: Diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18	22
Through-setting: Diameter of clearance hole in the fixture	d_f	[mm]	11	14	16	20	24
Maximum fixture thickness	t_{fix}	[mm]	48	87	120	303	326
Maximum fixture thickness with seismic filling set	t_{fix}	[mm]	41	79	111	292	314
Installation torque moment b)	T_{inst}	[Nm]	10	25	40	80	150
Critical spacing for splitting failure	$s_{cr,sp}$	[mm]	2 $c_{cr,sp}$				
Critical edge distance for splitting failure c)	$c_{cr,sp}$	[mm]	**$1{,}5 \cdot h_{nom}$**	for h / h_{nom} ≥ 2,35			
			$6{,}2\ h_{nom}$ - 2,0 h	for 2,35 > h / h_{nom} > 1,35			
			$3{,}5\ h_{nom}$	for h / h_{nom} ≤ 1,35			
Critical spacing for concrete cone failure	$s_{cr,N}$	[mm]	2 $c_{cr,N}$				
Critical edge distance concrete cone failure d)	$c_{cr,N}$	[mm]	1,5 h_{nom}				

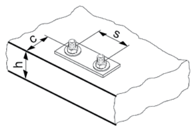
For spacing (edge distance) smaller than critical spacing (critical edge distance) the design loads have to be reduced.

a) $h_{nom,min} \leq h_{nom} \leq h_{nom,max}$ (h_{nom}: embedment depth)

b) Recommended torque moment to avoid splitting failure during instalation with minimum spacing and edge distance

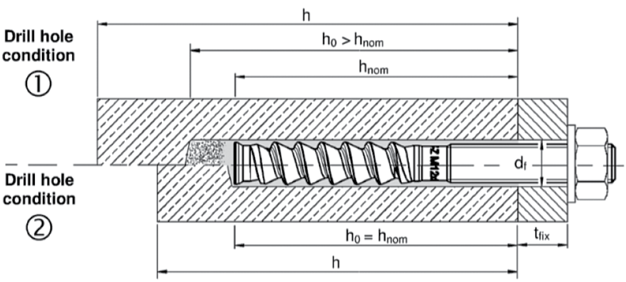
c) h: base material thickness (h ≥ h_{min})

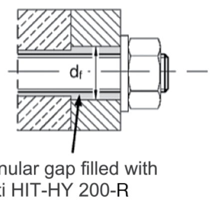
d) The critical edge distance for concrete cone failure depends on the embedment depth h_{ef} and the design bond resistance. The simplified formula given in this table is on the save side



Pre-setting:
Install anchor before positioning fixture

Through-setting:
Install anchor through positioned fixture

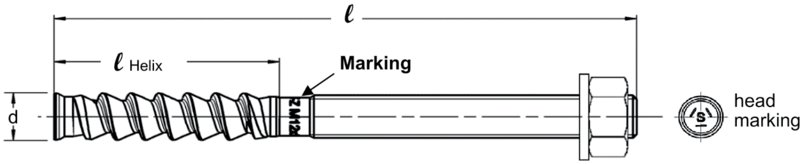




Drill hole condition 1 → non-cleaned borehole
Drill hole condition 2 → drilling dust is completely removed

Anchor dimension for HIT-Z

Anchor size			M8	M10	M12	M16	M20
Length of anchor	min ℓ	[mm]	80	95	105	155	215
	max ℓ	[mm]	120	160	196	420	450
Helix length	ℓ_{Helix}	[mm]	50	60	60	96	100



Minimum edge distance and spacing for HIT-Z

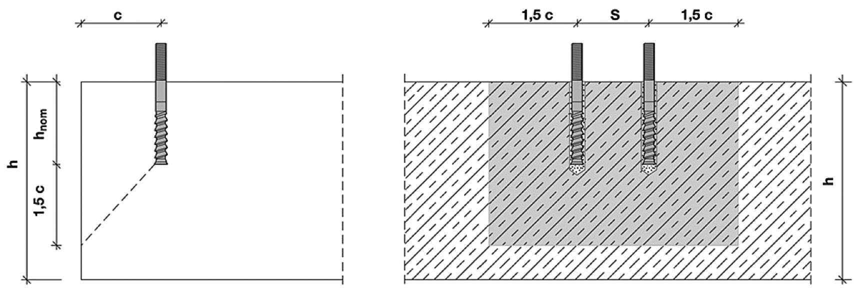
For the calculation of minimum spacing and minimum edge distance of anchors in combination with different embedment depth and thickness of concrete member the following equation shall be fulfilled: $\mathbf{A_{i,req} < A_{i,cal}}$

Required interaction area $A_{i,cal}$ for HIT-Z

Anchor size		M8	M10	M12	M16	M20
Cracked concrete	[mm²]	19200	40800	58800	94700	148000
Non-cracked concrete	[mm²]	22200	57400	80800	128000	198000

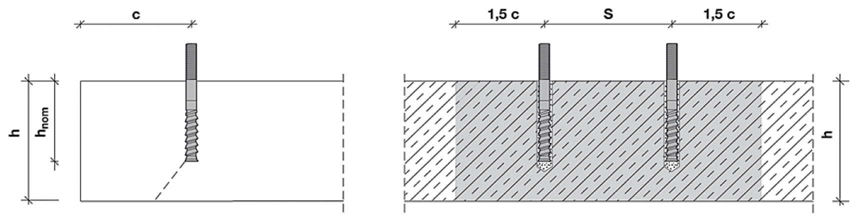
Effective area $A_{i,ef}$ of HIT-Z

Member thickness $h \geq h_{nom} + 1{,}5 \cdot c$



Single anchor and group of anchors with s > 3·c	[mm²]	$\mathbf{A_{i,cal} = (6 \cdot c) \cdot (h_{nom} + 1{,}5 \cdot c)}$	with c ≥ 5·d
Group of anchors with s ≤ 3·c	[mm²]	$\mathbf{A_{i,cal} = (3 \cdot c + s) \cdot (h_{nom} + 1{,}5 \cdot c)}$	with c ≥ 5·d and s ≥ 5·d

Member thickness $h \geq h_{nom} + 1{,}5 \cdot c$



Single anchor and group of anchors with s > 3·c	[mm²]	$\mathbf{A_{i,cal} = (6 \cdot c) \cdot h}$	with c ≥ 5·d
Group of anchors with s ≤ 3·c	[mm²]	$\mathbf{A_{i,cal} = (3 \cdot c + s) \cdot h}$	with c ≥ 5·d and s ≥ 5·d

Best case minimum edge distance and spacing with required member thickness and embedment depth

Anchor size			M8	M10	M12	M16	M20
Cracked concrete							
Member thickness	h ≥	[mm]	140	200	240	300	370
Embedment depth	h_{nom} ≥	[mm]	80	120	150	200	220
Minimum spacing	s_{min}	[mm]	40	50	60	80	100
Corresponding edge distance	c ≥	[mm]	40	55	65	80	100
Minimum edge distance	c_{min} =	[mm]	40	50	60	80	100
Corresponding spacing	s ≥	[mm]	40	60	65	80	100
Non-cracked concrete							
Member thickness	h ≥	[mm]	140	230	270	340	410
Embedment depth	h_{nom} ≥	[mm]	80	120	150	200	220
Minimum spacing	s_{min}	[mm]	40	50	60	80	100
Corresponding edge distance	c ≥	[mm]	40	70	80	100	130
Minimum edge distance	c_{min}	[mm]	40	50	60	80	100
Corresponding spacing	s ≥	[mm]	40	145	160	160	235

Best case minimum member thickness and embedment depth with required minimum edge distance and spacing (borehole condition 1)

Anchor size			M8	M10	M12	M16	M20
Cracked concrete							
Member thickness	h ≥	[mm]	120	120	120	196	200
Embedment depth	h_{nom} ≥	[mm]	60	60	60	96	100
Minimum spacing	s_{min}	[mm]	40	50	60	80	100
Corresponding edge distance	c ≥	[mm]	40	100	140	135	215
Minimum edge distance	c_{min} =	[mm]	40	60	90	80	125
Corresponding spacing	s ≥	[mm]	40	160	220	235	365
Non-cracked concrete							
Member thickness	h ≥	[mm]	120	120	120	196	200
Embedment depth	h_{nom} ≥	[mm]	60	60	60	96	100
Minimum spacing	s_{min}	[mm]	40	50	60	80	100
Corresponding edge distance	c ≥	[mm]	50	145	200	190	300
Minimum edge distance	c_{min}	[mm]	40	80	115	110	165
Corresponding spacing	s ≥	[mm]	65	240	330	310	495

Minimum edge distance and spacing – Explanation

Minimum edge and spacing geometrical requirements are determined by testing the installation conditions in which two anchors with a given spacing can be set close to an edge without forming a crack in the concrete due to tightening torque.

The HIT-Z boundary conditions for edge and spacing geometry can be found in the tables to the left. If the embedment depth and slab thickness are equal to or greater than the values in the table, then the edge and spacing values may be utilized.

PROFIS Anchor software is programmed to calculate the referenced equations in order to determine the optimized related minimum edge and spacing based on the following variables:

Cracked or non-cracked concrete	For cracked concrete it is assumed that a reinforcement is present which limits the crack width to 0,3 mm, allowing smaller values for minimum edge distance and minimum spacing
Anchor diameter	For smaller anchor diameter a smaller installation torque is required, allowing smaller values for minimum edge distance and minimum spacing
Slab thickness and embedment depth	Increasing these values allows smaller values for minimum edge distance and minimum spacing

Installation equipment

Anchor size		M8	M10	M12	M16	M20	M24	M27	M30
Rotary hammer	HAS-U	TE 2 – TE 16				TE 40 - TE 80			
	HIT-Z	TE 2 – TE 40			TE 40 – TE 80		-		
	HIS-N	TE (-A) – TE 16(-A)		TE 40 – TE 80			-		
Other tools		compressed air gun and blow out pump, set of cleaning brushes, dispenser Hollow Drill Bit							

Cleaning, drilling and installation parameters

HAS-U	HIT-Z	HIS-N	Drill bit diameters d_0 [mm]		Cleaning and installation	
			Hammer drill (HD)	Hollow Drill Bit (HDB)	Brush HIT-RB	Piston plug HIT-SZ
						
M8	**M8**	**-**	10	-	10	-
M10	**M10**	**-**	12	12	12	12
M12	**M12**	**M8**	14	14	14	14
M16	**M16**	**M10**	18	18	18	18
M20	**M20**	**M12**	22	22	22	22
M24	**-**	**M16**	28	28	28	28
M27	**-**	**-**	30	-	30	30
-	**-**	**M20**	32	32	32	32
M30	**-**	**-**	35	35	35	35

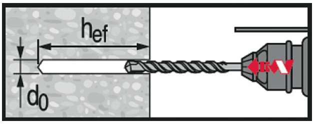
Setting instructions for HAS-U rods and HIS-N internally threaded sleeves

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

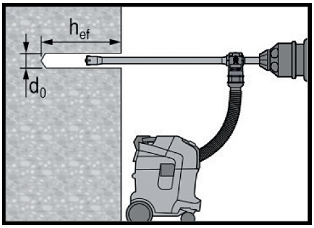
Safety regulations.

Review the Material Safety Data Sheet (MSDS) before use for proper and safe handling! Wear well-fitting protective goggles and protective gloves when working with Hilti HIT-HY 200-R.

Drilling

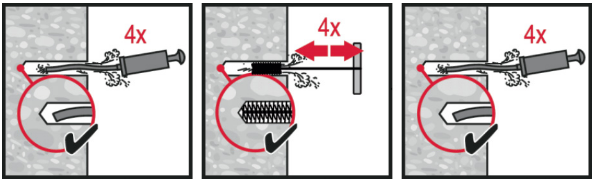


Hammer drilled hole (HD)

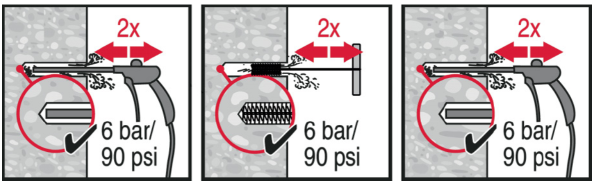


Hammer drilled hole with Hollow Drilled Bit (HDB)
No cleaning required

Cleaning

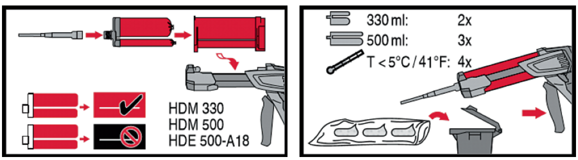


Manual cleaning (MC)
for drill diameters $d_0 \leq 20$ mm and drill hole depth $h_0 \leq 10 \cdot d$.

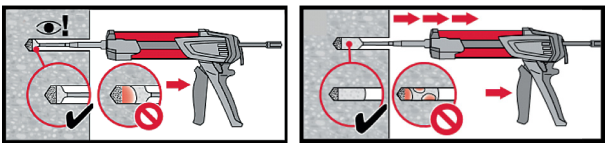


Compressed air cleaning (CAC)
for all drill hole diameters d_0 and drill hole depths $h_0 \leq 20 \cdot d$.

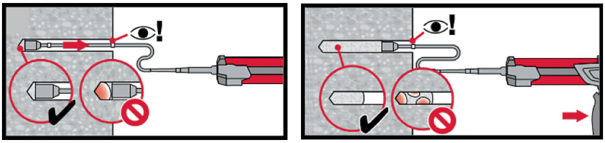
Injection



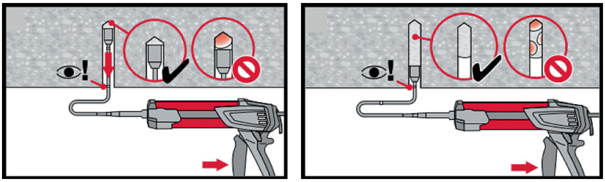
Injection system preparation.



Injection method for drill hole depth $h_{ef} \leq 250$ mm.

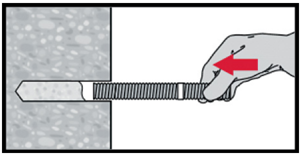


Injection method for drill hole depth h_{ef} > 250mm.

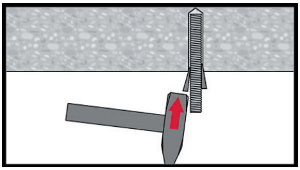


Injection method for overhead application and/or installation with embedment depth > 250 mm.

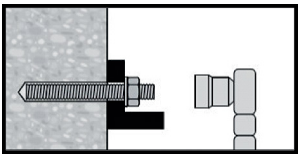
Setting the element



Setting element, observe working time "t_{work}".



Setting element for overhead applications, observe working time "t_{work}".



Loading the anchor after required curing time t_{cure}

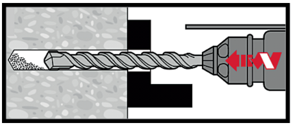
Setting instructions for HIT-Z rods

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

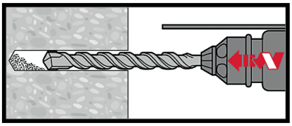
Safety regulations.

Review the Material Safety Data Sheet (MSDS) before use for proper and safe handling! Wear well-fitting protective goggles and protective gloves when working with Hilti HIT-HY 200-R

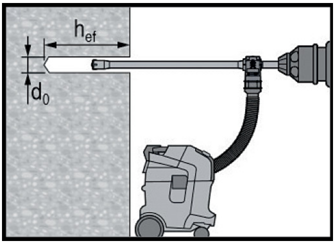
Drilling



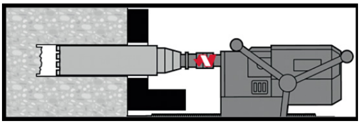

Hammer drilling: Through-setting
No cleaning required



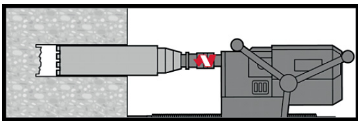

Hammer drilling: Pre-setting
No cleaning required



Hammer drilling with hollow drill bit: Through / pre-setting
No cleaning required

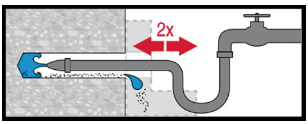


Diamond coring: Through-setting

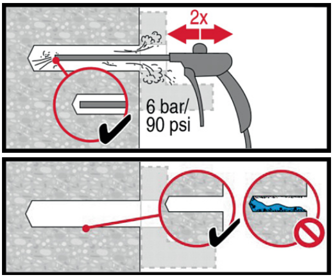


Diamond coring: Pre-setting

Cleaning

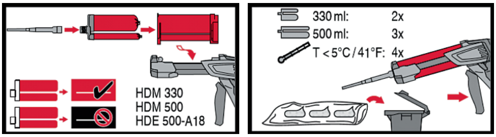


Hole flushing required for wet-drilled diamond cored holes.

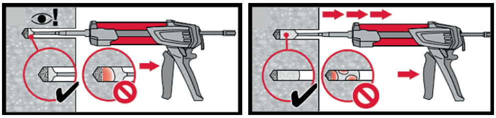


Evacuation required for wet-drilled diamond cored holes.

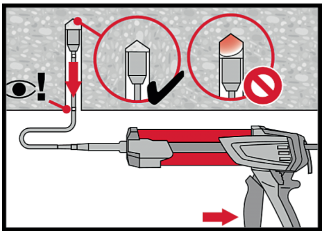
Injection



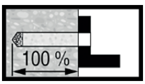
Injection system preparation.



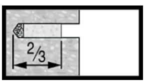
Injection of adhesive from the back of the drill hole without forming air voids.



Overhead installation only with the aid of extensions and piston plugs.

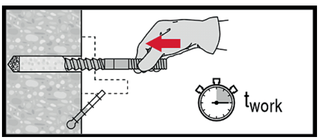


Through-setting:
Fill 100% of the drill hole.

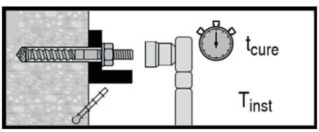


Pre-setting:
Fill approx. 2/3 of the drill hole.

Setting the element



Setting element to the required embedment depth before working time “t_{work}” has elapsed.



Loading the anchor: After required curing time t_{cure}.

Hilti HIT-RE 500 V3 mortar for concrete

Ultimate-performance epoxy mortar for rebar connections and heavy anchoring

Injection mortar system

Foil pack: HIT-RE 500 V3

(available in 330, 500 and 1400 ml cartridges)

Anchor rod:
HIT-V
HIT-V-F
HIT-V-R
HIT-V-HCR
AM 8.8 (HDG)
(M8-M39)

Internally threaded insert:
HIS-N,
HIS-RN
(M8-M20)

Benefits

- Approved for use under seismic conditions C1 & C2
- Long working time before being fully cured at elevated temperatures
- High loading capacity
- Suitable for dry, water saturated concrete and under water application
- Odourless epoxy
- **SafeSet** technology: Simplified method of borehole preparation using either Hilti hollow drill bit for hammer drilling or roughening tool for diamond cored applications

Base material

Uncracked concrete

Cracked concrete

Installation conditions

Hammer drilled holes

Diamond drilled holes [c)]

Hilti **SafeSet** technology

Small edge distance and spacing

Variable embedment depth

Load conditions

Static/ quasi-static

Seismic, ETA-C1, C2

Fire resistance

Other information

European Technical Assessment

CE conformity

PROFIS Anchor design software

A4 316
Corrosion resistance

HCR highMo
High corrosion resistance [a)]

a) Applications only with HIT-V anchor rods

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European technical Assessment [a)]	CSTB	ETA-16/0143 / 2017-07-12
Fire test report [b)]	MFPA Leipzig	GS 3.2/15-361-4 / 2016-08-04

a) All data given in this section according to ETA-16/0143 issue 2017-07-12
b) Fire test report only available for HIT-V rods

Recommended general notes

* The below clauses based on Hilti product qualifications are for references only. Selection of clauses by the engineer shall be based on the specific application needs. Please contact Hilti's technical team for further details.

- Two-component ready mix foil-pack epoxy resin (styrene-free).
- Approved for use in cracked and uncracked concrete under static, quasi-static (and seismic) loading
- Approved for use in diamond cored drilled holes. In such case the performance shall be on the same level of hammer drilled holes when proper installation steps are followed.
- Anchor shall be installed in combination with dust removal drilling accessories to ensure dust free environment and clean borehole.
- Anchor shall be approved for overhead installation.
- For overhead or deep embedment depth (>250mm) installation, specialized accessories shall be applied to ensure drill hole is fully grouted with no voids.
- Anchors shall obtain the European Technical Assessment (ETA) report.
- The anchor bolt design shall be done either according to "ETAG001 Annex C Design Method" issued by EOTA or "Guides on design of post-installed anchor bolt systems in Hong Kong" issued by HKISC.
- Anchors shall be tested in accordance to either ETAG-001 Annex A or ACI 355.2 by accredited laboratories under HOKLAS Mutual Recognition Arrangement (MRA) Partners.
- Anchor to be approved by NSF for use in contact with drinking water.

For seismic application:

- Approved for use under seismic actions category 1 (C1) and 2 (C2) according to EOTA TR045 "Design of Metal Anchors For Use In Concrete Under Seismic Actions, 02/2013".

For underwater application:

- Anchor shall be assessed applicable for underwater condition and technical data shall be supported on anchor load resistance and installation steps to ensure workmanship.

Static and quasi-static resistance (for a single anchor)

All data in this section applies to:

- Correct setting (See setting instruction)
- No edge distance and spacing influence
- *Steel* failure
- HIT-V anchor rod with strength class 5.8 and 8.8, AM anchor rod with strength class 8.8, HIS-N internally threaded insert with screw 8.8
- Base material thickness, as specified in the table
- One typical embedment depth as specified in the table
- Concrete C 20/25, $f_{ck,cube}$ = 25 N/mm²
- Temperature range I
  (min. base material temperature -40°C, max. long/short term base material temperature: +24°C/40°C)

Embedment depth [a] and base material thickness

		ETA-16/0143, issue 2017-07-12								Additional Hilti technical data		
Anchor size		M8	M10	M12	M16	M20	M24	M27	M30	M33	M36	M39
HIT-V												
Eff. anchorage depth	[mm]	80	90	110	125	170	210	240	270	300	330	360
Base material thickness	[mm]	110	120	140	161	214	266	300	340	374	410	444
HIS-N												
Eff. anchorage depth	[mm]	90	110	125	170	205	-	-	-	-	-	-
Base material thickness	[mm]	120	150	170	230	270	-	-	-	-	-	-

a) The allowed range of embedment depth is shown in the setting

For hammer drilled holes, hollow drill bit [a] and diamond cored with roughening tool [b]:

Characteristic resistance

Anchor size			ETA-16/0143, issue 2019-05-14								Hilti technical data		
			M8	M10	M12	M16	M20	M24	M27	M30	M33	M36	M39
Non-cracked concrete													
Tension N_{Rk}	HAS-U 5.8	[kN]	18,3	28,8	42,0	69,9	111,0	152,4	186,0	222,0	216,6	249,9	284,7
	HAS-U 8.8, AM		29,1	42,9	57,9	69,9	111,0	152,4	186,0	222,0	216,6	249,9	284,7
	HAS-U A4		20,4	32,4	47,1	69,9	111,0	152,4	119,4	145,8	180,3	212,4	253,5
	HAS-U HCR		29,1	42,9	57,9	69,9	111,0	152,4	186,0	222,0	-	-	-
	HIS-N 8.8		24,9	45,9	66,9	111,0	114,9	-	-	-	-	-	-
Shear V_{Rk}	HAS-U 5.8	[kN]	10,9	17,4	25,2	46,8	72,9	105,0	136,5	166,8	206,4	243,0	290,1
	HAS-U 8.8, AM		17,4	27,6	40,2	74,7	116,7	168,0	218,4	266,7	330,0	388,5	463,8
	HAS-U A4		12,3	19,5	28,2	52,5	81,9	117,9	71,7	87,6	108,3	127,5	152,4
	HAS-U HCR		17,4	27,6	40,2	74,7	116,7	105,0	136,5	166,8	-	-	-
	HIS-N 8.8		15,6	27,6	40,5	75,0	69,0	-	-	-	-	-	-
Cracked concrete													
Tension N_{Rk}	HAS-U 5.8	[kN]	15,0	22,5	39,3	50,1	79,2	108,6	132,6	158,4	-	-	-
	HAS-U 8.8, AM		15,0	22,5	39,3	50,1	79,2	108,6	132,6	158,4	-	-	-
	HAS-U A4		15,0	22,5	39,3	50,1	79,2	108,6	119,4	145,8	-	-	-
	HAS-U HCR		15,0	22,5	39,3	50,1	79,2	108,6	119,4	145,8	-	-	-
	HIS-N 8.8		24,9	41,4	50,1	79,2	104,7	-	-	-	-	-	-
Shear V_{Rk}	HAS-U 5.8	[kN]	10,9	17,4	25,2	46,8	72,9	105,0	136,5	166,8	-	-	-
	HAS-U 8.8, AM		17,4	27,6	40,2	74,7	116,7	168,0	218,4	266,7	-	-	-
	HAS-U A4		12,3	19,5	28,2	52,5	81,9	117,9	71,7	87,6	-	-	-
	HAS-U HCR		17,4	27,6	40,2	74,7	116,7	105,0	136,5	166,8	-	-	-
	HIS-N 8.8		15,6	27,6	40,5	75,0	69,0	-	-	-	-	-	-

Design resistance

Anchor size			ETA-16/0143, issue 2019-05-14								Hilti technical data		
			M8	M10	M12	M16	M20	M24	M27	M30	M33	M36	M39
Non-cracked concrete													
Tension N_{Rd}	HAS-U 5.8	[kN]	9,1	9,6	21,0	34,9	55,5	76,2	93,0	111,0	108,3	124,9	142,3
	HAS-U 8.8, AM		14,5	14,3	28,9	34,9	55,5	76,2	93,0	111,0	108,3	124,9	142,3
	HAS-U A4		10,2	10,8	23,5	34,9	55,5	76,2	59,7	72,9	90,15	106,2	126,7
	HAS-U HCR		14,5	14,3	28,9	34,9	55,5	76,2	93,0	111,0	-	-	-
	HIS-N 8.8		12,4	15,3	33,4	55,5	57,4	-	-	-	-	-	-
Shear V_{Rd}	HAS-U 5.8	[kN]	5,4	5,8	12,6	23,4	36,4	52,5	68,2	83,4	103,2	121,5	145
	HAS-U 8.8, AM		8,7	9,2	20,1	37,3	58,3	84,0	109,2	133,3	165,0	142,4	231,9
	HAS-U A4		6,1	6,5	14,1	26,2	40,9	58,9	35,8	43,8	54,1	63,7	76,2
	HAS-U HCR		8,7	9,2	20,1	37,3	58,3	52,5	68,2	83,4	-	-	-
	HIS-N 8.8		7,8	9,2	20,2	37,3	34,5	-	-	-	-	-	-
Cracked concrete													
Tension N_{Rd}	HAS-U 5.8	[kN]	7,5	11,2	19,6	25,0	39,6	54,3	66,3	79,2	-	-	-
	HAS-U 8.8, AM		7,5	11,2	19,6	25,0	39,6	54,3	66,3	79,2	-	-	-
	HAS-U A4		7,5	11,2	19,6	25,0	39,6	54,3	59,7	72,9	-	-	-
	HAS-U HCR		7,5	11,2	19,6	25,0	39,6	54,3	59,7	72,9	-	-	-
	HIS-N 8.8		12,4	20,7	25,0	39,6	52,3	-	-	-	-	-	-
Shear V_{Rd}	HAS-U 5.8	[kN]	5,4	8,7	12,6	23,4	36,4	52,5	68,2	83,4	-	-	-
	HAS-U 8.8, AM		8,7	13,8	20,1	37,3	58,3	84,1	109,2	133,3	-	-	-
	HAS-U A4		6,1	9,7	14,1	26,2	40,9	58,9	35,8	43,8	-	-	-
	HAS-U HCR		8,7	13,8	20,1	37,3	58,3	52,5	68,2	83,4	-	-	-
	HIS-N 8.8		7,8	13,8	20,2	37,5	34,5	-	-	-	-	-	-

Anchor technology & design | Heavy / medium duty metal anchors | Plastic / light duty / other metal anchors | Chemical anchors

Recommended loads

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30	M33	M36	M39
			ETA-16/0143, issue 2019-05-14								Hilti technical data		
Non-cracked concrete													
Tension N_{Rec}	HAS-U 5.8	[kN]	6,1	9,6	14,0	23,3	37,0	50,8	62,0	74,0	72,2	83,3	94,9
	HAS-U 8.8, AM		9,7	14,3	19,3	23,3	37,0	50,8	62,0	74,0	72,2	83,3	94,9
	HAS-U A4		6,8	10,8	15,7	23,3	37,0	50,8	39,8	48,6	60,1	70,8	84,5
	HAS-U HCR		9,7	14,3	19,3	23,3	37,0	50,8	62,0	74,0	-	-	-
	HIS-N 8.8		8,3	15,3	22,3	37,0	38,3	-	-	-	-	-	-
Shear V_{Rec}	HAS-U 5.8	[kN]	3,6	5,8	8,4	15,6	24,3	35,0	45,5	55,6	68,8	81,0	96,7
	HAS-U 8.8, AM		5,8	9,2	13,4	24,9	38,9	56,0	72,8	88,9	110,0	129,5	154,6
	HAS-U A4		4,1	6,5	9,4	17,5	27,3	39,3	23,9	29,2	36,1	42,5	50,8
	HAS-U HCR		5,8	9,2	13,4	24,9	38,9	35,0	45,5	55,6	-	-	-
	HIS-N 8.8		5,2	9,2	13,5	25,0	23,0	-	-	-	-	-	-
Cracked concrete													
Tension N_{Rec}	HAS-U 5.8	[kN]	5,0	7,5	13,1	16,7	26,4	36,2	44,2	52,8	-	-	-
	HAS-U 8.8, AM		5,0	7,5	13,1	16,7	26,4	36,2	44,2	52,8	-	-	-
	HAS-U A4		5,0	7,5	13,1	16,7	26,4	36,2	39,8	48,6	-	-	-
	HAS-U HCR		5,0	7,5	13,1	16,7	26,4	36,2	39,8	48,6	-	-	-
	HIS-N 8.8		8,3	13,8	16,7	26,4	34,9	-	-	-	-	-	-
Shear V_{Rec}	HAS-U 5.8	[kN]	3,6	5,8	8,4	15,6	24,3	35,0	45,5	55,6	-	-	-
	HAS-U 8.8, AM		5,8	9,2	13,4	24,9	38,9	56,0	72,8	88,9	-	-	-
	HAS-U A4		4,1	6,5	9,4	17,5	27,3	39,3	23,9	29,2	-	-	-
	HAS-U HCR		5,8	9,2	13,4	24,9	38,9	35,0	45,5	55,6	-	-	-
	HIS-N 8.8		5,2	9,2	13,5	25,0	23,0	-	-	-	-	-	-

For diamond drilling [a]:

Characteristic resistance

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete										
Tension N_{Rk}	HIT-V 5.8	[kN]	*18,0*	*29,0*	*42,0*	70,6	111,9	153,7	187,8	224,0
	HIT-V 8.8, AM 8.8		24,1	33,9	49,8	70,6	111,9	153,7	187,8	224,0
Shear V_{Rk}	HIT-V 5.8	[kN]	*9,0*	*15,0*	*21,0*	*39,0*	*61,0*	*88,0*	*115,0*	*140,0*
	HIT-V 8.8, AM 8.8		*15,0*	*23,0*	*34,0*	*63,0*	*98,0*	*141,0*	*184,0*	*224,0*

a) No data for HIS-N when diamond coring without roughening tools

Design resistance

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete										
Tension N_{Rd}	HIT-V 5.8	[kN]	12,0	18,8	27,6	33,6	53,3	73,2	89,4	106,7
	HIT-V 8.8, AM 8.8		13,4	18,8	27,6	33,6	53,3	73,2	89,4	106,7
Shear V_{Rd}	HIT-V 5.8	[kN]	7,2	12,0	16,8	31,2	48,8	70,4	92,0	112,0
	HIT-V 8.8, AM 8.8		12,0	18,4	27,2	50,4	78,4	112,8	147,2	179,2

a) No data for HIS-N when diamond coring without roughening tools

Recommended loads [b]

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete										
Tension N_{Rec}	HIT-V 5.8	[kN]	6.0	9,7	14.0	23,6	37,3	51,3	62,6	74,7
	HIT-V 8.8, AM 8.8		8,1	11,3	16,6	23,6	37,3	51,3	62,6	74,7
Shear V_{Rec}	HIT-V 5.8	[kN]	3.0	5.0	7.0	13.0	20,4	29,4	38,4	46,7
	HIT-V 8.8, AM 8.8		5.0	7,7	11,4	21.0	32,7	47.0	61,4	74,7

a) No data for HIS-N when diamond coring without roughening tools
b) With overall partial safety factor for action γ = 3.0. The recommended loads vary according to the safety factor requirement from national regulations.

Materials

Mechanical properties for HIT-V

Anchor size			ETA-16/0143, issue 2017-07-12								Additional Hilti technical data		
			M8	M10	M12	M16	M20	M24	M27	M30	M33	M36	M39
Nominal tensile strength f_{uk}	HIT-V 5.8(F)	[N/mm²]	500	500	500	500	500	500	500	500	500	500	500
	HIT-V 8.8(F)		800	800	800	800	800	800	800	800	800	800	800
	AM 8.8(HDG)		800	800	800	800	800	800	800	800	800	800	800
	HIT-V-R		700	700	700	700	700	700	500	500	500	500	500
	HIT-V-HCR		800	800	800	800	800	700	700	700	500	500	500
Yield strength f_{yk}	HIT-V 5.8(F)	[N/mm²]	400	400	400	400	400	400	400	400	400	400	400
	HIT-V 8.8(F)		640	640	640	640	640	640	640	640	640	640	640
	AM 8.8(HDG)		640	640	640	640	640	640	640	640	640	640	640
	HIT-V-R		450	450	450	450	450	450	210	210	210	210	210
	HIT-V-HCR		640	640	640	640	640	400	400	400	250	250	250
Stressed cross-section A_s	HIT-V AM 8.8	[mm²]	36,6	58,0	84,3	157	245	353	459	561	694	817	976
Moment of resistance W	HIT-V AM 8.8	[mm³]	31,2	62,3	109	277	541	935	1387	1874	2579	3294	4301

Mechanical properties for HIS-N

Anchor size			ETA-16/0143, issue 2017-07-12				
			M8	M10	M12	M16	M20
Nominal tensile strength f_{uk}	HIS-N	[N/mm²]	490	490	460	460	460
	Screw 8.8		800	800	800	800	800
	HIS-RN		700	700	700	700	700
	Screw A4-70		700	700	700	700	700
Yield strength f_{yk}	HIS-N	[N/mm²]	410	410	375	375	375
	Screw 8.8		640	640	640	640	640
	HIS-RN		350	350	350	350	350
	Screw A4-70		450	450	450	450	450
Stressed cross-section A_s	HIS-(R)N	[mm²]	51,5	108,0	169,1	256,1	237,6
	Screw		36,6	58	84,3	157	245
Moment of resistance W	HIS-(R)N	[mm³]	145	430	840	1595	1543
	Screw		31,2	62,3	109	277	541

Material quality for HIT-V

Part	Material
Zinc coated steel	
Threaded rod, HIT-V 5.8 (F)	Strength class 5.8; Elongation at fracture A5 > 8% ductile Electroplated zinc coated ≥ 5µm; (F) hot dip galvanized ≥ 45 µm
Threaded rod, HIT-V 5.8 (F)	Strength class 8.8; Elongation at fracture A5 > 12% ductile Electroplated zinc coated ≥ 5µm; (F) hot dip galvanized ≥ 45 µm
Hilti Meter rod, AM 8.8 (HDG)	Strength class 8.8; Elongation at fracture A5 > 12% ductile Electroplated zinc coated ≥ 5µm (HDG) hot dip galvanized ≥ 45 µm
Washer	Electroplated zinc coated ≥ 5 µm, hot dip galvanized ≥ 45 µm
Nut	Strength class of nut adapted to strength class of threaded rod. Electroplated zinc coated ≥ 5µm, hot dip galvanized ≥ 45 µm
Stainless Steel	
Threaded rod, HIT-V-R	Strength class 70 for ≤ M24 and strength class 50 for > M24; Elongation at fracture A5 > 8% ductile Stainless steel 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362
Washer	Stainless steel 1.4401, 1.4404, 1.4578, 1.4571, 1.4439, 1.4362 EN 10088-1:2014
Nut	Stainless steel 1.4401, 1.4404, 1.4578, 1.4571, 1.4439, 1.4362 EN 10088-1:2014
High corrosion resistant steel	
Threaded rod, HIT-V-HCR	Strength class 80 for ≤ M20 and class 70 for > M20, Elongation at fracture A5 > 8% ductile High corrosion resistance steel 1.4529; 1.4565;
Washer	High corrosion resistant steel 1.4529, 1.4565 EN 10088-1:2014
Nut	High corrosion resistant steel 1.4529, 1.4565 EN 10088-1:2014

Material quality for HIS-N

Part		Material
HIS-N	Internal threaded sleeve	C-steel 1.0718; Steel galvanized ≥ 5 µm
	Screw 8.8	Strength class 8.8, A5 > 8 % Ductile; Steel galvanized ≥ 5 µm
HIS-RN	Internal threaded sleeve	Stainless steel 1.4401,1.4571
	Screw 70	Strength class 70, A5 > 8 % Ductile Stainless steel 1.4401; 1.4404, 1.4578; 1.4571; 1.4439; 1.4362

Setting information

Installation temperature
-5°C to + 40°C

Service temperature range
Hilti HIT-RE 500 V3 injection mortar may be applied in the temperature ranges given below. An elevated base material temperature may lead to a reduction of the design bond resistance.

Temperature range	Base material temperature	Max. long term base material temperature	Max. short term base material temperature
Temperature range I	-40 °C to +40 °C	+24 °C	+40 °C
Temperature range II	-40 °C to +70 °C	+43 °C	+70 °C

Max short term base material temperature
Short-term elevated base material temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

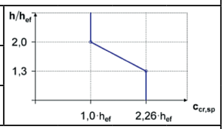
Max long term base material temperature
Long-term elevated base material temperatures are roughly constant over significant periods of time.

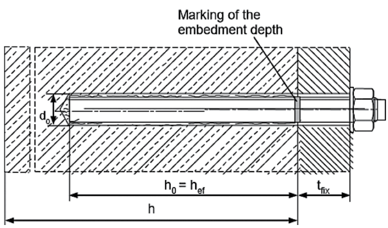
Working time and curing time

Temperature of the base material T	Working time t_{work}	Minimum curing time t_{cure} a)
-5 °C to -1 °C	2 h	168 h
0 °C to 4 °C	2 h	48 h
5 °C to 9 °C	2 h	24 h
10 °C to 14 °C	1,5 h	16 h
15 °C to 19 °C	1 h	16 h
20 °C to 24 °C	30 min	7 h
25 °C to 29 °C	20 min	6 h
30 °C to 34 °C	15 min	5 h
35 °C to 39 °C	12 min	4,5 h
40 °C	10 min	4 h

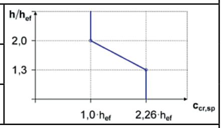
a) The curing time data are valid for dry base material only. In wet base material, the curing times must be doubled

Setting details for HIT-V

			ETA-16/0143, issue 2017-07-12								Additional Hilti technical data		
Anchor size			M8	M10	M12	M16	M20	M24	M27	M30	M33	M36	M39
Nominal diameter of drill bit	d_0	[mm]	10	12	14	18	22	28	30	35	37	40	42
Effective anchorage and drill hole depth range a)	$h_{ef,min}$	[mm]	60	60	70	80	90	96	108	120	132	144	156
	$h_{ef,max}$	[mm]	160	200	240	320	400	480	540	600	660	720	780
Minimum base material thickness	h_{min}	[mm]	h_{ef} +30 mm ≥ 100 mm			$h_{ef} + 2\ d_0$							
Max. torque moment	T_{max}	[mm]	10	20	40	80	150	200	270	300	330	360	390
Minimum spacing	s_{min}	[mm]	40	50	60	75	90	115	120	140	165	180	195
Min. edge distance	c_{min}	[mm]	40	45	45	50	55	60	75	80	165	180	195
Critical spacing for splitting failure	$s_{cr,sp}$	[mm]	2 ccr,sp										
Critical edge distance for splitting failure b)	$c_{cr,sp}$	[mm]	**1,0 · h_{ef}**			for h / h_{ef} ≥ 2,0							
		[mm]	**4,6 h_{ef} - 1,8 h**			for 2,0 > h / h_{ef} > 1,3							
		[mm]	**2,26 h_{ef}**			for h / h_{ef} ≤ 1,3							
Critical spacing for concrete cone failure	$s_{cr,N}$	[mm]	2 $c_{cr,N}$										
Critical edge distance for concrete cone failure c)	$c_{cr,N}$	[mm]	1,5 h_{ef}										



Setting details for HIS-N

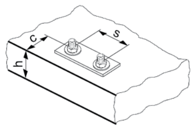
Anchor size			M8	M10	M12	M16	M20
Nominal diameter of drill bit	d_0	[mm]	14	18	22	28	32
Diameter of element	d	[mm]	12,5	16,5	20,5	25,4	27,6
Effective anchorage and drill hole depth	h_{ef}	[mm]	90	110	125	170	205
Minimum base material thickness	h_{min}	[mm]	120	150	170	230	270
Diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18	22
Thread engagement length; min - max	h_s	[mm]	8-20	10-25	12-30	16-40	20-50
Minimum spacing	s_{min}	[mm]	60	70	90	115	130
Minimum edge distance	c_{min}	[mm]	40	45	55	65	90
Critical spacing for splitting failure	$s_{cr,sp}$	[mm]	$2\ c_{cr,sp}$				
Critical edge distance for splitting failure [b)]	$c_{cr,sp}$	[mm]	**$1{,}0 \cdot h_{ef}$**	for $h / h_{ef} \geq 2{,}0$			
		[mm]	**$4{,}6\ h_{ef} - 1{,}8\ h$**	for $2{,}0 > h / h_{ef} > 1{,}3$			
		[mm]	**$2{,}26\ h_{ef}$**	for $h / h_{ef} \leq 1{,}3$			
Critical spacing for concrete cone failure	$s_{cr,N}$	[mm]	$2\ c_{cr,N}$				
Critical edge distance for concrete cone failure [c)]	$c_{cr,N}$	[mm]	$1{,}5\ h_{ef}$				
Max. torque moment [a)]	T_{max}	[Nm]	10	20	40	80	150

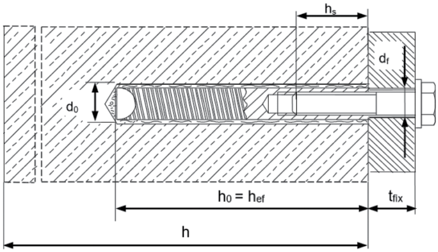
For spacing (edge distance) smaller than critical spacing (critical edge distance) the design loads have to be reduced.

a) $h_{ef,min} \leq h_{ef} \leq h_{ef,max}$ (h_{ef}: embedment depth)

b) h: base material thickness ($h \geq h_{min}$)

c) The critical edge distance for concrete cone failure depends on the embedment depth hef and the design bond resistance. The simplified formula given in this table is on the save side.





Setting details for HIT-V

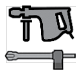
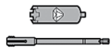
Anchor size		M8	M10	M12	M16	M20	M24	M27	M30	M36	M39
Rotary hammer	HIT-V	TE 2 – TE 16				TE 40 – TE 80				Not available from Hilti	
	HIS-N	TE 2 – TE 16		TE 40 – TE 80			-				
Other tools		compressed air gun, set of cleaning brushes, dispenser									
		roughening tools TE-YRT								-	
Additional Hilti recommended tools		DD EC-1, DD 100 … DD 160 [a)]								-	

a) For anchors in diamond drilled holes load values for combined pull-out and concrete cone resistance have to be reduced

Minimum roughening time $t_{roughen}$ ($t_{roughen}$ [sec] = h_{ef} [mm] /10)

h_{ef} [mm]	$t_{roughen}$ [sec]
0 to 100	10
101 to 200	20
201 to 300	30
301 to 400	40
401 to 500	50
501 to 600	60

Parameters of cleaning and setting tools

HIT-V	HIS-N	Drill bit diameters d_0 [mm]				Installation	
		Hammer drill (HD)	Hollow Drill Bit (HDB)	Diamond coring		Brush HIT-RB	Piston plug HIT-SZ
				Diamond coring (DD)	With roughening tool (RT)		
							
M8	**-**	10	-	10	-	10	-
M10	**-**	12	-	12	-	12	12
M12	**M8**	14	14	14	-	14	14
M16	**M10**	18	18	18	18	18	18
M20	**M12**	22	22	22	22	22	22
M24	**M16**	28	28	28	28	28	28
M27	**-**	30	-	30	30	30	30
-	**M20**	32	32	32	32	32	32
M30	**-**	35	35	35	35	35	35
M33	**-**	37	-	-	-	37	37
M36	**-**	40	-	-	-	40	40
M39	**-**	42	-	-	-	42	42

Associated components for the use of Hilti Roughening tool TE-YRT

Diamond coring		Roughening tool TE-YRT	Wear gauge RTG…
			
d_0 [mm]		d_0 [mm]	size
Nominal	measured		
18	17,9 to 18,2	18	18
20	19,9 to 20,2	20	20
22	21,9 to 22,2	22	22
25	24,9 to 25,2	25	25
28	27,9 to 28,2	28	28
30	29,9 to 30,2	30	30
32	31,9 to 32,2	32	32
35	34,9 to 35,2	35	35

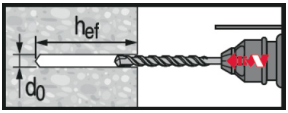
Setting instructions

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

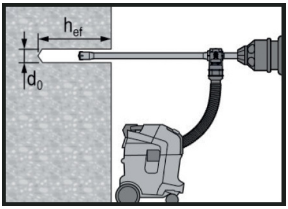
Safety regulations.

Review the Material Safety Data Sheet (MSDS) before use for proper and safe handling! Wear well-fitting protective goggles and protective gloves when working with Hilti HIT-RE 500 V3

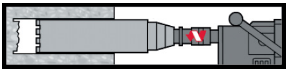
Drilling



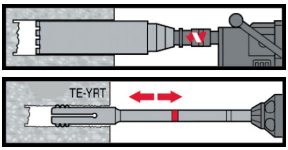
Hammer drilled hole
For dry and wet concrete and installation in flooded holes (no sea water).



Hammer drilled hole with Hollow Drilled Bit (HDB)
No cleaning required.
For dry and wet concrete only.

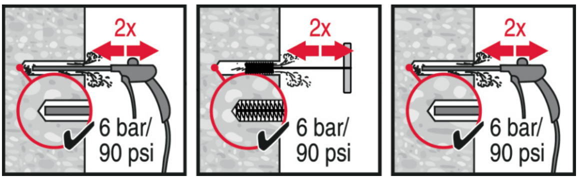


Diamond Coring
For dry and wet concrete only.



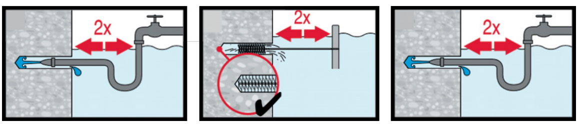
Diamond Coring + Roughening Tool
For dry and wet concrete only.
Before roughening, the borehole needs to be dry.

Cleaning (Inadequate hole cleaning=poor load values.)



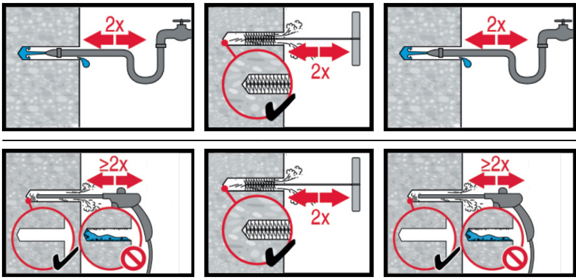
Hammer Drilling:

Compressed air cleaning (CAC)
For all drill hole diameters d_0 and drill hole depths h_0.



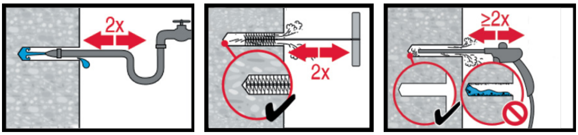
Hammer drilling:

Cleaning for under water:
For all bore hole diameters d_0 and all bore hole depth h_0.



Hammer drilled flooded holes and diamond cored holes:

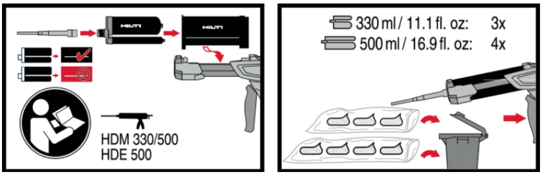
Compressed air cleaning (CAC)
For all drill hole diameters d_0 and drill hole depths h_0.



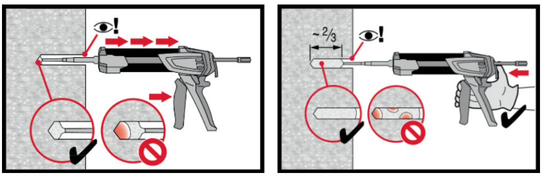
Diamond cored holes with Hilti roughening tool:

Compressed air cleaning (CAC)
For all drill hole diameters d_0 and drill hole depths h_0.

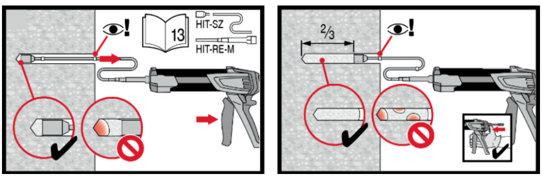
Injection preparation



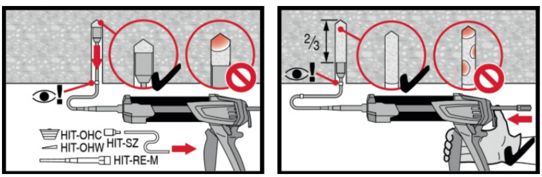
Injection system preparation.



Injection method for drill hole depth h_{ef} > 250mm.

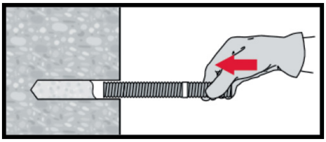


Injection method for drill hole depth h_{ef} > 250mm.

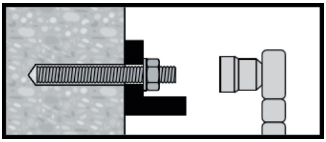


Injection method for overhead application.

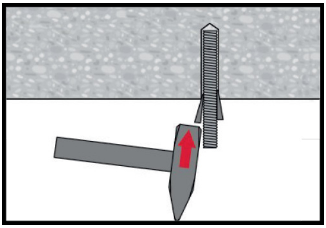
Setting the element



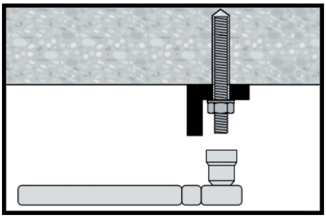
Setting element, observe working time "t_{work}".



Loading the anchor after required curing time t_{cure} the anchor can be loaded.
The applied installation torque shall not exceed T_{max}.



Setting element for overhead applications, observe working time "t_{work}"



Loading the anchor after required curing time t_{cure} the anchor can be loaded.
The applied installation torque shall not exceed T_{max}.

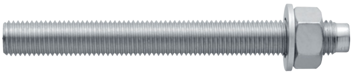
HIT-RE 100 injection mortar

Anchor design (ETAG 001) / Rods&Sleeves / Concrete

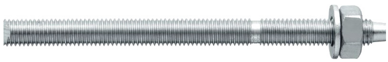
Injection mortar system

Hilti HIT-RE 100

500 ml foil pack (also available as 330 ml foil pack)



Anchor rods:
HIT-V
HIT-V-F
HIT-V-R
HIT-V-HCR
(M8-M30)



Anchor rods:
HAS-(E)
HAS-(E)-R
HAS-(E)-HCR
(M8-M30)

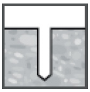
Anchor rods:
HAS-(U)
HAS-(U)-R
HAS-(U)-HCR
(M8-M30)

Benefits

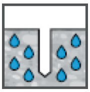
- Suitable for cracked and non-cracked concrete C 20/25 to C 50/60
- High loading capacity
- Suitable for dry and water saturated concrete
- Large diameter applications
- Long working time at elevated temperatures
- Odourless epoxy

Base material

Non-cracked concrete

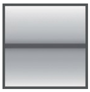


Dry concrete



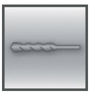
Wet concrete

Load conditions



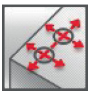
Static/ quasi-static

Installation conditions



Hammer drilling

Variable embedment depth



Small edge distance and spacing

Other information

European Technical Assessment

CE conformity

A4 316
Corrosion resistance

HCR highMo
High corrosion resistance

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European technical Assessment [a)]	DIBt, Berlin	ETA-15/0882 / 2019-8-30

a) All data given in this section according to ETA-15/0882 issue 2019-8-30

Recommended general notes

* The below clauses based on Hilti product qualifications are for references only. Selection of clauses by the engineer shall be based on the specific application needs. Please contact Hilti's technical team for further details.

- Adhesive mortar shall be foilpack two-component ready mix epoxy resin (styrene-free).
- Anchor shall be approved for overhead installation.
- For overhead or deep embedment depth (>250mm) installation, specialized accessories shall be applied to ensure drill hole is fully grouted with no voids.
- Borehole drilled and cleaned in one step with Hilti hollow drill bit is recommended to reduce installation error.
- Anchors shall obtain the European Technical Assessment (ETA) report.
- The anchor bolt design shall be done either according to "ETAG001 Annex C Design Method" issued by EOTA or "Guides on design of post-installed anchor bolt systems in Hong Kong" issued by HKISC.
- Anchors shall be tested in accordance to either ETAG-001 Annex A or ACI 355.2 by accredited laboratories under HOKLAS Mutual Recognition Arrangement (MRA) Partners.
- Anchor to be approved by WRAS and NSF for use in contact with drinking water.

Static and quasi-static loading (for a single anchor)

All data in this section applies to:

- Correct setting (See setting instruction)
- No edge distance and spacing influence
- *Steel* failure
- Anchor HIT-V and HAS-(E,U) with strength 5.8
- Base material thickness, as specified in the table
- One typical embedment depth, as specified in the table
- Concrete C 20/25, $f_{ck,cube}$ = 25 N/mm²
- Temperate range I
  (min. base material temperature -40°C, max. long term/short term base material temperature: +24°C/40°C)

Embedment depth and base material thickness

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Typical embedment depth		[mm]	80	90	110	125	170	210	240	270
Base material thickness		[mm]	110	120	140	165	220	270	300	340

Characteristic resistance

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete										
Tension N_{RK}	HIT-V, HAS-(E,U)	[kN]	*18,3*	*29,0*	*42,2*	70,6	111,9	153,7	187,8	224,0
Shear V_{Rk}	HIT-V, HAS-(E,U)	[kN]	*9,2*	*14,5*	*21,1*	*39,3*	*61,3*	*88,3*	*114,8*	*140,3*
Tension N_{RK}	HIT-V, HAS-(E,U) A4	[kN]	*25,6*	40,6	58,2	70,5	111,9	153,6	*229,5*	*280,5*
Shear V_{Rk}	HIT-V, HAS-(E,U) A4	[kN]	*12,8*	*20,3*	*29,5*	*55,0*	*85,8*	*123,6*	*114,8*	*140,3*

Design resistance

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete										
Tension N_{Rd}	HIT-V, HAS-(E,U)	[kN]	12,2	19,3	27,7	33,6	53,3	73,2	89,4	106,7
Shear V_{Rd}	HIT-V, HAS-(E,U)	[kN]	7,3	11,6	16,9	31,4	49,0	70,6	91,8	112,2
Tension N_{Rd}	HIT-V, HAS-(E,U) A4	[kN]	17,0	27,0	38,8	47,0	74,6	102,4	153,0	187,0
Shear V_{Rd}	HIT-V, HAS-(E,U) A4	[kN]	8,5	13,5	19,6	36,6	57,2	82,4	76,5	93,5

Recommended loads [a)]

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete										
Tension N_{Rec}	HIT-V, HAS-(E,U)	[kN]	6,1	9,6	14,0	23,5	37,3	51,2	62,6	74,6
Shear V_{Rec}	HIT-V, HAS-(E,U)	[kN]	3,1	4,8	7,0	13,1	20,4	29,4	38,2	46,7
Tension N_{Rec}	HIT-V, HAS-(E,U) A4	[kN]	8,5	13,5	19,4	23,5	37,3	51,2	76,5	93,5
Shear V_{Rec}	HIT-V, HAS-(E,U) A4	[kN]	4,2	6,7	9,8	18,3	28,6	41,2	38,2	46,7

a) With overall partial safety factor for action γ = 3.0. The partial safety factors for action depend on the type of loading and shall be taken from national regulations.

Materials

Materials properties

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Nominal tensile strength f_{uk}	HIT-V 5.8 HAS-(E,U) 5.8	[N/mm²]	500	500	500	500	500	500	500	500
	HIT-V 8.8 HAS-(E,U) 8.8	[N/mm²]	800	800	800	800	800	800	800	800
	HIT-V-R HAS-(E,U)R	[N/mm²]	700	700	700	700	700	700	500	500
	HIT-V-HCR HAS-(E,U)HCR	[N/mm²]	800	800	800	800	800	700	700	700
Yield strength f_{yk}	HIT-V 5.8 HAS-(E,U) 5.8	[N/mm²]	400	400	400	400	400	400	400	400
	HIT-V 8.8 HAS-(E,U) 8.8	[N/mm²]	640	640	640	640	640	640	640	640
	HIT-V-R HAS-(E,U)R	[N/mm²]	450	450	450	450	450	450	210	210
	HIT-V-HCR HAS-(E,U)HCR	[N/mm²]	640	640	640	640	640	400	400	400
Stressed cross-section A_s	HIT-V	[mm²]	36,6	58,0	84,3	157	245	353	459	561
	HAS-(E,U)	[mm²]	32,8	52,3	76,2	144,0	225,0	324,0	427,0	519,0
Moment of resistance W	HIT-V	[mm³]	31,2	62,3	109	277	541	935	1387	1874
	HAS-(E,U)	[mm³]	27,0	54,1	93,8	244,0	474,0	809,0	1274,0	1706,0

Material quality for HIT-V and HAS-(E,U)

Part	Material
Zinc coated steel	
Threaded rod, HIT-V 5.8 (F) HAS-(E,U) 5.8	Strength class 5.8; Elongation at fracture A5 > 8% ductile Electroplated zinc coated ≥ 5µm; (F) hot dip galvanized ≥ 45 µm
Threaded rod, HIT-V 8.8 (F) HAS-(E,U) 8.8	Strength class 8.8; Elongation at fracture A5 > 12% ductile Electroplated zinc coated ≥ 5µm; (F) hot dip galvanized ≥ 45 µm
Washer	Electroplated zinc coated ≥ 5 µm, hot dip galvanized ≥ 45 µm
Nut	Strength class of nut adapted to strength class of threaded rod. Electroplated zinc coated ≥ 5µm, hot dip galvanized ≥ 45 µm
Stainless Steel	
Threaded rod, HIT-V-R HAS-(E,U)-R	Strength class 70 for ≤ M24 and strength class 50 for > M24; Elongation at fracture A5 > 8% ductile Stainless steel 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362
Washer	Stainless steel 1.4401, 1.4404, 1.4578, 1.4571, 1.4439, 1.4362 EN 10088-1:2014
Nut	Stainless steel 1.4401, 1.4404, 1.4578, 1.4571, 1.4439, 1.4362 EN 10088-1:2014
High corrosion resistant steel	
Threaded rod, HIT-V-HCR HAS-(E,U)-HCR	Strength class 80 for ≤ M20 and class 70 for > M20, Elongation at fracture A5 > 8% ductile High corrosion resistance steel 1.4529; 1.4565;
Washer	High corrosion resistant steel 1.4529, 1.4565 EN 10088-1:2014
Nut	High corrosion resistant steel 1.4529, 1.4565 EN 10088-1:2014

Setting information

Installation temperature
+5°C to +40°C

Service temperature range
Hilti HIT-RE 100 injection mortar may be applied in the temperature ranges given below. An elevated base material temperature may lead to a reduction of the design bond resistance.

Temperature range	Base material temperature	Max. long term base material temperature	Max. short term base material temperature
Temperature range I	-40 °C to + 40 °C	+ 24 °C	+ 40 °C
Temperature range II	-40 °C to + 58 °C	+ 35 °C	+ 58 °C
Temperature range III	-40 °C to + 70 °C	+ 43 °C	+ 70 °C

Max short term base material temperature
Short-term elevated base material temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

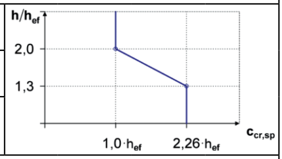
Max long term base material temperature
Long-term elevated base material temperatures are roughly constant over significant periods of time.

Working time and curing time

Temperature of the base material	Max. working time in which rebar can be inserted and adjusted t_{work}	Min. curing time before rebar can be fully loaded t_{cure}
5 °C ≤ T_{BM} < 10 °C	2 h	72 h
10 °C ≤ T_{BM} < 15 °C	1,5 h	48 h
15 °C ≤ T_{BM} < 20 °C	30 min	24 h
20 °C ≤ T_{BM} < 30 °C	20 min	12 h
30 °C ≤ T_{BM} < 40 °C	12 min	8 h
40 °C	12 min	4 h

The curing time data are valid for dry base material only. In wet base material the curing times must be doubled

Settings details

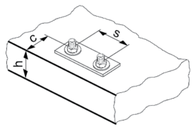
Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Nominal diameter of drill bit	d_0	[mm]	10	12	14	18	22	28	30	35
Diameter of element	d	[mm]	8	10	12	16	20	24	27	30
Effective anchorage and drill hole depth	h_{ef}	[mm]	60 to 160	60 to 200	70 to 240	80 to 320	90 to 400	96 to 480	108 to 540	120 to 600
Minimum base material thickness	h_{min}	[mm]	h_{ef} + 30 ≥ 100 mm			h_{ef} + 2 d_0				
Diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18	22	26	30	33
Minimum spacing	s_{min}	[mm]	40	50	60	80	100	120	135	150
Minimum edge distance	c_{min}	[mm]	40	50	60	80	100	120	135	150
Critical spacing for splitting failure	$s_{cr,sp}$	[mm]	2 $c_{cr,sp}$							
Critical edge distance for splitting failure a)	$c_{cr,sp}$	[mm]	**1,0 · h_{ef}**	for h / h_{ef} ≥ 2,0						
			4,6 h_{ef} - 1,8 h	for 2,0 > h / h_{ef} > 1,3						
			2,26 h_{ef}	for h / h_{ef} ≤ 1,3						
Critical spacing for concrete cone failure	$s_{cr,N}$	[mm]	2 $C_{cr,N}$							
Critical edge distance concrete cone failure b)	$c_{cr,N}$	[mm]	1,5 h_{ef}							
Torque moment c)	T_{max}	[Nm]	10	20	40	80	150	200	270	300

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

a) $h_{ef,min} \leq h_{ef} \leq h_{ef,max}$ (h_{ef}: embedment depth) h: base material thickness (h ≥ h_{min})

b) The critical edge distance for concrete cone failure depends on the embedment depth h_{ef} and the design bond resistance. The simplified formula given in this table is on the save side

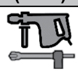
c) This is the maximun recommended torque moment to avoid splitting failure during installation for anchors with minimun spacing and/or edge distance



Installation equipment

Anchor size	M8	M10	M12	M16	M20	M24	M27	M30
Rotary hammer	TE 2– TE 16				TE 40 – TE 80			
Other tools	Compressed air gun or blow out pump Set of cleaning brushes, dispenser, piston plug							

Drilling and cleaning parameters

HIT-V HAS	Drill bit diameters d_0 [mm]		Installation size [mm]	
	Hammer drill (HD)	**Hollow Drill Bit (HDB)**	**Brush HIT-RB**	**Piston plug HIT-SZ**
				
M8	10	-	10	**-**
M10	12	12	12	**12**
M12	14	14	14	**14**
M16	18	18	18	**18**
M20	22	22	22	**22**
M24	28	28	28	**28**
M27	30	-	30	**30**
M30	35	35	35	**35**

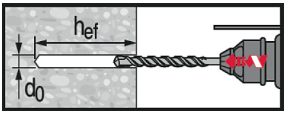
Setting instructions

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

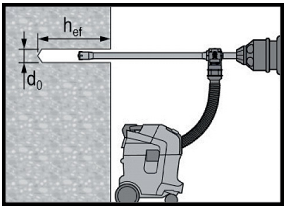
Safety regulations.

Review the Material Safety Data Sheet (MSDS) before use for proper and safe handling! Wear well-fitting protective goggles and protective gloves when working with Hilti HIT-RE 500.

Drilling

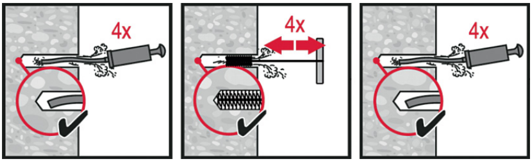


Hammer drilled hole
For dry and wet concrete.

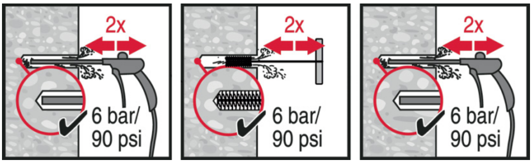


Hammer drilled hole with Hollow Drilled Bit (HDB)
No cleaning required.

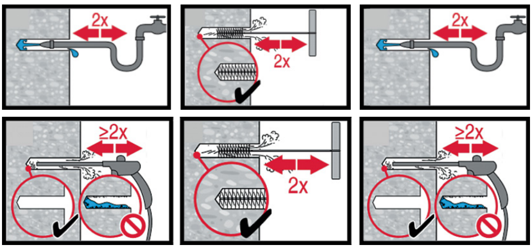
Cleaning



Manual cleaning (MC)
Non-cracked concrete only
for drill diameters $d_0 \leq 20$ mm and drill hole depth $h_0 \leq 10 \cdot d$.

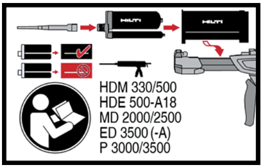


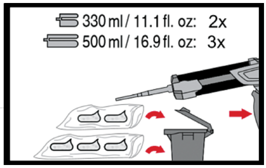
Compressed air cleaning (CAC)
for all drill hole diameters d_0 and drill hole depths $h_0 \leq 20 \cdot d$.



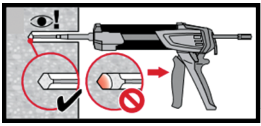
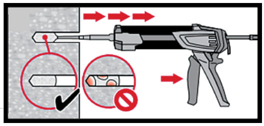
Compressed air cleaning (CAC)
cleaning of flooded holes
for all drill hole diameters d_0 and drill hole depths h_0

Injection system

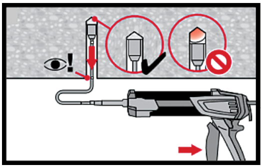
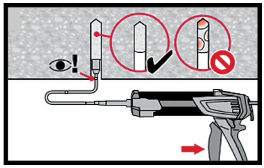




Injection system preparation.

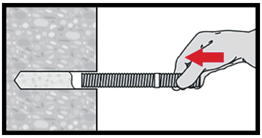



Injection method for drill hole depth $h_{ef} \leq 250$ mm.

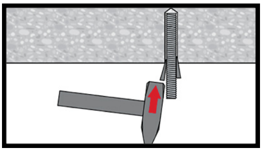



Injection method for overhead application and/or installation with embedment depth $h_{ef} > 250$ mm.

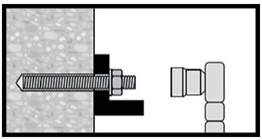
Setting the element



Setting element, observe working time "t_{work}",



Setting element for overhead applications, observe working time "t_{work}".



Loading the anchor: After required curing time tcure the anchor can be loaded.

HVU2 adhesive capsule for concrete

Ultimate performance foil capsule for heavy-duty anchoring in concrete

Anchor version

HVU2
Mortar capsule

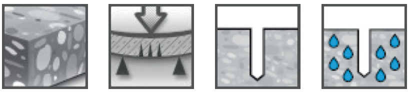
Anchor rod:
HAS-U
HDG
HAS-U A4
HAS-U HCR
AM 8.8 (HDG)
(M8-M39)

Internally threaded sleeves:
HIS-N
HIS-RN
(M8-M20)

Benefits

- High loading capacity suitable for restricted on site conditions
- Instant curing down to 5 minutes
- Clean and fast installation that suits hard jobsite conditions
- Pre-dosed volume of mortar per fastening point
- Suitable for cracked and non-cracked concrete C20/25 to C50/60 both for hammer drilled and diamond cored holes
- Suitable for dry and water saturated concrete
- SafeSet technology: Hilti hollow drill bit for automatic cleaning

Base material



Non-cracked concrete | Cracked concrete (Tension zone) | Dry concrete | Wet concrete

Load conditions

Static/ quasi-static | Fire resistance

Installation conditions

Hammer drilled holes | Diamond drilled holes | Hilti SafeSet technology | Small edge distance and spacing

Other information

European Technical Assessment | CE conformity | PROFIS Engineering Suite | Corrosion resistance | High corrosion resistance

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European technical Assessment [a]	DIBt, Berlin	ETA-16/0515 / 2017-07-13
Fire test assessment	ING.Thiele, Pirmasens	21735 / 2017-08-01

a) All data given in this section according ETA-16/0515 issue 2017-07-13

Recommended general notes

* The below clauses based on Hilti product qualifications are for references only. Selection of clauses by the engineer shall be based on the specific application needs. Please contact Hilti's technical team for further details.

- Anchor shall be capsule type adhesive
- Anchor shall be tested for water tightness
- Approved for use in uncracked and cracked concrete under static and quasi-static loading
- Approved for use in diamond cored drilled holes. In such case the performance shall be on the same level of hammer drilled holes when proper installation steps are followed.
- Anchor shall be installed in combination with dust removal drilling accessories to ensure dust free environment and clean borehole.
- Anchor shall be approved for overhead installation.
- Anchors shall obtain the European Technical Assessment (ETA) report.
- The anchor bolt design shall be done either according to "ETAG001 Annex C Design Method" issued by EOTA or "Guides on design of post-installed anchor bolt systems in Hong Kong" issued by HKISC.
- Anchors shall be tested in accordance to either ETAG-001 Annex A or ACI 355.2 by accredited laboratories under HOKLAS Mutual Recognition Arrangement (MRA) Partners.
- Anchor to be approved by NSF for use in contact with drinking water.

For seismic application:
- Approved for use under seismic actions category 1 (C1) and 2 (C2) according to EOTA TR045 "Design of Metal Anchors For Use In Concrete Under Seismic Actions, 02/2013".

Static and quasi-static resistance (for a single anchor)

All data in this section applies to:
- Correct setting (See setting instruction)
- No edge distance and spacing influence
- *Steel* failure
- Minimum base material thickness
- Concrete C 20/25, $f_{ck,cube}$ = 25 N/mm²

Effective anchorage depth

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
HAS-U										
Eff. Anchorage depth	h_{ef}	[mm]	80	90	110	125	170	210	240	270
Base material thickness	h_{min}	[mm]	110	120	140	160	220	270	300	340
HIS-N										
Eff. Anchorage depth	h_{ef}	[mm]	90	110	125	170	205	-	-	-
Base material thickness	h_{min}	[mm]	120	150	170	230	270	-	-	-

Hammer drilled holes and hammer drilled holes with hollow drill bit [a]:

Characteristic resistance

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete										
Tension N_{Rk}	HAS-U 5.8	[kN]	*18,3*	*29,0*	*42,2*	68,8	109	150	-	-
	HAS-U 8.8		24,1	42,0	56,8	68,8	109	150	183	218
	HAS-U A4		24,1	*40,6*	56,8	68,8	109	150	183	218
	HAS-U HCR		24,1	42,0	56,8	68,8	109	150	-	-
	HIS-N 8.8		*25,0*	*46,0*	*67,0*	109	*116*	-	-	-
	HIS-RN 70		*26,0*	*41,0*	*59,0*	109	144	-	-	-
Shear V_{Rk}	HAS-U 5.8	[kN]	*9,2*	*14,5*	*21,1*	*39,3*	*61,3*	*88,3*	-	-
	HAS-U 8.8		*14,6*	*23,2*	*33,7*	*62,8*	*98,0*	*141*	*184*	*224*
	HAS-U A4		*12,8*	*20,3*	*29,5*	*55,0*	*85,8*	*124*	*115*	*140*
	HAS-U HCR		*14,6*	*23,2*	*33,7*	*62,8*	*98,0*	*124*	-	-
	HIS-N 8.8		*13,0*	*23,0*	*34,0*	*63,0*	*58,0*	-	-	-
	HIS-RN 70		*13,0*	*20,0*	*30,0*	*55,0*	*83,0*	-	-	-
Cracked concrete										
Tension N_{Rk}	HAS-U 5.8	[kN]	10,1	24,0	35,2	48,1	76,3	105	-	-
	HAS-U 8.8		10,1	24,0	35,2	48,1	76,3	105	128	153
	HAS-U A4		10,1	24,0	35,2	48,1	76,3	105	128	153
	HAS-U HCR		10,1	24,0	35,2	48,1	76,3	105	-	-
	HIS-N 8.8		23,0	37,1	48,1	76,3	101	-	-	-
	HIS-RN 70		23,0	37,1	48,1	76,3	101	-	-	-
Shear V_{Rk}	HAS-U 5.8	[kN]	*9,2*	*14,5*	*21,1*	*39,3*	*61,3*	*88,3*	-	-
	HAS-U 8.8		*14,6*	*23,2*	*33,7*	*62,8*	*98,0*	*141*	*184*	*224*
	HAS-U A4		*12,8*	*20,3*	*29,5*	*55,0*	*85,8*	*124*	*115*	*140*
	HAS-U HCR		*14,6*	*23,2*	*33,7*	*62,8*	*98,0*	*124*	-	-
	HIS-N 8.8		*13,0*	*23,0*	*34,0*	*63,0*	*58,0*	-	-	-
	HIS-RN 70		*13,0*	*20,0*	*30,0*	*55,0*	*83,0*	-	-	-

a) Hilti hollow drill bit is available for the element sizes M12 to M30

Design resistance

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete										
Tension N_{Rd}	HAS-U 5.8	[kN]	12,2	19,3	28,1	45,8	72,7	99,8	-	-
	HAS-U 8.8		16,1	28,0	37,8	45,8	72,7	99,8	122	145
	HAS-U A4		15,3	24,2	35,1	45,8	72,7	99,8	80,2	98,1
	HAS-U HCR		16,1	28,0	37,8	45,8	72,7	99,8	-	-
	HIS-N 8.8		16,7	30,7	44,7	72,7	77,3	-	-	-
	HIS-RN 70		13,9	21,9	31,6	58,8	69,2	-	-	-
Shear V_{Rd}	HAS-U 5.8	[kN]	7,3	11,6	16,9	31,4	49,0	70,6	-	-
	HAS-U 8.8		11,7	18,6	27,0	50,2	78,4	113	147	180
	HAS-U A4		9,2	14,5	21,1	39,3	55,0	79,2	48,2	58,9
	HAS-U HCR		11,7	18,6	27,0	50,2	78,4	70,6	-	-
	HIS-N 8.8		10,4	18,4	27,2	50,4	46,4	-	-	-
	HIS-RN 70		8,3	12,8	19,2	35,3	41,5	-	-	-
Cracked concrete										
Tension N_{Rd}	HAS-U 5.8	[kN]	6,7	16,0	23,5	32,1	50,9	69,9	-	-
	HAS-U 8.8		6,7	16,0	23,5	32,1	50,9	69,9	85,4	102
	HAS-U A4		6,7	16,0	23,5	32,1	50,9	69,9	80,2	98,1
	HAS-U HCR		6,7	16,0	23,5	32,1	50,9	69,9	-	-
	HIS-N 8.8		15,3	24,7	32,1	50,9	67,4	-	-	-
	HIS-RN 70		13,9	21,9	31,6	50,9	67,4	-	-	-
Shear V_{Rd}	HAS-U 5.8	[kN]	7,3	11,6	16,9	31,4	49,0	70,6	-	-
	HAS-U 8.8		11,7	18,6	27,0	50,2	78,4	113	147	180
	HAS-U A4		9,2	14,5	21,1	39,3	55,0	79,2	48,2	58,9
	HAS-U HCR		11,7	18,6	27,0	50,2	78,4	70,6	-	-
	HIS-N 8.8		10,4	18,4	27,2	50,4	46,4	-	-	-
	HIS-RN 70		8,3	12,8	19,2	35,3	41,5	-	-	-

a) Hilti hollow drill bit is available for the element sizes M12 to M30

Recommended loads [b)]

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete										
Tension N_{Rec}	HAS-U 5.8	[kN]	6,1	9,7	14,1	22,9	36,3	50,0	-	-
	HAS-U 8.8		8,0	14,0	18,9	22,9	36,3	50,0	61,0	72,7
	HAS-U A4		8,0	13,5	18,9	22,9	36,3	50,0	61,0	72,7
	HAS-U HCR		8,0	14,0	18,9	22,9	36,3	50,0	-	-
	HIS-N 8.8		8,3	15,3	22,3	36,3	38,7	-	-	-
	HIS-RN 70		8,7	13,7	19,7	36,3	48,0	-	-	-
Shear V_{Rec}	HAS-U 5.8	[kN]	3,1	4,8	7,0	13,1	20,4	29,4	-	-
	HAS-U 8.8		4,9	7,7	11,2	20,9	32,7	47,0	61,3	74,7
	HAS-U A4		4,3	6,8	9,8	18,3	28,6	41,3	38,3	46,7
	HAS-U HCR		4,9	7,7	11,2	20,9	32,7	41,3	-	-
	HIS-N 8.8		4,3	7,7	11,3	21,0	19,3	-	-	-
	HIS-RN 70		4,3	6,7	10,0	18,3	27,7	-	-	-
Cracked concrete										
Tension N_{Rec}	HAS-U 5.8	[kN]	4,8	11,4	16,8	22,9	36,3	49,9	-	-
	HAS-U 8.8		4,8	11,4	16,8	22,9	36,3	49,9	61,0	72,7
	HAS-U A4		4,8	11,4	16,8	22,9	36,3	49,9	57,3	70,1
	HAS-U HCR		4,8	11,4	16,8	22,9	36,3	49,9	-	-
	HIS-N 8.8		10,9	17,6	22,9	36,3	48,1	-	-	-
	HIS-RN 70		9,9	15,7	22,5	36,3	48,1	-	-	-
Shear V_{Rec}	HAS-U 5.8	[kN]	5,2	8,3	12,0	22,4	35,0	50,4	-	-
	HAS-U 8.8		8,4	13,3	19,3	35,9	56,0	80,7	105	128
	HAS-U A4		6,5	10,4	15,1	28,0	39,3	56,6	34,4	42,1
	HAS-U HCR		8,4	13,3	19,3	35,9	56,0	50,4	-	-
	HIS-N 8.8		7,4	13,1	19,4	36,0	33,1	-	-	-
	HIS-RN 70		6,0	9,2	13,7	25,2	29,6	-	-	-

a) Hilti hollow drill bit is available for the element sizes M12 to M30

b) With overall partial safety factor for action γ = 3.0. The recommended loads vary according to the safety factor requirement from national regulations

Diamond cored holes:

Characteristic resistance

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete										
Tension N_{Rk}	HAS-U 5.8	[kN]	-	29,0	42,2	68,8	109	150	-	-
	HAS-U 8.8		-	39,6	56,8	68,8	109	150	183	218
	HAS-U A4		-	39,6	56,8	68,8	109	150	183	218
	HAS-U HCR		-	39,6	56,8	68,8	109	150	-	-
	HIS-N 8.8		25,0	46,0	67,0	109	116	-	-	-
	HIS-RN 70		26,0	41,0	59,0	109	144	-	-	-
Shear V_{Rk}	HAS-U 5.8	[kN]	-	14,5	21,1	39,3	61,3	88,3	-	-
	HAS-U 8.8		-	23,2	33,7	62,8	98,0	141	184	224
	HAS-U A4		-	20,3	29,5	55,0	85,8	124	115	140
	HAS-U HCR		-	23,2	33,7	62,8	98,0	124	-	-
	HIS-N 8.8		13,0	23,0	34,0	63,0	58,0	-	-	-
	HIS-RN 70		13,0	20,0	30,0	55,0	83,0	-	-	-
Cracked concrete										
Tension N_{Rk}	HAS-U 5.8	[kN]	-	19,8	29,0	44,0	74,8	105	-	-
	HAS-U 8.8		-	19,8	29,0	44,0	74,8	105	128	153
	HAS-U A4		-	19,8	29,0	44,0	74,8	105	128	153
	HAS-U HCR		-	19,8	29,0	44,0	74,8	105	-	-
	HIS-N 8.8		15,9	25,7	36,2	61,0	80,0	-	-	-
	HIS-RN 70		15,9	25,7	36,2	61,0	80,0	-	-	-
Shear V_{Rk}	HAS-U 5.8	[kN]	-	14,5	21,1	39,3	61,3	88,3	-	-
	HAS-U 8.8		-	23,2	33,7	62,8	98,0	141	184	224
	HAS-U A4		-	20,3	29,5	55,0	85,8	124	115	140
	HAS-U HCR		-	23,2	33,7	62,8	98,0	124	-	-
	HIS-N 8.8		13,0	23,0	34,0	63,0	58,0	-	-	-
	HIS-RN 70		13,0	20,0	30,0	55,0	83,0	-	-	-

Design resistance

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete										
Tension N_{Rd}	HAS-U 5.8	[kN]	-	19,3	28,1	45,8	72,7	99,8	-	-
	HAS-U 8.8		-	26,4	37,8	45,8	72,7	99,8	122	145
	HAS-U A4		-	24,2	35,1	45,8	72,7	99,8	80,2	98,1
	HAS-U HCR		-	26,4	37,8	45,8	72,7	99,8	-	-
	HIS-N 8.8		16,7	30,7	44,7	72,7	77,3	-	-	-
	HIS-RN 70		13,9	21,9	31,6	58,8	69,2	-	-	-
Shear V_{Rd}	HAS-U 5.8	[kN]	-	11,6	16,9	31,4	49,0	70,6	-	-
	HAS-U 8.8		-	18,6	27,0	50,2	78,4	113	147	180
	HAS-U A4		-	14,5	21,1	39,3	55,0	79,2	48,2	58,9
	HAS-U HCR		-	18,6	27,0	50,2	78,4	70,6	-	-
	HIS-N 8.8		10,4	18,4	27,2	50,4	46,4	-	-	-
	HIS-RN 70		8,3	12,8	19,2	35,3	41,5	-	-	-
Cracked concrete										
Tension N_{Rd}	HAS-U 5.8	[kN]	-	13,2	19,4	29,3	49,8	69,9	-	-
	HAS-U 8.8		-	13,2	19,4	29,3	49,8	69,9	85,4	102
	HAS-U A4		-	13,2	19,4	29,3	49,8	69,9	80,2	98,1
	HAS-U HCR		-	13,2	19,4	29,3	49,8	69,9	-	-
	HIS-N 8.8		10,6	17,1	24,2	40,7	53,3	-	-	-
	HIS-RN 70		10,6	17,1	24,2	40,7	53,3	-	-	-
Shear V_{Rd}	HAS-U 5.8	[kN]	-	11,6	16,9	31,4	49,0	70,6	-	-
	HAS-U 8.8		-	18,6	27,0	50,2	78,4	113	147	180
	HAS-U A4		-	14,5	21,1	39,3	55,0	79,2	48,2	58,9
	HAS-U HCR		-	18,6	27,0	50,2	78,4	70,6	-	-
	HIS-N 8.8		10,4	18,4	27,2	50,4	46,4	-	-	-
	HIS-RN 70		8,3	12,8	19,2	35,3	41,5	-	-	-

Recommended loads [a)]

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete										
Tension N_{Rec}	HAS-U 5.8	[kN]	-	9,7	14,1	23,0	36,4	50,0	-	-
	HAS-U 8.8		-	13,2	18,9	23,0	36,4	50,0	61,0	72,7
	HAS-U A4		-	13,2	18,9	23,0	36,4	50,0	61,0	72,7
	HAS-U HCR		-	13,2	18,9	23,0	36,4	50,0	-	-
	HIS-N 8.8		8,3	15,3	22,3	36,4	38,7	-	-	-
	HIS-RN 70		8,7	13,7	19,7	36,4	48,0	-	-	-
Shear V_{Rec}	HAS-U 5.8	[kN]	-	4,8	7,0	13,1	20,5	29,5	-	-
	HAS-U 8.8		-	7,7	11,2	21,0	32,7	47,0	61,4	74,7
	HAS-U A4		-	6,8	9,8	18,4	28,6	41,4	38,4	46,7
	HAS-U HCR		-	7,7	11,2	21,0	32,7	41,4	-	-
	HIS-N 8.8		4,3	7,7	11,3	21,0	19,4	-	-	-
	HIS-RN 70		4,3	6,7	10,0	18,4	27,7	-	-	-
Cracked concrete										
Tension N_{Rec}	HAS-U 5.8	[kN]	-	6,6	9,7	14,7	25,0	35,0	-	-
	HAS-U 8.8		-	6,6	9,7	14,7	25,0	35,0	42,7	51,0
	HAS-U A4		-	6,6	9,7	14,7	25,0	35,0	42,7	51,0
	HAS-U HCR		-	6,6	9,7	14,7	25,0	35,0	-	-
	HIS-N 8.8		5,3	8,6	12,1	20,4	26,7	-	-	-
	HIS-RN 70		5,3	8,6	12,1	20,4	26,7	-	-	-
Shear V_{Rec}	HAS-U 5.8	[kN]	-	4,8	7,1	13,1	20,5	29,5	-	-
	HAS-U 8.8		-	7,7	11,3	21,0	32,7	47,0	61,4	74,7
	HAS-U A4		-	6,7	9,9	18,4	28,6	41,4	38,4	46,7
	HAS-U HCR		-	7,7	11,3	21,0	32,7	41,4	-	-
	HIS-N 8.8		4,3	7,7	11,4	21,0	19,4	-	-	-
	HIS-RN 70		4,3	6,7	10,0	18,4	27,7	-	-	-

a) With overall partial safety factor for action γ = 1,4. The partial safety factors for action depend on the type of loading and shall be taken from national regulations.

Materials

Mechanical properties for HAS-U

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Nominal tensile strength f_{uk}	HAS-U 5.8	[N/mm²]	500	500	500	500	500	500	-	-
	HAS-U 8.8		800	800	800	800	800	800	800	800
	HAS-U A4		700	700	700	700	700	700	500	500
	HAS-U HCR		800	800	800	800	800	700	-	-
Yield strength f_{yk}	HAS-U 5.8	[N/mm²]	440	440	440	440	440	440	-	-
	HAS-U 8.8		640	640	640	640	640	640	640	640
	HAS-U A4		450	450	450	450	450	450	210	210
	HAS-U HCR		640	640	640	640	640	400	-	-
Stressed cross-section A_s	HAS-U	[mm²]	36,6	58,0	84,3	157	245	353	459	561
Moment of resistance W	HAS-U	[mm³]	31,2	62,3	109	277	541	935	1387	1874

Mechanical properties for HIS-N

Anchor size			M8	M10	M12	M16	M20
Nominal tensile strength f_{uk}	HIS-N	[N/mm²]	490	490	490	490	490
	Screw 8.8		800	800	800	800	800
	HIS-RN		700	700	700	700	700
	Screw 70		700	700	700	700	700
Yield strength f_{yk}	HIS-N	[N/mm²]	390	390	390	390	390
	Screw 8.8		640	640	640	640	640
	HIS-RN		350	350	350	350	350
	Screw 70		450	450	450	450	450
Stressed cross-section A_s	HIS-(R)N	[mm²]	51,5	108	169	256	238
	Screw		36,6	58,0	84,3	157	245
Moment of resistance W	HIS-(R)N	[mm³]	145	430	840	1595	1543
	Screw		31,2	62,3	109	277	541

Material quality for HAS-U

Part	Material
Metal parts made of zinc coated steel	
HAS-U	M8 to M24 Strength class 5.8: - Rupture elongation (l_0 = 5d) > 8% ductile M8 to M24 Strength class 8.8: - Rupture elongation (l_0 = 5d) > 12% ductile Electroplated zinc coated ≥5 µm; (F) hot dip galvanized ≥45 µm
Washer	Electroplated zinc coated ≥5 µm; hot dip galvanized ≥45 µm
Nut	Strength class adapted to strength class of threaded rod. Electroplated zinc coated ≥5 µm; hot dip galvanized ≥45 µm
Metal parts made of stainless steel	
HAS-U A4	M8 to M24 Strength class 70: M27 to M30 Strength class 50: - Rupture elongation (l_0 = 5d) > 8% ductile Stainless steel A4 according to EN 10088-1:2014
Washer	Stainless steel A4 according to EN 10088-1:2014
Nut	Strength class adapted to strength class of threaded rod. Stainless steel A4 according to EN 10088-1:2014
Metal parts made of stainless steel	
HAS-U HCR	M8 to M20 Strength class 70: M24 Strength class 80: - Rupture elongation (l_0 = 5d) > 8% ductile High corrosion resistant steel according to EN 10088-1:2014
Washer	High corrosion resistant steel according to EN 10088-1:2014
Nut	Strength class adapted to strength class of threaded rod. High corrosion resistant steel according to EN 10088-1:2014

Material quality for HIS-N

Part		Material
HIS-N	Internal threaded sleeve	C-steel 1.0718; Steel galvanized ≥ 5 µm
	Screw 8.8	Strength class 8.8, A5 > 8 % Ductile Steel galvanized ≥ 5 µm
HIS-RN	Internal threaded sleeve	Stainless steel 1.4401,1.4571
	Screw 70	Strength class 70, A5 > 8 % Ductile Stainless steel 1.4401; 1.4404, 1.4578; 1.4571; 1.4439; 1.4362

Setting information

Installation temperature range:
-10°C to +40°C

Service temperature range
Hilti HVU 2 adhesive may be applied in the temperature ranges given below. An elevated base material temperature may lead to a reduction of the design bond resistance.

Temperature range	Base material temperature	Max. long term base material temperature	Max. short term base material temperature
Temperature range I	-40 °C to +40 °C	+24 °C	+40 °C
Temperature range II	-40 °C to +80 °C	+50 °C	+80 °C
Temperature range III	-40 °C to +120 °C	+72 °C	+120 °C

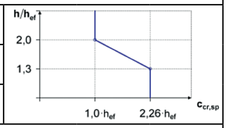
Max short term base material temperature
Short-term elevated base material temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Max long term base material temperature
Long-term elevated base material temperatures are roughly constant over significant periods of time.

Curing time

Temperature of the base material	Minimum curing time t_{cure}
-10 °C to -6 °C	5 hours
-5 °C to -1 °C	3 hours
0 °C to 4 °C	40 min
5 °C to 9 °C	20 min
10 °C to 19 °C	10 min
20 °C to 40 °C	5 min

Setting details for HAS-U

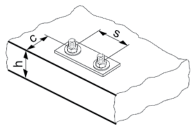
Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Foil capsule HVU2			**8x80**	**10x90**	**12x110**	**16x125**	**20x170**	**24x210**	**27x240**	**30x270**
Diameter of element	$d_1=d_{nom}$	[mm]	8	10	12	16	20	24	27	30
Nominal diameter of drill bit	d_0	[mm]	10	12	14	18	22	28	30	35
Eff. Embedment depth and drill hole in the fixture	$h_{ef}=h_0$	[mm]	80	90	110	125	170	210	240	270
Max. diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18	22	26	30	33
Min. thickness of concrete member	h_{min}	[mm]	110	120	140	160	220	270	300	340
Max. torque moment [a)]	T_{max}	[Nm]	10	20	40	80	150	200	270	300
Min. spacing	s_{min}	[mm]	40	50	60	75	90	115	120	140
Min. edge distance	c_{min}	[mm]	40	45	45	50	55	60	75	80
Critical spacing for splitting failure	$s_{cr,sp}$	[mm]	$2\ c_{cr,sp}$							
Critical edge distance for splitting failure [b)]	$c_{cr,sp}$	[mm]	**$1{,}0 \cdot h_{ef}$**		for $h / h_{ef} \geq 2{,}0$					
		[mm]	**$4{,}6\ h_{ef} - 1{,}8\ h$**		for $2{,}0 > h / h_{ef} > 1{,}3$					
		[mm]	**$2{,}26\ h_{ef}$**		for $h / h_{ef} \leq 1{,}3$					
Critical spacing for concrete cone failure	$s_{cr,N}$	[mm]	$3\ h_{ef}$							
Critical edge distance for concrete cone failure [c)]	$c_{cr,N}$	[mm]	$1{,}5\ h_{ef}$							

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

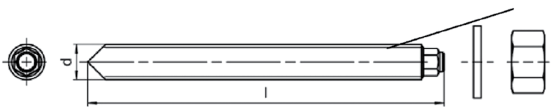
a) Max. recommended torque moment to avoid splitting failure during installation with min. spacing and/or edge distance

b) h: base material thickness ($h \geq h_{min}$)

c) The critical edge distance for concrete cone failure depends on the embedment depth h_{ef} and the design bond resistance. The simplified formula given in this table is on the save side.



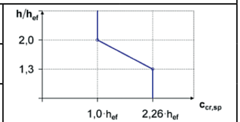
HAS-U-...



Marking:

Steel grade number and length identification letter: e.g. 8L

Setting details of HIS-(R)N

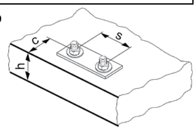
Anchor size			M8	M10	M12	M16	M20
Foil capsule HVU2			**10x90**	**12x110**	**16x125**	**20x170**	**24x210**
Diameter of element	$d_1 = d_{nom}$	[mm]	12,5	16,5	20,5	25,4	27,8
Nominal diameter of drill bit	d_0	[mm]	14	18	22	28	32
Eff. Embedment depth and drill hole in the fixture	$h_{ef} = h_0$	[mm]	90	110	125	170	205
Max. diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18	22
Min. thickness of concrete member	h_{min}	[mm]	120	150	170	230	270
Max. torque moment [a)]	T_{max}	[Nm]	10	20	40	80	150
Thread engagement	h_s	[mm]	8-20	10-25	12-30	16-40	20-50
Min. spacing	s_{min}	[mm]	60	75	90	115	130
Min. edge distance	c_{min}	[mm]	40	45	55	65	90
Critical spacing for splitting failure	$s_{cr,sp}$	[mm]	$2\ c_{cr,sp}$				
Critical edge distance for splitting failure [b)]	$c_{cr,sp}$	[mm]	$\mathbf{1{,}0 \cdot h_{ef}}$	for $h / h_{ef} \geq 2{,}0$			
		[mm]	$\mathbf{4{,}6\ h_{ef} - 1{,}8\ h}$	for $2{,}0 > h / h_{ef} > 1{,}3$			
		[mm]	$\mathbf{2{,}26\ h_{ef}}$	for $h / h_{ef} \leq 1{,}3$			
Critical spacing for concrete cone failure	$s_{cr,N}$	[mm]	$3\ h_{ef}$				$1{,}5\ h_{ef}$
Critical edge distance for concrete cone failure [c)]	$c_{cr,N}$	[mm]	$1{,}5\ h_{ef}$				

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

a) Max. recommended torque moment to avoid splitting failure during installation with min. spacing and/or edge distance

b) h: base material thickness ($h \geq h_{min}$)

c) The critical edge distance for concrete cone failure depends on the embedment depth h_{ef} and the design bond resistance. The simplified formula given in this table is on the save side.



Installation equipment

Anchor size		M8	M10	M12	M16	M20
Rotary hammer		TE 1- TE 30		TE 1-TE 60	TE 50-TE 60	TE 50–TE 80
Drill driver	HAS-U	SF (H)				-
	HIS-N	-				
Other tools		Compressed air gun, blow out pump, Hilti hollow drill bit				
		Set of cleaning brushes				

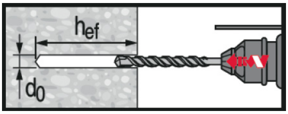
Drilling and cleaning parameters

HAS-U	HIS-N	Hammer drill	Hollow Drill Bit	Diamond coring	Brush HIT-RB
		d_0 [mm]			size [mm]
					
M8	**-**	10	-	-	-
M10	**-**	12	-	12	12
M12	**M8**	14	14	14	14
M16	**M10**	18	18	18	18
M20	**M12**	22	22	22	22
-	**M16**	28	28	28	28

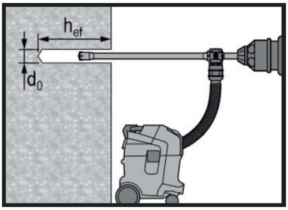
Setting instructions

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

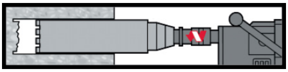
Hole drilling



Hammer drilled hole
For dry and wet concrete and installation in flooded holes (no sea water).

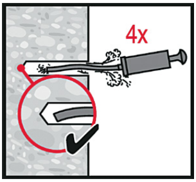


Hammer drilled hole with Hollow Drilled Bit (HDB)
No cleaning required.
For dry and wet concrete only.

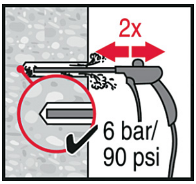


Diamond Coring
For dry and wet concrete only.

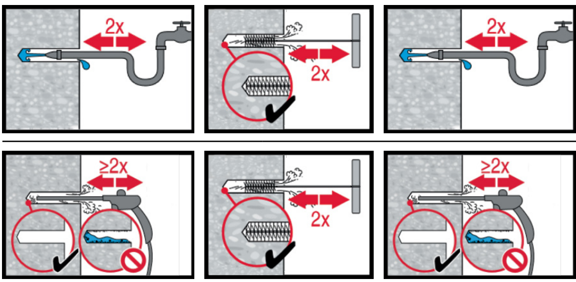
Hole cleaning



Manual cleaning for hammer drilled hole
For drill diameters $d_0 \leq 18$ mm and drill hole depth $h_0 \leq 10 \cdot d$.

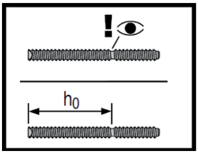


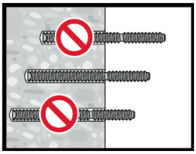
Compressed air cleaning (CAC) for hammer drilled hole
For all drill hole diameters d_0 and drill hole depths h_0.



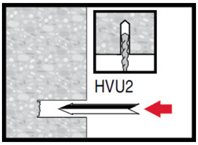
Hammer drilled flooded holes and diamond cored holes:
For all drill hole diameters d_0 and drill hole depths h_0.

Setting the element

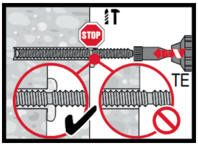


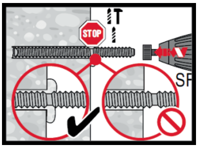


Check the setting depth.

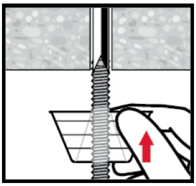


Insert the foil capsule with the peak ahead to the back of the hole.

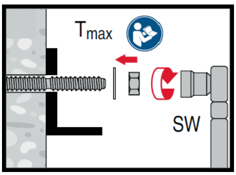




Drive the anchor rod with the plugged tool into the hole.



Overhead installation.



Loading the anchor after required curing time t_{cure}.

HIT-HY 270 injection mortar for masonry

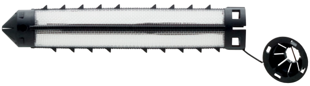
Anchor design (ETAG 029) / Rods&Sleeves / Masonry

Injection mortar system

Hilti HIT-HY 270

330 ml foil pack (also available as 500 ml foil pack)

Anchor rod:
HAS-U
HDG
HAS-U A4
HAS-U HCR
AM 8.8 (HDG)
(M8-M39)

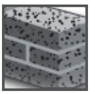


Sieve sleeves:
HIT-SC
(16-22)

Benefits

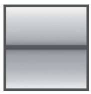
- Suitable for fastenings in masonry base materials including:
  Hollow and solid clay bricks, calcium silicate bricks, normal and light weight concrete blocks
- Two-component hybrid mortar
- Versatile and convenient handling with HDE dispenser
- Flexible setting depth and fastening thickness
- Small edge distance and anchor spacing
- Suitable for overhead fastenings

Base material


Solid brick

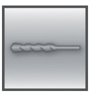

Hollow brick

Load conditions

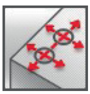

Static/ quasi-static


Fire resistance

Installation conditions


Hammer drilling


Variable embedment depth


Small edge distance and spacing

Other information


European Technical Assessment

CE conformity

Corrosion resistance

High corrosion resistance

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European technical Assessment [a)]	DIBt, Berlin	ETA-13/1036 / 2015-04-28
Fire test report	MFPA, Leipzig	PB 3.2/14-179-1 / 2014-09-05

a) All data given in this section according to ETA-13/1036 issue 2015-04-28

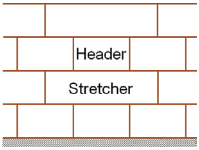
Recommended general notes

* The below clauses based on Hilti product qualifications are for references only. Selection of clauses by the engineer shall be based on the specific application needs. Please contact Hilti's technical team for further details.

- Anchor shall be two-component hybrid mortar.
- Anchors shall obtain the European Technical Assessment (ETA) report.
- For application in hollow bricks, anchor shall be installed with the insertion of sieve sleeve.
- For other bricks in solid or hollow masonry, not covered by the Hilti HIT-HY 270 ETA or this technical data manual, the characteristic resistance may be determined by on-site tension tests (pull-out tests or proof-load tests.

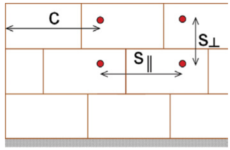
Anchor installation parameters

Brick position:



- **Header (H):** The longest dimension of the brick represents the width of the wall
- **Stretcher (S):** The longest dimension of the brick represents the length of the wall

Spacing and edge distance:

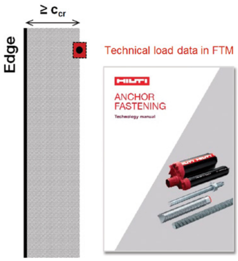


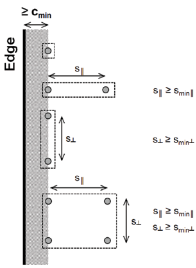
- c - Distance to the edge
- $s_{\parallel}$ - Spacing parallel to the bed joint
- $s_{\perp}$ - Spacing perpendicular to the bed joint

Minimum and characteristic spacing and edge distance parameters

- c_{min} - Minimum edge distance
- ccr - Characteristic edge distance
- $s_{min\parallel}$ - Min. spacing distance parallel to the bed joint
- $s_{cr\parallel}$ - Characteristic spacing distance parallel to the bed joint
- $s_{min\perp}$ - Min. spacing distance perpendicular to the bed joint
- $s_{cr\perp}$ - Characteristic spacing distance perpendicular to the bed joint

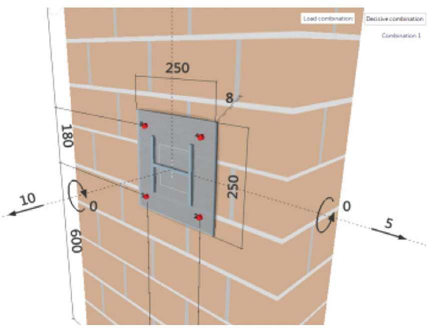
Allowed anchor positions:





- This FTM includes the load data for single anchors in masonry with a distance to edge equal to or greater than the characteristic edge distance.
- For the cases not covered in this technical data, including anchor groups, please consult ETA-13/1036.

PROFIS Anchor software interface:



Anchor dimensions for HAS-U

Anchor size			M6	M8	M10	M12	M16
Embedment depth	with HIT-SC	h_{ef} [mm]	Variable length from 50 to 160				
	without HIT-SC		Variable length from 50 to 300				

Design

- Anchorages are designed under the responsibility of an engineer experienced in anchorages and masonry 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 supports, etc.).
- Anchorages under static or quasi-static loading are designed in accordance with: ETAG 029, Annex C, Design method A

Basic loading data (for a single anchor)

The load tables provide the design resistance values for a single loaded anchor.

All data in this section applies to

- Edge distance $c \geq c_{cr}$. For other applications, use Hilti PROFIS Anchor software.
- Correct anchor setting (see instruction for use, setting details)

Anchorages subject to:		Hilti HIT-HY 270 with HAS-U or HIT-IC	
		in solid bricks	**in hollow bricks**
Hole drilling		hammer mode	rotary mode
Use category: dry or wet structure		Category **d/d - Installation and use** in structures subject to **dry**, internal conditions, Category **w/d - Installation in** dry or **wet** substrate and **use** in structures subject to **dry**, internal conditions (except calcium silicate bricks), Category **w/w - Installation and use** in structures subject to dry or wet environmental conditions (except calcium silicate bricks).	
Installation direction	Masonry	horizontal	
Installation direction	Ceiling brick	overhead	
Temperature in the base material at installation		+5° C to +40° C	-5° C to +40° C
In-service temperature	Temperature range Ta:	-40 °C to +40 °C	(max. long term temperature +24 °C and max. short term temperature +40 °C)
	Temperature range Tb:	-40 °C to +80 °C	(max. long term temperature +50 °C and max. short term temperature +80 °C)

On-site tests

For other bricks in solid or hollow masonry, not covered by the Hilti HIT-HY 270 ETA or this technical data manual, the characteristic resistance may be determined by on-site tension tests (pull-out tests or proof-load tests), according to ETAG029, Annex B.

For the evaluation of test results, the characteristic resistance may be obtained taking into account the β factor, which considers the different influences of the product.

Materials

Material quality

Part	Material
Threaded rod HIT-V 5.8 (F) HAS-U 5.8 (F)	Strength class 5.8, A5 > 8% ductile Electroplated zinc coated ≥ 5 µm; (F) Hot dip galvanized ≥ 45 µm
Threaded rod HIT-V 8.8 (F) HAS-U 8.8 (F)	Strength class 8.8, A5 > 8% ductile Electroplated zinc coated ≥ 5 µm; (F) Hot dip galvanized ≥ 45 µm
Threaded rod HIT-V-R HAS-U-R	Stainless steel grade A4 A5 > 8% ductile strength class 70, 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362
Threaded rod HIT-V-HCR HAS-U-HCR	High corrosion resistant steel, A5 > 8% ductile 1.4529, 1.4565
Washer	Electroplated zinc coated, hot dip galvanized
	Stainless steel 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362
	High corrosion resistant steel 1.4529, 1.4565 EN 10088
Nut	Strength class 8 steel galvanized ≥ 5 µm, ; hot dipped galvanized ≥ 45 µm
	Strength class 70, stainless steel grade A4, 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362
	Strength class 70, high corrosion resistant steel,1.4529; 1.4565

Setting information

Installation temperature range:
-5°C to +40°C

Service temperature range
Hilti HIT-HY 270 injection mortar may be applied in the temperature ranges given below. An elevated base material temperature may lead to a reduction of the design bond resistance.

Temperature range	Base material temperature	Max. long term base material temperature	Max. short term base material temperature
Temperature range I	-40 °C to + 40 °C	+ 24 °C	+ 40 °C
Temperature range II	-40 °C to + 80 °C	+ 50 °C	+ 80 °C

Max short term base material temperature
Short-term elevated base material temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

Max long term base material temperature
Long-term elevated base material temperatures are roughly constant over significant periods of time.

Curing time

Temperature of the base material	Maximum working time t_{work}	Minimum curing time t_{cure}
-5 °C ≤ T_{BM} < 0 °C [a)]	10 min	6 h
0 °C ≤ T_{BM} < 5 °C [a)]	10 min	4 h
5 °C ≤ T_{BM} < 10 °C	10 min	2,5 h
10°C ≤ T_{BM} < 20 °C	7 min	1,5 h
20 °C ≤ T_{BM} < 30 °C	4 min	30 min
30 °C ≤ T_{BM} < 40 °C	1 min	20 min

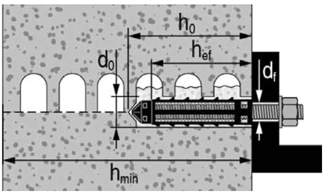
The curing time data are valid for dry base material only. In wet base material the curing times must be doubled.
a) Data valid for hollow bricks only

Installation parameters

Applications for hollow and solid bricks with sieve sleeve.

Installation parameters of HIT-V / HAS-U with one sieve sleeve HIT-SC in hollow and solid brick

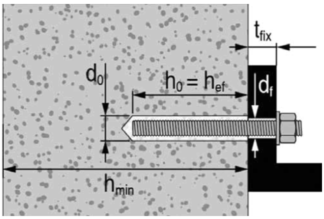
HIT-V / HAS-U			M6	M8		M10		M12		M16	
with HIT-SC			**12x85**	**16x50**	**16x85**	**16x50**	**16x85**	**18x50**	**18x85**	**22x50**	**22x85**
Nominal diameter of drill bit	d_0	[mm]	12	16	16	16	16	18	18	22	22
Drill hole depth	h_0	[mm]	95	60	95	60	95	60	95	60	95
Effective embedment depth	h_{ef}	[mm]	80	50	80	50	80	50	80	50	80
Maximum diameter of clearance hole in the fixture	d_f	[mm]	7	9	9	12	12	14	14	18	18
Minimum wall thickness	h_{min}	[mm]	115	80	115	80	115	80	115	80	115
Brush HIT-RB	-	[-]	12	16	16	16	16	18	18	22	22
Number of strokes HDM	-	[-]	5	4	6	4	6	4	8	6	10
Nr. of strokes HDE 500-A	-	[-]	4	3	5	3	5	3	6	5	8
Maximum torque moment for all brick types except “parpaing creux”	T_{max}	[Nm]	0	3	3	4	4	6	6	8	8
Maximum torque moment for “parpaing creux”	T_{max}	[Nm]	-	2	2	2	2	3	3	6	6



Applications for solid bricks without sieve sleeve.

Installation parameters of HIT-V / HAS-U in solid bricks

Threaded rods and HIT-V / HAS-U 			M8	M10	M12	M16
Nominal diameter of drill bit	d_0	[mm]	10	12	14	18
Drill hole depth = Effective embedment depth	$h_0 = h_{ef}$	[mm]	50…300	50…300	50…300	50…300
Maximum diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18
Minimum wall thickness	h_{min}	[mm]	h_0+30	h_0+30	h_0+30	h_0+36
Brush HIT-RB	-	[mm]	10	12	14	18
Maximum torque moment	T_{max}	[mm]	5	8	10	10



Installation equipment

Anchor size	M6	M8	M10	M12	M16
Rotary hammer	TE2(A) – TE30(A)				
Other tools	compressed air gun or blow out pump, set of cleaning brushes, dispenser				

Drilling and cleaning parameters

HIT-V / HAS-U [a)]	HIT-V / HAS-U + sieve sleeve	Hammer drill	Brush HIT-RB	Piston plug HIT-SZ
		d_0 [mm]	size [mm]	
				
-	-	8	8	-
M8	-	10	10	-
M10	-	12	12	12
M12	-	14	14	14
-	M8	16	16	16
-	M10	16	16	16
M16	M12	18	18	18
-	M16	22	22	22

a) Installation without the sieve sleeve HIT-SC can be used only in case of solid bricks

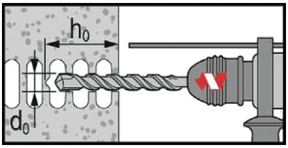
Setting instructions

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

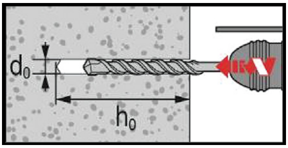
Safety regulations.

Review the Material Safety Data Sheet (MSDS) before use for proper and safe handling! Wear well-fitting protective goggles and protective gloves when working with Hilti HIT-HY 270.

Drilling

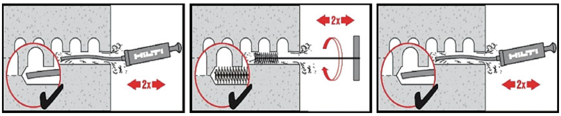


In hollow bricks: rotary mode

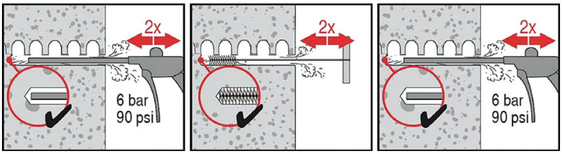


In solid bricks: hammer mode

Cleaning (Inadequate hole cleaning=poor load values.)



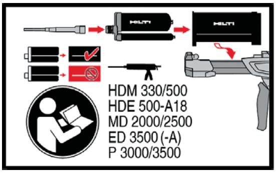
Manual cleaning (MC)
For drill hole diameter $d_0 \leq 18$ mm and drill hole depth $h_0 \leq 100$ mm

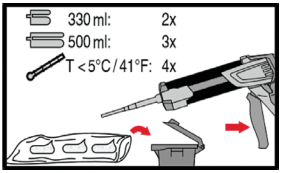


Compressed air cleaning (CAC)
For drill hole depth $h_0 \leq 300$ mm

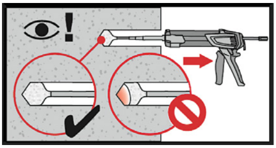
Instructions for solid bricks without sieve sleeve

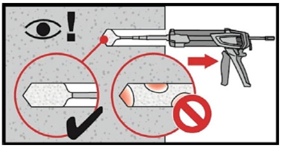
Injection system





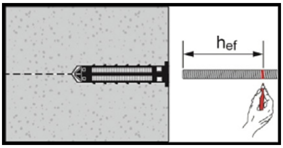
Injection system preparation



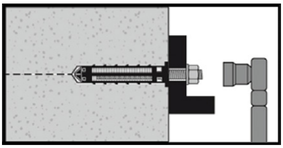


Injection method for drill hole

Setting the element



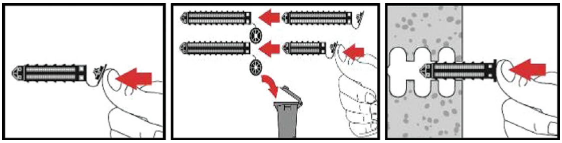
Presetting element, observe working time "t_{work}"



Loading the anchor: After required curing time t_{cure} the anchor can be loaded

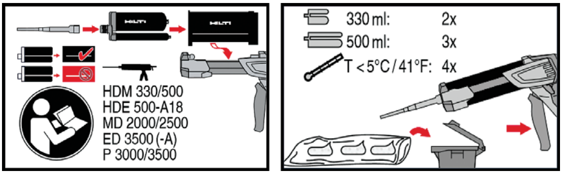
Instructions for hollow and solid bricks with sieve sleeve

Praparation of the sieve sleeve



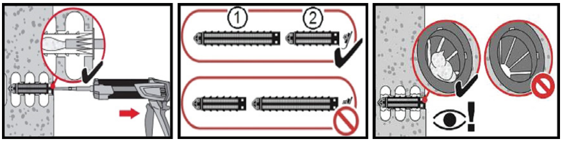
Close lid and insert sieve sleeve manually

Injection system



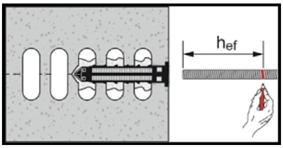
Injection system preparation

Injection system: hollow bricks

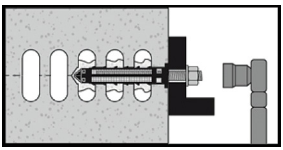


Installation with sieve sleeve HIT-SC. Use extension for installation with two sieve sleeves

Setting the element



Presetting element, observe working time “t_{work}”



Loading the anchor: After required curing time t_{cure} the anchor can be loaded askHilti

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