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 on and is 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, fire resistance, shock and fatigue tests may have been performed - see respective reports for full details.
5. The data and values are based on 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 to consider the intended use of the products concerned. The customer must check that the listed prerequisites and criteria conform with the conditions existing on the jobsite. 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 service conditions. Due to variations in local base materials, on-site testing may be 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 assumed 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

1. INTRODUCTION

1.1 Legal environment

1.1.1 Technical data

The technical data presented in this Anchor Fastening Technology Manual are all based on numerous tests and evaluation according to the state of the art. Hilti anchors are tested in our test labs in Kaufering (Germany), Schaan (Principality of Liechtenstein), Zhanjiang (CN) or Irving (USA) and evaluated by our experienced engineers and/or tested and evaluated by independent and accredited testing institutes in Europe and the USA. Where national or international regulations do not cover all possible types of applications, additional Hilti data helps to find customized solutions.

In addition to the standard tests for admissible service conditions and suitability tests, tests are performed for safety relevant applications such as fire resistance, shock, seismic and fatigue.

1.1.2 European Technical Approval Guidelines

European standards and regulatory frameworks guide testing, assessment and design of post-installed systems. The construction products regulation (CPR) lays down harmonized rules for marketing construction products in Europe. Below are definitions to help facilitate understanding of the wording that may be used along the document:

European Committee for Standardization (CEN)

CEN, recognized by the European Union as a European Standardization Organization, brings together knowledge and expertise from its members, from business and industry and from other stakeholders, in order to develop European Standards. CEN provides a platform for the development of European Standards and other technical documents in relation to various kinds of products, materials, services and processes. They help to protect the environment, as well as the health and safety of consumers and workers.

European Organization for Technical Assessment (EOTA)

EOTA is set up by the Regulation (EU) No 305/2011 and comprises all Technical Assessment Bodies (TABs) designated by member states of the European Union and the European Economic Area.

EOTA co-ordinates the application of the procedures set for requests for European Technical Assessment (ETA) and for the procedures for adopting a European Assessment Document (EAD). EOTA also informs the European Commission and the Standing Committee on Construction of any question related to the preparation of EADs and suggests improvements to the European Commission based on its gained experience.

European Assessment Document (EAD)

A European Assessment Document, or EAD for short, is a harmonized technical specification developed by EOTA as the basis for European Technical Assessments (ETAs). The development of new, or the amendment of existing, EADs is usually triggered by an ETA request from a manufacturer.

European Technical Assessment (ETA)

The European Technical Assessment (ETA) provides an independent Europe-wide procedure for assessing the essential performance characteristics of a construction product. It provides the documented assessment of the performance of a construction product, in relation to its essential characteristic, in accordance with the respective EAD.

Technical Reports (TR)

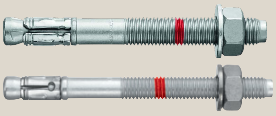
EOTA Technical reports are developed as supporting documents to EADs containing detailed aspects relevant for construction products such as design, execution and evaluation of tests, and express the common understanding of existing knowledge and experience of the Technical Assessment Bodies in EOTA at a particular point in time.

Eurocodes

Eurocodes, or EC or EN, are harmonized technical rules specifying how structural design should be conducted within the European Union. These codes have been developed by the European Committee for Standardization upon the request of the European Commission.

1.1.3 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 	65	• 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	–	–
HSL4 / HSL-3-R Heavy duty anchor 	85 99			–	–
Medium duty metal anchors					
HSC undercut anchor 	75	–	–	• Applicable on narrow curb, parapet wall and thin base material • Internal threads allows bolt re-installation	–
HST4 / HST3 stud anchor 	109 121	• 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	–
HUS4 -HR / -CR / HUS4 Screw anchor 	143 163	–	–	• 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-R V3 Injection adhesive anchor 	269	• High loads in cracked concrete conditions, design with variable embedment depth		–	–
HVU2 Capsule adhesive anchor 	311	–	–	• 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 	327	–	–	–	–

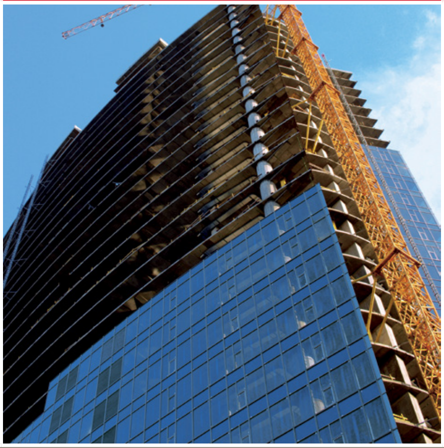
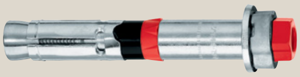
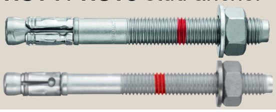
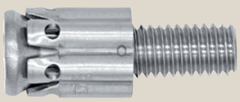
* The above recommendations are provided based on typical requirements of the stated applications, for reference only. Project specific conditions such as loading, edge/spacing, base material, environmental conditions etc. should be considered in the selection of anchors and final decision is subject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

Temporary hoarding / fencing	Architectural metal	Signage	Laundry rack	Roller-shutter / collapsible gate
				
• 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	–	–
• Easy installation and removal • Partially removable, leaving no steel parts on concrete surface	–		–	–
–	–	–	–	–
–	• Simple and flexible installation • Ideal for use in A&A works; applicable in extended concrete grades C15/20			
• 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	
–	–	–	• 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	–
–	–	–	–	–
–	–	–	–	• Safe anchoring on solid/ hollow brickworks in combined use with HIT-SC sleeve (interlocking to the base material)

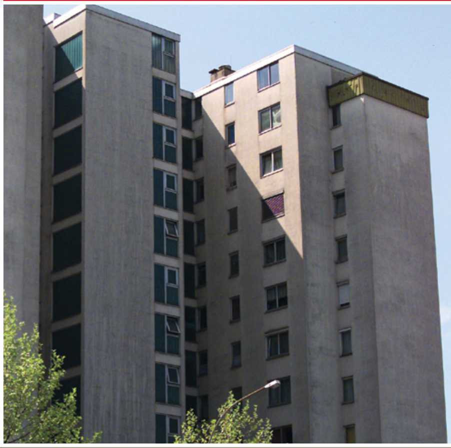
Anchor Application Selector

Façade

Application / Recommended product	Page	Curtain wall	Stone façade
			
Heavy duty anchors			
HDA-T/P Undercut anchor 	65	• 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	–
HSL4 / HSL-3-R heavy duty anchor 	85		–
Medium duty anchors			
HST4 / HST3 stud anchor 	109 121	• Simple and flexible installation • Wide range of sizes from medium-heavy duty loading in cracked and un-cracked concrete	
HUS4 -HR / -CR / HUS4 Screw anchor 	143 163	–	–
Plastic / light duty / other metal anchors			
HSU-R Stone undercut anchor 	255	–	• 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 	327	–	• Safe anchoring on solid/ hollow brickworks in combined use with HIT-SC sleeve (interlocking to the base material)

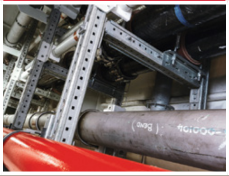
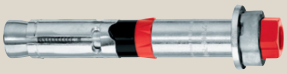
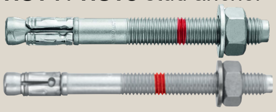
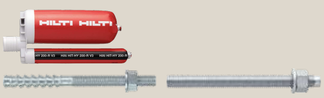
* The above recommendations are provided based on typical requirements of the stated applications, for reference only. Project specific conditions such as loading, edge/spacing, base material, environmental conditions etc. should be considered in the selection of anchors and final decision is subject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

Louvre	Cladding / Roofing	Window frame
		
–	• 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	–
		–
• Simple and flexible installation • Wide range of sizes from medium-heavy duty loading 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
–	–	–
–	–	–

Anchor Application Selector

Mechanical & Electrical

Application / Recommended product	Page	Cable tray / trunking	HVAC duct & pipe	Plumbing and drainage	Air conditioner
					
Heavy duty anchors					
HSL4 / HSL-3-R Heavy duty anchor 	65	–	–	–	–
Medium duty anchors					
HSC Safety anchor 	75	• Cracked concrete approved anchor for overhead installation of fastening with bolts or threaded rods			–
HST4 / HST3 stud anchor 	109 121	–	–	–	• Simple and flexible installation of frames • Ideal for short edge distances and spacing • Approved for cracked concrete
HSA Expansion anchor 	133				• Conventional approved anchor for installation on canopy/slabs
HUS4 -HR / -CR / HUS4 Screw anchor 	143 163	–	–	–	• Fast installation and small edge and spacing in cracked and un-cracked concrete
HKD Push-in anchor 	183	• 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					
HLC-H 	243	–	–	–	–
Adhesive anchors					
HIT-HY 200-R V3 Injection adhesive anchor 	269	–	–	–	–
HVU2 Capsule adhesive anchor 	311	–	–	–	–

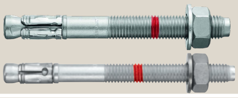
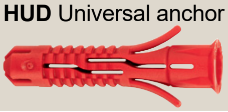
* The above recommendations are provided based on typical requirements of the stated applications, for reference only. Project specific conditions such as loading, edge/spacing, base material, environmental conditions etc. should be considered in the selection of anchors and final decision is subject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

Elevator guide rail	Water tank / roof fixings	Plant room equipment	Conveyor belt	Socket box	Fire services
					
–	–	• 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	–	–	–
–	–	–	–	–	–
• 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		–	–	–
• Conventional approved anchor, preferred choice for elevator installers	–	–	–	–	–
–	–	–	–	• Fast installation and small edge and spacing in cracked and un-cracked concrete • Nice flush finish with countersunk head version	–
• 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
–	–	–	–	• Well proven sleeve anchor with fire assessment	• Well proven sleeve anchor with fire assessment, preferred choice for fire service installers
–	• High load resistance in cracked and uncracked concrete with variable embedment depths • Water tight and approved for use in drinking water	–	–	–	–
–	• 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		–	–

Anchor Application Selector

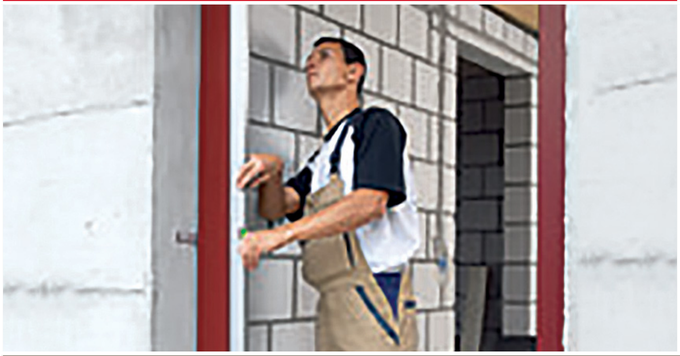
Interior finishing

Application / Recommended product	Page	Windproof ceiling	Suspended ceiling
			
Medium duty anchors			
HST4 / HST3 Stud anchor 	109 121	• Flexible and simple installation, for medium loads in cracked concrete	
HSA Expansion anchor 	133	• Conventional approved anchor for medium loads in uncracked concrete	
HUS4 -HR / -CR / HUS4 Screw anchor 	143 163	–	–
HKD Push-in anchor 	183	–	• 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 	215	–	–
HPS-1 Plastic anchors 	223	–	–
HUD Universal anchor 	227	–	–
HLC-H 	243	–	–
Adhesive anchors			
HIT-HY 270 Injection adhesive anchor 	327	–	–

* 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.

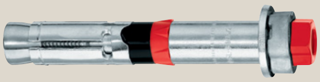
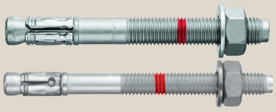
* For unknown base materials, e.g. natural stone, Hilti recommends conducting on-site pull-out tests to evaluate the recommended load values and proper functionality of the system.

*** Please refer to anchor selector for information on different base materials

Door frame	Interior finishings
	
–	–
–	–
–	• Ideal for light duty fastenings such as cabinets, sanitary fixtures, electrical installations etc. in different base materials***
–	–
• Approved anchor, suitable for installation of variable door frame thickness on different base materials***	–
–	• Light duty impact anchor, ideal for fastening cabinets
–	• Ideal for light duty fastenings such as cabinets, sanitary fixtures, electrical installations etc. in different base materials***
–	• Ideal for light duty fastenings such as mounted fans, sanitary fixtures, kitchen equipment, electrical installations etc. in different base materials***
–	• Highest load in masonry base materials e.g sand bricks, hollow bricks

Anchor Application Selector

Building construction

Application / Recommended product	Page	Formwork	Temporary works
			
Heavy duty metal anchors			
HSL4 / HSL-3-R Heavy duty anchor 	85	–	• Ideal for heavy loading conditions • Partially removable, leaving no steel parts on concrete surface
Medium duty metal anchors			
HST4 / HST3 stud anchor 	109 121	–	–
HUS4 Screw anchor 	143	• Fast installation and complete removal • Approved for re-use	
Chemical anchors			
HIT-HY 200-R V3 Injection adhesive anchor 	269	–	–
HIT-RE 100 Injection adhesive anchor 	303	–	–

* 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.

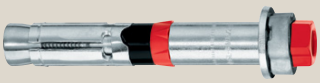
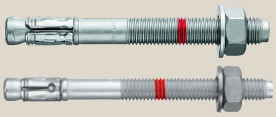
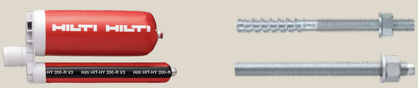
* For unknown base materials, e.g. natural stone, Hilti recommends conducting on-site pull-out tests to evaluate the recommended load values and proper functionality of the system.

*** Please refer to anchor selector for information on different base materials

Scaffolding	Tower crane	Wall tie bracket
		
• Ideal for heavy loading conditions • Partially removable, leaving no steel parts on concrete surface	–	–
• Flexible and simple installation • Small edge and spacing • Approved for use in cracked concrete	–	• Flexible and simple installation • Small edge and spacing
–	–	–
–	• Variable embedment depths offers highest tension and shear loads in cracked and uncracked concrete	• High loads for use in cracked and uncracked concrete
–	• Variable embedment depths offers highest tension and shear loads	• Applicable on various base material e.g natural stones, brickworks

Anchor Application Selector

Civil construction

Application / Recommended product	Page	Wire mesh on soil nails	Excavation Lateral Support System
			
Heavy duty metal anchors			
HDA-T/P Undercut anchor 	65	–	• Ideal for heavy shear loading conditions • Fully removable using special removal tools
HSL4 / HSL-3-R Heavy duty anchor 	85	–	• Ideal for heavy shear loading conditions • Partially removable, leaving no steel parts on concrete surface
Medium duty metal anchors			
HST4 / HST3 stud anchor 	109 121	• Ideal for external applications; corrosion resistance of A4 stainless steel • Flexible and simple installation in cracked and un-cracked concrete	–
HUS4 -HR / -CR / HUS4 Screw anchor 	143 163	• 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-R V3 Injection adhesive anchor 	269	–	• High shear loads to withstand lateral shear force from diaphragm wall • Fast curing
HIT-RE 500 V3 Injection adhesive anchor 	289	–	• High shear loads to withstand lateral shear force from diaphragm wall
HIT-RE 100 Injection adhesive anchor 	303	–	–

* 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

<table>
<tr><th>Noise / crash barrier</th><th>Light pole</th><th>Pier fencing</th><th>Platform screen door</th></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="4"></td></tr>
<tr><td>–</td><td>–</td><td>–</td><td rowspan="2">• 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</td></tr>
<tr><td>–</td><td>–</td><td>–</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td>–</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>–</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td colspan="4">• 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</td></tr>
<tr><td colspan="4">• 120 years service life
• Variable embedment depths for highest tension and shear loads</td></tr>
<tr><td colspan="4">• Variable embedment depths for highest tension and shear loads</td></tr>
</table>

1.1.4 Anchor selector: focus on the product

Anchor type		Heavy duty			Medium duty		
		HDA	HSL-4	HSL-3 (R)	HSC	HST4	HST3
							
Anchor size		M10-M20	M8-M24	M8-M20	M6- M12	M8-M20	M8-M24
Base material	Cracked concrete	■	■	■	■	■	■
	Non-cracked concrete	■	■	■	■	■	■
	Lightweight concrete						
	Aerated concrete						
	Solid brick masonry						
	Hollow brick masonry						
	Drywall						
European technical data (ETA)		■	■	■	■	■	■
Load types	Static/ Quasi-static	■	■	■	■	■	■
	Seismic C1	■	■	■		■	■
	Seismic C2	■	■		■	■	■
	Fatigue	■	■	■			
	Fire tested	■	■	■	■	■	■
	Shock resistance*	■	■	■	■		
Materials	Steel galvanized	■	■		■	**	■
	Hot dip galvanized	■					
	Stainless steel A2						
	Stainless steel A4	■		■	■	■	■
	HCR steel						
Setting	Redundant configuration						
	External thread	■	■	■	■	■	■
	Internal thread				■		
	Pre-setting	■	■	■	■	■	■
	Through-fastening		■	■		■	■
	Diamond coring		■			■	■
	Hollow bit drilling		■	■		■	■
	Adaptive torque.		■			■	■
	QR code technology	■	■				
PROFIS Engineering		■	■	■	■	■	■

*Local approvals
** Available in Q1 2025

Anchor type		Medium duty					
		HSA	HKD	HKV	HUS4	HUS4-HR/CR	HUS3
Anchor size		M6 - M20	M6 - M20	M6-M16	M8-M16	M6-M14	M6
Base material	Cracked concrete				■	■	■
	Non-cracked concrete	■	■	■	■	■	■
	Lightweight concrete						
	Aerated concrete				■	■	■
	Solid brick masonry				■	■	■
	Hollow brick masonry						
	Pre-stressed hollow slab				■		
European technical data (ETA)		■	■		■	■	■
Load types	Static/ Quasi-static	■	■	■	■	■	■
	Seismic C1				■	■	■
	Seismic C2				■		
	Fatigue						
	Fire tested	■			■	■	■
	Shock resistance						
Materials	Steel galvanized	■	■	■	■		■
	Hot dip galvanized	■			■		■
	Stainless steel A2	■					
	Stainless steel A4	■	■			■	
	HCR steel						
Setting	Redundant configuration						
	External thread	■			■	■	
	Internal thread		■	■	■	■	■
	Pre-setting	■	■	■			
	Through-fastening	■			■	■	■
	Diamond coring	■			■	■	■
	Certified for reusability*						
	Hollow bit drilling	■			■		■
PROFIS Engineering		■	■		■	■	■

*Local approvals

Anchor type		Plastic anchors					
		HPS-1	HUD-1	HUD-2	HUD-L	HRD-C (R)	HLD
							
Anchor size		M4-M8	M10-M14	M5-M8	M6-M10	M10	M10
Base material	Cracked concrete					■	
	Non-cracked concrete	■	■	■	■	■	■
	Lightweight concrete	■	■	■	■		
	Aerated concrete	■	■	■	■		
	Solid brick masonry	■	■	■	■		■
	Hollow brick masonry	■	■	■	■		■
	Drywall		■	■	■		■
	Pre-stressed hollow slab						
European technical data (ETA)							
Load types	Static/ Quasi-static	■	■	■	■	■	
	Seismic C1						
	Seismic C2						
	Fatigue						
	Fire tested						
	Shock resistance						
Materials	Steel galvanized	■	■	■	■	■	■
	Hot dip galvanized					■	
	Stainless steel A2	■				■	
	Stainless steel A4						
	HCR steel						
Setting	Redundant configuration						
	External thread						
	Internal thread						
	Pre-setting		■	■	■		■
	Through-fastening	■	■	■	■	■	
	Diamond coring						
	Hollow bit drilling						
PROFIS Engineering							

*Local approvals

Anchor type		Light duty anchors					Other anchors
		HHD-S	HLC	HTB 2	HT	HA8 NG	HSU-R
							
Anchor size		M4-M8	M5-M16	M5-M6	M8-M10	M8	M6-M8
Base material	Cracked concrete		■		■	■	
	Non-cracked concrete				■		
	Lightweight concrete				■		
	Aerated concrete		■	■	■		
	Solid brick masonry			■	■		
	Hollow brick masonry	■		■			
	Drywall						
European technical data (ETA)							■
Load types	Static/ Quasi-static	■	■	■	■	■	
	eta Seismic						■
	Seismic C2						
	Fatigue						
	Fire tested		■		■		
	Shock resistance						
Materials	Steel galvanized		■		■		
	Hot dip galvanized					■	
	Stainless steel A2						
	Stainless steel A4						■
	HCR steel						
Setting	Redundant configuration						
	External thread		■				■
	Internal thread	■					
	Pre-setting	■	■	■			■
	Through-fastening		■		■		
	Diamond coring						
	Hollow bit drilling						
PROFIS Engineering							

*Local approvals

Anchor type		Ultimate performance						
		HIT-HY 200 R V3				HIT-RE 500 V3		
								
Anchor size		M8-M20	M8-M30	M8-M20	M8-M40	M8-M39	M8-M20	M8-M40
Base material	Cracked concrete	■	■	■	■	■	■	■
	Non-cracked concrete	■	■	■	■	■	■	■
	Lightweight concrete							
	Aerated concrete							
	Solid brick masonry							
	Hollow brick masonry							
	Drywall							
European technical data (ETA)		■	■	■	■	■	■	■
ETA for 100 years design life		■	■	■	■	■	■	■
Load types	Static/ Quasi-static	■	■	■	■	■	■	■
	Seismic C1 (Baseplate to concrete)	■	■		■	■	■	■
	Seismic C2 (Baseplate to concrete)	■	■			■		
	Seismic (Concrete to concrete)				■	■*		■
	Fatigue	with special rods: HAS-D or HIT-Z-D						
	Fire tested	■	■	■	■	■	■	■
	Shock resistance*					■	■	■
Materials	Steel galvanized	■	■	■		■		
	Hot dip galvanized		■					
	Stainless steel A2							
	Stainless steel A4	■	■	■		■	■	
	HCR steel		■			■		■
	Rebar class B and C				■			■
Setting	External thread	■	■ a)	■ a)	■ a)	■		
	Internal thread	■	■	■		■	■	
	Pre-setting	■	■	■		■	■	
	Through-fastening	■	■	■		■	■	
	Diamond coring	■				■	■	■
	Hollow bit drilling	■	■	■	■	■	■	■
PROFIS Engineering		■	■	■	■	■	■	■

*Local approvals
a) only with roughening tol

Anchor type	Day-to-day applications				Masonry application		
	HIT-RE100		HVU2		HIT-HY 270		
Anchor size	M8-M30	M8-M40	M8-M30	M8-M20	M8-M24	M8-M12	M6-M12
Base material							
Cracked concrete			■	■			
Non-cracked concrete	■	■	■	■			
Lightweight concrete							
Aerated concrete							
Solid brick masonry					■	■	■
Hollow brick masonry					■	■	
Drywall							
European technical data (ETA)	■	■	■	■	■	■	■
ETA for 100 years design life							
Load types							
Static/ Quasi-static	■	■	■	■	■	■	
Seismic C1 (Baseplate to concrete)			■				
Seismic C2 (Baseplate to concrete)			■				
Seismic (masonry)					■		■
Fatigue							
Fire tested			■	■			
Shock resistance*							
Materials							
Steel galvanized	■		■	■	■	■	
Hot dip galvanized			■		■		
Stainless steel A2							
Stainless steel A4			■	■	■		
HCR steel			■		■		
Rebar class B and C	■	■					
Setting							
External thread			■		■		
Internal thread			■	■	■	■	
Pre-setting	■		■	■	■	■	
Through-fastening	■		■	■	■	■	
Diamond coring			■	■			
Hollow bit drilling	■	■	■	■			
PROFIS Engineering			■	■	■	■	■

*Local approvals

Anchor type		HAC-C hot rolled	HAC-C-P	HAC (-V)
				
Channel size		HAC-C 52/34	HAC-C-P 40/22, HAC-C-P 50/30	HAC (-V) 40, HAC (-V) 50, HAC (-V) 60, HAC (-V) 70
Base material	Cracked concrete	■	■	■
	Non-cracked concrete	■	■	■
	Lightweight concrete			
	Aerated concrete			
	Solid brick masonry			
	Hollow brick masonry			
	Drywall			
European technical data (ETA)		■	■	■
Load types	Static/ Quasi-static	■	■	■
	2D	■	■	■
	3D*	■	■	■
	Seismic C1			■
	Seismic C2			
	Fatigue**	■	■	■
	Fire tested	■	■	■
	Shock resistance			
Materials	Steel galvanized			
	Hot dip galvanized	■	■	■
	Stainless steel A2			
	Stainless steel A4	■	■	
	HCR steel			
Profis Anchor Channel		■	■	■

* HDG channels only.
** HDG channels only. HAC-C hot rolled: HAC-C 52/34 only; HAC and HAC-V: all channels except HAC-(V)-T50 and HAC-(V)-T70

1.2 Design Principles and Applications

1.2.1 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.

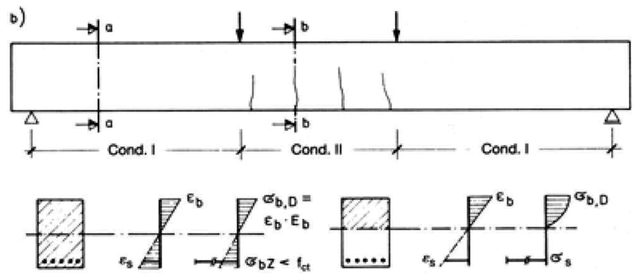
Concrete

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 0.3mm, 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.

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

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

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.

Different types and shapes

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.

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.

Plaster coating is not a base material for fastenings

Other base materials

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.

Aerated 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.

Lightweight concrete

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.

Drywall / gypsum panels

In addition to the previously named building materials, a large variety of others, e.g. natural stone, etc, can be encountered in practice. Further- more, speci 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.

Variety of base materials

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.

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

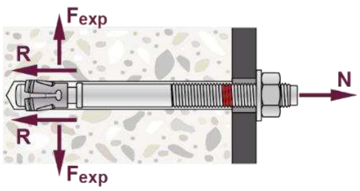
Jobsite tests

1.2.2 Design approach

Working principles in steel to concrete connections

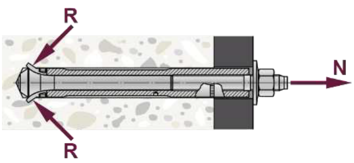
In anchoring a steel element to the concrete, it is possible to observe four main working principles illustrated in the following:

Friction



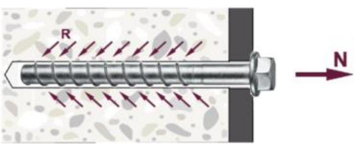
The tensile load, N, is transferred to the base material by friction, R. This is the load-transfer mechanism typical of expansion anchors, where a clip or a wedge is pressed against the walls of the bore-hole during the installation process. In the case of torque-controlled expansion fasteners a hole is drilled, and the fastener is inserted into the drill hole and anchored by tightening the screw or nut with a calibrated torque wrench. A tensile force is produced in the bolt, the cone at the tip of the anchor is drawn into the expansion sleeve and forced against the sides of the drilled hole. Within the torque-controlled expansion fasteners are distinguished sleeve types (e.g., HSL4) and bolt types where the anchor is expanded through an expansion clip instead of a sleeve (e.g.; HST3 as per the drawing on the left). Deformation-controlled anchors comprise an expansion sleeve and cone. They are set in place by expanding the sleeve through controlled deformation. This is achieved either by driving the cone into the sleeve or the sleeve over the cone (e.g., HKD).

Mechanical interlock



With the mechanical interlock working principle the load is transferred by means of a bearing interlock between the fastener and the base material. Typical examples includes undercut fasteners, concrete screws and anchor channels.

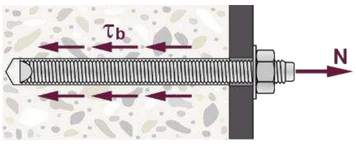
Undercut anchors develop a mechanical interlock between the anchor and the base material. To do this, a cylindrically drilled hole is modified to create a notch, or undercut, of a specific dimension at a defined location either by means of a special drilling apparatus, or by the undercutting action of the anchor itself. In cases of self-undercutting the undercut is generated using the expansion element inserted into the pre-drilled hole. Use of rotary-impact action permits the expansion element to simultaneously undercut the concrete and widen to its fully installed position. This process results in a precise match between the undercut form and the anchor geometry (e.g., HDA as per drawing on the left).



Concrete screws which work by using mechanical interlock principle distributed along the entire anchor length, are gaining popularity thanks to their high performance and installation productivity. Screw anchors are typically hardened to permit the thread to engage the base material during installation. They are installed in drilled holes. They may be driven by means of special impact drivers, or in other systems using a conventional drill equipped with an adapter. The diameter of the drilled hole is matched to the geometry of the screw so that the thread cuts into the concrete and an external force can be transferred to the concrete through this positive interlocking connection (e.g., HUS4 as per drawing on the left).

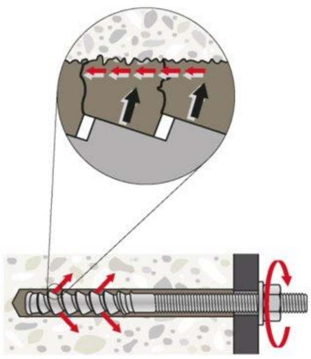
Anchor channels are anchored in concrete by mechanical interlock between the anchor and the concrete member. Differently from previous anchor types, anchor channels are so called cast-in place systems installed before concrete pouring (e.g., HAC-V and HAC-C).

Bonding



The forces are transferred from the anchor element (e.g., threaded rod) to the mortar via mechanical interlocking and to the anchor base via a combination of micro-interlock, and chemical adhesion between the mortar and hole wall. Bonded anchors are available in various systems. A distinction can be made between anchors in which the mortar is contained in plastic or glass capsules (e.g., HVU2) and injection systems in which the mortar is delivered from cartridges or foil packs in the bore hole by a dispenser (e.g., RE500 V3 and HY200-R V3).

Combined working principles



Some anchor systems work combining some of the basic principles described previously.

Some examples are:

Hybrid screws: they rely on combination mechanical interlocking and bonding. A screw fastener, which cuts a thread into the concrete, and bonding material. Both components contribute to the functioning of the fastening system

Bonded expansion fasteners transfer loads into the base material combining bond and friction: those fasteners are installed in cylindrical hole, the load transfer is obtained by mechanical interlock of a cone or several cones in the bonding material and then via combination of bonding and friction forces in the concrete (e.g., HIT-Z rod with HY200-R V3 mortar as per drawing on the left).

The weakest resistance to the possible failure modes of an anchor fastening determines the cause of failure. Typical failures under tension loads are steel failure, concrete cone, pullout or combined concrete cone-pullout and splitting. Failure modes under shear loads are steel failure, pryout and concrete edge breakout.

The following illustration visually shows the mentioned failure modes:

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.

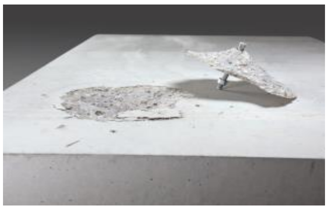
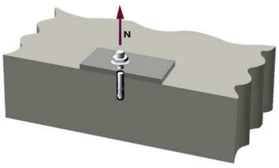
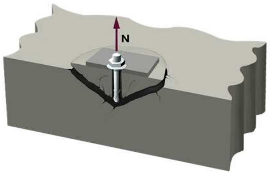
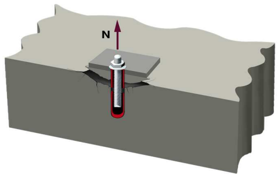
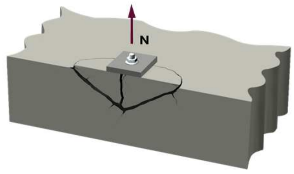
In the case of movement-controlled types, expansion takes place over a distance that is predetermined by the geometry of the anchor in the expanded state. Thus an expansion force is produced (HKD anchor) which is governed by the modulus of elasticity of the base material.

Adhesive/resin anchor

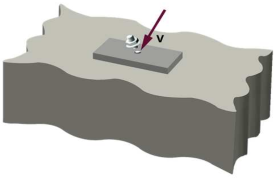
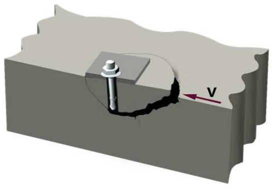
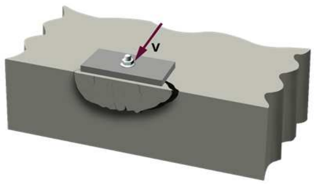
The synthetic resin of an adhesive anchor infiltrates into the pores of the base material and, after it has hardened and cured, achieves a local keying action in addition to the bond.

1.2.3 Failure modes

Failure modes under tension loads for post-installed anchors

Steel	Concrete cone	Combined concrete cone pullout	Splitting
			
			

Failure modes under shear loads for post-installed anchors

Steel	Steel with lever arm	Pryout	Concrete edge
			
			

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.

HILTI

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).

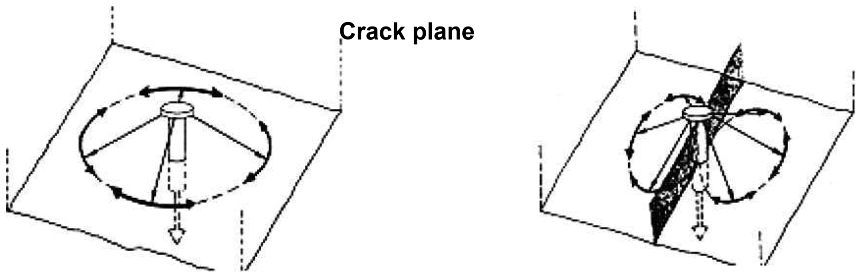
Efficient utilisation of reinforcement

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

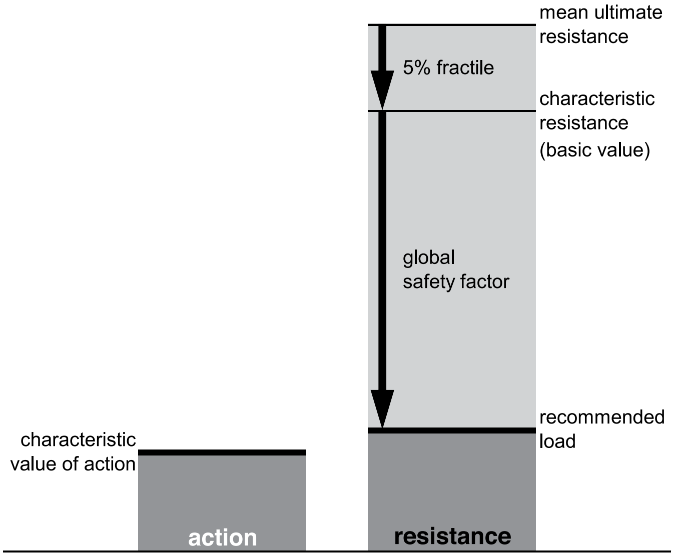
As a structure responds to earthquake ground motion it experiences displacement and consequently deformation of its individual members. This deformation leads to the formation and opening of cracks in members. Consequently all anchorages intended to transfer earthquake loads should be suitable for use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

1.2.4 Design approach

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.

Global safety factor concept



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.

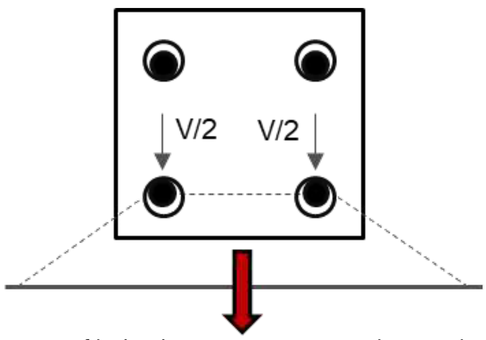
The following methods can be used for design using PROFIS Anchor:

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

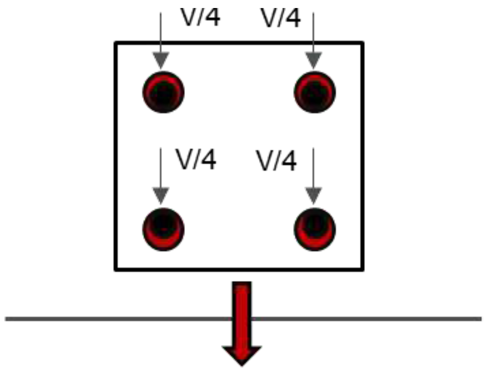
1.2.5 What is the Hilti filling set and how to use it

If an anchor group is loaded towards the edge of a concrete member (shear load), the gap between anchor shaft and clearance hole can have a significant effect on the load-bearing behavior of the anchor group. An uneven shear load distribution within the anchors of the group is the result as the clearance hole is always larger than the anchor diameter to ensure an easy installation. EN1992-4 takes this fact into account by assuring that only the row of anchors nearest to the concrete edge takes up all shear load.

To guarantee an even load distribution in case of shear loading, filling of the annular gap is necessary. This will allow all anchors to take up the shear loads.

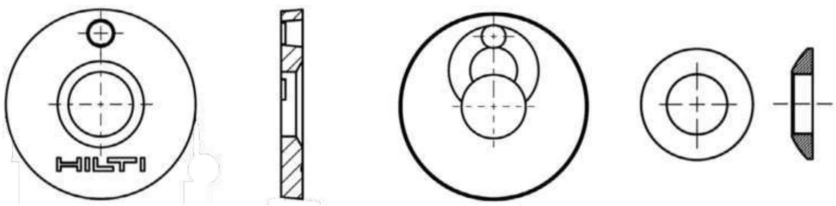


In case of hole clearance, you never know where the anchor is located relative to the hole in the steel plate. Therefore, always the worst configuration is assumed



In case the annular gap is filled, all anchors are assumed to take up shear loads

If an unsuitable filling method is used, it cannot be guaranteed that the annular gap is properly filled with mortar. Therefore, the method needs to be qualified. Hilti always recommends using the Hilti filling set. This consists of a special sealing washer, which permits HIT injection adhesive (HY200-R V3) to be dispensed into the clearance hole and a spherical washer, a nut and a lock nut to prevent loosening of the nut.

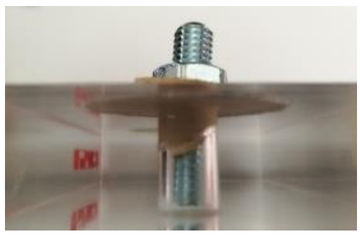


Sealing washer with hole for injection

Spherical washer

Not using the Hilti filling set can lead to an unproper filling of the annular gap.

Hilti filling set used



Unsuitable filling method used

In case of chemical anchors, the borehole is sealed. No mortar can enter the borehole and the functionality of the anchor is not influenced independent of the mortar used to fill the annular gap.

In case of mechanical anchors, mortar entering the borehole can negatively influence the load-bearing behavior (e.g., disturbance of follow up expansion needed to activate the anchor in cracked concrete). Therefore, close attention needs to be paid to the mortars covered in the installation instruction (IFU). The IFU requires to use for all expansion and undercut anchors Hilti HIT-HY products a per the table below:

Anchor	HIT-HY... HIT-RE...	HST, HST3, HDA, HSL4, HSA	HUS3 HUS4
Element	HAS-U, HIT- (V/Z) AM, HIS-N	-	-
HIT-HY* products Filling set suitability	Yes	Yes	Yes
HIT-RE** products Filling set suitability	Yes	No	Yes

**HIT-HY: 200 R-V3, 270*
***HIT-RE: 500 V3, 100*

When is the use of the filling set needed?

Load type		
Static loading	**Fatigue loading**	**Seismic loading**
Filling set is not needed: 1) Pure tension loading 2) The minimum edge distance in all directions is larger than max($10h_{ef}$, $60d_{nom}$) 3) Concrete edge breakout in shear is verified according EN 1992-4 **Filling set is needed:** Concrete edge breakout is verified according to the SOFA method. This method requires that all anchors are evenly loaded in shear.	**Filling set is always required in case the design is done acc. to EN 1992-4:** EN 1992-4, section 8.1 (6): Annular gaps are not allowed and loosening of the nut or screw shall be avoided (both for tension and shear loading). **Filling set is required for shear loading in case the design is done according to EOTA/TR 061:** EOTA/TR 061, section 1.1: If only tension loads are involved in the application, the annular gap does not need to be filled.	**The use of a filling set is optional, however brings two benefits in design:** 1) To consider a so-called hammering effect on the anchors in case of hole clearance, EN 1992-4 requires to reduce the group capacity in case of shear loading by a factor α_{gap}. α_{gap} = 0.5 in case the annular gap between anchor and steel plate is not filled, a 50% reduction is applied. α_{gap} = 1.0 in case the annular gap between anchor and steel plate is filled (no reduction). 2) For some products a higher value $V_{Rk,s,seis}$ (seismic steel resistance in shear) is given in the ETA (e.g. HST3)

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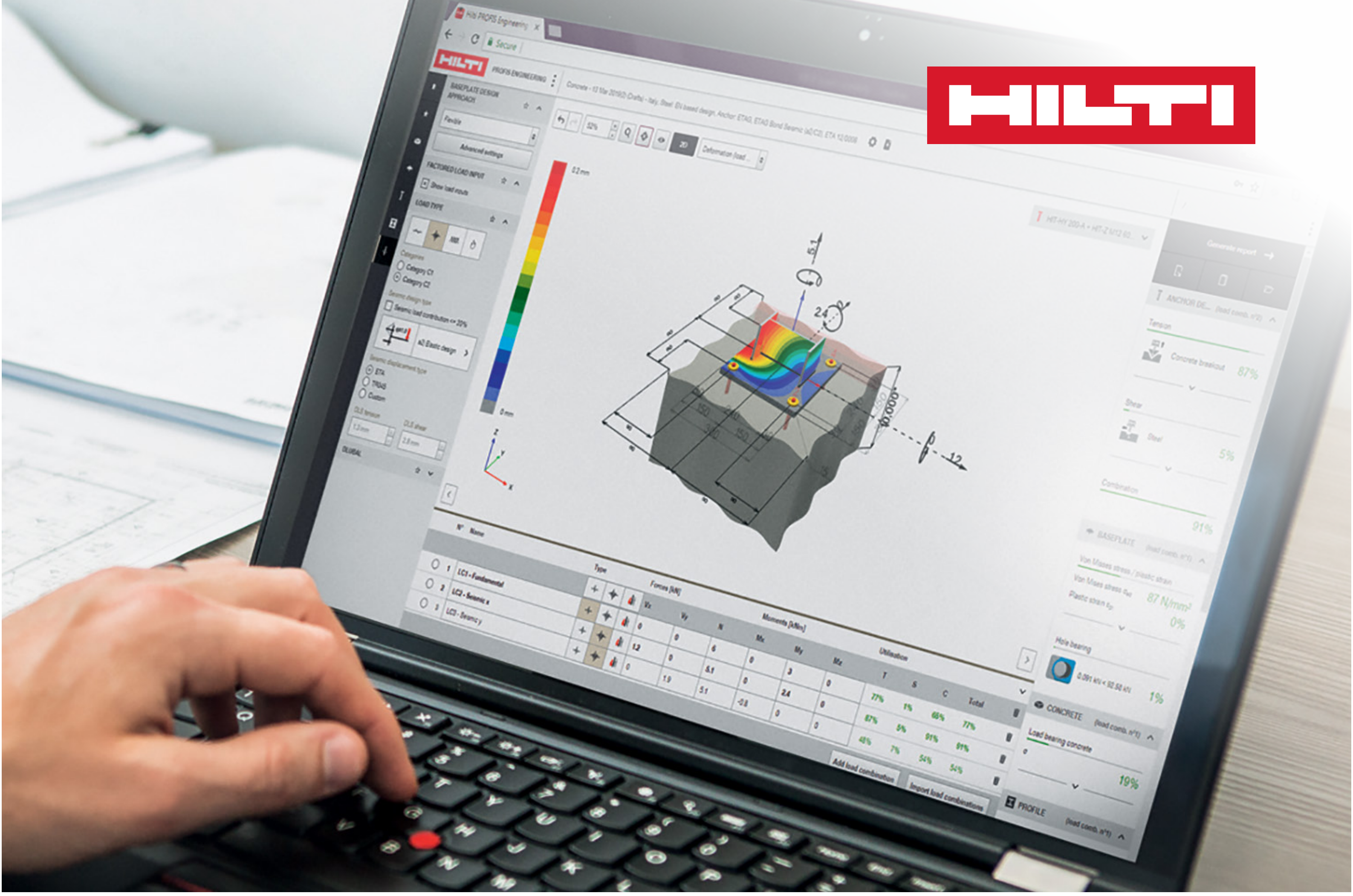
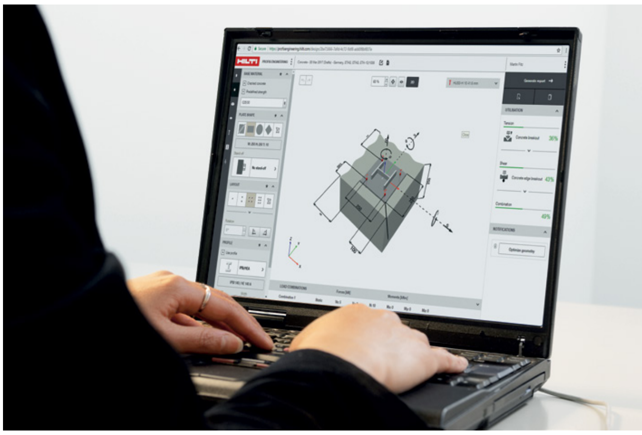
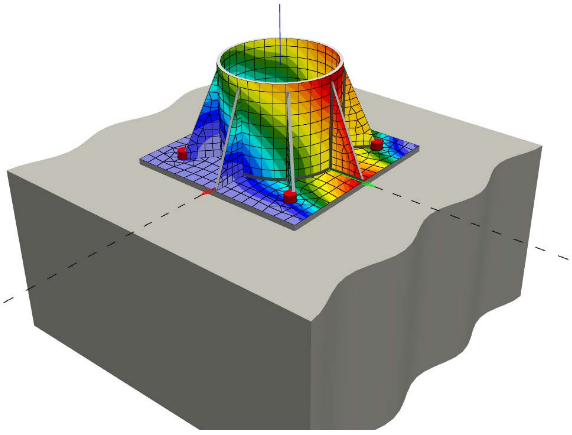
PROFIS Engineering suite tackles the most common design challenges in our industry with the time and cost saving benefits of being able to design steel to concrete connections as a whole.



INCREASE DESIGN PRODUCTIVITY



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



- Comprehensive solution for anchor system design including baseplate, stiffener & welding

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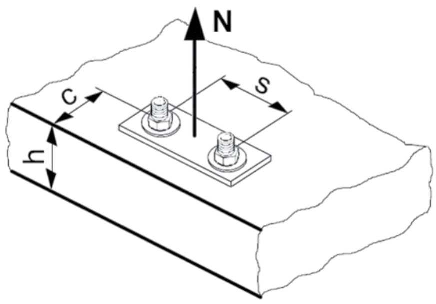
Anchor design method according to Annex C of ETAG 001 and EOTA TR 29

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

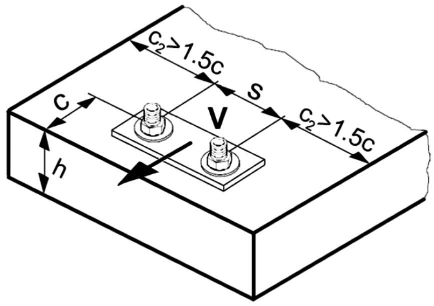
\+ Values have to be calculated according data given in the relavant ETA (details of calculation see Annex C of ETAG 001 or EOTA TR 029)

++ 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 proportionally 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

$\beta_N \le 1$

$\beta_V \le 1$

$\beta_N + \beta_V \le 1{,}2$ or $\beta_N^{\alpha} + \beta_V^{\alpha} \le 1$

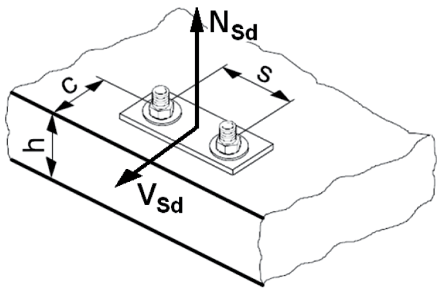
With

$\beta_N = N_{Sd} / N_{Rd}$ and

$\beta_V = V_{Sd} / V_{Rd}$

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

1.3 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.

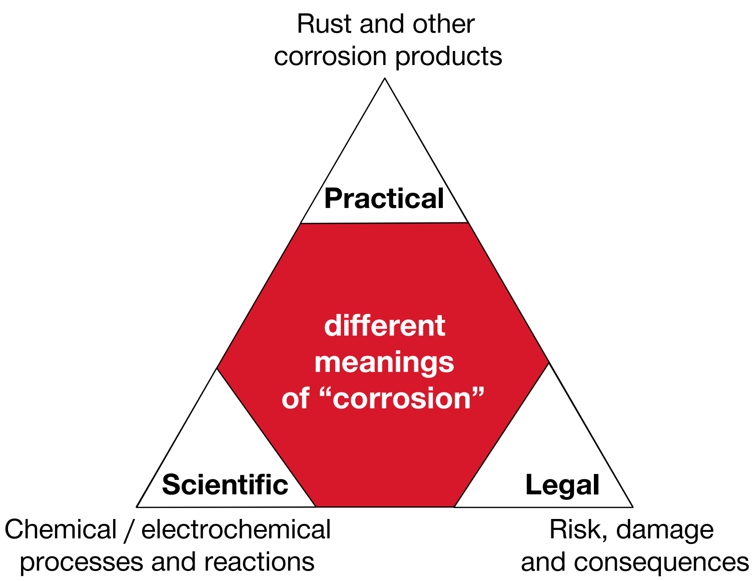


Fig. 1: Different meanings of corrosion.

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.

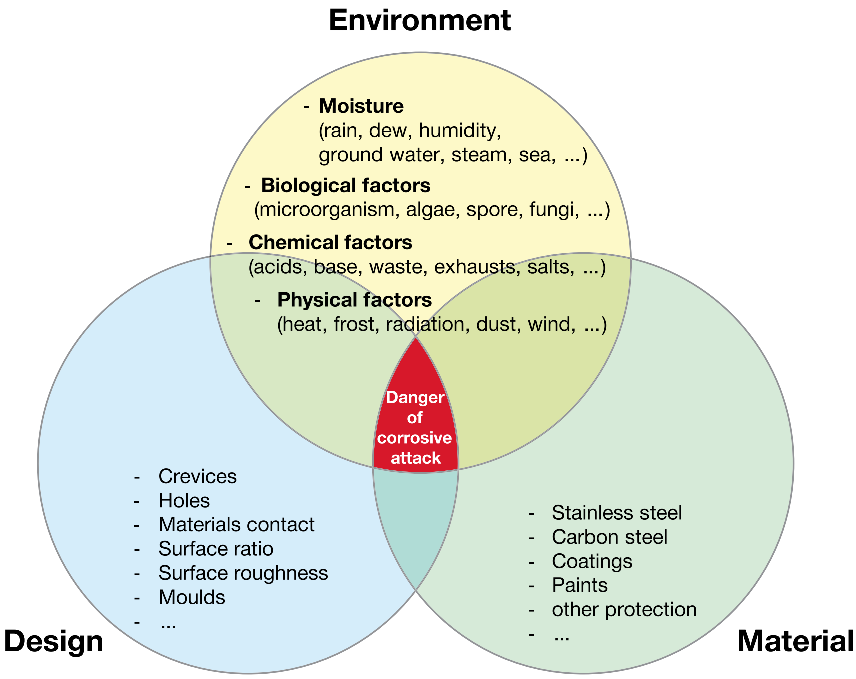


Fig. 2: Corrosion will occur only if more than one critical factor is present.

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.

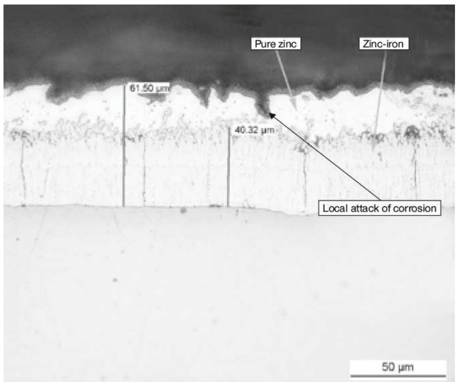
3.4 Hot-dip galvanizing

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

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

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.

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.

Table 6
Selection aid for fasteners in different environments

HILTI

Selection of corrosion protection for anchors

	Anchors	HSA HUS3 HST3 HST4 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		-	-			
Outdoor with moderate concentration of pollutants	Steel (zinc-coated, painted), aluminum, stainless steel	-	□ *	□ *	■ *	■	■
	Stainless steel		-	-			
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

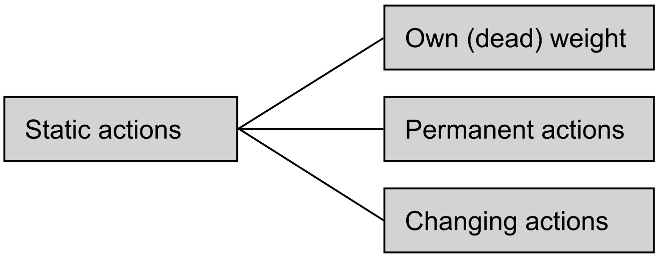
1.4 Dynamic

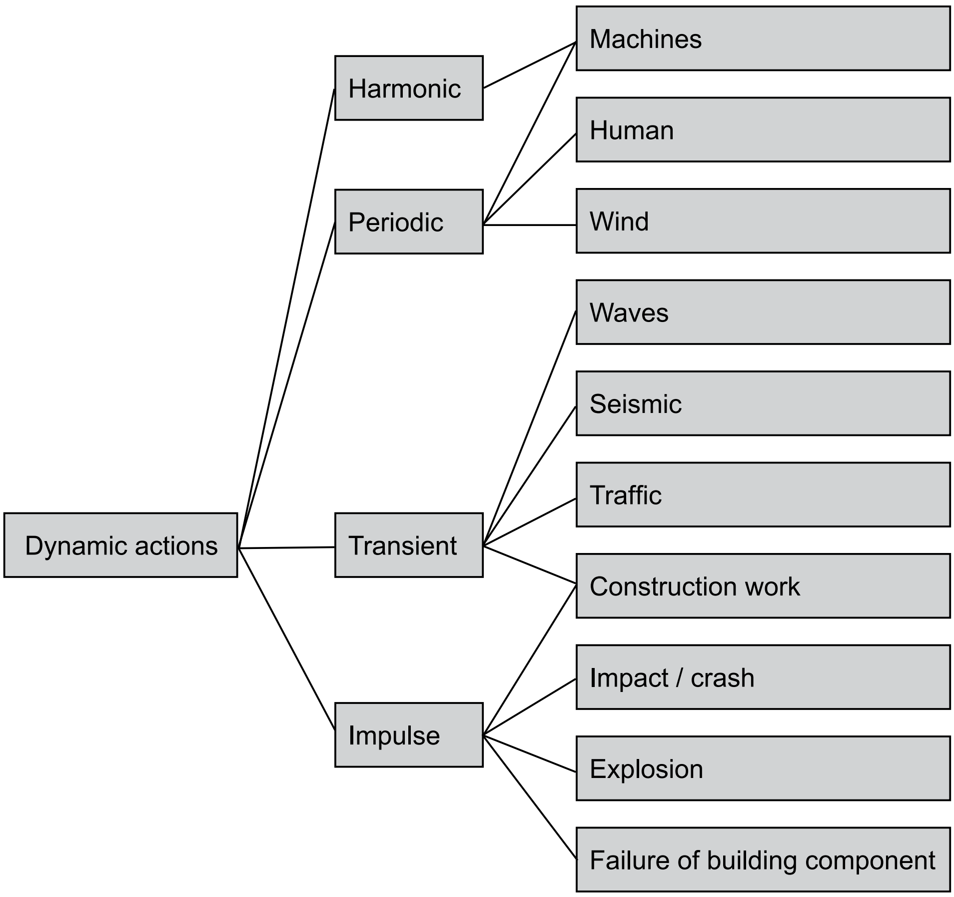
1. Impacts on Fasteners

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

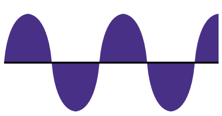
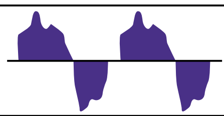
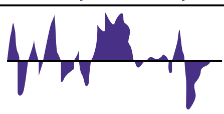
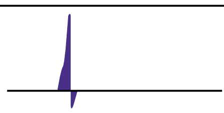
Static loads can be segregated as follows:

- 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

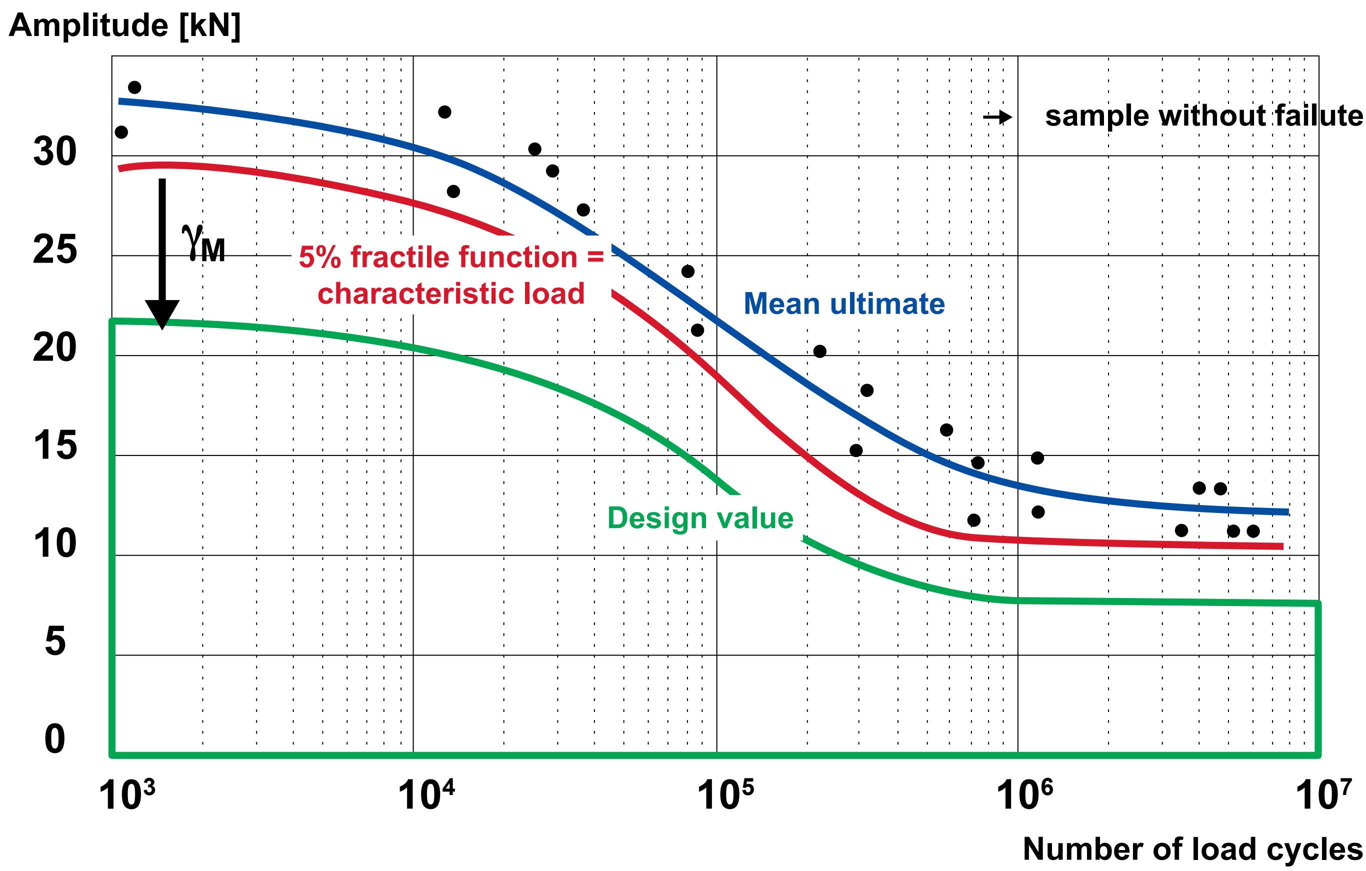
Material behaviour under static loading

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

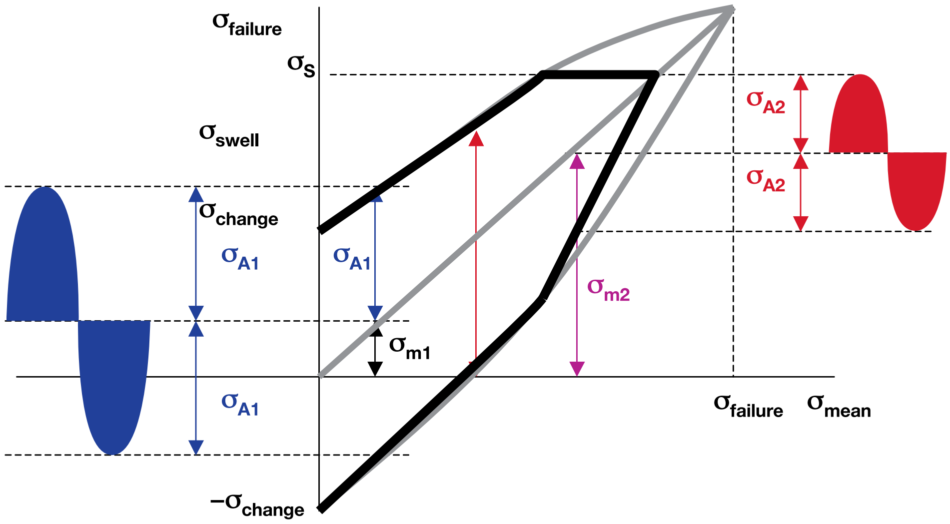
If a material is subjected to a sustained load that changes with respect to time, it can fail after a certain number of load cycles even though the upper limit of the load with- stood up to this time is clearly lower than the ultimate tensile strength under static loading. This loss of strength is referred 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 $>10^7$.

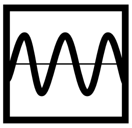
Fatigue behaviour of concrete

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.

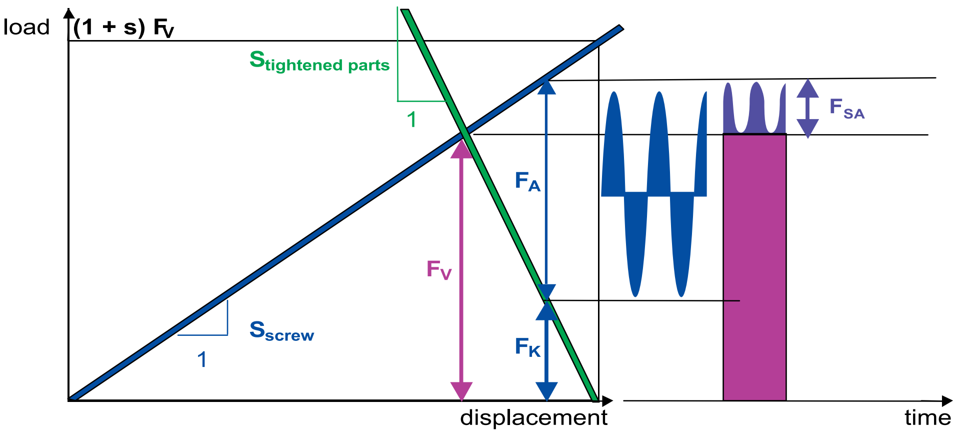
In the range of short-term strength, i.e. $n < 10^4$, the concrete can also be crucial. This is dependent very much on the cross-sectional area of the steel in relation to the anchorage depth, i.e. a large diameter combined with a small anchorage depth => concrete failure or a small diameter with a large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

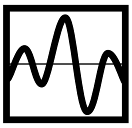
It is recommended that shear pins be provided to take up the dynamic shear forces. As a result, the anchors, provided that the through-hole has a suitable shape, can be designed for pure tensile loading.

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.

1.5 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.

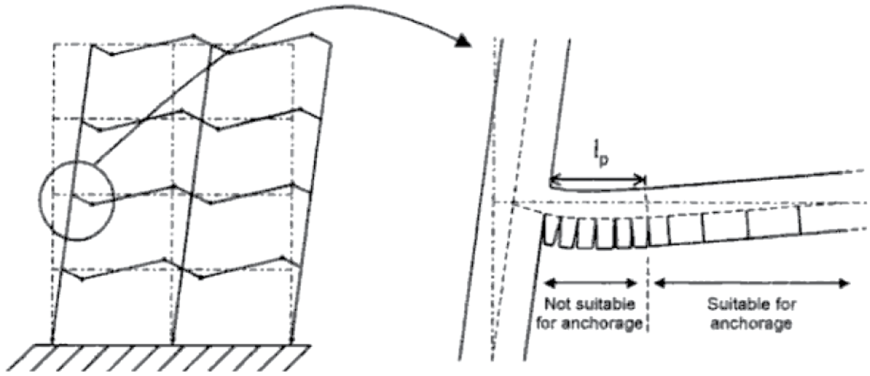


Fig.1 - Member cracking assuming a strong-column, weak girder design

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.

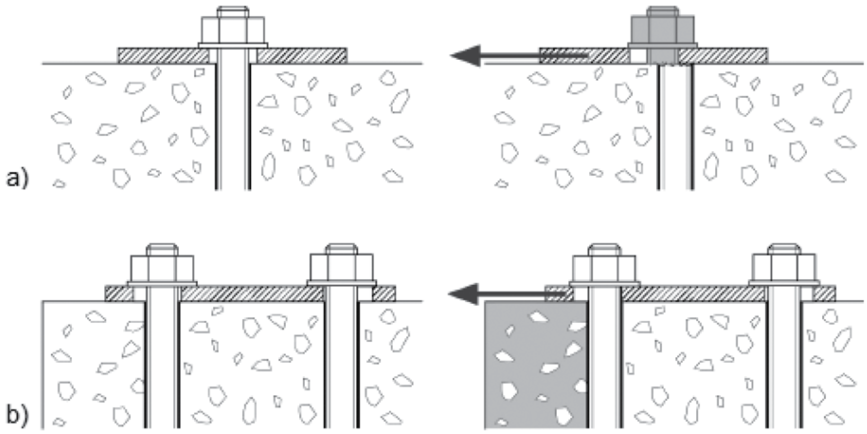


Fig.2 - Mains consequence possibility resulting from annular gaps

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.

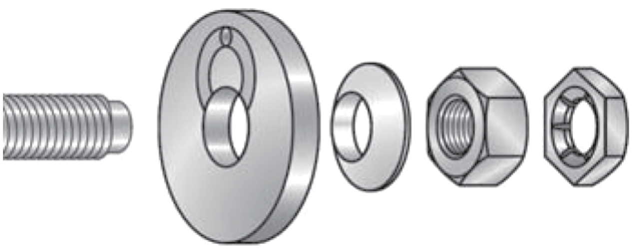


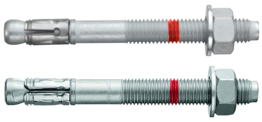
Fig.3 - Hilti Dynamic Set: Filling washer, conical washer nut and lock-nut

Seismic Fastening systems

Approved per new European regulations (ETAG 001 Annex E)

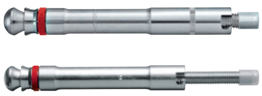
ETA seismic categories C1 and C2

Hilti HY 200-R V3 w / HIT-Z
- Fast-curing bonded anchor
- No cleaning required with the innovative HIT-Z ord



Hilti HST 3 / HST 4
- Medium-duty mechanical anchor
- Designed to excel in cracked concrete

Hilti HSL-4
- 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

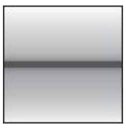
Anchor version		Benefits
	HDA-P HDA-PR HDA-PF Anchor for pre-setting (M10-M20)	- Safe and high performance structural seismic design with ETA C1 and C2 - Mechanical interlock (undercut) - Low expansion force (thus small edge distance / spacing) - Self undercutting (without special undercutting tool) - Performance of a headed stud - Complete system (anchor, stop drill bit, setting tool, drill hammer) - Setting mark on anchor for control (easy and safe) - Completely removable
	HDA-T HDA-TR HDA-TF Anchor for through-fasting (M10-M20)	

Base material

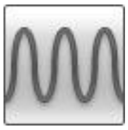

Concrete (non-cracked)


Concrete (cracked)

Load conditions


Static/ quasi-static


Seismic ETA-C1, C2

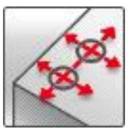

Fatigue


Shock


Fire resistance

Installation conditions


Hammer drilled holes


Small edge distance and spacing


Performance of a headed stud

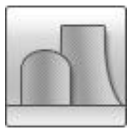

Tracefast

Other information


European Technical Assessment


CE conformity


PROFIS ENGINEERING


Nuclear power plant approval

Corrosion resistance

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European Technical Assessment [a)]	CSTB, Paris	ETA-99/0009 / 2015-01-06
European Technical Assessment [a)]	DIBt, Berlin	ETA-18/0974 / 2019-06-20
ICC-ES report incl. seismic [b)]	ICC evaluation service	ESR 1546 / 2014-02-01
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 / 2014-07-22
Fire assessment report	IBMB MPA, Braunschweig	2103/508/21 / 2021-12-06

a) All data given in this section according ETA-99/0009, issue 2015-01-06, and ETA-18/0974, issue 2019-06-20.
b) For more details on Technical Data according to ICC please consult the relevant HNA FTM.

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

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 for static

Anchor size			M10	M12	M16	M20
Effective anchorage depth	h_{ef}	[mm]	100	125	190	250

Characteristic resistance

Anchor size				M10		M12				M16					M20a)			
Non-cracked concrete																		
Tension	HDA-P(F), HDA-T(F)b)	N_{Rk}	[kN]	46		67				126					192			
Tension	HDA-PR, HDA-TR	N_{Rk}	[kN]	46		67				126					-			
Cracked concrete																		
Tension	HDA-P(F), HDA-T(F)b)	N_{Rk}	[kN]	25		35				75					95			
Tension	HDA-PR, HDA-TR	N_{Rk}	[kN]	25		35				75					-			
Non-cracked and cracked concrete																		
Shear	HDA-T(F)b)	$t_{fix,min}$	[mm]	10≤	15≤	10≤	15≤	20≤	30≤	15≤	20≤	25≤	30≤	35≤	20≤	25≤	40≤	55≤
Shear	HDA-T(F)b)	$t_{fix,max}$	[mm]	<15	≤20	<15	<20	<30	≤50	<20	<25	<30	<35	≤60	<25	<40	<55	≤100
Shear	HDA-T(F)b)	V_{Rk}	[kN]	65c)	70	80	80	100	100	140c)	140	155	170	190	205	205	235	250
Shear	HDA-TR	$t_{fix,min}$	[mm]	10≤	15≤	10≤	15≤	20≤	30≤	15≤	20≤	25≤	30≤	35≤	-			
Shear	HDA-TR	$t_{fix,max}$	[mm]	<15	≤20	<15	<20	<30	≤50	<20	<25	<30	<35	≤60	-			
Shear	HDA-TR	V_{Rk}	[kN]	71c)	71	87	87	94	109	152	152	158	158	170	-			
Shear	HDA-P(F)b)	V_{Rk}	[kN]	22		30				62					92			
Shear	HDA-PR	V_{Rk}	[kN]	23		34				63					-			

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

Design resistance

Anchor size				M10		M12				M16					M20[a)]			
Non-cracked concrete																		
Tension	HDA-P(F), HDA-T(F)[b)]	N_{Rd}	[kN]	30,7		44,7				84,0					128,0			
	HDA-PR, HDA-TR			28,8		41,9				78,8					-			
Cracked concrete																		
Tension	HDA-P(F), HDA-T(F)[b)]	N_{Rd}	[kN]	16,7		23,3				50,0					63,3			
	HDA-PR, HDA-TR			16,7		23,3				50,0					-			
Non-cracked and cracked concrete																		
Shear	HDA-T(F)[b)]	$t_{fix,min}$	[mm]	10≤	15≤	10≤	15≤	20≤	30≤	15≤	20≤	25≤	30≤	35≤	20≤	25≤	40≤	55≤
		$t_{fix,max}$	[mm]	<15	≤20	<15	<20	≤30	≤50	<20	<25	<30	<35	≤60	<25	<40	<55	≤100
		V_{Rd}	[kN]	43,3[c]	46,7	53,3[c)]	53,3	66,7	66,7	93,3[c]	93,3	103,3	113,3	126,7	136,7[c]	136,7	156,7	166,7
	HDA-TR	$t_{fix,min}$	[mm]	10≤	15≤	10≤	15≤	20≤	30≤	15≤	20≤	25≤	30≤	35≤	-			
		$t_{fix,max}$	[mm]	<15	≤20	<15	<20	<30	≤50	<20	<25	<30	<35	≤60	-			
		V_{Rd}	[kN]	53,4[c]	53,4	65,4[c]	65,4	70,7	82,0	114,3[c]	114,3	118,8	118,8	127,8	-			
	HDA-P(F)[b)]	V_{Rd}	[kN]	17,6		24,0				49,6					73,6			
	HDA-PR			17,3		25,6				47,4					-			

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

Recommended loads [d)]

Anchor size				M10		M12				M16					M20[a)]			
Non-cracked concrete																		
Tension	HDA-P(F), HDA-T(F)[b)]	N_{Rec}	[kN]	15.3		22.3				42					64			
	HDA-PR, HDA-TR			15.3		22.3				42					-			
Cracked concrete																		
Tension	HDA-P(F), HDA-T(F)[b)]	N_{Rec}	[kN]	8.3		11.7				25					31.7			
	HDA-PR, HDA-TR			8.3		11.7				25					-			
Non-cracked and cracked concrete																		
Shear	HDA-T(F)[b)]	$t_{fix,min}$	[mm]	10≤	15≤	10≤	15≤	20≤	30≤	15≤	20≤	25≤	30≤	35≤	20≤	25≤	40≤	55≤
		$t_{fix,max}$	[mm]	<15	≤20	<15	<20	≤30	≤50	<20	<25	<30	<35	≤60	<25	<40	<55	≤100
		V_{Rk}	[kN]	21.7[c)]	23.3	26.7[c)]	26.7	33.3	33.3	46.7[c)]	46.7	51.7	56.7	63.3	68.3[c)]	68.3	78.3	83.3
	HDA-TR	$t_{fix,min}$	[mm]	10≤	15≤	10≤	15≤	20≤	30≤	15≤	20≤	25≤	30≤	35≤	-			
		$t_{fix,max}$	[mm]	<15	≤20	<15	<20	<30	≤50	<20	<25	<30	<35	≤60	-			
		V_{Rk}	[kN]	23.7[c)]	23.7	29[c)]	29	31.3	36.3	50.7[c)]	50.7	52.7	52.7	56.7	-			
	HDA-P(F)[b)]	V_{Rec}	[kN]	7.3		10				20.7					30.7			
	HDA-PR			7.6		11.3				21					-			

a) HDA M20: only galvanized 5µm version is available.
b) HDA-PF and HDA-TF: anchors are not covered by ETA-99/0009
c) With use of centering washer (t=5mm) only
d) With overall global safety factor for action $\gamma_F = 3.0$. The partial safety factors for action depend on the type of loading.

Materials

Mechanical properties of HDA

Anchor size			HDA-P(F), HDA-T(F)				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: only a galvanized 5µm version is available

b) The recommended bending moment of the HDA anchor bolt may be calculated from $M_{rec} = M_{Rd,s} / \gamma_F = M_{Rk,s} / (\gamma_{Ms} \cdot \gamma_F) = (1,2 \cdot W_{el} \cdot f_{uk}) / (\gamma_{Ms} \cdot \gamma_F)$, 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.

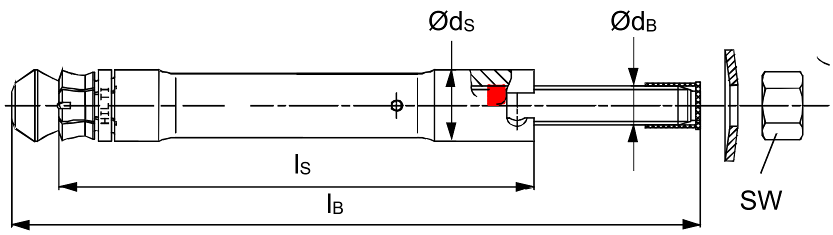
Material quality

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 / HDA-TF	
Sleeve	Machined steel with brazed tungsten carbide tips, sherardized
Bolt M10-M16:	Cold formed steel, strength 8.8, sherardized

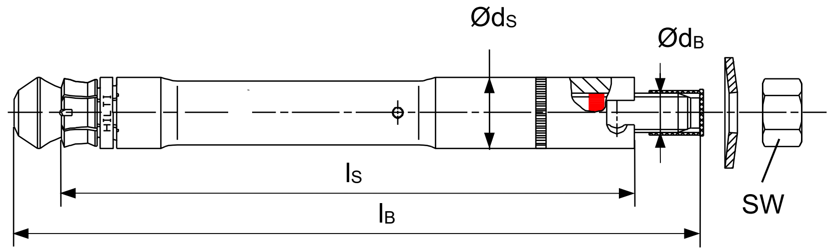
Anchor dimensions

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	d_B	[mm]	10	12		16		20	
Total length of 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	

HDA-P / HDA-PR



HDA-T / HDA-TR



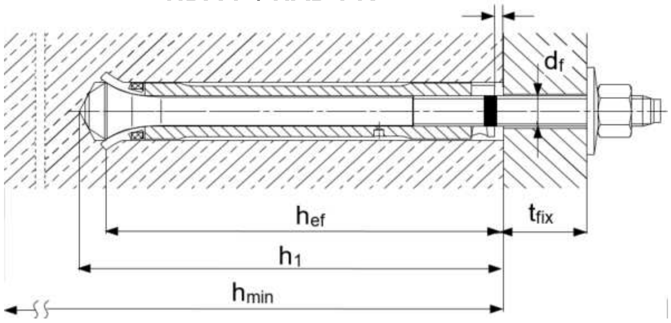
Setting information

Setting details

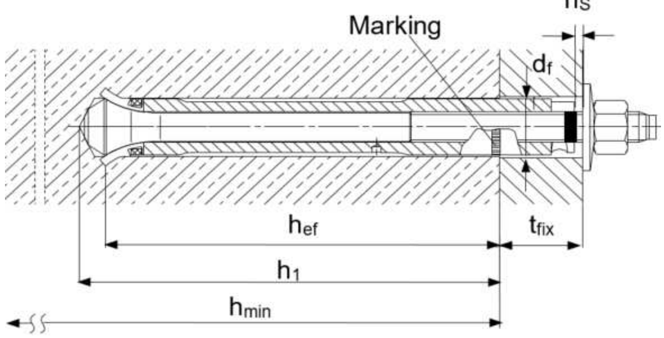
Anchor size			HDA-P / HDA-PR / HDA-T / HDA-TR						
			M10	M12		M16		M20	
			x100/20	x125/30	x125/50	x190/40	x190/60	x250/50	x250/100
Length code letter			I	L	N	R	S	V	X
Nominal drill bit diameter	d_0	[mm]	20	22		30		37	
Cutting diameter of drill bit	$d_{cut,min}$	[mm]	20,10	22,10		30,10		37,15	
	$d_{cut,max}$	[mm]	20,55	22,55		30,55		37,70	
Depth of drill hole	$h_1 \geq$	[mm]	107	133		203		266	
Effective 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	$t_{fix,min}$	[mm]	10	10		15		20	-
Max. fixture thickness	$t_{fix,max}$	[mm]	20	30	50	40	60	50	100

* Minimum fixture thickness is 10 mm under cyclic loads according to ETA-18/0974

HDA-P / HAD-PR



HDA-T / HAD-TR

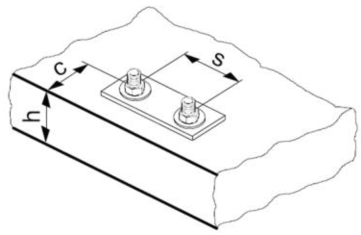


Setting parameters

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	$c_{cr,N}$	[mm]	150	190		285		375		

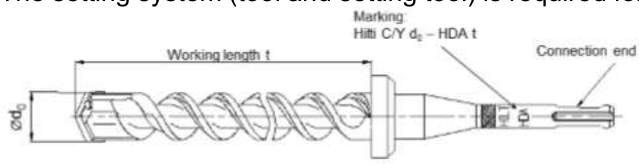
For spacing (edge distance) smaller than critical spacing (critical edge distance) the design loads have to be reduced.

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 bit HDA

The stop drill is required for drilling 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.



Required stop drill bits for HDA and HDA-R

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/ PF/ PR M10x100/20	TE-C-HDA-B 20x100	TE-Y-HDA-B 20x100	107	20
HDA-T/ TF/ TR M10x100/20	TE-C-HDA-B 20x120	TE-Y-HDA-B 20x120	127	20
HDA-P/ PF/ PR M12x125/30 HDA-P/ PF/ PR M12x125/50	TE-C HDA-B 22x125	TE-Y HDA-B 22x125	133	22
HDA-T/ TF/ TR M12x125/30	TE-C HDA-B 22x155	TE-Y HDA-B 22x155	163	22
HDA-T/ TF/ TR M12x125/50	TE-C HDA-B 22x175	TE-Y HDA-B 22x175	183	22
HDA-P/ PF/ PR M16 x190/40 HDA-P/ PF/ PR M16 x190/60		TE-Y HDA-B 30x190	203	30
HDA-T/ TF/ TR M16x190/40		TE-Y HDA-B 30x230	243	30
HDA-T/ TF/ 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

Anchor 	TE 24 a) TE 25 a)	TE 30-A36	TE 35	TE 40 TE 40 AVR	TE 56 TE 56-ATC	TE 60 TE 60-ATC	TE 70 b) TE 70-ATC b)	TE 75	TE 76 TE 76-ATC	TE 80-ATC TE 80-ATC AVR	Setting tool 
HDA-P/T M10x100/20	■	■		■							TE-C-HDA-ST 20 M10
					■	■					TE-Y-HDA-ST 20 M10
HDA-P/T M12x125/30 HDA-P/T M12x125/50	■	■		■							TE-C-HDA-ST 22 M12
					■	■					TE-Y-HDA-ST 22 M12
HDA-P/T M16x190/40 HDA-P/T M16x190/60							■	■	■	■	TE-Y-HDA-ST 30 M16
HDA-P/T M20x250/50 HDA-P/T M20x250/100							■		■	■	TE-Y-HDA-ST 37 M20

a) 1st gear
b) With TE 70 hmin = 340 mm - tfix for tfix,max = 40 mm and hmin = 360 mm - tfix for tfix,max = 60 mm when using HDA-T(TR) M16

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

a) 1st gear
b) With TE 70 hmin = 340 mm - tfix for tfix,max = 40 mm and hmin = 360 mm - tfix for tfix,max = 60 mm when using HDA-T(TR) M16

Anchor 	TE 24 a) TE 25 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/TF M10x100/20		■	■	■		■					TE-C-HDA-ST 20 M10
HDA-PF/TF M12x125/30 HDA-PF/TF M12x125/50		■	■	■		■					TE-C-HDA-ST 22 M12
HDA-PF/TF M16x190/40 HDA-PF/TF M16x190/60							■	■	■	■	TE-Y-HDA-ST 30 M16

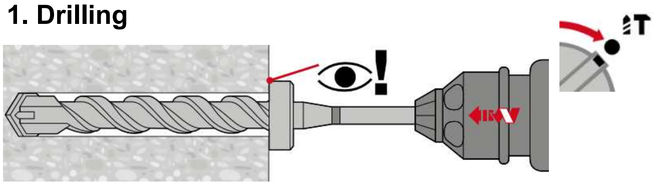
a) 1st gear

Setting instructions

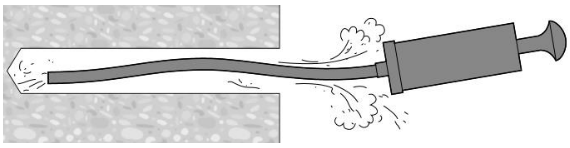
***For detailed information on installation see instruction for use given with the package of the product.**

HDA-P / HDA-PR (prepositioning)

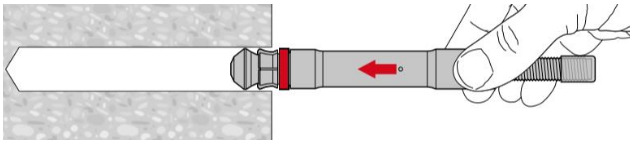
1. Drilling



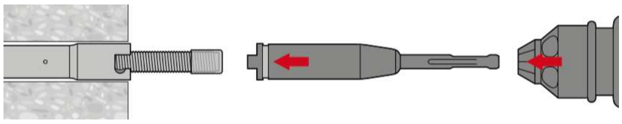
2.Cleaning



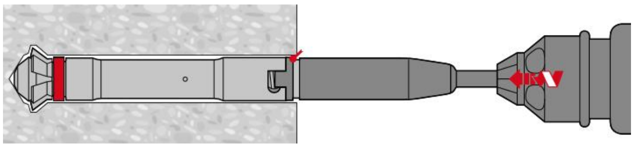
3.Inserting the anchor by hand



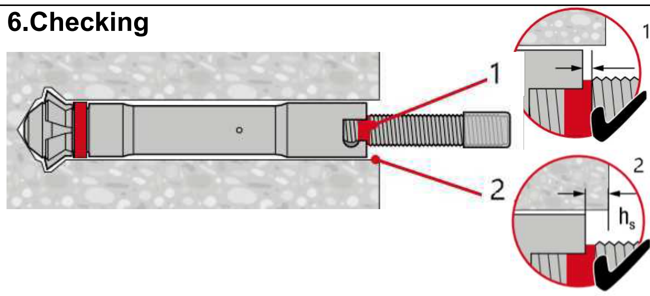
4. Applying hammerdrill



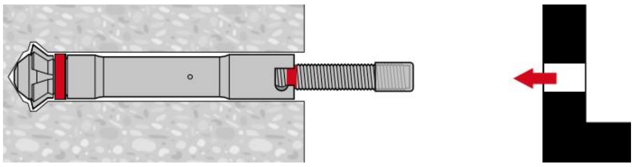
5.Applying hammer drill



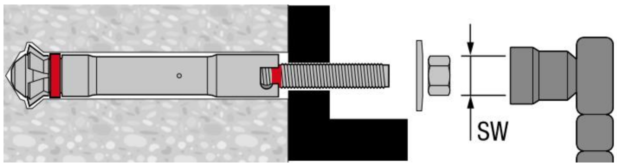
6.Checking

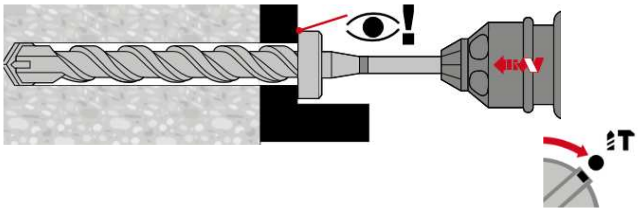
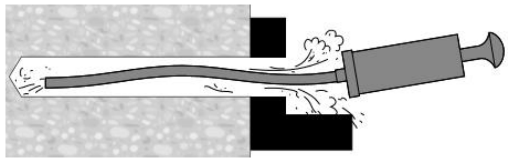
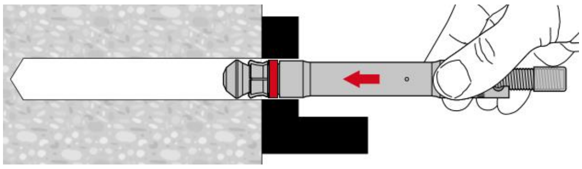
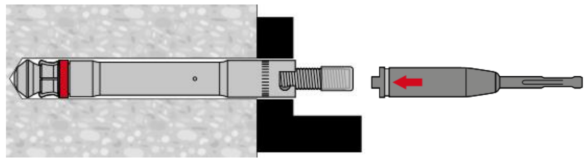
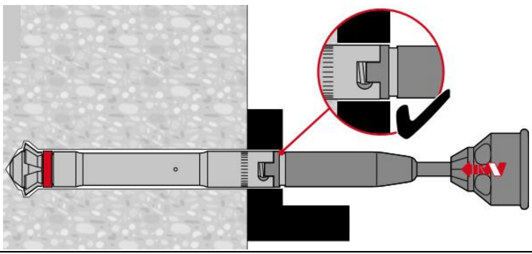
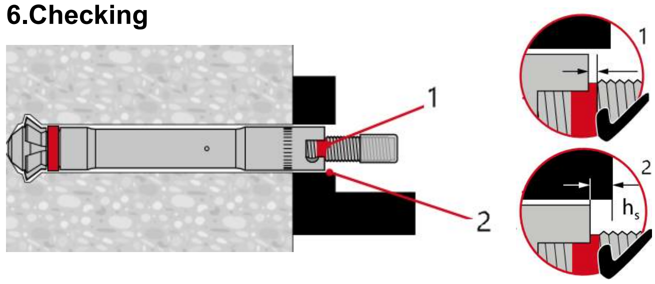
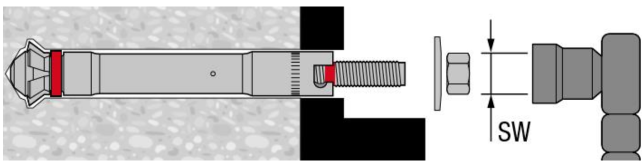


7.Attaching the fixture



8.Attaching the belonging washer



HDA-T / HDA-TR / HAD-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 	

HSC Shallow Undercut anchors

Ultimate-performance undercut anchor for shallow embedment depth

Anchor version		Benefits
	HSC-A HSC-AR (M8-M12)	- The perfect solution for small edge and space distance - Suitable for thin concrete blocks due to low embedment depth - Seismic design with ETA C2 approval - Suitable for cracked concrete - Self-cutting undercut anchor - Available as bolt version for through applications - Stainless steel available for external applications
	HSC-I HSC-IR (M6-M12)	

Base material

- Concrete (non-cracked)
- Concrete (cracked)

Load conditions

- Static/ quasi-static
- Shock
- Fire resistance
- Seismic ETA-C2

Installation conditions

- Hammer drilled holes

Other information

- European Technical Assessment
- CE conformity
- PROFIS ENGINEERING
- 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
Fire test report 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 / 2006-07-10

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

Static resistance

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 C20/25, $f_{ck,cube}$ = 25 N/mm²

HSC-A (R)

Effective anchorage depth of HSC-A (R)

Anchor size			M8	M8	M10	M12
Effective anchorage depth	h_{ef}	[mm]	40	50	40	60

Characteristic resistance of HSC-A (R)

Anchor size				M8 x 40	M8 x 50	M10 x 40	M12 x 60
Non-cracked concrete							
Tension	HSC-A, HSC-AR	N_{Rk}	[kN]	12,4	17,4	12,4	22,9
Shear	HSC-A	V_{Rk}	[kN]	14,6	14,6	23,2	33,7
	HSC-AR			12,8	12,8	20,3	29,5
Cracked concrete							
Tension	HSC-A, HSC-AR	N_{Rk}	[kN]	8,7	12,2	8,7	16,0
Shear	HSC-A	V_{Rk}	[kN]	14,6	14,6	17,4	32,0
	HSC-AR			12,8	12,8	17,4	29,5

Design resistance of HSC-A (R)

Anchor size				M8 x 40	M8 x 50	M10 x 40	M12 x 60
Non-cracked concrete							
Tension	HSC-A, HSC-AR	N_{Rd}	[kN]	8,3	11,6	8,3	15,2
Shear	HSC-A	V_{Rd}	[kN]	11,7	11,7	16,6	27,0
	HSC-AR			8,2	8,2	13,0	18,9
Cracked concrete							
Tension	HSC-A, HSC-AR	N_{Rd}	[kN]	5,8	8,1	5,8	10,7
Shear	HSC-A	V_{Rd}	[kN]	11,7	11,7	11,6	21,3
	HSC-AR			8,2	8,2	11,6	18,9

Recommended loads [a] of HSC-A (R)

Anchor size				M8 x 40	M8 x 50	M10 x 40	M12 x 60
Non-cracked concrete							
Tension	HSC-A, HSC-AR	N_{Rec}	[kN]	4.1	5.8	4.1	7.6
Shear	HSC-A	V_{Rec}	[kN]	4.9	4.9	7.7	11.2
	HSC-AR			4.3	4.3	6.8	9.8
Cracked concrete							
Tension	HSC-A, HSC-AR	N_{Rec}	[kN]	2.9	4.1	2.9	5.3
Shear	HSC-A	V_{Rec}	[kN]	4.9	4.9	5.8	10.7
	HSC-AR			4.3	4.3	5.8	9.8

a) With overall global 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.

HSC-I (R)

Effective anchorage depth of HSC-I (R)

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

Characteristic resistance of HSC-I (R)

Anchor size				M6 x 40	M8 x 40	M10 x 50	M10 x 60	M12 x 60
Non-cracked concrete								
Tension	HSC-I, HSC-IR	N_{Rk}	[kN]	12,4	12,4	17,4	22,9	22,9
Shear	HSC-I	V_{Rk}	[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	HSC-I, HSC-IR	N_{Rk}	[kN]	8,7	8,7	12,2	16,0	16,0
Shear	HSC-I	V_{Rk}	[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 (R)

Anchor size				M6 x 40	M8 x 40	M10 x 50	M10 x 60	M12 x 60
Non-cracked concrete								
Tension	HSC-I	N_{Rd}	[kN]	8,3	8,3	11,6	15,2	15,2
	HSC-IR			7,5	8,3	11,6	14,2	15,2
Shear	HSC-I	V_{Rd}	[kN]	6,4	9,8	12,2	12,2	14,6
	HSC-IR			4,5	6,9	8,5	8,5	10,3
Cracked concrete								
Tension	HSC-I, HSC-IR	N_{Rd}	[kN]	5,8	5,8	8,1	10,7	10,7
Shear	HSC-I	V_{Rd}	[kN]	6,4	9,8	12,2	12,2	14,6
	HSC-IR			4,5	6,9	8,5	8,5	10,3

Recommended loads a) of HSC-I (R)

Anchor size				M6 x 40	M8 x 40	M10 x 50	M10 x 60	M12 x 60
Non-cracked concrete								
Tension	HSC-I / HSC-IR	N_{Rec}	[kN]	4.1	4.1	5.8	7.6	7.6
Shear	HSC-I	V_{Rec}	[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	HSC-I, HSC-IR	N_{Rec}	[kN]	4,1	4,1	5,8	7,6	7,6
Shear	HSC-I	V_{Rec}	[kN]	4,6	7,0	8,7	8,7	10,4
	HSC-IR			3,2	4,9	6,1	6,1	7,3

a) With overall global 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

Mechanical properties for HSC-A (R)

Anchor size				M8 x 40	M8 x 50	M10 x 40	M12 x 60
Nominal tensile strength	HSC-A	f_{uk}	[N/mm²]	800	800	800	800
	HSC-AR			700	700	700	700
Yield strength	HSC-A	f_{yk}	[N/mm²]	640	640	640	640
	HSC-AR			450	450	450	450
Stressed cross-section for bolt version	HSC-A HSC-AR	$A_{s,A}$	[mm²]	36,6	36,6	58,0	84,3
Moment of resistance	HSC-A HSC-AR	W	[mm³]	31,2	31,2	62,3	109,2
Characteristic bending resistance	HSC-A	$M^0_{Rk,s}$	[Nm]	30	30	60	105
	HSC-AR			26	26	52	92

Mechanical properties for HSC-I (R)

Anchor size				M6 x 40	M8 x 40	M10 x 50	M10 x 60	M12 x 60
Nominal tensile strength	HSC-I	f_{uk}	[N/mm²]	800	800	800	800	800
	HSC-IR			700	700	700	700	700
Yield strength	HSC-I	f_{yk}	[N/mm²]	640	640	640	640	640
	HSC-IR			355	355	350	350	340
Stressed cross-section for internal thread version	HSC-I HSC-IR	$A_{s,I}$	[mm²]	22,0	28,3	34,6	34,6	40,8
Moment of resistance	HSC-I HSC-IR	W	[mm³]	12,7	31,2	62,3	62,3	109,2
Characteristic bending resistance	HSC-I	$M^0_{Rk,s}$	[Nm]	12	30	60	60	105
	HSC-IR			11	26	52	52	92

Material quality

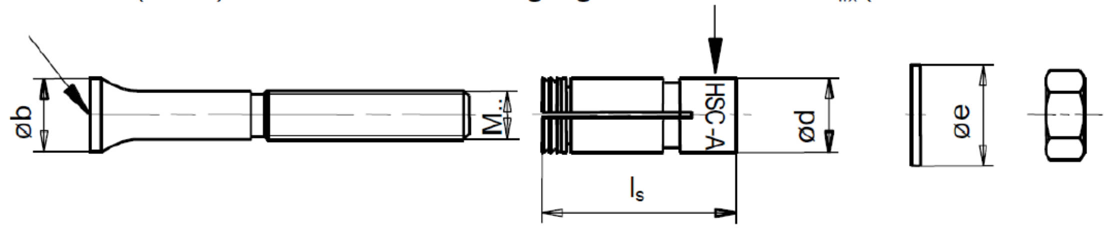
Part		Material
Metal parts made of zinc coated steel		
HSC-A HSC-I	Cone bolt with external thread (-A)	Carbon steel strength 8.8, galvanized to min. 5 µm
	Cone bolt with internal thread (-I)	
	Expansion sleeve	Galvanized to min. 5 µm
	Washer	
	Hexagon nut	Grade 8
HSC-AR / HSC-IR Stainless steel		
HSC-AR HSC-IR	Cone bolt with external thread (-AR)	A4-70, Stainless steel 1.4401, 1.4571 EN 10088-1:2014
	Cone bolt with internal thread (-IR)	
	Expansion sleeve	Stainless steel 1.4401, 1.4571 EN 10088-1:2014
	Washer	
	Hexagon nut	A4-70, Stainless steel 1.4401, 1.4571 EN 10088-1:2014

Anchor dimension of HSC-A (R)

Anchor size			M8 x 40	M8 x 50	M10 x 40	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

marking HILTI 8.8 (or A4)

marking e.g. HSC-A M8 x 40 /t_{fix} (or HSC-AR M8 x 40 /t_{fix}A4)

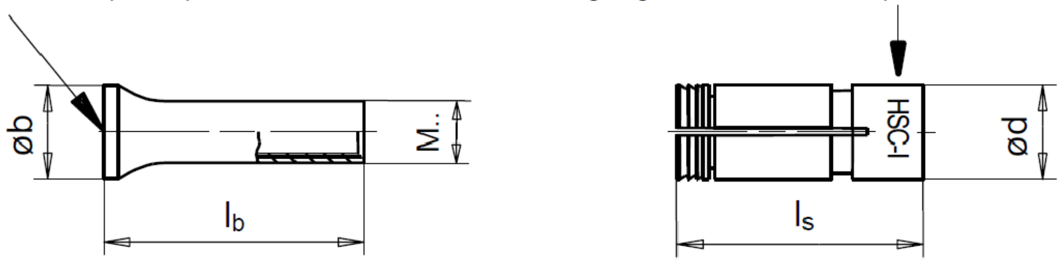


Anchor dimension of HSC-I (R)

Anchor size			M6 x 40	M8 x 40	M10 x 50	M10 x 60	M12 x 60
Length of cone bolt	l_b	[mm]	43,3	43,3	54,8	64,8	64,8
Diameter of cone bolt	b	[mm]	13,5	15,5	17,5	17,5	19,5
Length of expansion sleeve	l_s	[mm]	40,8	40,8	50,8	60,8	60,8
Diameter of expansion sleeve	d	[mm]	13,5	15,5	17,5	17,5	19,5

marking HILTI 8.8 (or A4)

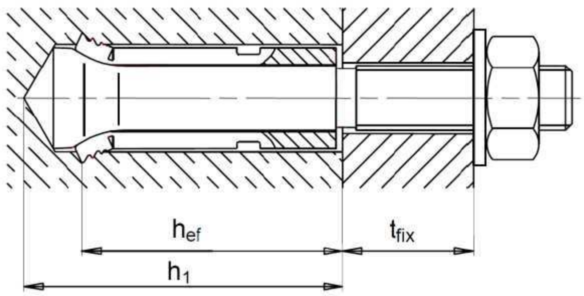
marking e.g. HSC-I M6 x 40 (or HSC-IR M6 x 40 A4)



Setting information

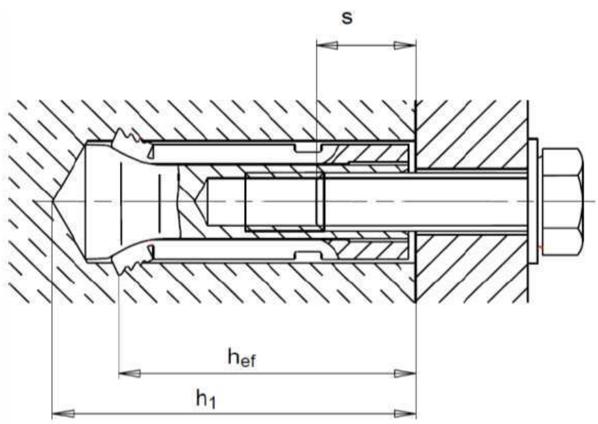
Setting details of HSC-A (R)

Anchor size			M8 x 40	M10 x 40	M12 x 60
Effective anchorage depth	h_{ef}	[mm]	40	40	60
Nominal Diameter of drill bit	d_0	[mm]	14	16	18
Cutting diameter of drill bit [1)]	d_{cut}	[mm]	14,5	16,5	18,5
Maximum fastening thickness	t_{fix}	[mm]	15	20	20
Depth of drill hole	h_1	[mm]	46	46,5	68
Diameter of clearance hole in the fixture	$d_f \leq$	[mm]	9	12	14
Torque moment	T_{inst}	[Nm]	10	20	30
Width across nut flats	SW	[mm]	13	17	19



Setting details of HSC-I (R)

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



Installation equipment for HSC-A (R)

Anchor size		M8 x 40	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	16x40	18x60
Setting tool	TE-C-HSC-MW	14	16	18

Installation equipment for HSC-I (R)

Anchor size		M6 x 40	M8 x 40	M10 x 50	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	20x60
Setting tool	TE-C-HSC-MW	14	16	18	20
Insert tool	TE-C-HSC-EW	14	16	18	20

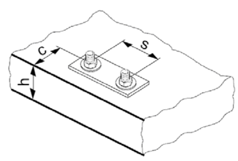
Setting parameters for HSC-A (R)

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

Setting parameters for HSC-I (R)

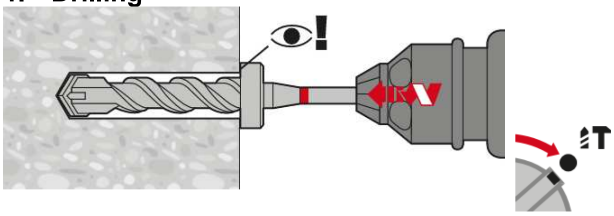
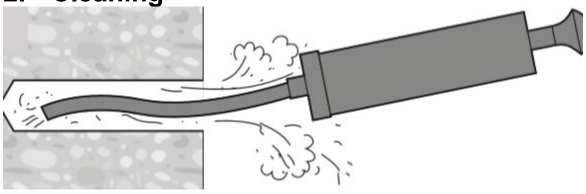
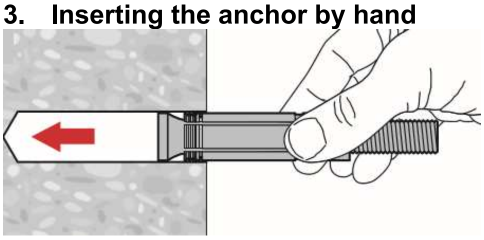
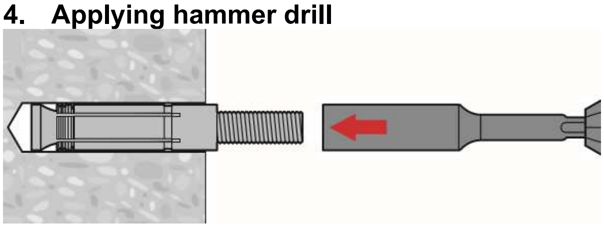
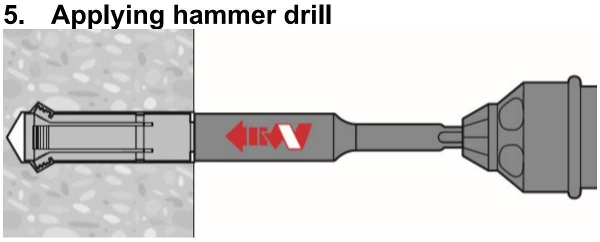
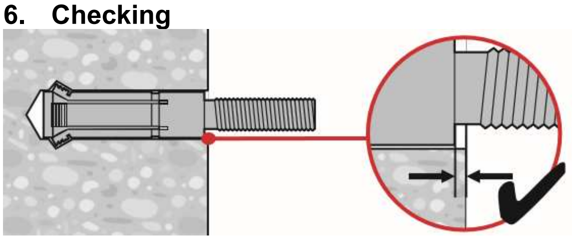
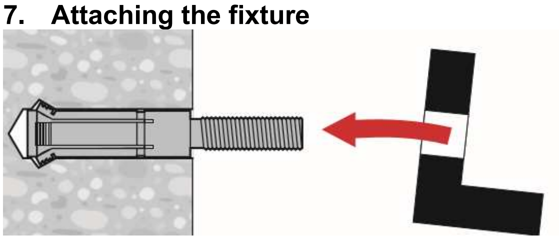
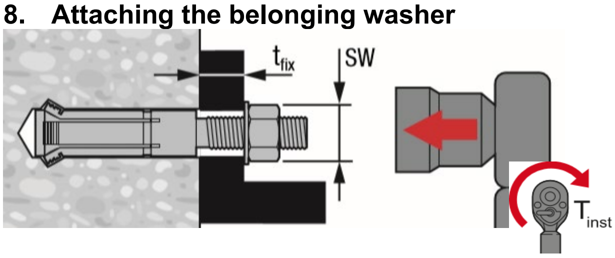
Anchor size			M6 x 40	M8 x 40	M10 x 50	M12 x 60
Effective anchorage depth	h_{ef}	[mm]	40	40	50	60
Minimum base material thickness	$h_{min} \geq$	[mm]	100	100	100	130
Minimum spacing	$s_{min} \geq$	[mm]	40	40	50	60
Minimum edge distance	$c_{min} \geq$	[mm]	40	40	50	60
Critical spacing for splitting failure	$s_{cr,sp}$	[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

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 EN 1992-4.
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.



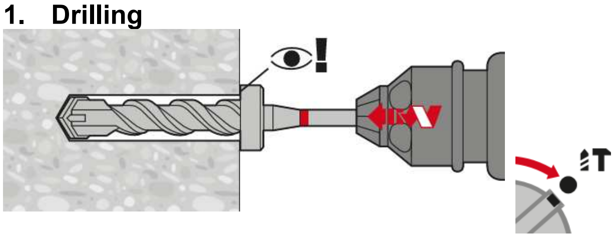
Setting instruction

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

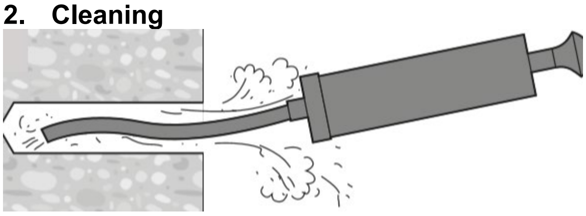
Setting instruction for HSC-I (R)	
1. **Drilling** 	2. **Cleaning** 
3. **Inserting the anchor by hand** 	4. **Applying hammer drill** 
5. **Applying hammer drill** 	6. **Checking** 
7. **Attaching the fixture** 	8. **Attaching the belonging washer** 

Setting instruction for HSC-I (R)

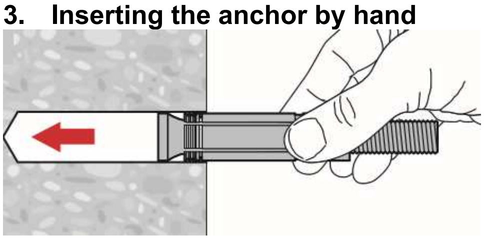
1. Drilling



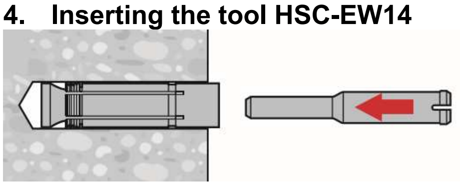
2. Cleaning



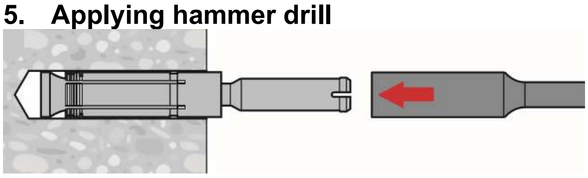
3. Inserting the anchor by hand



4. Inserting the tool HSC-EW14

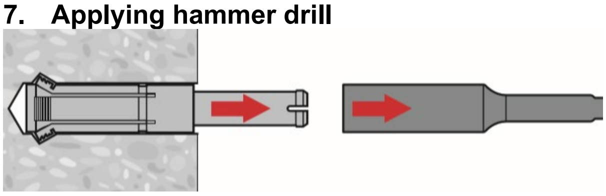


5. Applying hammer drill

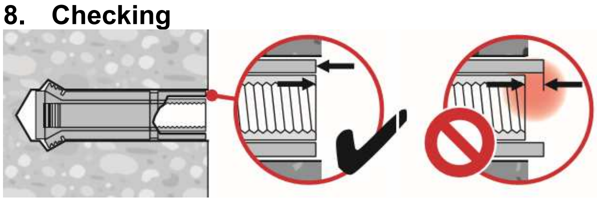


6. Applying hammer drill

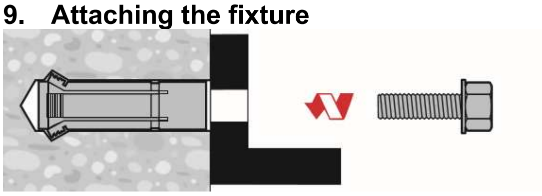
7. Applying hammer drill



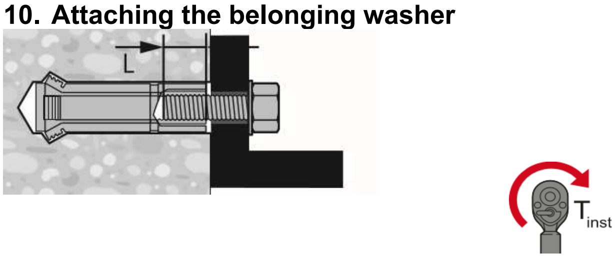
8. Checking



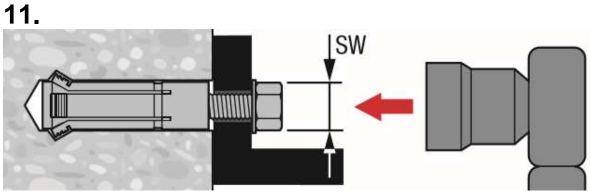
9. Attaching the fixture



10. Attaching the belonging washer



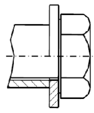
11.

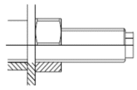


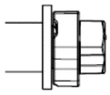
HSL4 expansion anchor

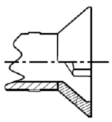
Ultimate-performance heavy-duty expansion anchor

Anchor versions



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

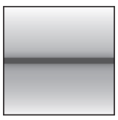
- Suitable for cracked concrete C20/25 to C50/60
- Suitable for seismic C1 and C2, shock, fire and fatigue
- Installation with hammer drilling, diamond drilling and hollow drill bit available for same performance
- Top shear performance due to high strength expansion and shear sleeves
- HSL4-B special 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

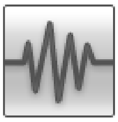
Base material

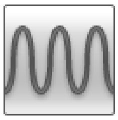

Concrete (uncracked)

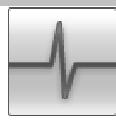

Concrete (cracked)

Load conditions


Static/ quasi-static

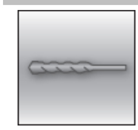

Seismic ETA-C1, C2

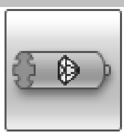

Fatigue ETA


Shock

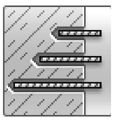

Fire resistance ETA

Installation conditions


Hammer drilled holes

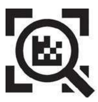

Diamond cored holes


Hollow drill bit drilling


Variable embedment depth

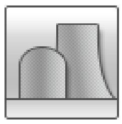

Impact wrench with adaptative torque module

Other information


Tracefast

European Technical Assessment

CE conformity


Nuclear power plant approval

PROFIS ENGINEERING

Approvals/certificates

Description	Authority / Laboratory	No. / Date of issue
European technical Assessment [a)]	CSTB, Marne-la-Vallèe	ETA-19/0556 / 2022-11-02
Fire test report	CSTB, Marne-la-Vallèe	ETA-19/0556 / 2022-11-02
European technical Assessment [b)]	CSTB, Marne-la-Vallèe	ETA-19/0858 / 2022-11-02
ICC-ES report incl. seismic [c)]	ICC evaluation service	ESR 4386 / 2020-03
Shock approval	Civil Protection of Switzerland	BZS D 19-601
ACI 349-01 nuclear suitability	Hilti, Inc. Plano, Texas	2021-01-19

a) All data for static or seismic load cases given in this section according to ETA-19/0556, issued 2022-11-02.
b) All data for fatigue relevant load cases given in this section according to ETA-19/0858, issued 2022-11-02.
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/mm^2

Effective anchorage depth [a)]

Anchor size			M8			M10			M12		
Effective anchorage depth	h_{ef}	[mm]	$h_{ef,1}$ [b)]	$h_{ef,2}$	$h_{ef,3}$ [c)]	$h_{ef,1}$ [b)]	$h_{ef,2}$	$h_{ef,3}$ [c)]	$h_{ef,1}$ [b)]	$h_{ef,2}$	$h_{ef,3}$ [c)]
			60	80	100	70	90	110	80	105	130
Anchor size			**M16**			**M20**			**M24**		
Effective anchorage depth	h_{ef}	[mm]	$h_{ef,1}$	$h_{ef,2}$	$h_{ef,3}$ [c)]	$h_{ef,1}$	$h_{ef,2}$	$h_{ef,3}$ [c)]	$h_{ef,1}$	$h_{ef,2}$	$h_{ef,3}$ [c)]
			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.
c) The data of $h_{ef,3}$ is non-standard item.

Characteristic resistance

Anchor size				M8			M10			M12		
Non-cracked concrete												
Tension	HSL4 / HSL4-B HSL4-G HSL4-SK[a)]	N_{Rk}	[kN]	22,9	29,3	29,3	28,8	42,0	46,4	35,2	52,9	67,4
Shear	HSL4 / HSL4-B	V_{Rk}	[kN]	31,1	31,1	31,1	60,5	60,5	60,5	89,6	89,6	89,6
	HSL4-G			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	HSL4 / HSL4-B HSL4-G HSL4-SK[a)]	N_{Rk}	[kN]	12,0	12,0	12,0	16,0	16,0	16,0	24,6	24,0	24,0
Shear	HSL4 / HSL4-B	V_{Rk}	[kN]	31,1	31,1	31,1	52,4	60,5	60,5	66,5	89,6	89,6
	HSL4-G			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	-	-	52,4	-	-	66,5	-	-
		t_{fix}	[mm]	<11	-	-	<11	-	-	<13	-	-
		V_{Rk}	[kN]	14,6	-	-	23,2	-	-	33,7	-	-
Anchor size				**M16**			**M20**			**M24**		
Non-cracked concrete												
Tension	HSL4 / HSL4-B HSL4-G	N_{Rk}	[kN]	49,2	65,0	65,0	68,8	94,9	95,0	90,4	100	100
Shear	HSL4 / HSL4-B	V_{Rk}	[kN]	137,7	158,5	158,5	186,0	186,0	186,0	204,5	204,5	204,5
	HSL4-G			120,6	120,6	120,6	155,3	155,3	155,3	204,5	204,5	204,5
Cracked concrete												
Tension	HSL4 / HSL4-B HSL4-G	N_{Rk}	[kN]	34,4	36,0	36,0	48,1	50,0	50,0	63,3	65,0	65,0
Shear	HSL4 / HSL4-B	V_{Rk}	[kN]	96,4	135	158,5	182,9	186,0	186,0	202,4	204,5	204,5
	HSL4-G			96,4	120,6	120,6	155,3	155,3	155,3	202,4	204,5	204,5

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

Design resistance

Anchor size				M8			M10			M12		
Non-cracked concrete												
Tension	HSL4 / HSL4-B HSL4-G HSL4-SK[a)]	N_{Rd}	[kN]	15,2	19,5	19,5	19,2	28,0	30,9	23,5	35,3	45,0
Shear	HSL4 / HSL4-B	V_{Rd}	[kN]	24,9	24,9	24,9	48,4	48,4	48,4	63,4	71,7	71,7
	HSL4-G	V_{Rd}	[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	HSL4 / HSL4-B HSL4-G HSL4-SK[a)]	N_{Rd}	[kN]	8,0	8,0	8,0	10,7	10,7	10,7	16,4	16,0	16,0
Shear	HSL4 / HSL4-B	V_{Rd}	[kN]	20,1	24,9	24,9	35,0	48,4	48,4	44,4	66,7	71,7
	HSL4-G	V_{Rd}	[kN]	20,9	20,9	20,9	33,4	33,4	33,4	44,4	47,4	47,4
	HSL4-SK[a)]	t_{fix}	[mm]	≥11	-	-	≥11	-	-	≥13	-	-
		V_{Rd}	[kN]	20,1	-	-	35,0	-	-	44,4	-	-
		t_{fix}	[mm]	<11	-	-	<11	-	-	<13	-	-
		V_{Rd}	[kN]	11,7	-	-	18,6	-	-	27,0	-	-
Anchor size				**M16**			**M20**			**M24**		
Non-cracked concrete												
Tension	HSL4 / HSL4-B HSL4-G	N_{Rd}	[kN]	32,8	43,3	43,3	45,8	63,3	63,3	60,2	66,7	66,7
Shear	HSL4 / HSL4-B	V_{Rd}	[kN]	91,8	126,8	126,8	148,8	148,8	148,8	163,6	163,6	163,6
	HSL4-G	V_{Rd}	[kN]	91,8	96,5	96,5	124,2	124,2	124,2	163,6	163,6	163,6
Cracked concrete												
Tension	HSL4 / HSL4-B HSL4-G	N_{Rd}	[kN]	23,0	24,0	24,0	32,1	33,3	33,3	42,2	43,3	43,3
Shear	HSL4 / HSL4-B	V_{Rd}	[kN]	64,3	89,8	118,1	121,9	148,8	148,8	135,0	163,6	163,6
	HSL4-G	V_{Rd}	[kN]	64,3	89,8	96,5	121,9	124,2	124,2	135,0	163,6	163,6

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

Recommended loads [b)]

Anchor size				M8			M10			M12		
Non-cracked concrete												
Tension	HSL4 / HSL4-B HSL4-G HSL4-SK[a)]	N_{Rec}	[kN]	7.6	9.8	9.8	9.6	14.0	15.5	11.7	17.6	22.5
Shear	HSL4 / HSL4-B	V_{Rec}	[kN]	10.4	10.4	10.4	20.2	20.2	20.2	29.9	29.9	29.9
	HSL4-G	V_{Rec}	[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	HSL4 / HSL4-B HSL4-G HSL4-SK[a)]	N_{Rec}	[kN]	4.0	4.0	4.0	5.3	5.3	5.3	8.2	8.0	8.0
Shear	HSL4 / HSL4-B	V_{Rec}	[kN]	10.4	10.4	10.4	17.5	20.2	20.2	22.2	29.9	29.9
	HSL4-G	V_{Rec}	[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	-	-	17.5	-	-	22.2	-	-
		t_{fix}	[mm]	<11	-	-	<11	-	-	<13	-	-
		V_{Rec}	[kN]	4.9	-	-	7.7	-	-	11.2	-	-
Anchor size				**M16**			**M20**			**M24**		
Non-cracked concrete												
Tension	HSL4 / HSL4-B HSL4-G	N_{Rec}	[kN]	16.4	21.7	21.7	22.9	31.6	31.7	30.1	33.3	33.3
Shear	HSL4 / HSL4-B	V_{Rec}	[kN]	45.9	52.8	52.8	62.0	62.0	62.0	68.2	68.2	68.2
	HSL4-G	V_{Rec}	[kN]	40.2	40.2	40.2	51.8	51.8	51.8	68.2	68.2	68.2
Cracked concrete												
Tension	HSL4 / HSL4-B HSL4-G	N_{Rec}	[kN]	11.5	12.0	12.0	16.0	16.7	16.7	21.1	21.7	21.7
Shear	HSL4 / HSL4-B	V_{Rec}	[kN]	32.1	45.0	52.8	61.0	62.0	62.0	67.5	68.2	68.2
	HSL4-G	V_{Rec}	[kN]	32.1	40.2	40.2	51.8	51.8	51.8	67.5	68.2	68.2

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

b) With overall global safety factor for action γ = 3.0. The partial safety factors for action depend on thy 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	800	800
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
Characteristic bending resistance without sleeve	$M^0_{Rk,s}$	[Nm]	30,0	60,0	105,0	266,0	519,0	898,0

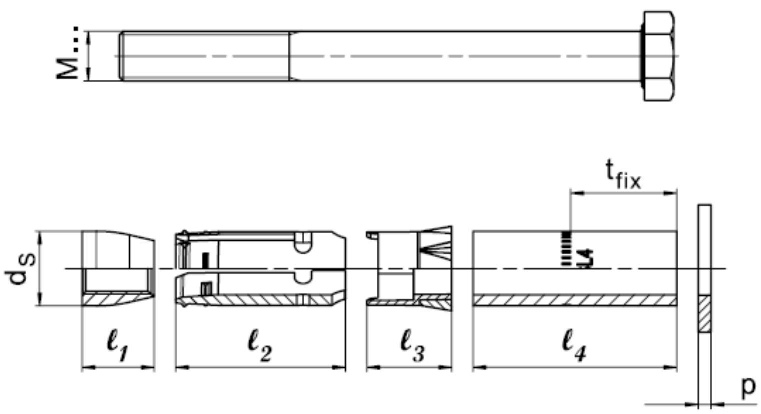
a) HSL4-SK only available in sizes M8-M12, HSL4-B only available in sizes M12-M24

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

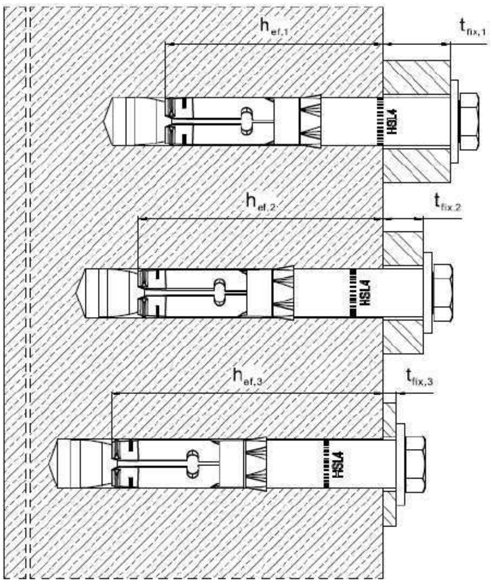
Anchor dimensions of HSL4, HSL4-G, HSL4-B, HSL4-SK

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					min	max	
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 HSL4-B	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-SK	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

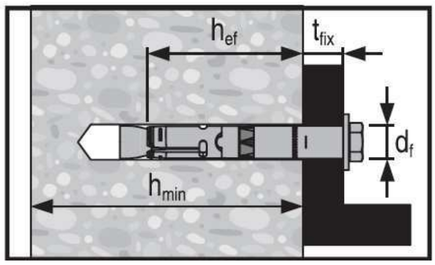
Setting positions [a]



Setting position ①

Setting position ②

Setting position ③

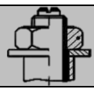


a) HSL4-SK can only be set in position 1.

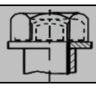
Setting details for HSL4

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			5-200			5-200		
Effective fixture thickness	$t_{fix,i}$		$t_{fix,1}$ [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	$h_{min,i}$	[mm]	120	170	190	140	195	215	160	225	250
Width across flats	SW	[mm]	13			17			19		
Installation torque	T_{inst}	[Nm]	15			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_{fix1}	[mm]	10-200			10-200			10-200		
Effective fixture thickness	$t_{fix,i}$		$t_{fix,1}$ [1] - Δi								
Reduction of fixture thickness	Δi	[mm]	0	25	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	$h_{min,i}$	[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		

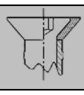
Setting details for HSL4-G

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			5-200			5-200		
Effective fixture thickness	$t_{fix,i}$		$t_{fix,1}$ [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	$h_{min,i}$	[mm]	120	170	190	140	195	215	160	225	250
Width across flats	SW	[mm]	13			17			19		
Installation torque	T_{inst}	[Nm]	20			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_{fix1}	[mm]	10-200			10-200			10-200		
Effective fixture thickness	$t_{fix,i}$		$t_{fix,1}$ [1)] - Δi								
Reduction of fixture thickness	Δi	[mm]	0	25	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	$h_{min,i}$	[mm]	200	275	300	250	380	410	300	405	435
Width across flats	SW	[mm]	24			30			36		
Installation torque	T_{inst}	[Nm]	70			105			180		

Setting details for HSL4-B

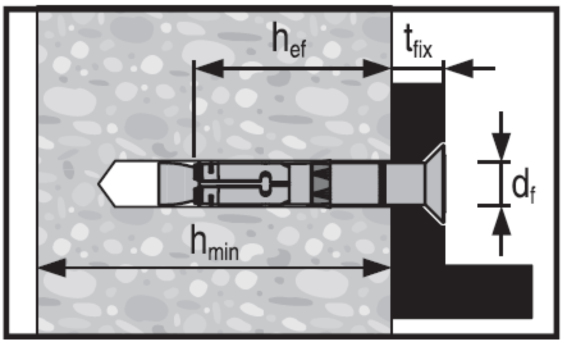
Anchor version 			M12			M16			M20			M24		
Nominal diameter of drill bit	d_0	[mm]	18			24			28			32		
Max. cutting diameter of drill bit	d_{cut}	[mm]	18,5			24,55			28,55			32,7		
Max. diameter of clearance hole in the fixture	d_f	[mm]	20			26			31			35		
Setting position	i		①	②	③	①	②	③	①	②	③	①	②	③
Fixture thickness	$t_{fix,1}$	[mm]	5 - 200			10 - 200			10 - 200			10 - 200		
Effective fixture thickness	$t_{fix,i}$		$t_{fix,1}$ [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	$h_{min,i}$	[mm]	160	225	250	200	275	300	250	380	410	300	405	435
Width across flats	SW	[mm]	24			30			36			41		
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.

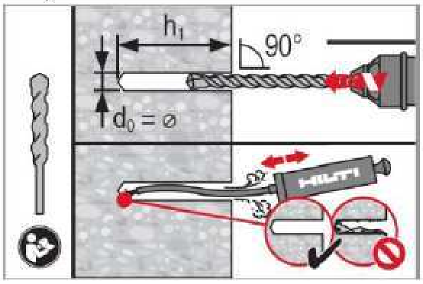
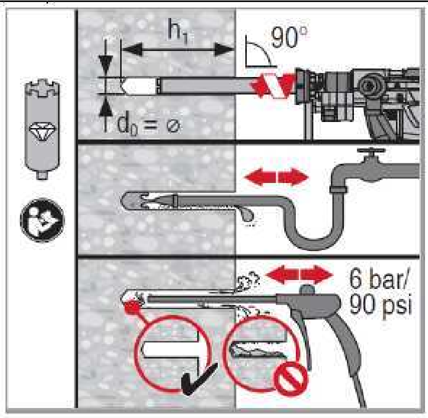
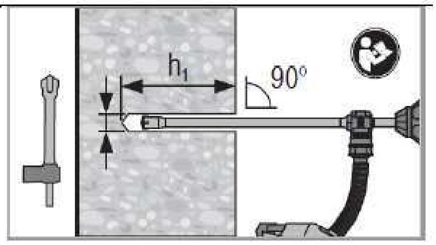
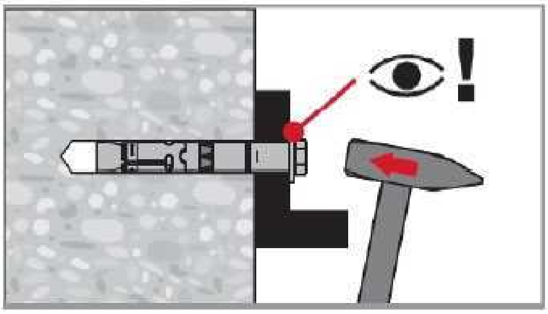
Setting parameters for HSL4, HSL4-G, HSL4-B, HSL4-SK [a)]

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 s ≥	[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 s ≥	[mm]	80			120			160		
Anchor size			**M16**			**M20**			**M24**		
Setting position	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 s ≥	[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 s ≥	[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.

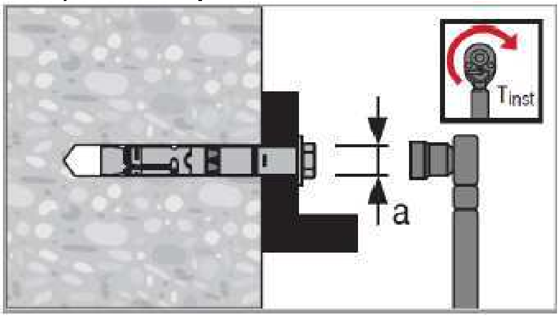
Setting instructions

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

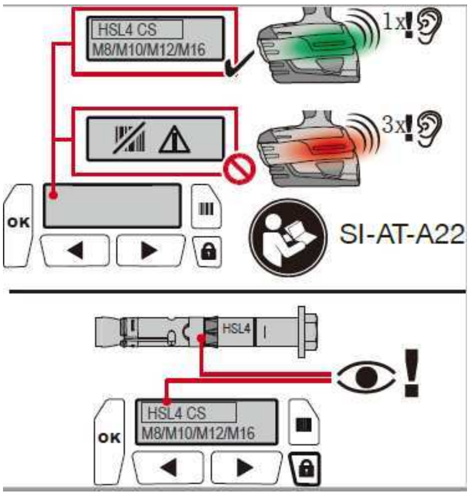
Setting instruction		
Hole drilling and cleaning		
a) Hammer drilling (HD) with manual cleaning (MC):	b) Diamond coring (DD) with flushing and blowing	c) Hammer drilling (HD) with hollow dril bit (HDB)
		
Anchor setting		
Hammer setting, check setting		
		

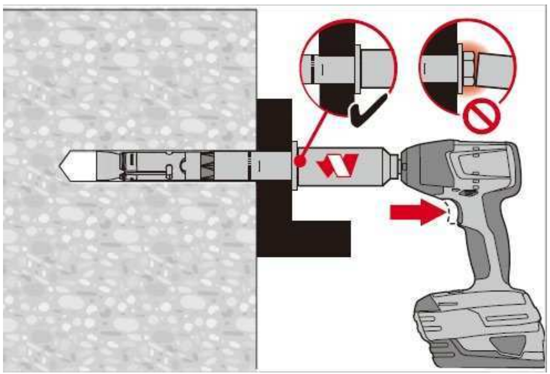
Anchor torqueing for HSL4, HSL4-G, SL-4-SK

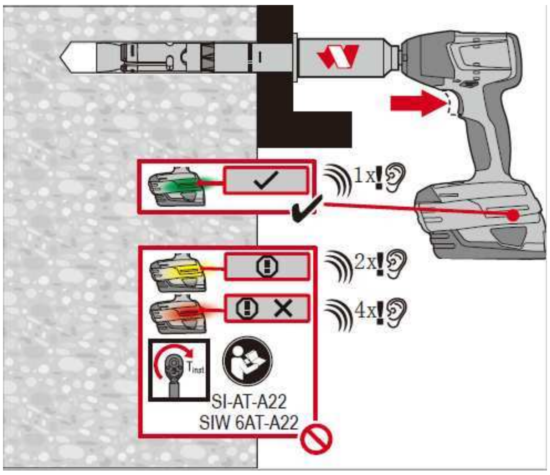
a) **Use torque wrench**



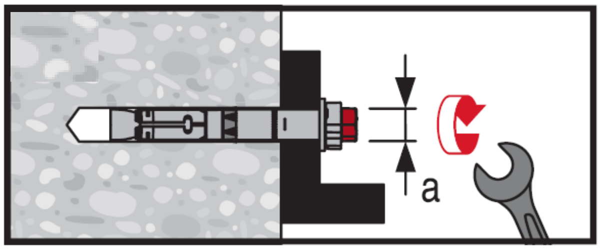
b) **Machine torqueing: Only HSL4 and HSL4-G M8 to M16** [a)].

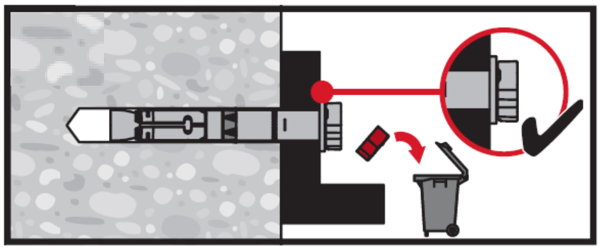






HSL4-B Safety cap



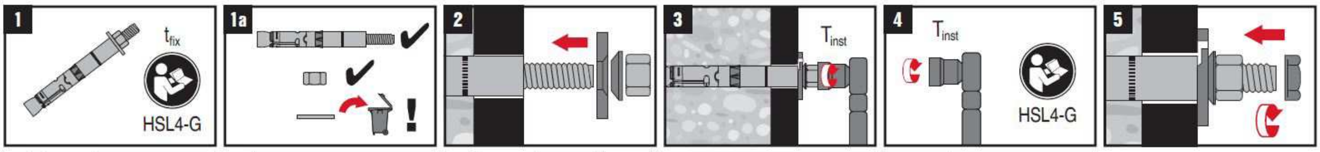


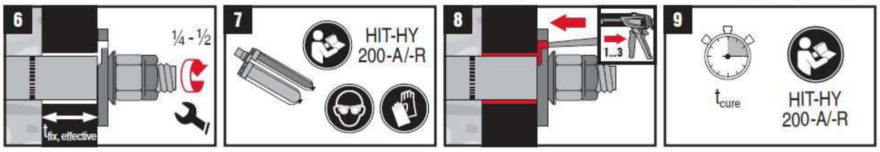
a) Equivalent combination of Hilti SIW + SI-AT tool, compatible to this anchor type, may be used (e.g. Hilti SIW 4AT-22 with SI-AT-22)

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



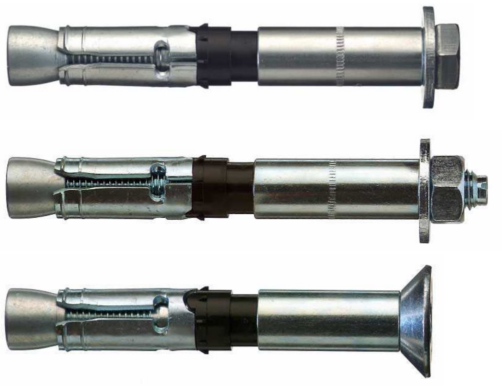


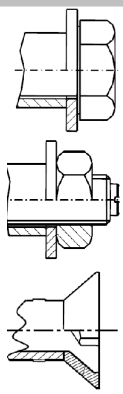
Size	$t_{fix, effective}$ (mm)
M16	10 ... 200
M20	10 ... 200

HSL-3-R expansion anchor

Ultimate-performance heavy-duty expansion anchor

Anchor versions





HSL-3-R
Bolt version
(M8-M20)

HSL-3-GR
Threaded rod version
(M8- M20)

HSL-3-SKR
Countersunk version
(M8-M12)

Benefits

- Suitable for cracked concrete C20/25 to C50/60
- Suitable for all dynamic loads: seismic C1, shock and fatigue
- Can be installed with hammer or Hollow drilling [a] 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

a) Condition valid only for size M12, M16 & M20

Base material

Concrete (non-cracked)

Concrete (cracked)

Load conditions

Static/ quasi-static

Seismic ETA-C1

Shock

Fire resistance

Installation conditions

Hammer drilled holes

Hollow drill-bits drilling

Variable embedment depth

Other information

European Technical Assessment

CE conformity

PROFIS ENGINEERING

A4 316
Corrosion resistance

Approvals/certificates

Description	Authority / Laboratory	No. / Date of issue
European technical Assessment [a]	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 [b]	ICC evaluation service	ESR 1545 / 2019-04
Shock approval	Civil Protection of Switzerland	BZS D 08-601

a) All data given in this section according to ETA-02/0042, issue 2017-11-22.
b) For more details on Technical Data according to ICC please consult the relevant HNA FTM.

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.
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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

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/mm^2
- Values for Hollow drill-bits drilling only applicable for M12, M16 and M20.

Effective anchorage depth [a)]

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

a) HSL-3-SKR only available in sizes M8-M12
b) HSL-3-SKR can only be set in position 1.

Characteristic resistance

Anchor size				M8			M10			M12		
Non-cracked concrete												
Tension	HSL-3-R / HSL-3-SKR [a]	N_{Rk}	[kN]	20,0	20,0	20,0	28,8	40,6	40,6	35,2	50,0	50,0
	HSL-3-GR			20,0	20,0	20,0	28,8	40,6	40,6	35,2	50,0	50,0
Shear	HSL-3-R / HSL-3-SKR [a]	V_{Rk}	[kN]	45,7	50,9	50,9	57,6	63,9	63,9	70,4	82,8	82,8
	HSL-3-GR			40,3	40,3	40,3	58,9	58,9	58,9	70,4	78,7	78,7
Cracked concrete												
Tension	HSL-3-R / HSL-3-SKR [a] HSL-3-GR	N_{Rk}	[kN]	12,0	12,0	12,0	16,0	16,0	16,0	24,6	24,0	24,0
Shear	HSL-3-R / HSL-3-SKR [a]	V_{Rk}	[kN]	32,0	49,3	50,9	40,3	58,8	63,9	49,3	74,1	82,8
	HSL-3-GR			32,0	40,3	40,3	40,3	58,8	58,9	49,3	74,1	78,7

Anchor size				M16			M20		
Non-cracked concrete									
Tension	HSL-3-R / HSL-3-GR	N_{Rk}	[kN]	49,2	65,0	65,0	68,8	95,0	95,0
Shear	HSL-3-R	V_{Rk}	[kN]	98,4	127,7	127,7	137,5	154,8	154,8
	HSL-3-GR			98,4	129,5	129,5	137,5	151,9	151,9
Anchor size				**M16**			**M20**		
Cracked concrete									
Tension	HSL-3-R / HSL-3-GR	N_{Rk}	[kN]	34,4	36,0	36,0	48,1	50,0	50,0
Shear	HSL-3-R	V_{Rk}	[kN]	68,9	96,3	126,5	96,3	132,9	154,8
	HSL-3-GR			68,9	96,3	126,5	96,3	132,9	151,9

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

Design resistance

Anchor size				M8			M10			M12		
Non-cracked concrete												
Tension	HSL-3-R / HSL-3-SKR [a]	N_{Rd}	[kN]	13,3	13,3	13,3	19,2	21,7	21,7	23,5	31,6	31,6
	HSL-3-GR			13,3	13,3	13,3	19,2	27,1	27,1	23,5	33,3	33,3
Shear	HSL-3-R / HSL-3-SKR [a]	V_{Rd}	[kN]	30,5	40,7	40,7	38,4	41,0	41,0	46,9	53,1	53,1
	HSL-3-GR			30,5	32,2	32,2	38,4	47,1	47,1	46,9	63,0	63,0
Cracked concrete												
Tension	HSL-3-R / HSL-3-SKR [a] HSL-3-GR	N_{Rd}	[kN]	8,0	8,0	8,0	10,7	10,7	10,7	16,4	16,0	16,0
Shear	HSL-3-R / HSL-3-SKR [a]	V_{Rd}	[kN]	21,3	32,9	40,7	26,9	39,2	41,0	32,9	49,4	53,1
	HSL-3-GR			21,3	32,2	32,2	26,9	39,2	47,1	32,9	49,4	63,0

Anchor size				M16			M20		
Non-cracked concrete									
Tension	HSL-3-R / HSL-3-GR	N_{Rd}	[kN]	32,8	43,3	43,3	45,8	63,3	63,3
Shear	HSL-3-R / HSL-3-GR	V_{Rd}	[kN]	65,6	81,9	81,9	91,7	99,2	99,2
	HSL-3-GR			65,6	91,7	103,6	91,7	121,5	121,5
Cracked concrete									
Tension	HSL-3-R / HSL-3-GR	N_{Rd}	[kN]	23,0	24,0	24,0	33,5	33,3	33,3
Shear	HSL-3-R	V_{Rd}	[kN]	45,9	64,2	81,9	64,2	88,6	99,2
	HSL-3-GR			45,9	64,2	84,3	64,2	88,6	115,5

a) HSL-3-SKR only available in sizes M8-M12

Recommended loads [b)]

Anchor size				M8			M10			M12		
Non-cracked concrete												
Tension	HSL-3-R / HSL-3-SKR [a)]	N_{Rec}	[kN]	6.7	6.7	6.7	9.6	13.5	13.5	11.7	16.7	16.7
	HSL-3-GR			6.7	6.7	6.7	9.6	13.5	13.5	11.7	16.7	16.7
Shear	HSL-3-R / HSL-3-SKR [a)]	V_{Rec}	[kN]	15.2	17.0	17.0	19.2	21.3	21.3	23.5	27.6	27.6
	HSL-3-GR			13.4	13.4	13.4	19.6	19.6	19.6	23.5	26.2	26.2
Cracked concrete												
Tension	HSL-3-R / HSL-3-SKR [a)] HSL-3-GR	N_{Rec}	[kN]	4.0	4.0	4.0	5.3	5.3	5.3	8.2	8.0	8.0
Shear	HSL-3-R / HSL-3-SKR [a)]	V_{Rec}	[kN]	10.7	16.4	17.0	13.4	19.6	21.3	16.4	24.7	27.6
	HSL-3-GR			10.7	13.4	13.4	13.4	19.6	19.6	16.4	24.7	26.2
Anchor size				M16			M20					
Non-cracked concrete												
Tension	HSL-3-R / HSL-3-GR	N_{Rec}	[kN]	16.4	21.7	21.7	22.9	31.7	31.7			
Shear	HSL-3-R / HSL-3-GR	V_{Rec}	[kN]	32.8	42.6	42.6	45.8	51.6	51.6			
	HSL-3-GR			32.8	43.2	43.2	45.8	50.6	50.6			
Cracked concrete												
Tension	HSL-3-R / HSL-3-GR	N_{Rec}	[kN]	11.5	12.0	12.0	16.0	16.7	16.7			
Shear	HSL-3-R	V_{Rec}	[kN]	23.0	32.1	42.2	32.1	44.3	51.6			
	HSL-3-GR			23.0	32.1	42.2	32.1	44.3	50.6			

a) HSL-3-SKR only available in sizes M8-M12.

b) With overall global safety factor for action γ = 3.0. The partial safety factors for action depend on thy type of loading and shall be taken from national regulations.

Materials

Mechanical properties

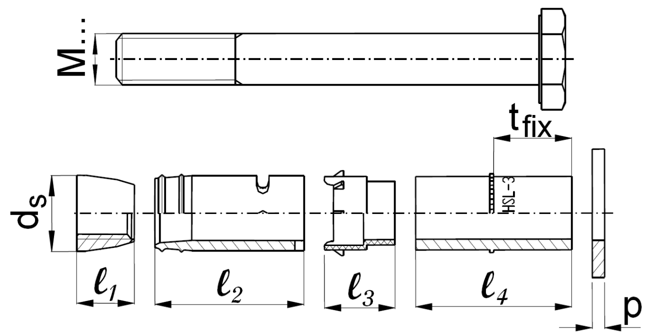
Anchor size				M8	M10	M12	M16	M20
HSL-3-R, HSL-3-GR, HSL-3-SKR								
Nominal tensile strength		f_{uk}	[N/mm²]	700	700	700	700	700
Yield strength	HSL-3-R HSL-3-SKR	f_{yk}	[N/mm²]	560	450	450	450	450
	HSL-3-GR			560	560	560	560	560
Stressed cross-section		A_s	[mm²]	36,6	58,0	84,3	157	245
Moment of resistance		W	[mm³]	31,3	62,5	109,4	277,1	540,6
Characteristic bending resistance		$M^0_{Rk,s}$	[Nm]	26,2	52,3	91,7	233,1	454,4

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

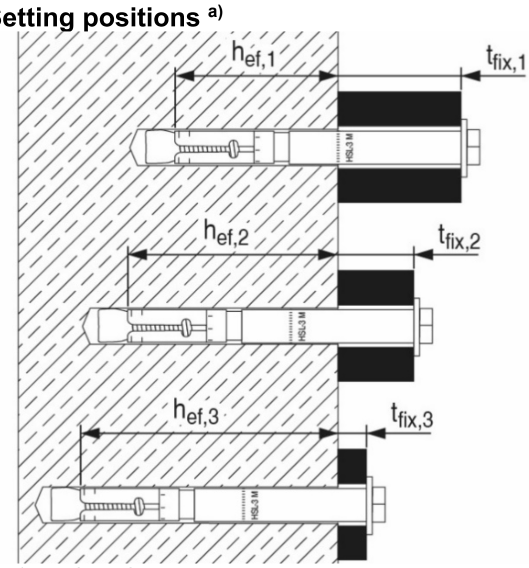
Anchor dimensions of HSL-3-R, HSL-3-GR, HSL-3-SKR

Anchor version	Thread size	t_{fix} [mm] min	t_{fix} [mm] max	d_s [mm]	ℓ_1 [mm]	ℓ_2 [mm]	ℓ_3 [mm]	ℓ_4 [mm min	ℓ_4 [mm max	p [mm]
HSL-3-R	M8	5	200	11,9	12	32	15,2	34	54	2
	M10	5	200	14,8	14	36	17,2	38	58	3
	M12	5	200	17,6	17	40	20	48	73	3
	M16	10	200	23,6	20	54,4	24,4	49,5	74,5	4
	M20	10	200	27,6	20	57	31,5	71	101	4
HSL-3-GR	M8	5	200	11,9	12	32	15,2	34	114	2
	M10	5	200	14,8	14	36	17,2	38	118	3
	M12	5	200	17,6	17	40	20	48	123	3
	M16	10	200	23,6	20	54,4	24,4	49,5	124,5	4
	M20	10	200	27,6	20	57	31,5	71	141	4
HSL-3-SKR	M8	10	20	11,9	12	32	15,2	18,2	28,2	2
	M10	20		14,8	14	36	17,2	32,2		3
	M12	25		17,6	17	40	20	40		3



Setting information

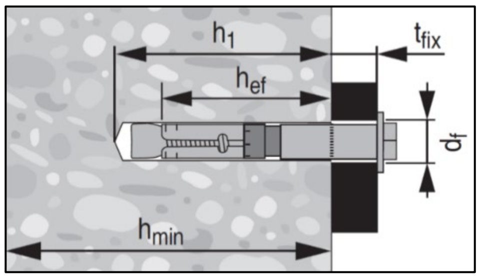
Setting positions a)



Setting position ①

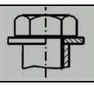
Setting position ②

Setting position ③



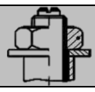
a) HSL-3-SKR can only be set in position 1.

Setting details for HSL-3-R

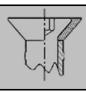
Anchor version 			M8			M10			M12		
Nominal diameter of drill bit	d_0	[mm]	12			15			18		
Max. cutting diameter of drill bit	d_{cut}	[mm]	12,5			15,5			18,5		
Max. diameter of clearance hole in the fixture	d_f	[mm]	14			17			20		
Setting position	i		①	②	③	①	②	③	①	②	③
Fixture thickness	$t_{fix,1}$	[mm]	5-200			5-200			5-200		
Effective fixture thickness	$t_{fix,i}$		$t_{fix,1}$[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	$h_{min,i}$	[mm]	120	170	195	140	195	215	160	225	250
Width across flats	SW	[mm]	13			17			19		
Installation torque	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		
Setting position	i		①	②	③	①	②	③
Fixture thickness	t_{fix1}	[mm]	10-200			10-200		
Effective fixture thickness	$t_{fix,i}$		$t_{fix,1}$[1)] - Δi					
Reduction of fixture thickness	Δi	[mm]	0	25	50	0	30	60
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		

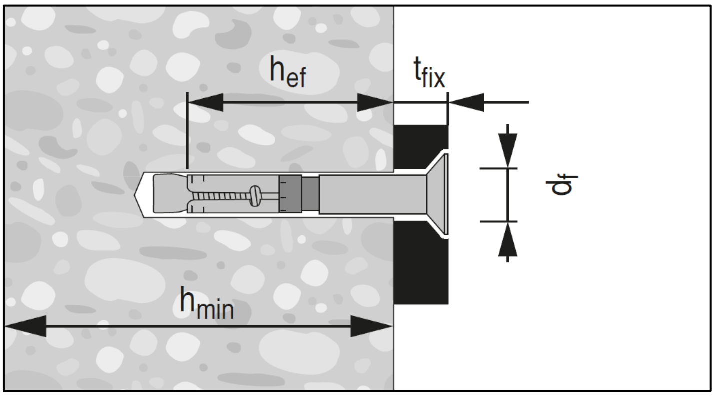
Setting details for HSL-3-GR

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		
Setting position	i		①	②	③	①	②	③	①	②	③
Fixture thickness	$t_{fix,1}$	[mm]	5-200			5-200			5-200		
Effective fixture thickness	$t_{fix,i}$		$t_{fix,1}$[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	$h_{min,i}$	[mm]	120	170	190 [a] / 195	140	195	215	160	225	250
Width across flats	SW	[mm]	13			17			19		
Installation torque	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					
Setting position	i		①	②	③	①	②	③			
Fixture thickness	t_{fix1}	[mm]	10-200			10-200					
Effective fixture thickness	$t_{fix,i}$		$t_{fix,1}$[1] - Δi								
Reduction of fixture thickness	Δi	[mm]	0	25	50	0	30	60			
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					

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	
Hollow drill bit	-		TE-CD, TE-YD		
Other tools	blow out pump, hammer, torque wrench				

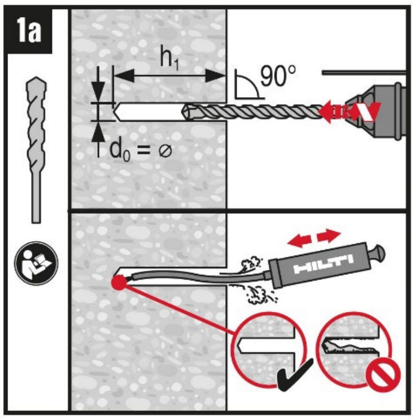
Setting parameters for HSL-3-R, HSL-3-GR, HSL-3-SKR

Anchor size			M8			M10			M12			M14			M20		
Setting position	i		①	②	③	①	②	③	①	②	③	①	②	③	①	②	③
Minimum base material thickness	h_{min}	[mm]	120	170	195	140	195	215	160	225	250	200	275	300	250	380	410
Non-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		
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		

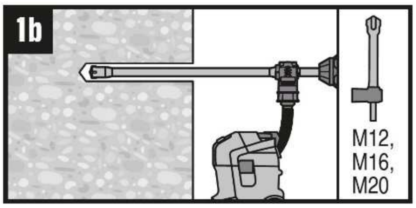
Setting instructions

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

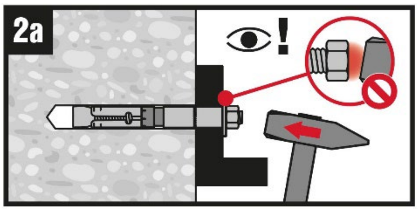
HSL-3-R / HSL-3-GR



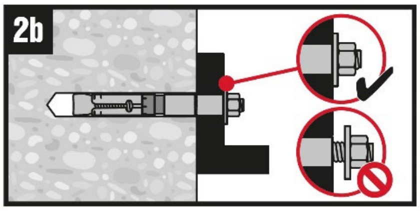
Hammer drilled hole
Drilling and cleaning



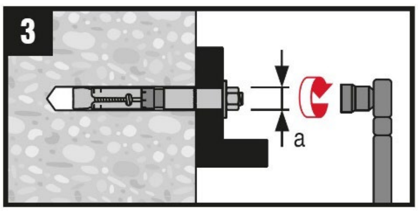
Hammer drilled hole with Hollow Drilled Bit (HDB)
No cleaning required



Insert the anchor with hammer

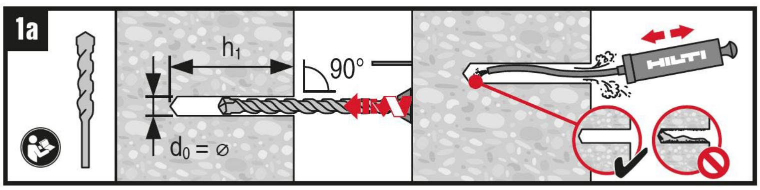


Check

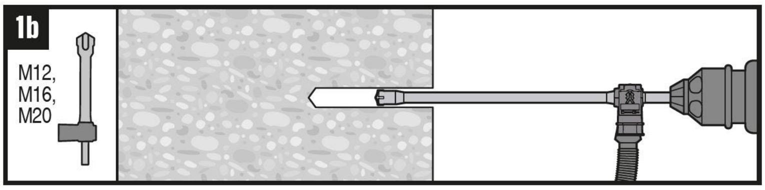


Applying tightening torque

HSL-3-SKR

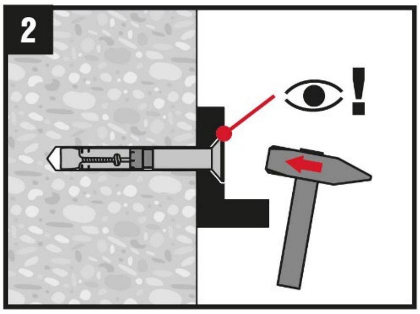


Hammer drilled hole
Drilling and cleaning

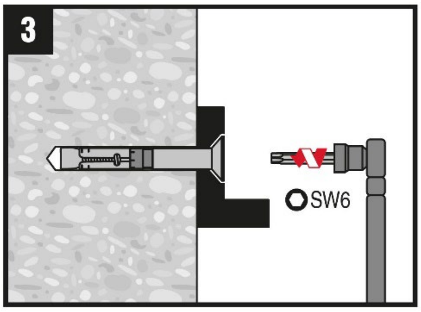


Hammer drilled hole with Hollow Drilled Bit (HDB)

No cleaning required



Insert the anchor with hammer



Applying tightening torque

HST4-R Expansion anchor

High-performance expansion anchor for cracked concrete and seismic

Anchor version

HST4-R
(M8-M20)

Benefits

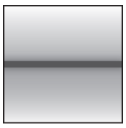
- High capacity anchor with ability to be used in reduced member thickness, small spacing and edge distances
- Suitable for uncracked and cracked concrete C20/25 to C50/60
- Highly reliable and safe anchor for structural seismic design with ETA C1/C2 assessment
- Longer embedment depth option to get higher resistance, closer distance to the edge or smaller spacing
- Full design flexibility with variable embedment depth and edge & spacing
- Faster and reliable installation thanks to approved non-cleaning and adaptive torqueing tool
- Dome-nut variant available for more aesthetic application finish
- Product and length identification mark facilitates quality control and inspection

Base material

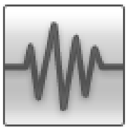
Concrete
(uncracked)

Concrete
(cracked)

Load conditions



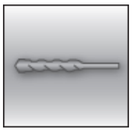
Static/
quasi-static



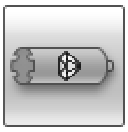
Seismic
C1/C2

Fire
resistance

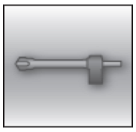
Installation conditions



Hammer
drilled holes
(with no
cleaning)



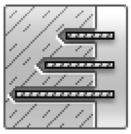
Diamond
drilled holes



Hollow
drill-bit drilling

Impact wrench
with adaptative
torque module

Other information



Variable
embedment
depth

European
Technical
Assessment

PROFIS
ENGINEERING

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European technical assessment	CSTB, France	ETA-21/0878 / 28-02-2023
Fire data ZTV-ING Tunnel	MFPA, Leipzig	GS 6.1/22-065-3-r1 30-11-2023

Static and quasi-static loading based on ETA-21/0878
Design according to EN 1992-4

All data in this section applies to:
- Correct setting (see setting details table)
- A single anchor
- No edge distance and spacing influence (see Setting details table for characteristic distances)
- *Steel* failure (only indicated for characteristic resistances)
- Minimum base material thickness (see Geometrical condition table)
- Concrete C20/25
- Values valid for hammer drilled and diamond cored holes (M8 to M20), hammer drilled holes with Hilti hollow drill bit (M10-M20)

Note: according to the EAD 330232-01-0601 effective embedment depths smaller than 40 mm are allowed only for dry indoor applications in statically indeterminate structural components, when in case of failure the load can be distributed to other fasteners.

Geometrical condition

Anchor size			M8			M10			M12			M16			M20		
Variable anchorage depth	h_{ef}	[mm]	30-90			30-100			40-125			65-160			101-180		
Effective anchorage depth [a]	h_{ef}	[mm]	30	47	90	30	60	100	40	70	125	65	85	160	101	120	180
Nominal embedment depth	h_{nom}	[mm]	36	53	96	38	68	108	49	79	134	77	97	172	116	135	195
Thickness of concrete member	$h \geq$	[mm]	80	80	135	80	100	150	100	115	190	120	140	240	160	180	270

a) Effective anchorage depth used for calculation of values below. For other embedment depths PROFIS Engineering can be used.

Characteristic resistance

Anchor size			M8			M10			M12			M16			M20		
Uncracked concrete																	
Tension	N_{Rk}	[kN]	8,1	15,9	19,0	9,3	26,4	32,0	14,4	33,3	46,0	29,8	44,5	60,0	49,9	49,9	49,9
Shear	V_{Rk}	[kN]	16,6	*17,4*	*17,4*	17,4	*27,5*	*27,5*	*34,4*	*41,3*	*41,3*	*72,4*	*72,4*	*72,4*	*97,2*	*97,2*	*97,2*
Cracked concrete																	
Tension	N_{Rk}	[kN]	5,7	10,0	10,0	6,5	18,5	20,0	10,1	23,3	28,0	20,9	31,2	38,0	35,0	35,0	35,0
Shear	V_{Rk}	[kN]	11,6	*17,4*	*17,4*	12,2	*27,5*	*27,5*	25,2	*41,3*	*41,3*	62,6	*72,4*	*72,4*	*97,2*	*97,2*	*97,2*

Design resistance

Anchor size			M8			M10			M12			M16			M20		
Uncracked concrete																	
Tension	N_{Rd}	[kN]	5,4	10,6	12,7	6,2	17,6	21,3	9,6	22,2	30,7	19,8	29,7	40,0	33,3	33,3	33,3
Shear	V_{Rd}	[kN]	11,0	13,9	13,9	11,6	22,0	22,0	23,9	33,0	33,0	57,5	57,9	57,9	77,8	77,8	77,8
Cracked concrete																	
Tension	N_{Rd}	[kN]	3,8	6,7	6,7	4,4	12,3	13,3	6,7	15,5	18,7	13,9	20,8	25,3	23,3	23,3	23,3
Shear	V_{Rd}	[kN]	7,7	13,9	13,9	8,1	22,0	22,0	16,8	33,0	33,0	41,7	57,9	57,9	74,6	77,8	77,8

Recommended loads[b)]

Anchor size			M8			M10			M12			M16			M20		
Uncracked concrete																	
Tension	N_{rec}	[kN]	2,7	5,3	6,3	3,1	8,8	10,7	4,8	11,1	15,3	9,9	14,8	20,0	16,6	16,6	16,6
Shear	V_{rec}	[kN]	5,5	5,8	5,8	5,8	9,2	9,2	11,5	13,8	13,8	24,1	24,1	24,1	32,4	32,4	32,4
Cracked concrete																	
Tension	N_{rec}	[kN]	1,9	3,3	3,3	2,2	6,2	6,7	3,4	7,8	9,3	7,0	10,4	12,7	11,7	11,7	11,7
Shear	V_{rec}	[kN]	3,9	5,8	5,8	4,1	9,2	9,2	8,4	13,8	13,8	20,9	24,1	24,1	32,4	32,4	32,4

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

Static and quasi-static loading based on ETA-21/0878 (Reference to position of Red Ring)
Design according to EN 1992-4

All data in this section applies to:
- Correct setting (see setting details table)
- A single anchor
- No edge distance and spacing influence (see Setting details table for characteristic distances)
- *Steel* failure (only indicated for characteristic resistances)
- Minimum base material thickness (see Geometrical condition table)
- Concrete C20/25
- Values valid for hammer drilled and diamond cored holes (M8 to M20), hammer drilled holes with Hilti hollow drill bit (M10-M20)

Note: For seismic actions, HTS4-R M8 and M10 effective embedment depths smaller than 40 mm have been tested and included in approval documentation; however, EN1992-4 does not cover embedment depths smaller than 40 mm for seismic loads. For this reason, the tables shown below only cover hef ≥ 40 mm.

Geometrical condition

Anchor size			**M8**	**M10**	**M12**	**M16**
Effective anchorage depth [a]	h_{ef}	[mm]	40	55	65	80
Nominal embedment depth	h_{nom}	[mm]	46	63	74	92
Thickness of concrete member [b]	$h \geq$	[mm]	80	94	110	132

a) Effective anchorage depth used for calculation of values below. For other embedment depths PROFIS Engineering can be used.
b) Values calculated under the hypothesis of cleaned, hammer drilled borehole.

Characteristic resistance

Anchor size			**M8**	**M10**	**M12**	**M16**
Non-cracked concrete						
Tension	N_{Rk}	[kN]	12.5	23.2	29.8	40.6
Shear	V_{Rk}	[kN]	17.4	27.5	41.3	72.4
Cracked concrete						
Tension	N_{Rk}	[kN]	8.7	16.2	20.9	28.5
Shear	V_{Rk}	[kN]	17.4	32.4	41.3	85.5

Design Resistance

Non-cracked concrete						
Tension	N_{Rd}	[kN]	8.3	15.5	19.9	27.1
Shear	V_{Rd}	[kN]	11.6	18.3	27.5	48.3
Cracked concrete						
Tension	N_{Rd}	[kN]	5.8	10.8	13.9	19.0
Shear	V_{Rd}	[kN]	11.6	21.6	27.5	57.0

Recommended loads[a]

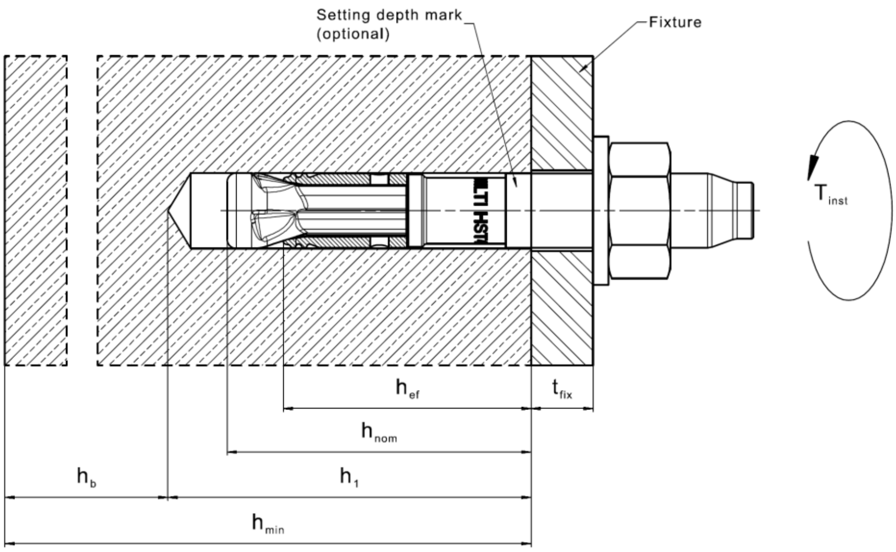
Non-cracked concrete						
Tension	N_{rec}	[kN]	4.2	7.7	9.9	13.5
Shear	V_{rec}	[kN]	5.8	9.2	13.8	24.1
Cracked concrete						
Tension	N_{rec}	[kN]	2.9	5.4	7.0	9.5
Shear	V_{rec}	[kN]	5.8	10.8	13.8	28.5

a) With overall partial safety factor for action γ = 3.0 from characteristic load, The partial safety factors for action depend on the type of loading and shall be taken from national regulations.

Setting information (Reference to position of Red Ring)

Anchor size			M8	M10	M12	M16
Nominal diameter of drill bit		d_o [mm]	8	10	12	16
Maximum diameter of clearance hole in the fixture		d_f [mm]	9	12	14	18
Torque moment		T_{inst} [Nm]	20	40	60	120
Effective anchorage depth		h_{ef} [mm]	40	55	65	80
Nominal embedment depth		h_{nom} [mm]	46	63	74	92
Hammer drill	not cleaned	$h_1 \geq$ [mm]	66	83	94	112
	cleaned	$h_1 \geq$ [mm]	49	67	78	98
Hollow drill		$h_1 \geq$ [mm]	-	67	78	98
Diamond coring [a]		$h_1 \geq$ [mm]	56	73	84	102
Concrete thickness below borehole		$h_b \geq$ [mm]	21	27	32	34
Minimum concrete thickness		$h_{min} \geq$ [mm]	max(80; 1,5· h_{ef}; h_1+h_b)	max(80; 1,5· h_{ef}; h_1+h_b)	max(100; 1,5· h_{ef}; h_1+h_b)	max(120; 1,5· h_{ef}; h_1+h_b)

a) Approval for M16 under static and quasi-static loading conditions in uncracked concrete not included in ETA-21/0878.
b) Values calculated under the hypothesis of cleaned, hammer drilled borehole.



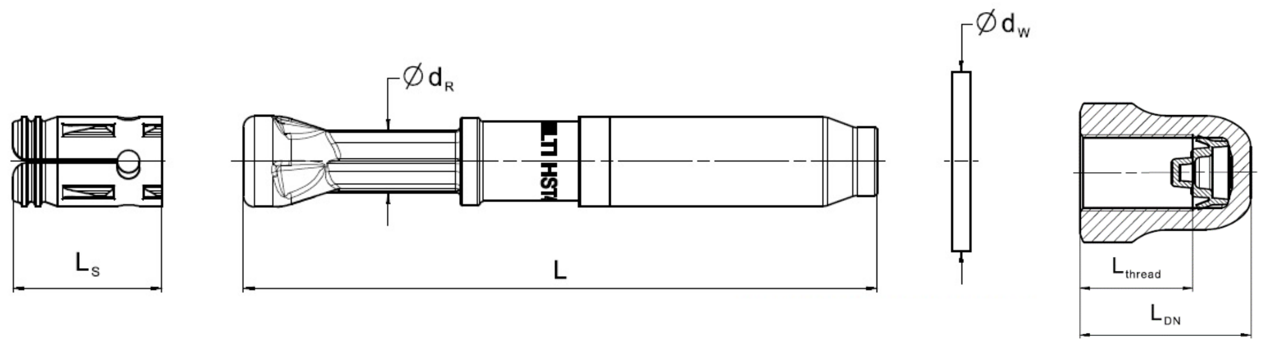
Installation equipment

Anchor size	M8	M10	M12	M16	M20	M24
Rotary hammer	TE2(-A) – TE30(-A)				TE40 – TE80	
Diamond coring tool	DD-30W, DD-EC1					
Torqueing tool	Hilti SIW 4AT 22 – SI-AT-22				-	
Setting tool	HS-SC				-	
Hollow drill bit	-		TE-CD, TE-YD			
Other tools	hammer, torque wrench, blow out pump					

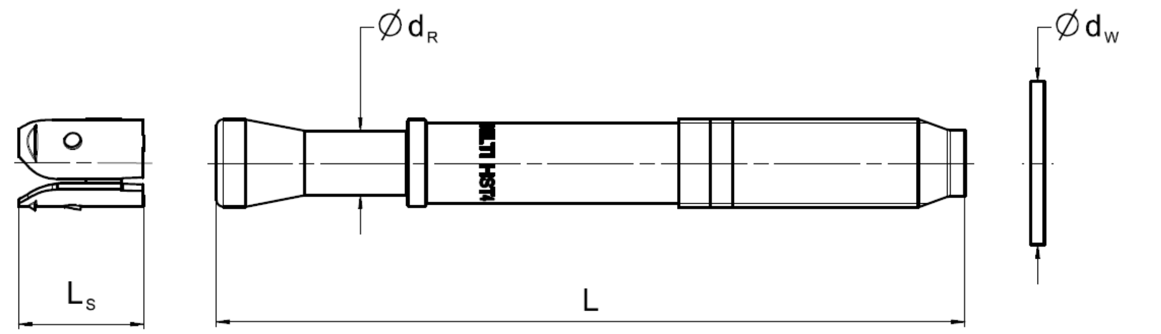
Anchor dimensions

Anchor size			M8	M10	M12	M16	M20
Maximum length of anchor	L	[mm]	115	180	200	260	200
Shaft diameter at the cone	d_R	[mm]	5,70	6,90	8,30	11,5	14,62
Length of expansion sleeve	L_s	[mm]	15,0	18,0	20,0	26,0	28,3
Diameter of washer	d_w	[mm]	15,57	19,48	23,48	29,48	36,38
Length of dome nut thread	$L_{thread}\geq$	[mm]	-	16,8	17,8	-	-
Length of dome nut	$L_{DN}\geq$	[mm]	-	21,9	24,0	-	-

HST4-R (M8-M16)



HST4-R (M20)

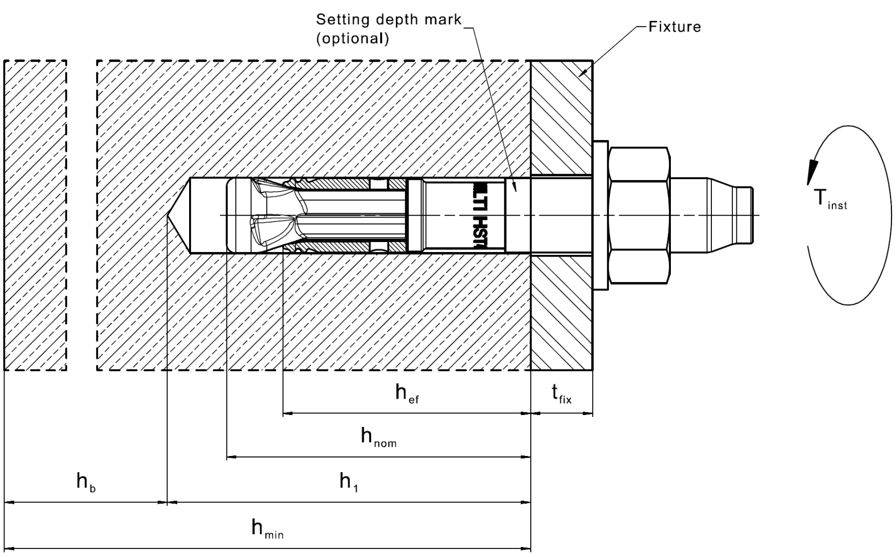


Setting information

Setting details

Anchor size			M8			M10			M12			M16			M20		
Nominal diameter of drill bit	d_o	[mm]	8			10			12			16			20		
Maximum diameter of clearance hole in the fixture	d_f	[mm]	9			12			14			18			22		
Torque moment	T_{inst}	[Nm]	20			40			60			120			180		
Effective anchorage depth	h_{ef}	[mm]	30	47	90	30	60	100	40	70	125	65	85	160	101	120	180
Nominal embedment depth	h_{nom}	[mm]	36	53	96	38	68	108	49	79	134	77	97	172	116	135	195
Drill hole depth																	
Hammer drill, not cleaned	$h_1 \geq$	[mm]	56	73	116	58	88	128	69	99	154	97	117	192	136	155	215
			$h_{nom}+20$														
Hammer drill, cleaned	$h_1 \geq$	[mm]	39	56	99	42	72	112	53	83	138	83	103	178	124	143	203
			$h_{nom}+3$			$h_{nom}+4$						$h_{nom}+6$			$h_{nom}+8$		
Hollow drill	$h_1 \geq$	[mm]	-			-			53	83	138	83	103	178	124	143	203
									$h_{nom}+4$			$h_{nom}+6$			$h_{nom}+8$		
Diamond coring	$h_1 \geq$	[mm]	46	63	106	48	78	118	59	89	144	87	107	182	126	145	205
			$h_{nom}+10$														
Concrete thickness below borehole	$h_b \geq$	[mm]	21			27			32			34			36		
Minimum concrete thickness	$h_{min} \geq$	[mm]	max(80; 1,5· h_{ef}; h_1+h_b)			max(80; 1,5· h_{ef}; h_1+h_b)			max(100; 1,5· h_{ef}; h_1+h_b)			max(120; 1,5· h_{ef}; h_1+h_b)			max(160; 1,5· h_{ef}; h_1+h_b)		
Characteristic spacing for splitting failure and concrete cone failure a)	$s_{cr,sp}$	[mm]	122	200	143	173	304	218	199	306	224	381	515	368	384	456	684
	$s_{cr,N}$	[mm]	90	141	270	90	180	300	120	210	375	195	255	480	303	360	540
Characteristic edge distance for splitting failure and concrete cone failure a)	$c_{cr,sp}$	[mm]	61	100	72	86	152	109	99	153	112	190	258	184	192	228	342
	$c_{cr,N}$	[mm]	45	71	135	45	90	150	60	105	188	98	128	240	152	180	270

a) Values calculated under the hypothesis of uncracked concrete C20/25, cleaned, hammer drilled borehole.

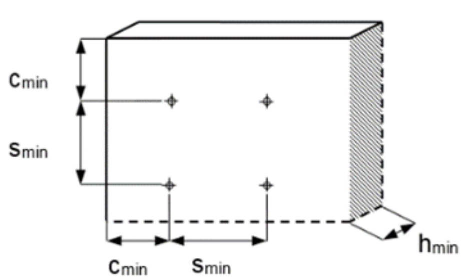


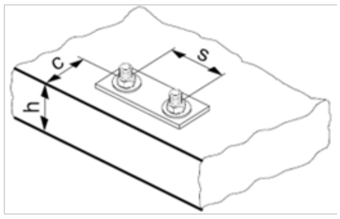
Installation equipment

<table>
<tr><th>Anchor size</th><th>M8</th><th>M10</th><th>M12</th><th>M16</th><th>M20</th></tr>
<tr><td>Rotary hammer</td><td colspan="4">TE2(-A) – TE30(-A)</td><td>TE40 – TE80</td></tr>
<tr><td>Diamond coring tool</td><td colspan="5">DD-30W, DD-EC, DD150-U</td></tr>
<tr><td rowspan="3">Torquing tool</td><td colspan="5">torque wrench</td></tr>
<tr><td colspan="3">SIW 4AT-22 + SI-AT-22</td><td colspan="2">-</td></tr>
<tr><td colspan="2">-</td><td colspan="3">SIW 4AT-22 + SI-AT-22</td></tr>
<tr><td>Setting tool</td><td colspan="4">HS-SC</td><td>-</td></tr>
<tr><td>Hollow drill bit</td><td colspan="2">-</td><td colspan="3">TE-CD, TE-YD</td></tr>
<tr><td>Other tools</td><td colspan="5">hammer, torque wrench, blow out pump</td></tr>
</table>

Minimum spacing s_{min}, edge distance c_{min} and required splitting area $A_{sp,req}$

We recommend checking your designs in Hilti's PROFIS Engineering software to verify the edge & spacing values. ETA-21/0878 provides formulae for the calculation of flexible edge & spacing for each anchor layout configuration depending on base material thickness.
Minimum spacing and edge distance values on the tables below are recommendations for specific anchor layout and base material dimensions.





Anchor size			M8					
Effective anchorage depth	h_{ef}	[mm]	30		47		90	
Drill hole conditions			cleaned	non cleaned	cleaned	non cleaned	cleaned	non cleaned
Min. base material thickness	h_{min}	[mm]	80	80	80	100	135	140
Uncracked concrete								
Minimum spacing	s_{min}	[mm]	35	35	35	35	35	35
	for c ≥	[mm]	70	70	70	55	45	45
Minimum edge distance	c_{min}	[mm]	40	40	40	40	40	40
	for s ≥	[mm]	120	120	120	70	65	55
Required splitting area	$A_{sp,req}$	[mm²]	18910					
Cracked concrete								
Minimum spacing	s_{min}	[mm]	35	35	35	35	35	35
	for c ≥	[mm]	50	50	50	50	40	40
Minimum edge distance	c_{min}	[mm]	40	40	40	40	40	40
	for s ≥	[mm]	55	55	55	35	35	35
Required splitting area	$A_{sp,req}$	[mm²]	13667					

Anchor size			**M10**					
Effective anchorage depth	h_{ef}	[mm]	30		60		100	
Drill hole conditions			cleaned	non cleaned	cleaned	non cleaned	cleaned	non cleaned
Min. base material thickness	h_{min}	[mm]	80	90	100	115	150	155
Uncracked concrete								
Minimum spacing	s_{min}	[mm]	40	40	40	40	40	40
	for c ≥	[mm]	100	90	80	70	55	55
Minimum edge distance	c_{min}	[mm]	45	45	45	45	45	45
	for s ≥	[mm]	205	170	140	105	100	90
Required splitting area	$A_{sp,req}$	[mm²]	27082					
Cracked concrete								
Minimum spacing	s_{min}	[mm]	40	40	40	40	40	40
	for c ≥	[mm]	80	70	65	55	50	50
Minimum edge distance	c_{min}	[mm]	45	45	45	45	45	45
	for s ≥	[mm]	145	115	90	60	55	50
Required splitting area	$A_{sp,req}$	[mm²]	22279					

Anchor size			**M12**					
Effective anchorage depth	h_{ef}	[mm]	40		70		125	
Drill hole conditions			cleaned	non cleaned	cleaned	non cleaned	cleaned	non cleaned
Min. base material thickness	h_{min}	[mm]	100	105	115	135	190	190
Uncracked concrete								
Minimum spacing	s_{min}	[mm]	50	50	50	50	50	50
	for c ≥	[mm]	125	120	105	90	70	70
Minimum edge distance	c_{min}	[mm]	55	55	55	55	55	55
	for s ≥	[mm]	255	235	200	145	120	120
Required splitting area	$A_{sp,req}$	[mm²]	41557					
Cracked concrete								
Minimum spacing	s_{min}	[mm]	50	50	50	50	50	50
	for c ≥	[mm]	95	90	80	65	60	60
Minimum edge distance	c_{min}	[mm]	55	55	55	55	55	55
	for s ≥	[mm]	160	145	120	75	55	55
Required splitting area	$A_{sp,req}$	[mm²]	32228					

Anchor size			M16					
Effective anchorage depth	h_{ef}	[mm]	65		85		160	
Drill hole conditions			cleaned	non cleaned	cleaned	non cleaned	cleaned	non cleaned
Min. base material thickness	h_{min}	[mm]	120	135	140	155	240	240
Uncracked concrete								
Minimum spacing	s_{min}	[mm]	65	65	65	65	65	65
	for c ≥	[mm]	115	100	95	85	70	70
Minimum edge distance	c_{min}	[mm]	65	65	65	65	65	65
	for s ≥	[mm]	210	165	150	120	80	80
Required splitting area	$A_{sp,req}$	[mm²]	48281					
Cracked concrete								
Minimum spacing	s_{min}	[mm]	65	65	65	65	65	65
	for c ≥	[mm]	100	85	80	70	65	65
Minimum edge distance	c_{min}	[mm]	65	65	65	65	65	65
	for s ≥	[mm]	160	120	110	80	65	65
Required splitting area	$A_{sp,req}$	[mm²]	42474					

Anchor size			M20					
Effective anchorage depth	h_{ef}	[mm]	101		120		180	
Drill hole conditions			cleaned	non cleaned	cleaned	non cleaned	cleaned	non cleaned
Min. base material thickness	h_{min}	[mm]	160	175	180	195	270	270
Uncracked concrete								
Minimum spacing	s_{min}	[mm]	90	90	90	90	90	90
	for c ≥	[mm]	140	125	120	110	90	90
Minimum edge distance	c_{min}	[mm]	80	80	80	80	80	80
	for s ≥	[mm]	260	220	205	170	140	140
Required splitting area	$A_{sp,req}$	[mm²]	79800					
Cracked concrete								
Minimum spacing	s_{min}	[mm]	90	90	90	90	90	90
	for c ≥	[mm]	100	90	85	80	80	80
Minimum edge distance	c_{min}	[mm]	80	80	80	80	80	80
	for s ≥	[mm]	145	110	100	90	90	90
Required splitting area	$A_{sp,req}$	[mm²]	61000					

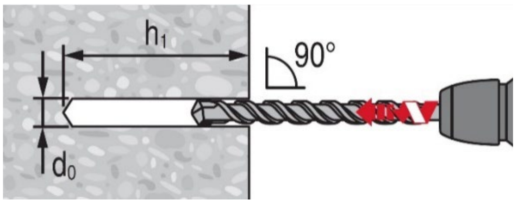
Setting instructions

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

Setting instruction for HST4

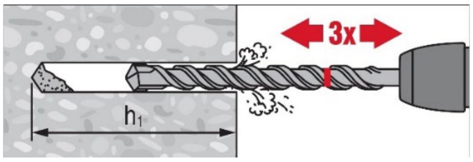
Hammer drilling (M8, M10, M12, M16, M20)

1. Drill the hole

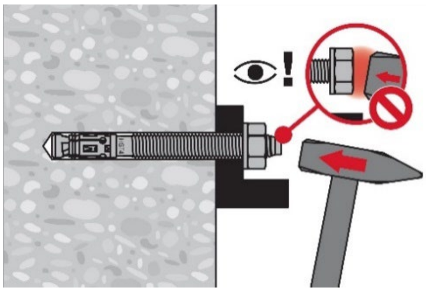


2a. Clean the hole

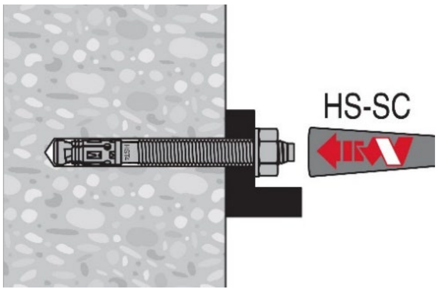
2b. Move the drill bit in & out (non-cleaned hole)



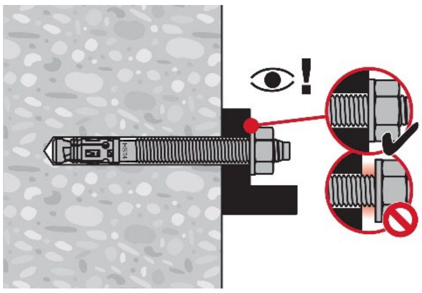
3a. Insert the anchor with hammer



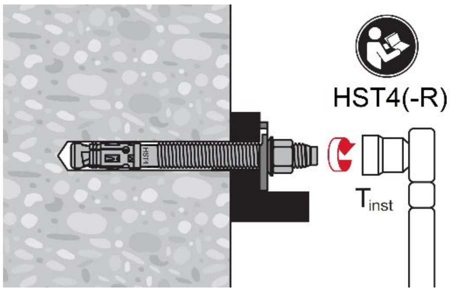
3b. Insert the anchor with setting tool HS-SC



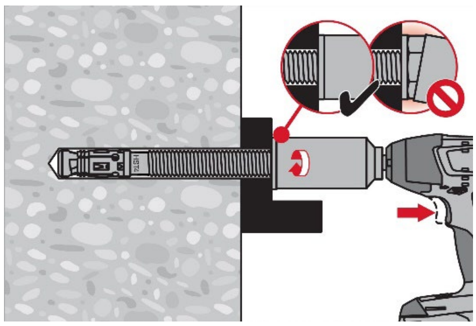
4. Check

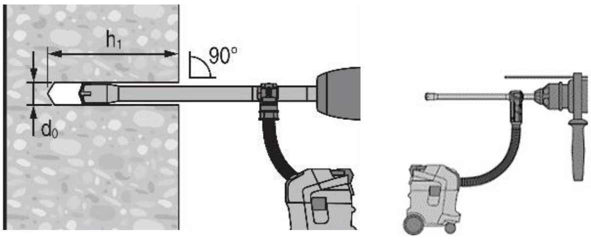
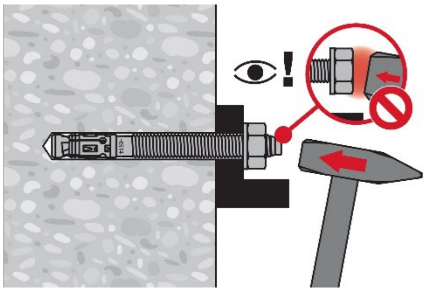
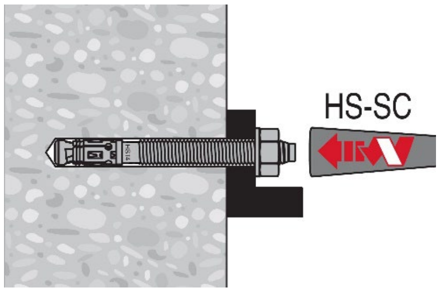
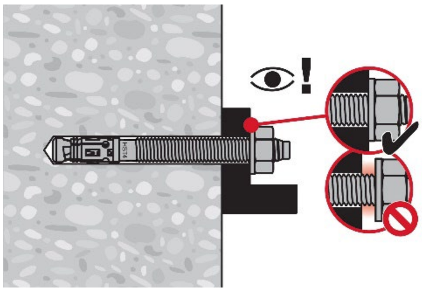
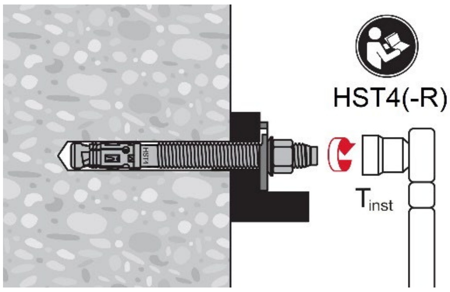
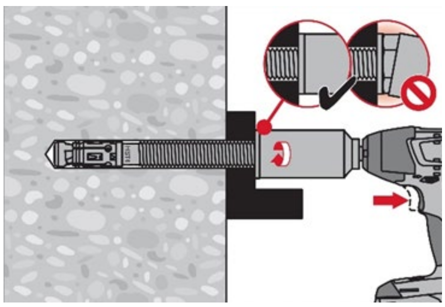


5a. Torque with calibrated torque wrench



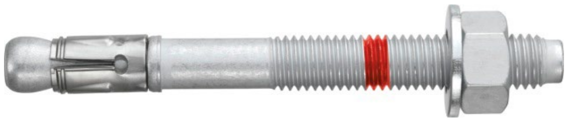
5b. Torque with impact wrench with Adaptive Torque module SI-AT-22



Hollow Drill Bit (M12, M16, M20), no cleaning required	
1. Drill the hole with Hollow Drill bit  	
2a. Insert the anchor with hammer 	**2b. Insert the anchor with setting tool HS-SC** 
3. Check 	
5a. Torque with calibrated torque wrench  	**5b. Torque with impact wrench with Adaptive Torque module SI-AT-22** 

HST3 Expansion anchor

Ultimate-performance expansion anchor for cracked concrete and seismic

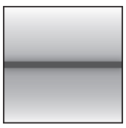
Anchor version		Benefits
	HST3 HST3-R (M8-M24)	- Ultimate resistance for reduced member thickness, short spacing and edge distances - Suitable for non-cracked and cracked concrete C 12/15 to C 80/95* - Highly reliable and safe anchor for structural seismic design with ETA C1/C2 assessment - Longer embedment depth option to get higher resistance, closer distance to the edge or smaller spacing. - Full design flexibility with variable embedment depth and edge & spacing - Faster and reliable installation thanks to approved non-cleaning and adaptive torqueing tool. - Dome-nut version is available with adaptive tool qualification - Product and length identification mark facilitates quality control and inspection

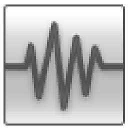
Base material


Concrete (non-cracked)

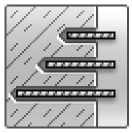

Concrete (cracked)

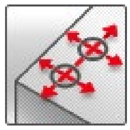
Load conditions


Static/ quasi-static

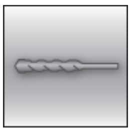

Seismic ETA-C1/C2

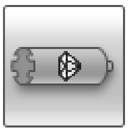

Fire resistance

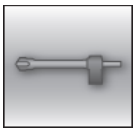

Variable embedment depth


Small edge distance and spacing

Installation conditions


Hammer drilled holes (with no cleaning)


Diamond drilled holes


Hollow drill-bit drilling

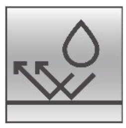

Impact wrench with adaptative torque module

Other information

European Technical Assessment

CE conformity

PROFIS ENGINEERING


Corrosion resistance

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European technical assessment [a)]	DIBt, Berlin	ETA-98/0001 / 2022-11-03
Fire test report	DIBt, Berlin	ETA-98/0001 / 2022-11-03
Evaluation report acc. to ICC-ES criteria	Uniform Evaluation Service	578 / 2019-02-28
Certificate of compliance	FM	003053697 / 2016-01-25
Shock approval M10 - M24	BABS, Spiez Laboratory	BZS D 08-602 / 2019-01-29

a) All data given in this section according to ETA-98/0001, issue 2022-11-03.

* ETA ETA-98/0001 covers the concrete strength class between C20/25 and C 50/60. Strength classes out of this invertal are covered by Hilti Technical Data

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/mm^2 (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

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
- Minimum base material thickness
- Concrete C 20/25, $f_{ck,cyl}$ = 20 N/mm² (EN 1992-4 design)

Effective anchorage depth for static

Anchor size			M8	M10		M12		M16		M20	M24
Approved variable embedment depth range a)	$h_{ef,min}$ - $h_{ef,max}$	[mm]	47-90	40-100		50-125		65-160		101-180	125
Effective anchorage depth b)	h_{ef}	[mm]	47	40	60	50	70	65	85	101	125

a) Variable embedmbent depth approved by ETA-98/0001 of 2022-11-03;
b) Standard embedment depth used for calculations of values below. For other embedment depths PROFIS Engineering can be used

Characteristic resistance

Anchor size				M8	M10		M12		M16		M20	M24
Non-cracked concrete												
Tension	HST3	N_{Rk}	[kN]	12,0	12,4	22,0	17,4	25,0	25,8	38,6	49,9	60,0
	HST3-R			12,0	12,4	22,0	17,4	25,0	25,8	38,6	49,9	60,0
Shear	HST3	V_{Rk}	[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	HST3	N_{Rk}	[kN]	8,0	8,7	15,0	12,2	20,0	18,0	27,0	35,0	40,0
	HST3-R			8,5	8,7	15,0	12,2	20,0	18,0	27,0	35,0	40,0
Shear	HST3	V_{Rk}	[kN]	13,8	21,9	23,6	33,8	35,4	54,5	55,3	83,9	94,0
	HST3-R			15,7	23,3	25,3	31,1	36,7	48,6	63,6	97,2	115,0

Design resistance

Anchor size				M8	M10		M12		M16		M20	M24
Non-cracked concrete												
Tension	HST3	N_{Rd}	[kN]	8,0	8,3	14,7	11,6	16,7	17,2	25,7	33,3	40,0
	HST3-R			8,0	8,3	14,7	11,6	16,7	17,2	25,7	33,3	40,0
Shear	HST3	V_{Rd}	[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	HST3	N_{Rd}	[kN]	5,3	5,8	10,0	8,1	13,3	12,0	18,0	23,3	26,7
	HST3-R			5,7	5,8	10,0	8,1	13,3	12,0	18,0	23,3	26,7
Shear	HST3	V_{Rd}	[kN]	11,0	15,5	18,9	22,6	28,3	41,0	44,2	67,1	62,7
	HST3-R			12,6	15,5	20,2	22,6	29,4	38,9	50,9	74,6	80,2

Recommended loads[a)]

Anchor size				M8	M10		M12		M16		M20	M24
Non-cracked concrete												
Tension	HST3	N_{Rec}	[kN]	4.0	4.1	7.3	5.8	8.3	8.6	12.9	16.6	20.0
	HST3-R			4.0	4.1	7.3	5.8	8.3	8.6	12.9	16.6	20.0
Shear	HST3	V_{Rec}	[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	HST3	N_{Rec}	[kN]	2.7	2.9	5.0	4.1	6.7	6.0	9.0	11.7	13.3
	HST3-R			2.8	2.9	5.0	4.1	6.7	6.0	9.0	11.7	13.3
Shear	HST3	V_{Rec}	[kN]	4.6	7.3	7.9	11.3	11.8	18.2	18.4	28.0	31.3
	HST3-R			5.2	7.8	8.4	10.4	12.2	16.2	21.2	32.4	38.3

a) With overall global 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

Mechanical properties

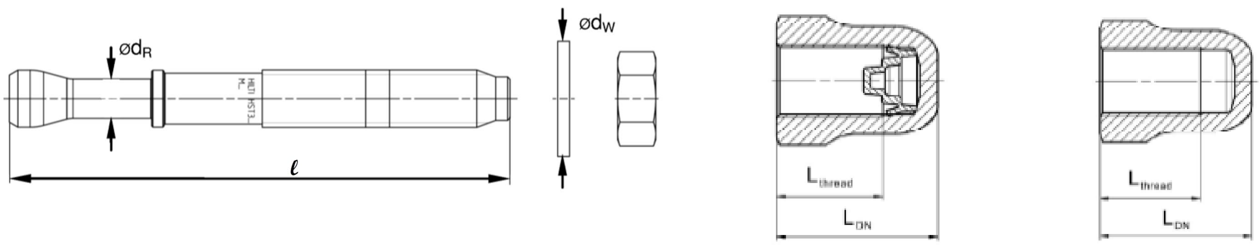
Anchor size				M8	M10	M12	M16	M20	M24
Nominal tensile strength	HST3	$f_{uk,thread}$	[N/mm²]	800	800	800	720	700	530
	HST3-R			720	710	710	650	650	650
Yield strength	HST3	$f_{yk,thread}$	[N/mm²]	640	640	640	576	560	450
	HST3-R			576	568	568	520	520	500
Stressed cross-section		A_s	[mm²]	36,6	58,0	84,3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

Material quality

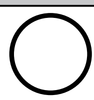
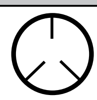
Part		Material
Expansion sleeve	HST3	M10, M16: Galvanized or Stainless steel M8, M12, M20, M24: Stainless steel
	HST3-R	Stainless steel A4
Bolt	HST3	Carbon steel, galvanized, coated (transparent)
	HST3-R	Stainless steel A4, cone coated (transparent)
Washer	HST3	Galvanized
	HST3-R	Stainless steel A4
Hexagon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

Anchor dimensions

Anchor size			M8	M10	M12	M16	M20	M24
Maximum length of anchor	$\ell_{max} \leq$	[mm]	260	280	350	475	450	500
Shaft diameter at the cone	d_R	[mm]	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	$d_w \geq$	[mm]	15,57	19,48	23,48	29,48	36,38	43,38
Length of dome nut thread	$L_{thread} \geq$	[mm]	13,3	16,8	17,8	22,3	-	-
Length of dome nut	$L_{DN} \geq$	[mm]	18,1	21,9	24,0	29,5	-	-



Material code for identification of different materials

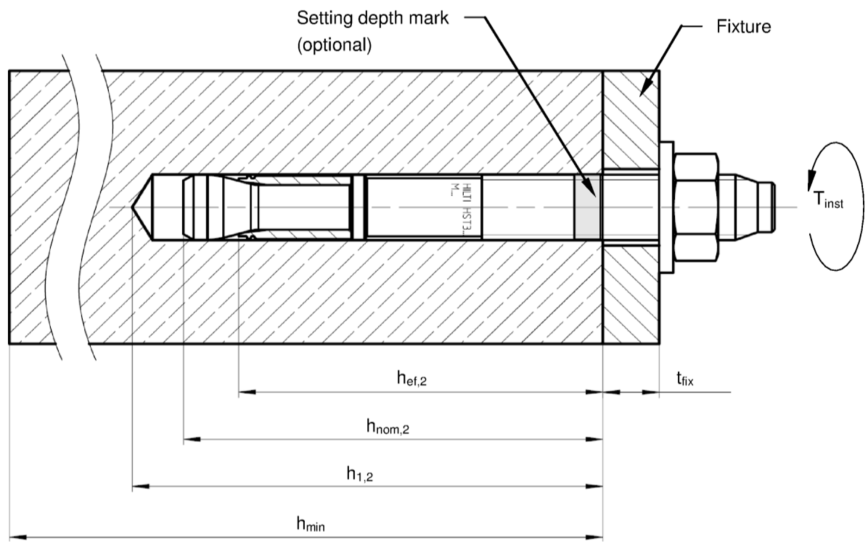
Type	HST3	HST3-R
Material Code		

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]	-	40-59	50-69	65-84	-	-
	$h_{ef,2}$	[mm]	47-90	60-100	70-125	85-160	101-180	125
Drill hole depth[1) 3)]	$h_{1,1} \geq$	[mm]	-	h_{ef}+13	h_{ef}+18	h_{ef}+21	-	-
	$h_{1,2} \geq$	[mm]	h_{ef}+12	h_{ef}+13	h_{ef}+18	h_{ef}+21	h_{ef}+23	151
Nominal embedment depth	$h_{nom,1}$	[mm]	-	h_{ef}+8	h_{ef}+10	h_{ef}+13	-	-
	$h_{nom,2}$	[mm]	h_{ef}+7	h_{ef}+8	h_{ef}+10	h_{ef}+13	h_{ef}+15	143
Maximum diameter of clearance hole in the fixture[2)]	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

1) In case of diamond drilling +5 mm for M8 to M10 and +2 mm for M12 to M24.
2) For the design of bigger clearance holes in the fixture see EN 1992-4:2018.
3) In case of hammer drilling with non-cleaned boreholes + 12 mm for M8 to M20.



Installation equipment

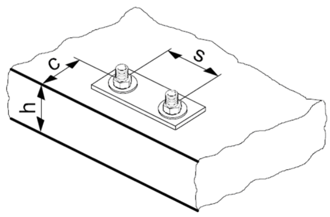
Anchor size	M8	M10	M12	M16	M20	M24
Rotary hammer	TE2(-A) – TE30(-A)				TE40 – TE80	
Diamond coring tool	DD-30W, DD-EC1					
Torqueing tool	Hilti SIW 6AT A22 – SI-AT-A22				-	
Setting tool	HS-SC				-	
Hollow drill bit	-		TE-CD, TE-YD			
Other tools	hammer, torque wrench, blow out pump					

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)]	C20/25 to C50/60[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]	70	55	65	65	90	75	90
Minimum spacing in cracked concrete	s_{min}	[mm]	35	35	35	40	40	40	45
	for c ≥	[mm]	55	40	55	50	70	55	85
Minimum edge distance in non-cracked concrete	c_{min}	[mm]	45	40	50	50	60	50	80
	for s ≥	[mm]	110	80	80	95	130	110	120
Minimum edge distance in cracked concrete	c_{min}	[mm]	40	40	40	45	50	45	70
	for s ≥	[mm]	70	35	75	55	90	65	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 edge distance 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 ETA-98/0001 of 2022-11-03.
b) Data covered by Hilti Technical Data

* ETA-98/0001 provides flexible edge & spacing values for each anchor layout configuration depending on base material thickness. Minimum spacing and edge distance values on the table are recommendations for specific anchor layout and base material dimensions. We kindly ask you to check your designs on PROFIS Engineering software to verify the edge & spacing values.

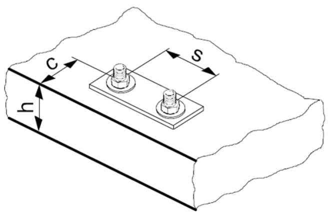


Setting parameters of HST3 / HST3-R for M12 and M16*

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 C50/60[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]	85	110	85	140	100	115	100	145
Minimum spacing in cracked concrete	s_{min}	[mm]	50	50	50	80	65	80	65	70
	for c ≥	[mm]	65	80	65	120	75	80	75	125
Minimum edge distance in non-cracked concrete	c_{min}	[mm]	60	75	60	90	65	80	70	110
	for s ≥	[mm]	130	145	135	190	175	180	160	170
Minimum edge distance in cracked concrete	c_{min}	[mm]	55	60	55	80	65	65	65	90
	for s ≥	[mm]	75	100	75	170	85	125	85	165
Critical spacing for splitting failure and concrete cone failure	$s_{cr,sp}$	[mm]	180	210		280	208	255		340
	$s_{cr,N}$	[mm]	150	210		210	195	255		255
Critical edge distance 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

c) Data covered by ETA-98/0001 of 2022-11-03.
d) Data covered by Hilti Technical Data

* ETA-98/0001 provides flexible edge & spacing values for each anchor layout configuration depending on base material thickness. Minimum spacing and edge distance values on the table are recommendations for specific anchor layout and base material dimensions. We kindly ask you to check your designs on PROFIS Engineering software to verify the edge & spacing values.



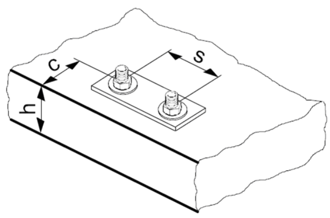
Setting parameters of HST3 / HST3-R for M20 and M24*

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]	130	105	165	255	375
	HST3-R	s_{min}	[mm]	120	90	90	125	180
		for c ≥	[mm]	130	105	165	205	375
Minimum spacing in cracked concrete	HST3	s_{min}	[mm]	90	90	90	125	140
		for c ≥	[mm]	100	80	165	180	325
	HST3-R	s_{min}	[mm]	90	90	90	125	140
		for c ≥	[mm]	100	80	140	130	325
Min. edge distance in non-cracked concrete	HST3	c_{min}	[mm]	110	80	90	170	260
		for s ≥	[mm]	170	160	140	295	400
	HST3-R	c_{min}	[mm]	110	80	120	150	260
		for s ≥	[mm]	170	160	270	235	400
Min. edge distance in cracked concrete	HST3	c_{min}	[mm]	90	80	100	125	230
		for s ≥	[mm]	115	90	240	240	295
	HST3-R	c_{min}	[mm]	90	80	100	125	230
		for s ≥	[mm]	115	90	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

e) Data covered by ETA-98/0001 of 2022-11-03.
f) Data covered by Hilti Technical Data

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

* ETA-98/0001 provides flexible edge & spacing values for each anchor layout configuration with M20 depending on base material thickness. Minimum spacing and edge distance values on the table are recommendations for specific anchor layout and base material dimensions. We kindly ask you to check your designs on PROFIS Engineering software to verify the edge & spacing values.



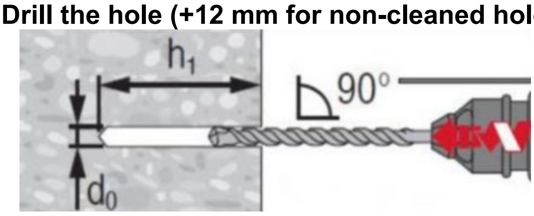
Setting instructions

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

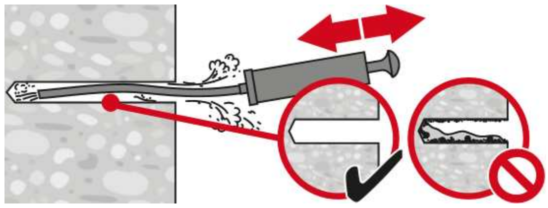
Setting instruction for HST3 / HST3-R [a)]

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

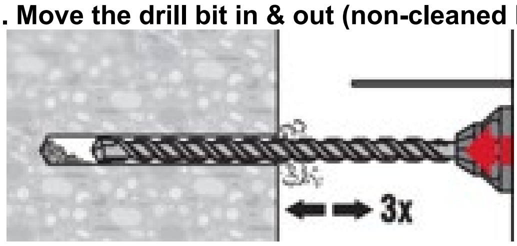
1. Drill the hole (+12 mm for non-cleaned holes)



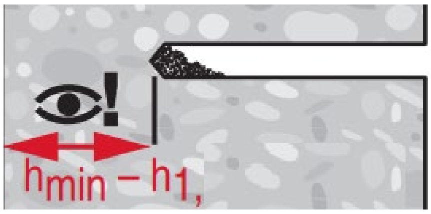
2a. Clean the hole



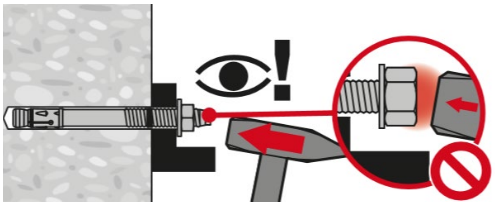
2bi. Move the drill bit in & out (non-cleaned hole)



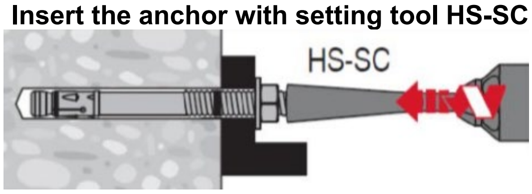
2bii. Check



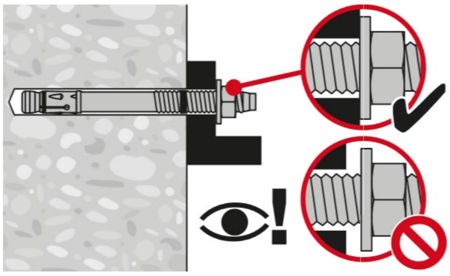
3a. Insert the anchor with hammer



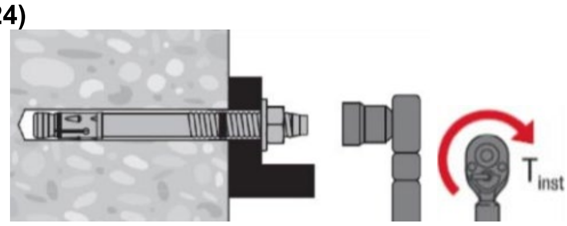
3b. Insert the anchor with setting tool HS-SC



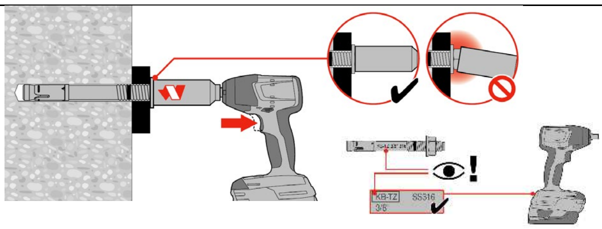
4. Check

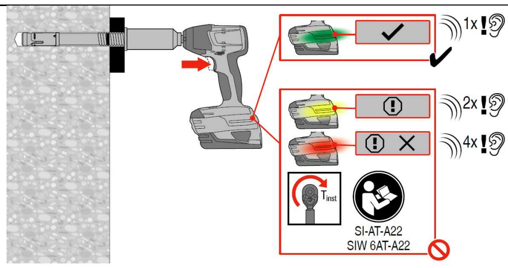


5a. Torque with calibrated torque wrench (M8-M24)

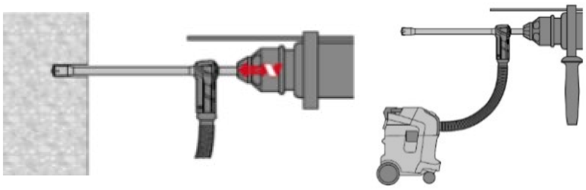
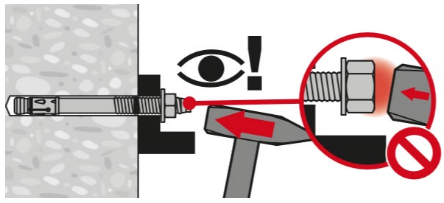
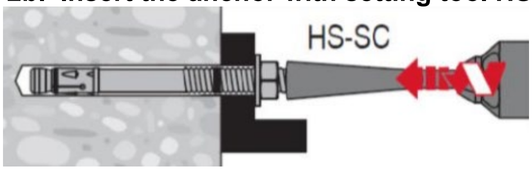
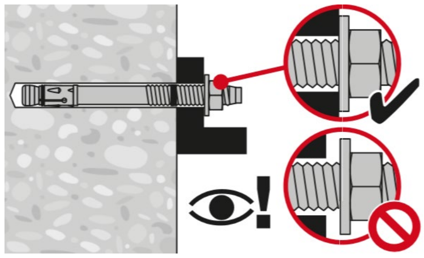
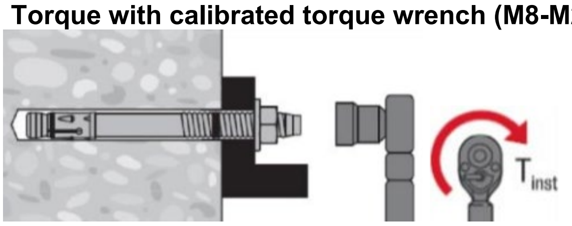
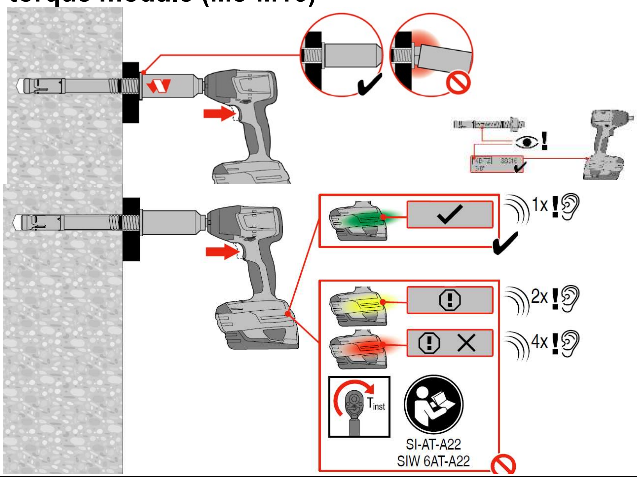


5b. Torque with impact wrench with Adaptative torque module (M8-M16) [b)]





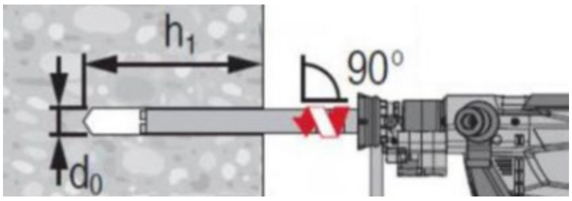
a) HST3 DN covers the diameter range between M8 and M16;
b) Equivalent combination of Hilti SIW + SI-AT tool, compatible to this anchor type, may be used (e.g. Hilti SIW 4AT-22 with SI-AT-22)

<table>
<tr><th colspan="2">Hollow Drill Bit (M16, M20, M24), no cleaning is required even without buffer [a)]</th></tr>
<tr><td>1. Drill the hole with the Hollow drill bit
</td><td>2a. Insert the anchor with hammer
</td></tr>
<tr><td>2b. Insert the anchor with setting tool HS-SC
</td><td>3. Check
</td></tr>
<tr><td>5a. Torque with calibrated torque wrench (M8-M24)
</td><td>5b. Torque with impact wrench with Adaptative torque module (M8-M16) [b)]
</td></tr>
</table>

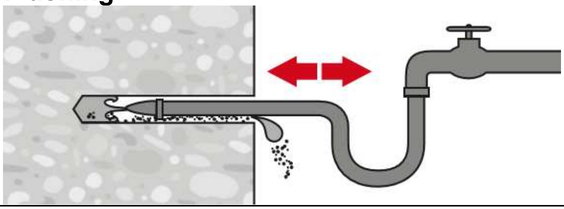
a) HST3 DN covers the diameter range between M8 and M16;
b) Equivalent combination of Hilti SIW + SI-AT tool, compatible to this anchor type, may be used (e.g. Hilti SIW 4AT-22 with SI-AT-22)

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

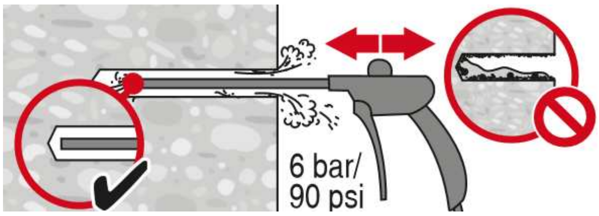
1. Core the hole



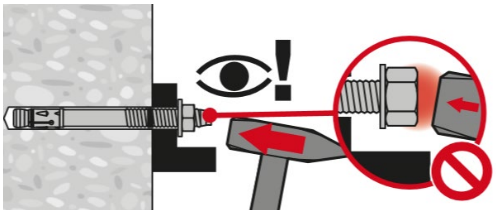
2. Flushing



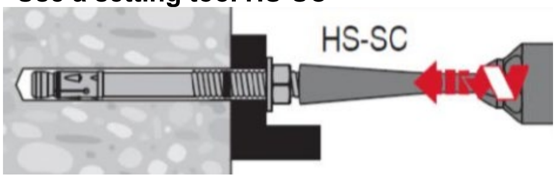
3. Clean the hole



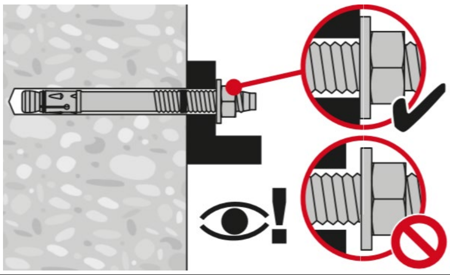
4a. Insert the anchor with hammer



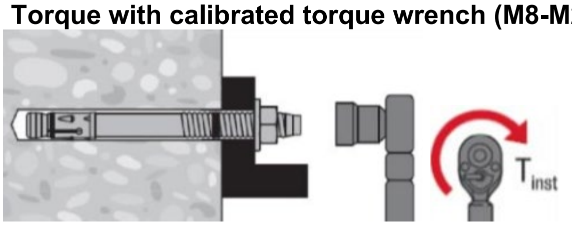
4b. Use a setting tool HS-SC



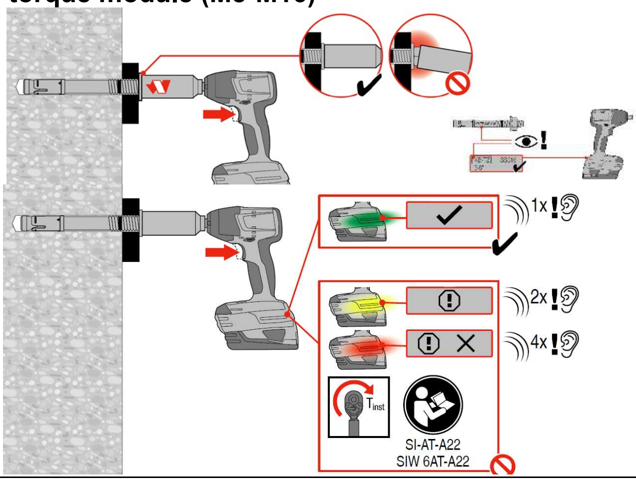
5. Check



6a. Torque with calibrated torque wrench (M8-M24)



5b. Torque with impact wrench with Adaptative torque module (M8-M16) b)



a) HST3 DN covers the diameter range between M8 and M16;
b) Equivalent combination of Hilti SIW + SI-AT tool, compatible to this anchor type, may be used (e.g. Hilti SIW 4AT-22 with SI-AT-22)

HSA Expansion anchor

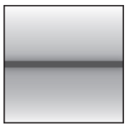
Everyday standard expansion anchor for uncracked concrete

Anchor version	Benefits
 HSA HSA-F HSA-R HSA-R2 (M6-M20)	- Fast & convenient setting behaviour - Reliable ETA approved torqueing using impact wrench with the innovative SIW 6AT-A22 and SI-AT-A22 system for automatic torqueing - Small edge and spacing distances - High loads - Three embedment depths for maximal design flexibility - M10, M12, M16 and M20 ETA approved for diamond cored holes using DD 30-W and matching diamond core bit - Suitable for pre- and through fastening - Long lengths available suitable for wood structures fastening applications

Base material

Concrete (non-cracked)

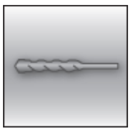
Load conditions



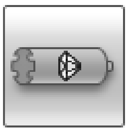
Static/ quasi-static

Fire resistance

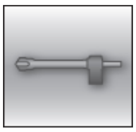
eInstallation conditions



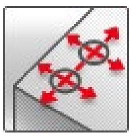
Hammer drilled holes



Diamond drilled holes



Hollow drill-bit drilling

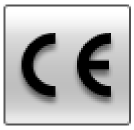


Small edge distance and spacing

Impact wrench with adaptative torque module

Other information

European Technical Assessment



CE conformity

PROFIS ENGINEERING

Corrosion resistance

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European technical assessment [a)]	DIBt, Berlin	ETA-11/0374 / 2022-11-03

a) All data given in this section according to ETA-11/0374, issued 2022-11-03.

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

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
- Minimum base material thickness
- Concrete C 20/25

Effective anchorage depth

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

Characteristic resistance

Anchor size				M6			M8			M10		
Effective anchorage depth		h_{ef}	[mm]	30	40	60	30	40	70	40	50	80
Tension	HSA,	N_{Rk}	[kN]	6,0	7,5	9,0	8,1	12,4	16,0	12,4	17,4	25,0
	HSA-R2, HSA-R			6,0	7,5	9,0	8,1	12,4	16,0	12,4	17,4	25,0
	HSA-F			6,0	7,5	9,0	8,1	12,4	15,9	12,4	17,4	25,0
Shear	HSA,	V_{Rk}	[kN]	6,5	6,5	6,5	8,1	10,6	10,6	18,9	18,9	18,9
	HSA-R2, HSA-R			7,2	7,2	7,2	8,1	12,3	12,3	22,6	22,6	22,6
	HSA-F			6,5	6,5	6,5	8,1	10,6	10,6	18,9	18,9	18,9
Anchor size				M12			M16			M20		
Effective anchorage depth		h_{ef}	[mm]	50	65	100	65	80	120	75	100	115
Tension	HSA,	N_{Rk}	[kN]	17,4	25,8	35,0	25,8	35,2	50,0	32,0	49,2	60,7
	HSA-R2, HSA-R			17,4	25,8	35,0	25,8	35,2	50,0	32,0	49,2	60,7
	HSA-F			17,4	25,8	35,0	25,8	35,2	50,0	32,0[a]	49,2[a]	60,7[a]
Shear	HSA,	V_{Rk}	[kN]	29,5	29,5	29,5	51,0	51,0	51,0	63,9	85,8	85,5
	HSA-R2, HSA-R			29,3	29,3	29,3	56,5	56,5	56,5	63,9	91,9	91,9
	HSA-F			29,5	29,5	29,5	51,0	51,0	51,0	63,9[a]	68,6[a]	68,6[a]

a) Data covered by Hilti Technical Data.

Design resistance

Anchor size				M6			M8			M10		
Effective anchorage depth		h_{ef}	[mm]	30	40	60	30	40	70	40	50	80
Tension	HSA,	N_{Rd}	[kN]	4,0	5,0	6,0	5,4	8,3	10,7	8,3	11,6	16,7
	HSA-R2, HSA-R			4,0	5,0	6,0	5,4	8,3	10,7	8,3	11,6	16,7
	HSA-F			4,0	5,0	6,0	5,4	8,3	10,7	8,3	11,6	16,7
Shear	HSA,	V_{Rd}	[kN]	5,2	5,2	5,2	5,4	8,5	8,5	15,1	15,1	15,1
	HSA-R2, HSA-R			5,8	5,8	5,8	5,4	9,8	9,8	18,1	18,1	18,1
	HSA-F			5,2	5,2	5,2	5,4	8,5	8,5	15,1	15,1	15,1
Anchor size				M12			M16			M20		
Effective anchorage depth		h_{ef}	[mm]	50	65	100	65	80	120	75	100	115
Tension	HSA,	N_{Rd}	[kN]	11,6	17,2	23,3	17,2	23,5	33,3	21,3	32,8	40,4
	HSA-R2, HSA-R			11,6	17,2	23,3	17,2	23,5	33,3	21,3	32,8	40,4
	HSA-F			11,6	17,2	23,3	17,2	23,5	33,3	21,3[a]	32,8[a]	40,4[a]
Shear	HSA,	V_{Rd}	[kN]	23,2	23,6	23,6	40,8	40,8	40,8	42,6	68,6	68,4
	HSA-R2, HSA-R			23,2	23,4	23,4	45,2	45,2	45,2	42,6	73,5	73,5
	HSA-F			23,2	23,6	23,6	40,8	40,8	40,8	42,6[a]	54,9[a]	54,9[a]

a) Data covered by Hilti Technical Data.

Recommended loads a)

Anchor size				M6			M8			M10		
Effective anchorage depth		h_{ef}	[mm]	30	40	60	30	40	70	40	50	80
Tension	HSA,	N_{rec}	[kN]	2.0	2.5	3.0	2.7	4.1	5.3	4.1	5.8	8.3
	HSA-R2, HSA-R			2.0	2.5	3.0	2.7	4.1	5.3	4.1	5.8	8.3
	HSA-F			2.0	2.5	3.0	2.7	4.1	5.3	4.1	5.8	8.3
Shear	HSA,	V_{rec}	[kN]	2.2	2.2	2.2	2.7	3.5	3.5	6.3	6.3	6.3
	HSA-R2, HSA-R			2.4	2.4	2.4	2.7	4.1	4.1	7.5	7.5	7.5
	HSA-F			2.2	2.2	2.2	2.7	3.5	3.5	6.3	6.3	6.3
Anchor size				**M12**			**M16**			**M20**		
Effective anchorage depth		h_{ef}	[mm]	50	65	100	65	80	120	75	100	115
Tension	HSA,	N_{rec}	[kN]	5.8	8.6	11.7	8.6	11.7	16.7	10.7	16.4	20.2
	HSA-R2, HSA-R			5.8	8.6	11.7	8.6	11.7	16.7	10.7	16.4	20.2
	HSA-F			5.8	8.6	11.7	8.6	11.7	16.7	10.7 b)	16.4 b)	20.2 b)
Shear	HSA,	V_{rec}	[kN]	9.8	9.8	9.8	17.0	17.0	17.0	21.3	28.6	28.5
	HSA-R2, HSA-R			9.8	9.8	9.8	18.8	18.8	18.8	21.3	30.6	30.6
	HSA-F			9.8	9.8	9.8	17.0	17.0	17.0	21.3 b)	22.9 b)	22.9 b)

a) With overall global 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.
b) Data covered by Hilti Technical data

Materials

Mechanical properties

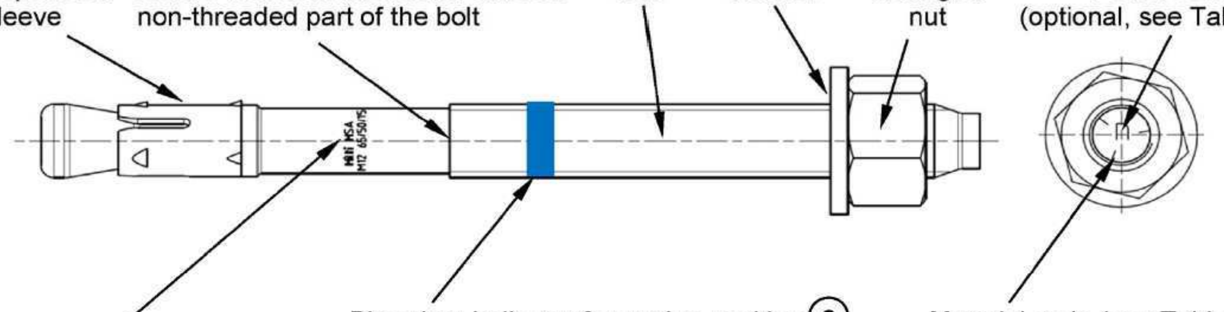
Anchor size				M6	M8	M10	M12	M16	M20
Nominal tensile strength	HSA, HSA-F	$f_{uk,thread}$	[N/mm²]	650	580	650	700	650	700
	HSA-R2, HSA-R			650	560	650	580	600	625
Yield strength	HSA, HSA-F	$f_{yk,thread}$	[N/mm²]	520	464	520	560	520	560
	HSA-R2, HSA-R			520	448	520	464	480	500
Stressed cross-section		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
Characteristic bending resistance	HSA, HSA-F	$M^0_{Rk,s}$	[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

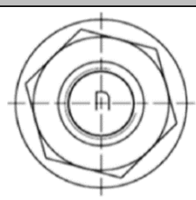
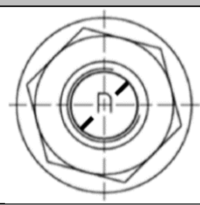
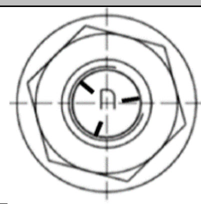
Part		Material
HSA	Bolt	Carbon steel, 18MnV5 or 1.0511 or 1.0501 / Galvanized (≥5 µm)
	Sleeve	Carbon steel, 1.0347 /Galvanized (≥5 µm)
	Washer	Carbon steel, DIN 125 strength class 140HV /Galvanized (≥5 µm)
	Hexagon nut	Carbon steel, DIN 934 strength class 8 / Galvanized (≥5 µm)
HSA-R2	Bolt	Stainless steel A2, 1.4301
	Sleeve	Stainless steel A2, 1.4301
	Washer	Stainless steel A2, DIN 125 strength class 140HV
	Hexagon nut	Stainless steel A2, DIN 934 strength class 8
HSA-R	Bolt	Stainless steel A4, 1.4401 or Duplex steel, 1.4362
	Sleeve	Stainless steel A2, 1.4301
	Washer	Stainless steel A4, DIN 125 strength class 140HV
	Hexagon nut	Stainless steel A4, DIN 934 strength class 8
HSA-F	Bolt	Carbon steel, 18MnV5 or 1.0501 or 1.1172 / Hot-dip galvanized (≥42 µm)
	Sleeve	Stainless steel A2, 1.4301
	Washer	Carbon steel, DIN 125 strength class 140HV / Hot-dip galvanized (≥42 µm)
	Hexagon nut	Carbon steel, DIN 934 strength class 8/ Hot-dip galvanized (≥42 µm)

Product marking and identification of anchor:

Product description: Hilti metal expansion anchor HSA, HSA-F, HSA-R2 and HSA-R



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 (optional) and maximum thickness of the fixture t_{fix}

Type	HSA, 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
aa	-	-	-	155/140/105	145/130/90	-
ab	-	-	-	165/150/115	155/140/100	-
ac	-	-	-	175/160/125	165/150/110	-
ad	-	-	-	180/165/130	190/175/135	-
ae	-	-	-	230/215/180	240/225/185	-
af	-	-	-	280/265/230	290/275/235	-
ag	-	-	-	330/315/280	340/325/285	-

Anchor length in bolt type and grey shaded are standard items. For selection of other anchor length, check availability of the items.

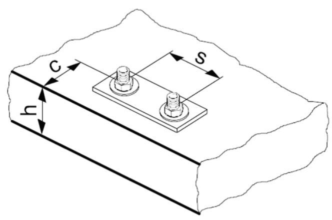
HILTI

Setting information

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 flats	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 flats	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

<table>
<tr><th colspan="2">Anchor size</th><th>M6</th><th>M8</th><th>M10</th><th>M12</th><th>M16</th><th>M20</th></tr>
<tr><td colspan="8">Drilling</td></tr>
<tr><td colspan="2">Rotary hammer</td><td colspan="5">TE2 – TE30</td><td>TE40 – TE80</td></tr>
<tr><td colspan="2">- With hammer drilling (HD)</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td colspan="2">- With Hilti hollow drill bits (HDB) TE-CD, TE-YD</td><td colspan="3">-</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td colspan="2">Diamond coring (DD) with DD-30W and C+…SPX-T (abrasive) core bits</td><td colspan="2">-</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td colspan="8">Borehole cleaning</td></tr>
<tr><td colspan="2">Manual cleaning: hand blow out pump</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td colspan="2">Automatic cleaning: rotary hammer with Hilti TE-CD and TE-YD drilling system including Hilti Vacuum Cleaner (VC)</td><td>-</td><td>-</td><td>-</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td colspan="8">Anchor setting</td></tr>
<tr><td colspan="2">Manual setting: hammer</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td colspan="2">Machine setting: rotary hammer with setting tool HS-SC</td><td>-</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>-</td></tr>
<tr><td colspan="8">Application of the torque moment</td></tr>
<tr><td colspan="2">Manual: calibrated torque wrench</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td colspan="2">Automatic: impact wrench with S-TB HSA torque bar</td><td>-</td><td colspan="3">Hilti SIW 14-A
Hilti SIW 22-A / Hilti SIW 6AT-A22</td><td>Hilti SIW 22T-A / Hilti SIW 6AT-A22</td><td>-</td></tr>
<tr><td rowspan="2">Speed setting of impact wrench</td><td>HSA, HSA-F</td><td>-</td><td colspan="2">1</td><td>3</td><td>-[1)]</td><td>-</td></tr>
<tr><td>HSA-R2, HSA-R</td><td>-</td><td colspan="2">3</td><td>3</td><td>-[1)]</td><td>-</td></tr>
<tr><td colspan="2">Setting time t_{set} [sec]</td><td>-</td><td colspan="4">4</td><td>-</td></tr>
<tr><td>Automatic: impact wrench with SIW 6AT-A22 and SI-AT-A22 adaptive torque module</td><td>HSA, HSA-R, HSA-R2</td><td>-</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>-</td></tr>
</table>

1) The impact wrench operates with a fixed speed.

Setting parameters

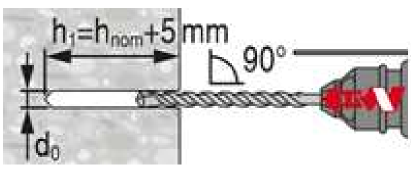
Anchor size			M6			M8			M10		
Nominal anchorage depth	h_{nom}	[mm]	37	47	67	39	49	79	50	60	90
Effective anchorage depth	h_{ef}	[mm]	30	40	60	30	40	70	40	50	80
Critical spacing for splitting failure	$s_{cr,sp}$	[mm]	100	120	130	130	180	200	190	210	290
Critical edge distance for splitting failure	$c_{cr,sp}$	[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

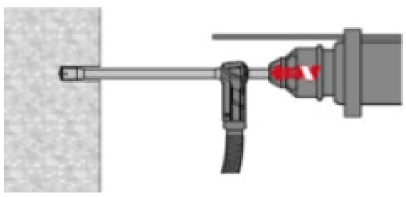
***For detailed information on installation see instruction for use given with the package of the product**

1. Hole drilling

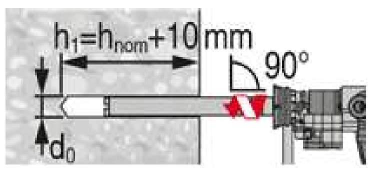
Hammer drilling (HD): M6-M20



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

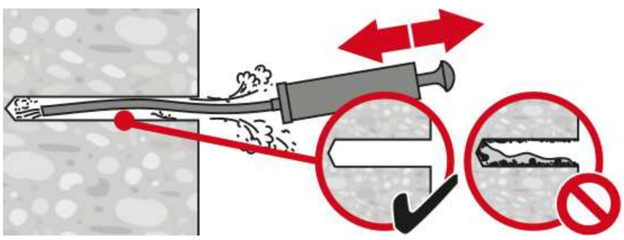


Diamond drilling (DD): M10-M20

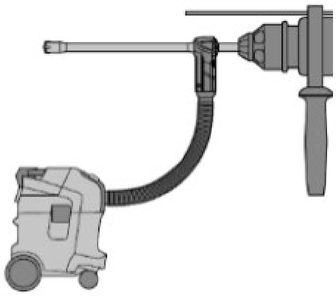


2. Cleaning

Manual cleaning (MC): M6-M20

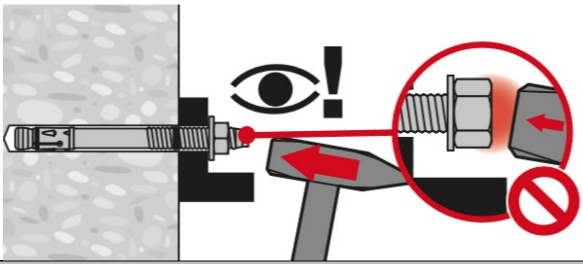


Automatic cleaning (AC): M12-M20

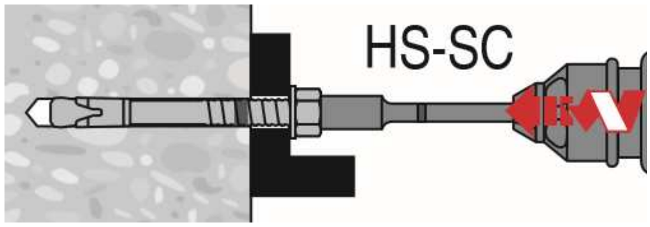


3. Anchor setting

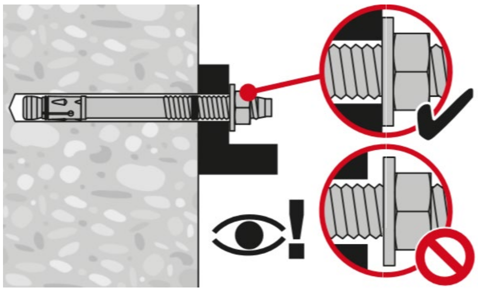
Hammer setting: M6-M20



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

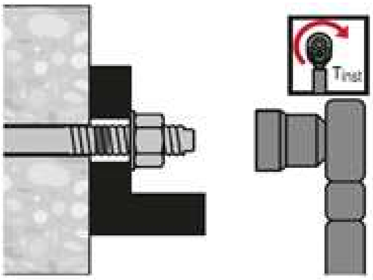


4. Check setting

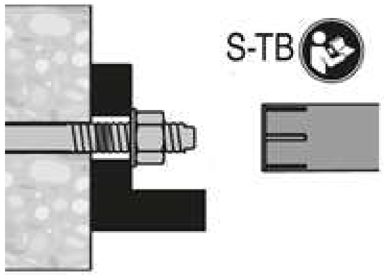


5. Anchor torqueing

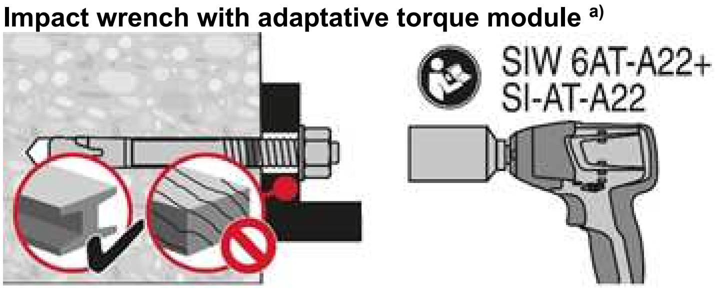
Torque wrench: M6-M20



Impact screw driver with setting tool (only for HSA-F)



Impact wrench with adaptative torque module [a)]



a) Equivalent combination of Hilti SIW + SI-AT tool, compatible to this anchor type, may be used (e.g. Hilti SIW 4AT-22 with SI-AT-22)

HUS4 Screw anchor

Ultimate performance screw anchor for single point fastening

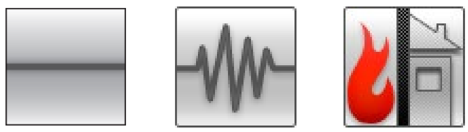
Anchor version		Benefits
	HUS4-H (8-16)*	- High productivity - less drilling and fewer operations than with conventional anchors
	HUS4-C (8-10)	- ETA approval for cracked and non-cracked concrete
	HUS4-A (10-14)	- ETA approval for Seismic C1 and C2

- ETA approval for adjustability (unscrew-rescrew)
- Smaller edge and spacing distance
- aBG (DIBt) approval for reusability in fresh concrete ($f_{ck,\ cube}$ = 10/15/20/25 Nmm^2) for temporary applications
- Three embedment depths for maximum design flexibility and flexible design for concrete cone capacity
- No cleaning required size 8 to 14
- HUS4-HF and HUS4-AF with multilayer coatings for additional corrosion protection
- Through fastening with H, A and C head
- Pre-fastening with A head

Base material

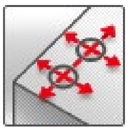
Concrete (non-cracked) | Concrete (cracked) | Hollow core slabs | Solid brick | Autoclaved aerated concrete

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 | DIBt Approval Reusability

Approvals / certificates

Description	Authority	No. / date of issue
European Technical Assessment	DIBt	ETA-20/0867 / 14-04-2022
Fire test report	DIBt	ETA-20/0867 / 14-04-2022
ABG for temporary fastening	DIBt	Z-21.8-2137 / 21-12-2021

*HUS4-HF not available in size 12

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

- 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

Static and quasi-static loading data (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

Anchorage depth

Anchor size		8			10			12			14			16	
Type	HUS4	H, C			H, C, A			H			H, A			H	
		h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}
Nominal embedmenth depth	h_{nom} [mm]	40	60	70	55	75	85	60	80	100	65	85	115	85	130

Characteristic resistance

Anchor size			8			10			12			14			16	
Type	HUS4		H, C			H, C, A			H			H, A			H	
			h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}
Non-cracked concrete																
Tension	N_{Rk}	[kN]	8,3	16,2	20,7	13,0	22,0	27,6	15,3	24,5	35,1	17,0	26,6	43,3	22,0	46,0
Shear	V_{Rk}	[kN]	8,3	18,8	21,9	13,6	28,8	32,0	30,6	38,9	44,9	34,1	53,1	62,0	53,5	73,1
Cracked concrete																
Tension	N_{Rk}	[kN]	5,5	11,3	14,5	9,5	15,8	19,3	10,0	17,2	24,6	11,9	18,6	30,3	16,0	32,0
Shear	V_{Rk}	[kN]	5,8	18,8	21,9	9,5	28,8	32,0	21,4	34,4	44,9	23,8	37,2	60,6	37,4	73,1

Design resistance

Anchor size			8			10			12			14			16	
Type	HUS4		H, C			H, C, A			H			H, A			H	
			h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}
Non-cracked concrete																
Tension	N_{Rd}	[kN]	5,6	10,8	13,8	7,2	14,7	18,4	10,2	16,4	23,4	11,4	17,7	28,8	14,7	30,7
Shear	V_{Rd}	[kN]	5,6	15,0	17,5	9,1	23,0	25,6	20,4	31,1	35,9	22,7	35,4	49,6	35,6	58,5
Cracked concrete																
Tension	N_{Rd}	[kN]	3,7	7,5	9,6	5,3	10,5	12,9	6,7	11,5	16,4	7,9	12,4	20,2	10,7	21,3
Shear	V_{Rd}	[kN]	3,9	15,0	17,5	6,4	21,1	25,6	14,3	22,9	32,8	15,9	24,8	40,4	25,0	49,3

Recommended loads

Anchor size			8			10			12			14			16	
Type	HUS4		H, C			H, C, A			H			H, A			H	
			h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}
Non-cracked concrete																
Tension	N_{Rec}	[kN]	2.8	5.4	6.9	4.3	7.3	9.2	5.1	8.2	11.7	5.7	8.9	14.4	7.3	15.3
Shear	V_{Rec}	[kN]	2.8	6.3	7.3	4.5	9.6	10.7	10.2	13.0	15.0	11.4	17.7	20.7	17.8	24.4
Cracked concrete																
Tension	N_{Rec}	[kN]	1.8	3.8	4.8	3.2	5.3	6.4	3.3	5.7	8.2	4.0	6.2	10.1	5.3	10.7
Shear	V_{Rec}	[kN]	1.9	6.3	7.3	3.2	9.6	10.7	7.1	11.5	15.0	7.9	12.4	20.2	12.5	24.4

With overall global safety factor for action $\gamma = 3.0$. The partial safety factors for action depend on the type of loading and shall be taken from national regulations.

Materials

Mechanical properties

Anchor size			8	10	12	14	16
Nominal tensile strength	f_{uk}	[N/mm²]	758	799	767	728	622
Yield strength	f_{yk}	[N/mm²]	606	639	613	582	494
Stressed cross-section	A_s	[mm²]	47,5	68,9	103	139	173
Moment of resistance	W	[mm³]	35	67	130	213	321
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	32	64	120	186	240

Material quality

Type	Material
HUS4 - H, A, C	Carbon steel, galvanized

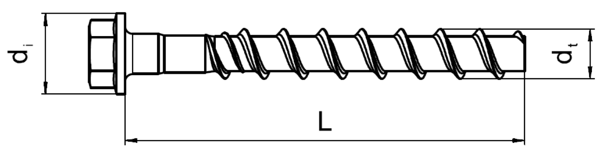
a) Multi-layer coating provides a higher corrosion resistance compared to regular hot dip galvanized (HDG) systems with a 40µm coating thickness.

Head configuration

Type	Part	
HUS4-H	Hexagonal head	
HUS4-C	Countersunk head	
HUS4-A	External thread	 Hilti HUS4-A, size 10 with external thread M12 and size 14 with external thread M16

Fastener dimensions and marking HUS4-H

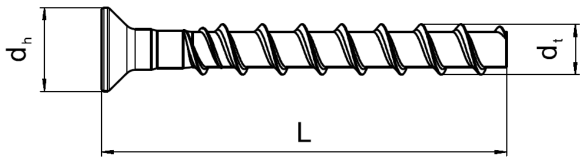
Anchor size			8	10	12	14	16
Type		HUS4	H	H	H	H	H
Outer diameter of screw thread	d_t	[mm]	10,50	12,70	14,70	16,70	18,80
Diameter of integrated washer	d_i	[mm]	17,50	20,50	23,60	29,00	32,60
Length of the screw (min/max)	L	[mm]	45/150	60/305	70/150	75/150	100/205



HUS4: Hilti Universal Screw 4th generation
H: Hexagonal head
10: Screw diameter
100: total length of the screw

Fastener dimensions and marking HUS4-C

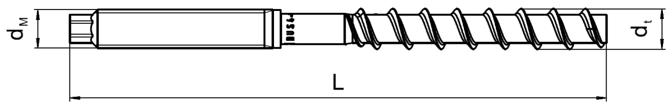
Anchor size			8	10
Type		**HUS4**	**C**	**C**
Outer diameter of the screw thread	d_t	[mm]	10,50	12,70
Countersunk head diameter	d_h	[mm]	18,00	21,00
Length of the screw (min/max)	L	[mm]	55/85	70/120

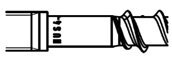


HUS4: Hilti Universal Screw 4th generation
C: Countersunk head
10: Screw diameter
100: total length of the screw

Fastener dimensions and marking HUS4-A

Anchor size			10	14
Type		**HUS4**	**A**	**A**
Outer diameter of the screw thread	d_t	[mm]	12,70	16,70
Diameter of the metric thread	d_M	[mm]	M12	M16
Length of the screw (min/max)	L	[mm]	120/165	155/205




E.g. HUS4-A 10x165

HUS4: Hilti Universal Screw 4th generation
A: Threaded head
10: Screw diameter
100: total length of the screw
8: carbon steel 8.8
K: length of the screw (more info in ETA)

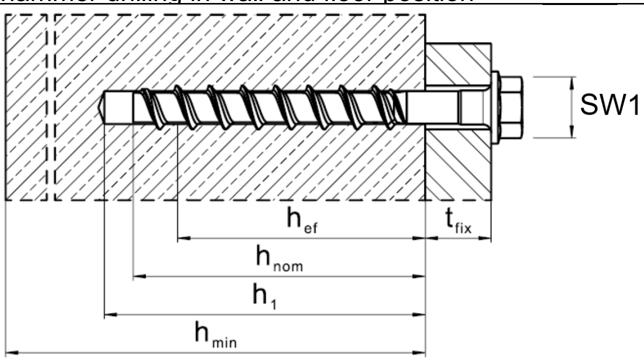
Setting information

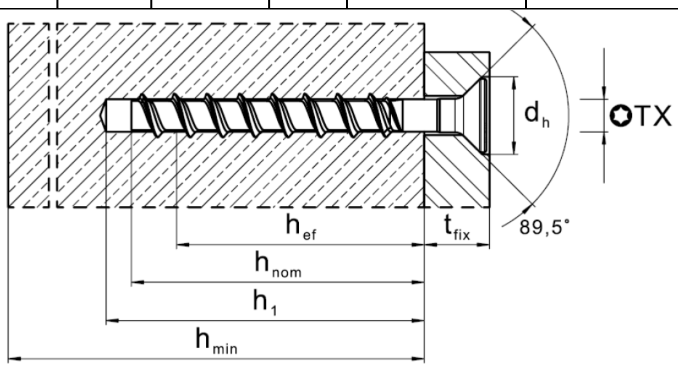
Setting details size 8-12

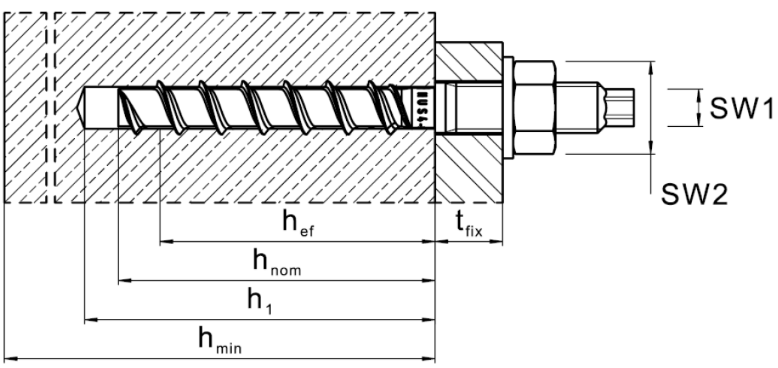
Anchor size			8			10			12		
Type		HUS4	H, C			H, C, A			H		
Nominal embedmenth depth		[mm]	h_{nom1} 40	h_{nom2} 60	h_{nom3} 70	h_{nom1} 55	h_{nom2} 75	h_{nom3} 85	h_{nom1} 60	h_{nom2} 80	h_{nom3} 100
Nominal diameter of drill bit	d_0	[mm]	8			10			12		
Clearance hole diameter	$d_f \leq$	[mm]	12			14			16		
Wrench size HEX head	SW1	[mm]	13			15			17		
Wrench size Threaded head	SW1	[mm]	-			8			-		
Wrench size for nut on Threaded head	SW2	[mm]	-			19			-		
Torx size "C" head	TX	-	45			50			-		
Countersunk head diameter	d_h	[mm]	18			21					
Depth of drill hole for cleaned hole; or uncleand hole overhead	$h_1 \geq$	[mm]	50	70	80	65	85	95	70	90	110
Depth of drill hole for uncleanded hole hammer drilling in wall and floor position	$h_1 \geq$	[mm]	66	86	96	85	105	115	94	114	134

Setting details size 14-16

Anchor size			14			16	
Type		**HUS4**	**H, A**			**H**	
Nominal embedmenth depth		**[mm]**	**h_{nom1}**	**h_{nom2}**	**h_{nom3}**	**h_{nom1}**	**h_{nom2}**
			65	**85**	**115**	**85**	**130**
Nominal diameter of drill bit	d_0	[mm]	14			16	
Clearance hole diameter	$d_f \leq$	[mm]	18			20	
Wrench size Hex head	SW1	[mm]	21			24	
Wrench size Threaded head	SW1	[mm]	12			-	
Wrench size for nut on Threaded head	SW2	[mm]	24			-	
Depth of drill hole for cleaned hole; or uncleand hole overhead	$h_1 \geq$	[mm]	75	95	125	95	140
Depth of drill hole for uncleanded hole hammer drilling in wall and floor position	$h_1 \geq$	[mm]	103	123	153	-	-







Installation equipment table:

Anchor size	8	10	12	14	16
Type HUS4-	**H,C**	**H, C, A**	**H**	**H, A**	**H**
Rotary hammer	TE4 – TE30				
Drill bit for concrete, solid clay brick and solid sand-lime brick	TE-CX 8	TE-CX 10	TE-CX 12	TE-CX 14	TE-CX 16
Socket wrench insert for hex screw (SW1)	SI-S ½“ 13S	SI-S ½“ 15S	S ½“ 17S	SI-S ½“ 21S	S ½“ 24S
Socket wrench insert for threaded head screw	-	SI-S ½“ 8S	-	SI-S ½“ 12S	-
Socket wrench insert for nuts for threaded head screw (SW2)	-	SI-S ½“ 19S	-	SI-S ½“ 24S	-
Torx bit for countersunk screw	S-SY TX45	S-SY TX50	-	-	-
Check gauge for reusability [1]	HRG 8	HRG 10	HRG 12	HRG 14	HRG 16
Setting tool for cracked and un-cracked concrete	SIW 6AT-A22 1/2” SIW 4AT-22 1/2" SIW 6-22 1/2” gear 1	SIW 22T-A 1/2” SIW 22T-A 3/4” SIW 6AT-A22 1/2” SIW 4AT-22 1/2" SIW 6-22 1/2” SIW 8-22 1/2" gear 1 SIW 9-A22 3/4”	SIW 22T-A 1/2” SIW 22T-A 3/4” SIW 6-22 1/2” SIW 8-22 1/2" SIW 9-A22 3/4”		
Setting tool for solid brick and aerated concrete	SIW 6AT-A22 1/2”, SIW 4AT-22 1/2"		-		
Setting tool for hollow core slab	SIW 6AT-A22 1/2” SIW 4AT-22 1/2"	SIW 6AT-A22 1/2” SIW 4AT-22 1/2" SIW 22T-A 1/2” SIW 22T-A 3/4” SIW 6AT-A22 1/2”			

1) For HUS4-A and HUS4-H

Setting parameters

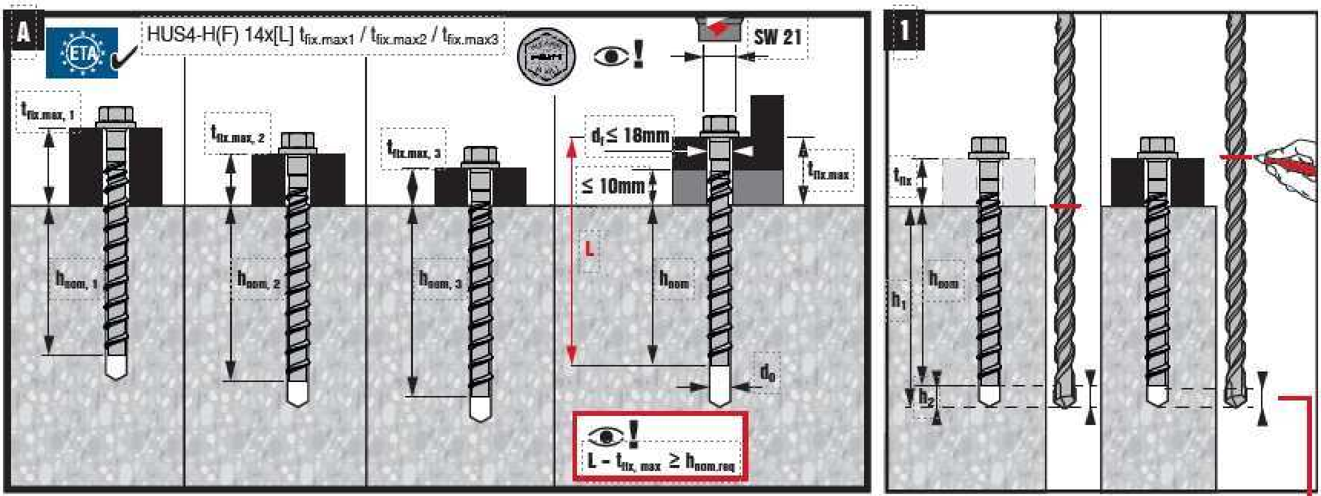
Anchor size			8			10			12			14			16	
Type		**HUS4**														
Nominal embedment depth	h_{nom}	[mm]	40	60	70	55	75	85	60	80	100	65	85	115	85	130
Minimum base material thickness	h_{min}	[mm]	80	100	120	100	130	140	110	130	150	120	160	200	130	195
Minimum spacing	s_{min}	[mm]	35			40			50			60			90	
Minimum edge distance	c_{min}	[mm]	35			40			50			60			65	
Critical spacing for splitting failure	$s_{cr,sp}$	[mm]	3 h_{ef}			3.3 h_{ef}			3.3 h_{ef}			3.3 h_{ef}				
Critical edge distance for splitting	$c_{cr,sp}$	[mm]	1.5 h_{ef}			1.65 h_{ef}			1.65 h_{ef}			1.65 h_{ef}				
Critical spacing for concrete cone failure	$s_{cr,N}$	[mm]	3 h_{ef}													
Critical edge distance for concrete cone failure	$c_{cr,N}$	[mm]	1,5 h_{ef}													

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

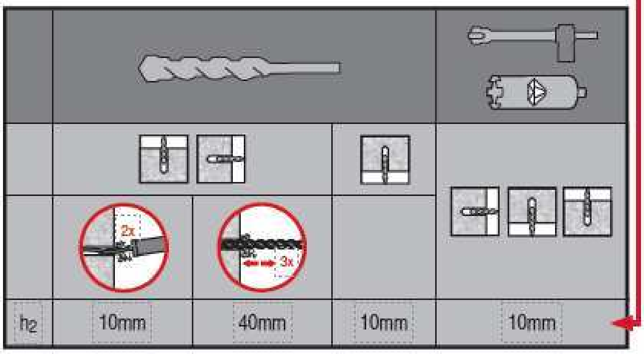
Setting instructions

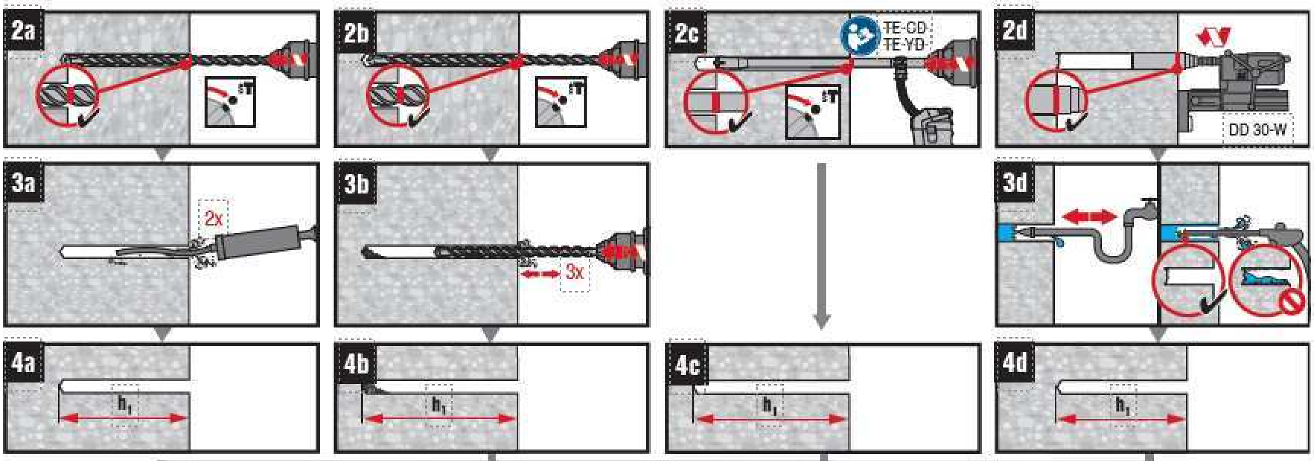
*For detailed information on installation see instruction for use given with the package of the product

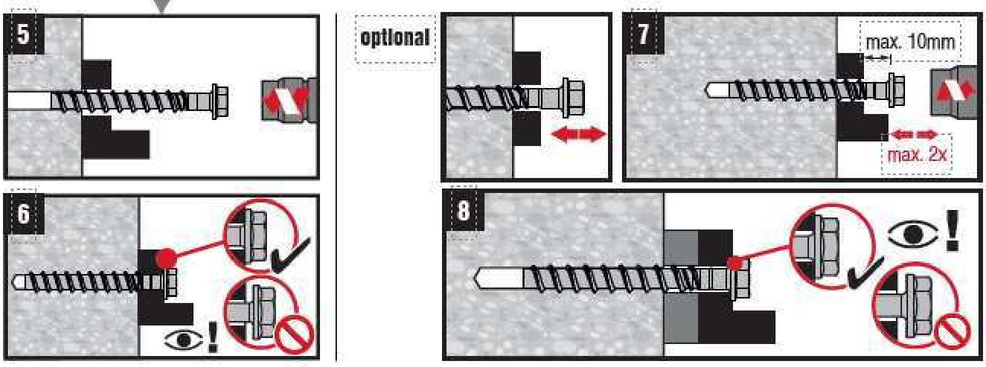
Setting instruction with adjustment



	d_0 [mm]			
	Ø 14	h_{nom1}	≥ 65mm	⊘
	Ø 14	h_{nom2}	≥ 85mm	✔
	Ø 14	h_{nom3}	≥ 115mm	







	HUS4-H(F) 14
SIW 22-A ½" (01)	⊘
SIW 6AT-A22 ½" (01)	⊘
SIW 22T-A ½" (01)	✔
SIW 22T-A ¾" (01)	✔
SIW 9-A22 ¾" (01)	✔

Basic loading data for temporary application in standard and fresh concrete <28 days old, $f_{ck,cube}$ ≥ 10 N/mm²

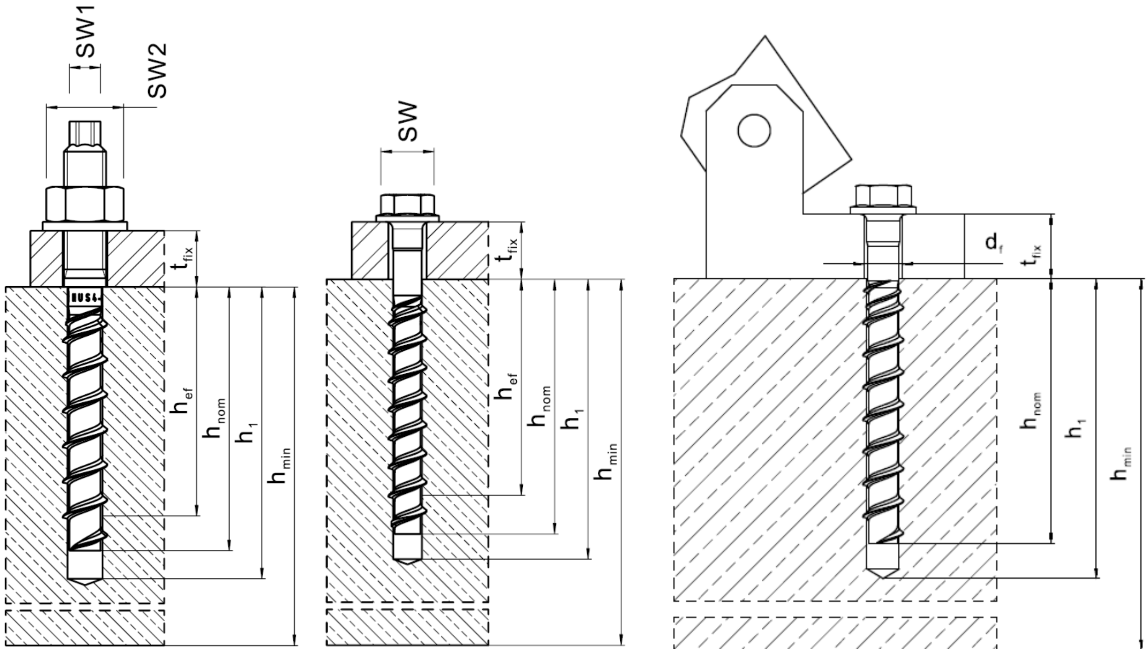
All data in this section applies to the following conditions:

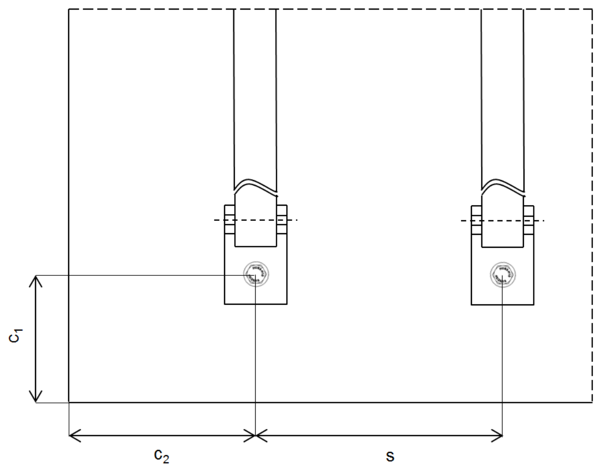
- Strength class, $f_{ck,cube}$ ≥ 10 N/mm²
- Only temporary use
- Screw is reusable, before each usage it must be checked according to Hilti instruction for use with the suited tube Hilti HRG
- Design resistance is valid for single anchor only
- Design resistence is valid for all load directions and valid for both cracked and non-cracked concrete
- Minimum base material thickness
- No edge distance and spacing influence
- Valid for HUS4-H and HUS4-A
- All data in this section are according to DIBt approval Z-21.8-2137 issue 2021-12-21

Anchor size		HUS4-H (A)	8		10			12			14			16	
			h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}
Nominal embedment depth	h_{nom}	[mm]	75	85	55	75	85	60	80	100	65	85	115	85	115
Tension = Shear, $f_{ck,cube}$ ≥ 10 N/mm²	N_{rd} = V_{rd}	[kN]	3,3	4,7	3,3	5,3	6,3	2,6	5,4	7,8	4,4	7,0	12,3	5,5	12,6
$f_{ck,cube}$ ≥ 15 N/mm²		[kN]	4,0	5,7	4,0	6,4	7,8	3,5	7,3	10,6	5,4	8,5	15,0	7,5	17,0
$f_{ck,cube}$ ≥ 20 N/mm²		[kN]	4,6	6,6	4,7	7,4	9,0	4,0	8,4	12,2	6,2	9,9	17,3	8,7	19,7
$f_{ck,cube}$ ≥ 25 N/mm²		[kN]	5,1	7,4	5,3	8,3	10,1	4,5	9,4	13,6	6,9	11,1	19,3	9,7	22,0

Setting details

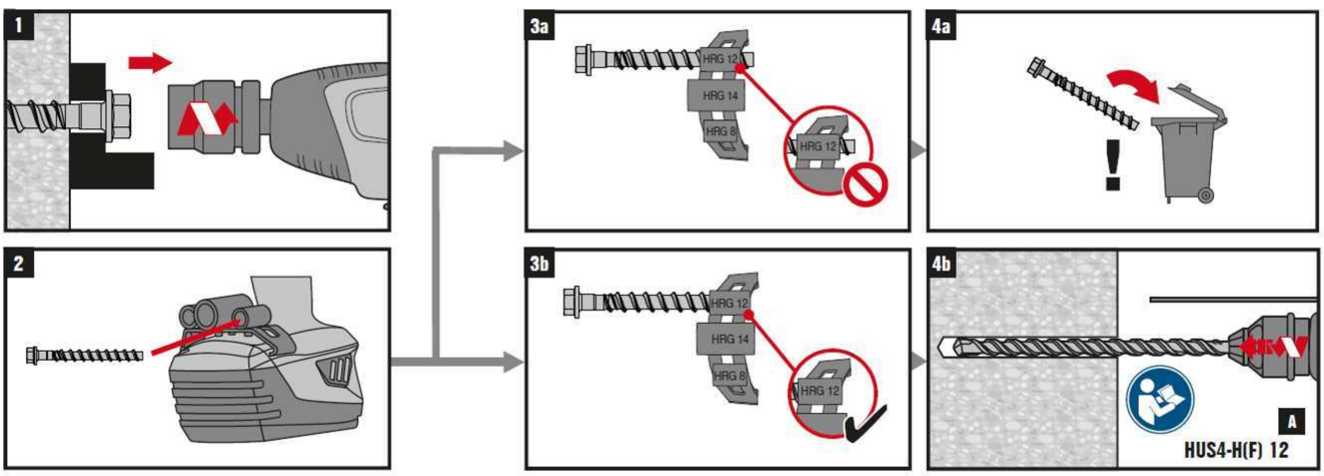
Anchor size		HUS4-H (A)	8		10			12			14			16	
			h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}
Nominal embedment depth	h_{nom}	[mm]	60	70	55	75	85	60	80	100	65	85	115	85	130
Drilling depth	h_1 ≥	[mm]	70	80	65	85	95	70	90	110	75	95	125	95	140
Option 1															
Minimum edge distance	c_1 ≥	[mm]	80	100	75	100	115	65	105	135	85	115	180	105	180
Minimum base material thickness	h_{min} ≥	[mm]	120	150	115	150	175	110	160	205	130	175	255	160	220
Option 2															
Minimum edge distance	c_1 ≥	[mm]	85	110	85	120	135	65	120	160	100	135	300	115	215
Minimum base material thickness	h_{min} ≥	[mm]	100	120	100	130	140	110	130	150	120	160	200	130	195
Minimum edge distance	c_2 ≥	[mm]	1.5 x c_1												
Minimum spacing	s_{min} ≥	[mm]	3.0 x c_1												
Check gauge			HRG 8		HRG 10			HRG 12			HRG 14			HRG 16	
Diameter of clearance hole for H head	d_f ≤	[mm]	14		16			20			22			24	
Diameter of clearance hole for A head	d_f ≤	[mm]	-		14			-			18			-	
Socket size H head	SW		13		15			17			21			24	
Socket size A head	SW1 (SW2)		-		8 (17)			-			12 (24)			-	





Setting instructions

*For detailed information on installation see instruction for use given with the package of the product example for size 10 screw



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 (without hammering for PPW)
- Correct anchor setting (see instruction for use, setting details)
- Recommended setting machine: SIW 6AT-A
- The ratio of hollow or holes space to solid 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

Anchor size			**8**	**10**
Nominal embedment depth	h_{nom}	[mm]	60	75
Drilling diameter for Mz, KS	d_0	[mm]	8	10
Drilling diameter for Vbl, PPW, Leca5®	d_0	[mm]	6	8

Anchor size			**8**	**10**
			H, C	**H, C**
	Compressive strength class	**[N/mm²]**	**N_{rec} Tensile loads**	
	Solid clay brick Mz 12 / 2,0 (EN 771-1)	≥ 12	1,4	1,4
		≥ 20	1,8	1,8
	Solid sand-lime brick KS 12 / 2,0 (EN 771-2)	≥ 12	3,7	4,2
		≥ 20	4,8	5,4
	Aerated concrete PPW 6-0,4 (EN 771-4)	≥ 6	1,0	1,6

Anchor size			**8**	**10**
			H, C	**H, C**
	Compressive strength class	**[N/mm²]**	**V_{rec} Shear loads**	
	Solid clay brick Mz 12 / 2,0 (EN 771-1)	≥ 12	3,8	5,5
	Solid sand-lime brick KS 12 / 2,0 (EN 771-2)	≥ 12	4,6	5,7
	Aerated concrete PPW 6-0,4 (EN 771-4)	≥ 6	1,3	1,5

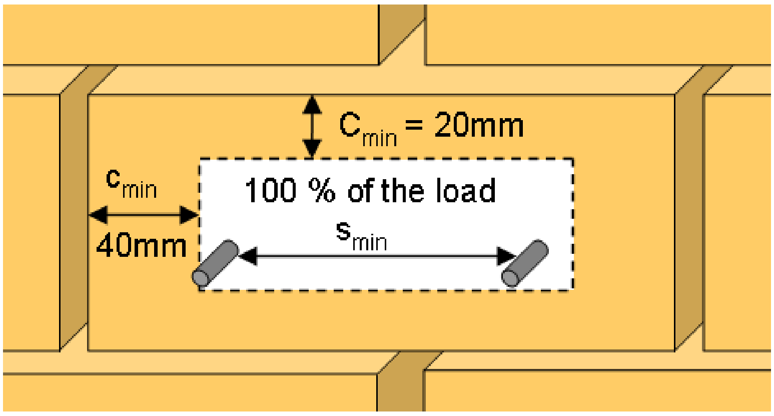
Permissible anchor location in brick and block walls

Edge distance and spacing influence

- The technical data for HUS4 anchors are reference loads for MZ 12, KS 12, Vbl 6, PPW 6 and Leca5®. Due to the large variation of natural stone slid bricks, on site anchor testing is recommended to validate technical data
- The HUS4 anchor was installed and tested in center of solid bricks as shown. The HUS4 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, KS and light weight concrete) 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 pre-stressed Hollow core slab (HCS) for permanent fastening

All data in this section applies to

- Correct anchor setting (see instruction for use, setting details)
- Recommended drilling machine: TE2 A22, recommended setting machine: SIW 6AT-A
- No edge distance and spacing influence
- Ratio core width / web thickness ≤ 5,3
- Concrete from C30/37, uncracked
- All data given in this section according to Hilti Technical Data

Anchor size			8	10
Nominal embedment depth	h_{nom}	[mm]	d_b	d_b
Drilling depth	d_0	[mm]	≥ d_b + 10 mm	

Characteristic resistance

Anchor size	HUS4		8					10				
Concrete strength			C30/37			C45/55		C30/37			C45/55	
Bottom flange thickness	d_b ≥	[mm]	30	35	40	35	40	30	35	40	35	40
Tension	N_{Rk}	[kN]	2,0	5,8	7,1	7,1	8,7	2,0	5,8	7,1	7,1	8,7
Shear	V_{Rk}	[kN]	2,0	9,3	11,4	11,4	14,0	2,0	10,2	12,4	12,5	15,2

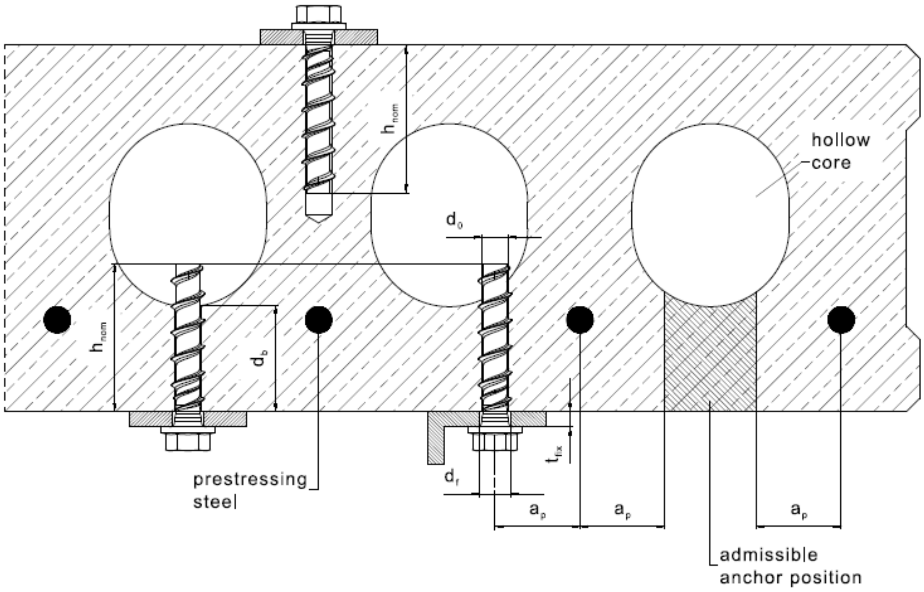
Design resistance

Anchor size	HUS4		8					10				
Concrete strength			C30/37			C45/55		C30/37			C45/55	
Bottom flange thickness	d_b ≥	[mm]	30	35	40	35	40	30	35	40	35	40
Tension	N_{Rd}	[kN]	1,3	3,2	3,9	4,0	4,8	1,3	3,2	3,9	4,0	4,8
Shear	V_{Rd}	[kN]	1,3	6,2	7,6	7,6	9,3	1,3	6,8	8,3	8,3	10,1

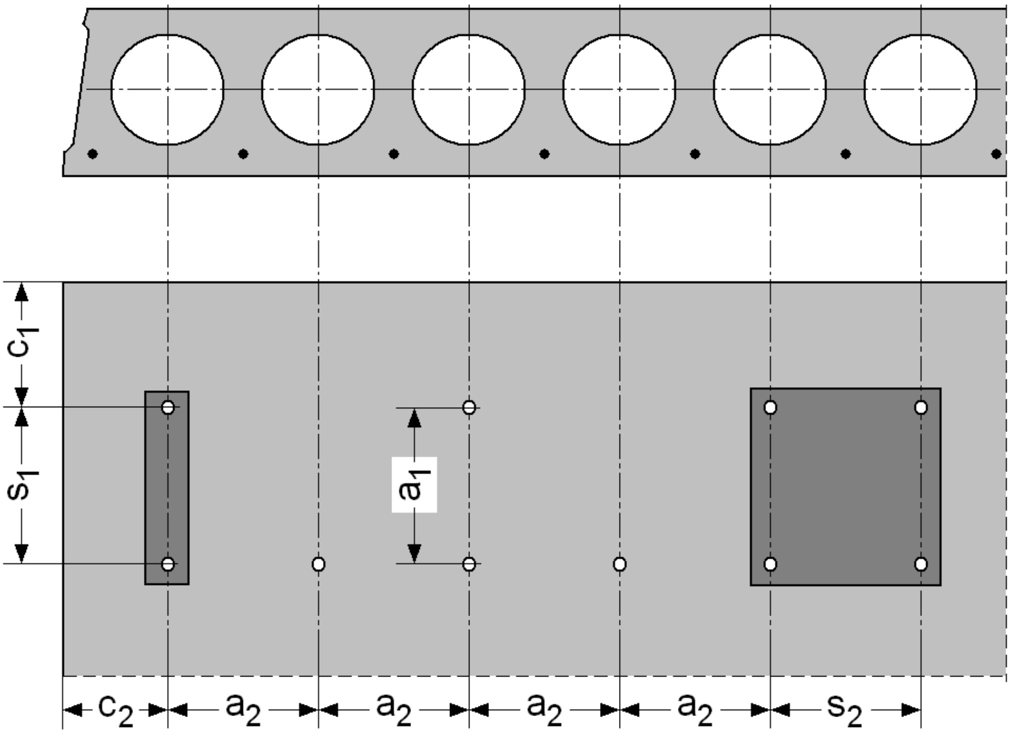
Recommended loads

Anchor size	HUS4		8					10				
Concrete strength			C30/37			C45/55		C30/37			C45/55	
Bottom flange thickness	d_b ≥	[mm]	30	35	40	35	40	30	35	40	35	40
Tension	N_{Rec}	[kN]	0.7	1.9	2.4	2.4	2.9	0.7	1.9	2.4	2.4	2.9
Shear	V_{Rec}	[kN]	0.7	3.1	3.8	3.8	4.7	0.7	3.4	4.1	4.2	5.1

With overall global 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.

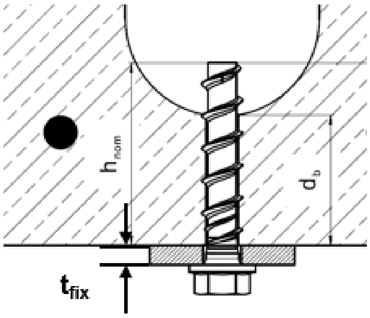


Loads recommendation applies also for installation from top position with no restriction of the admissible anchor position in case of no reinforcement in the related area



Anchor size			8	10
Type		HUS4	C, H	C, H, A
Minimum and characteristic spacing	$s_{min} = s_{cr}$	[mm]	$4 * d_b$	
Minimum and characteristic edge distance	$c_{min} = c_{cr}$	[mm]	$4 * d_b$	
Minimum group distance	a_{min}	[mm]	$4 * d_b$	

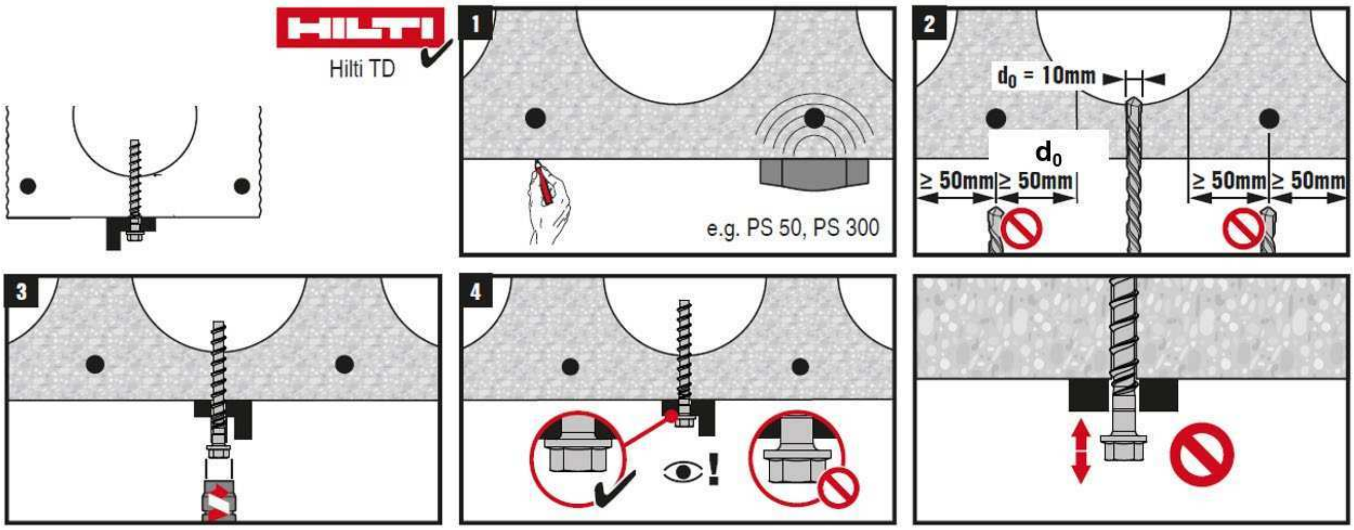
Anchor Type	Size	Length	d_b=30 [mm]		d_b=35 [mm]		d_b=40 [mm]		d_b=50 [mm]	
	[mm]	[mm]	$t_{fix,min}$ [mm]	$t_{fix,max}$ [mm]	$t_{fix,min}$ [mm]	$t_{fix,max}$ [mm]	$t_{fix,min}$ [mm]	$t_{fix,max}$ [mm]	$t_{fix,min}$ [mm]	$t_{fix,max}$ [mm]
HUS4-H	8	45	5	10	5	5	-	-	-	-
		55	15	20	15	15	-	-	-	-
		65	5	30	5	25	5	20	5	10
		75	10	40	10	35	10	30	10	20
		85	20	50	20	45	20	40	20	30
		100	35	65	35	60	35	55	35	45
		120	55	85	55	80	55	75	55	65
		150	85	115	85	110	85	105	85	95
HUS4-H	10	60	5	20	5	15	5	10	-	-
		70	15	30	15	25	15	20	-	-
		80	5	40	5	35	5	30	5	20
		90	10	50	10	45	10	40	10	30
		100	20	60	20	55	20	50	20	40
		110	30	70	30	65	30	60	30	50
		130	50	90	50	85	50	80	50	70
		150	70	110	70	105	70	100	70	90



Setting instructions

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

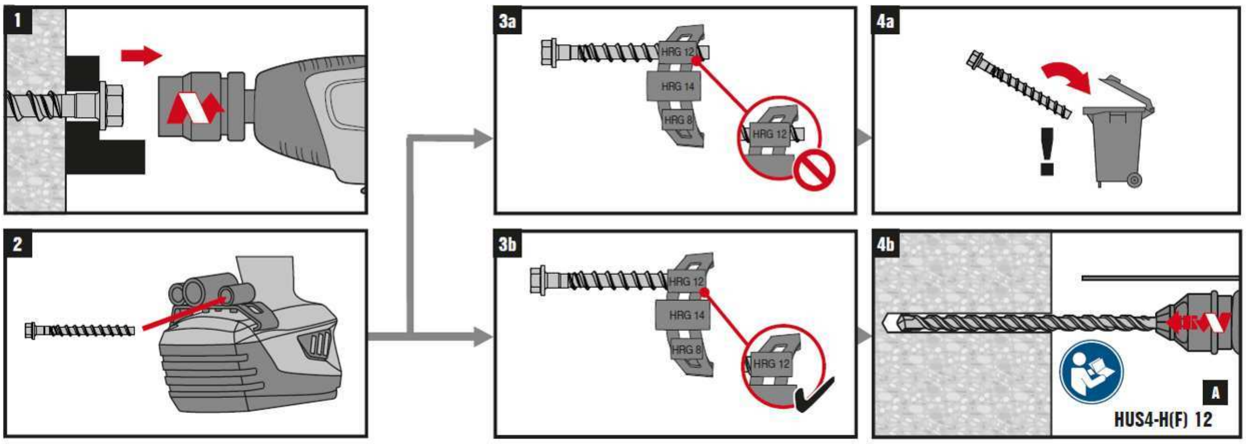
Installation in Hollow core slabs - example size 10



Basic loading data for single anchor in pre-stressed Hollow core slab (HCS) for temporary fastening

All data in this section applies to

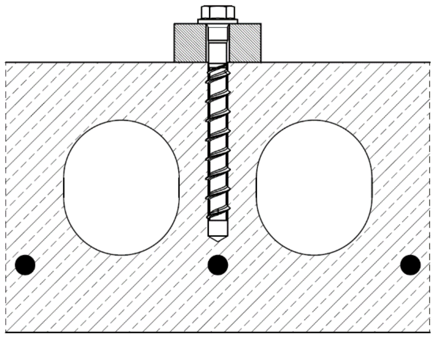
- Correct setting (see setting instruction)
- Verification of wear of the screw with HUS HRG check gauge is needed



- No edge distance and spacing influence
- Ratio core width / web thickness w/e ≤ 5,3
- Concrete C30/37 to C50/60, uncracked

Installation position for temporary fastening in HCS:

- Top position of the slab is allowed.
- Anchor to be installed within position of ± 10 mm of the thickest section of the solid part.



Anchor size			10	12	14
Nominal embed-ment depth	h_{nom}	[mm]	55 / 75 / 85	60 / 80 / 100	65 / 85 / 115
Drill hole depth	$h_1 \geq$	[mm]		h_{nom} + 10 mm	

Characteristic resistance: Concrete C30/37

Anchor size			10			12			14		
Type		HUS4	A, C, H			H			A, H,		
Nom. embedment depth	h_{nom}	[mm]	55	75	85	60	80	100	65	85	115
Tension	N_{Rk}	[kN]	14,3	22,1	23,6	16,9	24,0	30,1	18,2	26,5	37,6
Shear	V_{Rk}	[kN]	15,0	25,1	26,4	23,3	28,3	33,3	25,5	31,4	37,0

Design resistance: Concrete C30/37

Anchor size			10			12			14		
Type		HUS4	A, C, H			H			A, H,		
Nom. embedment depth	h_{nom}	[mm]	55	75	85	60	80	100	65	85	115
Tension	N_{Rd}	[kN]	9,6	14,7	15,8	11,2	16,0	20,1	12,1	17,7	25,1
Shear	V_{Rd}	[kN]	10,0	16,7	17,6	15,5	18,8	22,2	17,0	20,9	24,7

Recommended load: Concrete C30/37

Anchor size			10			12			14		
Type		HUS4	A, C, H			H			A, H,		
Nom. embedment depth	h_{nom}	[mm]	55	75	85	60	80	100	65	85	115
Tension	N_{Rec}	[kN]	4.8	7.4	7.9	5.6	8.0	10.0	6.1	8.8	12.5
Shear	V_{Rec}	[kN]	5.0	8.4	8.8	7.8	9.4	11.1	8.5	10.5	12.3

With overall global safety factor for action $\gamma = 3.0$. The partial safety factors for action depend on the type of loading and shall be taken from national regulations.

Characteristic resistance: Concrete C45/55

Anchor size			10			12			14		
Type		HUS4	A, C, H			H			A, H,		
Nom. embedment depth	h_{nom}	[mm]	55	75	85	60	80	100	65	85	115
Tension	N_{Rk}	[kN]	17,6	27,1	29,0	20,7	29,4	36,9	22,3	32,5	46,1
Shear	V_{Rk}	[kN]	18,4	25,1	26,4	23,3	28,3	33,3	25,9	31,4	37,0

Design resistance: Concrete C45/55

Anchor size			10			12			14		
Type		HUS4	A, C, H			H			A, H,		
Nom. embedment depth	h_{nom}	[mm]	55	75	85	60	80	100	65	85	115
Tension	N_{Rd}	[kN]	11,7	18,1	19,3	13,8	19,6	24,6	14,9	21,7	30,7
Shear	V_{Rd}	[kN]	12,3	16,7	17,6	15,5	18,8	22,2	17,3	20,9	24,7

Recommended load: Concrete C45/55

Anchor size			10			12			14		
Type	HUS4		A, C, H			H			A, H,		
Nom. embedment depth	h_{nom}	[mm]	55	75	85	60	80	100	65	85	115
Tension	N_{Rec}	[kN]	5.9	9.0	9.7	6.9	9.8	12.3	7.4	10.8	15.4
Shear	V_{Rec}	[kN]	6.1	8.4	8.8	7.8	9.4	11.1	8.6	10.5	12.3

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.

Anchor spacing and edge distance

Anchor size			10	12	14
Type		HUS4	A, C, H	H	A, H,
Minimum spacing	s_{min}	[mm]	40	50	60
Characteristic spacing	s_{cr}	[mm]	3 * h_{ef}		
Minimum edge distance	c_{min}	[mm]	40	50	60
Characteristic edge distance	c_{cr}	[mm]	1,5 * h_{ef}		

HUS4-HR / HUS4-CR Screw anchor

Ultimate performance screw anchor for single point fastening

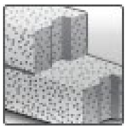
Anchor version		Benefits
	HUS4-HR (6-14)*	- High productivity - less drilling and fewer operations than with conventional anchors - ETA approval for cracked and non-cracked concrete
	HUS4-CR (6-10)	- ETA approval for Seismic C1 - Smaller edge and spacing distance - Three embedment depths for maximum design flexibility and flexible design for concrete cone capacity - No cleaning required size 6 to 14 - Through fastening with H and C head

Base material

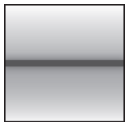

Concrete (non-cracked)

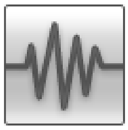

Concrete (cracked)


Solid brick


Autoclaved aerated concrete

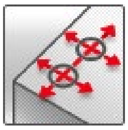
Load conditions


Static / quasi-static


Seismic ETA-C1


Fire resistance

Installation conditions


Small edge distance and spacing

Other information

European Technical Assessment

CE conformity

PROFIS ENGINEERING


Corrosion resistance

Approvals / certificates

Description	Authority	No. / date of issue
European Technical Assessment	DIBt	ETA-20/0867 / 14-07-2022
Fire test report	DIBt	ETA-20/0867 / 14-07-2022

*HUS4-HR not available in size 12

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

- 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/mm2 (including overall global safety factor=3)
- Effective anchorage depth of the anchor should not exceed mm

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

Anchorage depth

Anchor size			6	8			10			14		
Type	HUS4		HR, CR	HR, CR			HR, CR			HR		
Nominal embedment depth	h_{nom}	[mm]	55	50[a)]	60	80	60[a)]	70	90	-	70	110

a) Hilti Technical Data for empedment depth

Characteristic resistance

Anchor size			6	8			10			14		
Type	HUS4		HR,CR	HR, CR			HR, CR			HR		
Non-cracked concrete												
Tension	N_{Rk}	[kN]	9,0	9,0[a)]	12,0	16,0	12,0[a)]	16,0	25,0	-	18,4	39,2
Shear	V_{Rk}	[kN]	17,0	23,0[a)]	26,0	26,0	30,7[a)]	33,0	33,0	-	36,9	77,0
Cracked concrete												
Tension	N_{Rk}	[kN]	5,0	5,0[a)]	8,5	15,0	7,5[a)]	12,0	16,0	-	12,0	25,0
Shear	V_{Rk}	[kN]	15,6	16,1[a)]	22,2	26,0	21,5[a)]	27,3	33,0	-	25,8	54,9

a) Hilti Technical Data

Design resistance

Anchor size			6	8			10			14		
Type	HUS4		HR,CR	HR, CR			HR, CR			HR		
Non-cracked concrete												
Tension	N_{Rd}	[kN]	4,3	5,0[a)]	8,0	8,9	6,7[a)]	8,9	16,7	-	10,2	21,8
Shear	V_{Rd}	[kN]	11,3	15,4[a)]	17,3	17,3	20,5[a)]	22,0	22,0	-	24,6	51,3
Cracked concrete												
Tension	N_{Rd}	[kN]	2,4	2,8[a)]	5,7	8,3	4,2[a)]	6,7	10,7	-	6,7	13,9
Shear	V_{Rd}	[kN]	10,4	10,8[a)]	14,8	17,3	14,3[a)]	18,2	22,0	-	17,2	36,6

a) Hilti Technical Data

Recommended loads[b)]

Anchor size			6	8			10			14		
Type	HUS4		HR,CR	HR, CR			HR, CR			HR		
Non-cracked concrete												
Tension	N_{Rec}	[kN]	3.0	3.0[a)]	4.0	5.3	4.0[a)]	5.3	8.3	-	6.1	13.1
Shear	V_{Rec}	[kN]	5.7	7.7[a)]	8.7	8.7	10.2[a)]	11.0	11.0	-	12.3	25.7
Cracked concrete												
Tension	N_{Rec}	[kN]	1.7	1.7[a)]	2.8	5.0	2.5[a)]	4.0	5.3	-	4.0	8.3
Shear	V_{Rec}	[kN]	5.2	5.4[a)]	7.4	8.7	7.2[a)]	9.1	11.0	-	8.6	18.3

a) Hilti Technical Data

b) With overall global 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

Mechanical properties

Anchor size			6	8	10	14
Type		HUS4-	HR, CR	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
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	19	36	66	193

Material quality

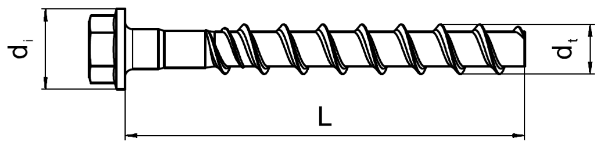
Part	Material
Hexagonal head concrete screw	Stainless steel (grade A4)
Countersunk head concrete screw	Stainless steel (grade A4)

Head configuration

Type	Part	
HUS4-HR	Hexagonal head	
HUS4-CR	Countersunk head	

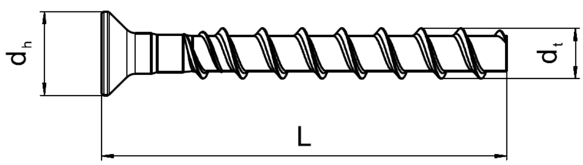
Fastener dimensions

Anchor size			6	8	10	14
Type		HUS4-	HR	HR	HR	HR
Outer diameter of the screw thread	d_t	[mm]	7,55	10,05	12,25	16,56
Diameter of integrated	d_i	[mm]	17,00	17,50	20,50	30,00
Length of the screw (min/max)	L	[mm]	60/70	65/105	75/130	80/135



HUS4: Hilti Universal Screw 4th generation
HR: Hexagonal head, stainless steel
10: Nominal screw diameter
100: total length of the screw

Anchor size			6	8	10
Type		HUS4-	CR	CR	CR
Outer diameter of the screw thread	d_t	[mm]	7,55	10,05	12,25
Countersunk head diameter	d_h	[mm]	17,50	18,00	21,00
Length of the screw (min/max)	L	[mm]	60/70	65/95	75/105



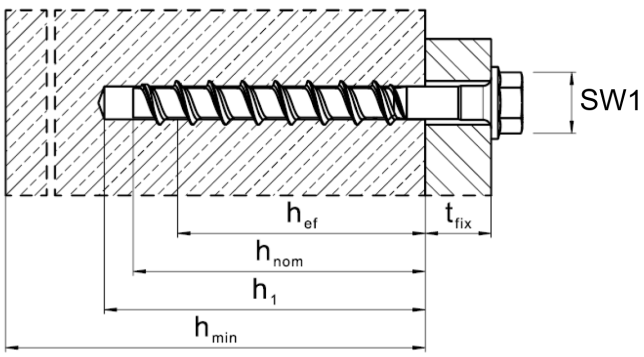
HUS4: Hilti Universal Screw 4th generation
HR: Hexagonal head, stainless steel
CR: Countersunk head, stainless steel
10: Nominal screw diameter
100: total length of the screw

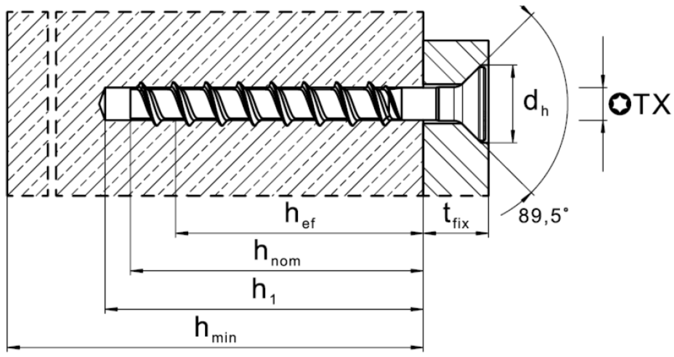
Setting information

Setting details

Anchor size			6	8			10			14	
Type		HUS-	HR, CR	HR, CR a)			HR, CR a)			HR	
Nominal embedment depth	h_{nom}	[mm]	55	50	60	80	60	70	90	70	110
Effective anchorage depth	h_{ef}	[mm]	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 drill hole (cleaning)	h_1	[mm]	65	60	70	90	70	80	100	80	120
Depth drill hole (no cleaning)	h_1	[mm]	77	76	86	106	90	100	120	108	148
Wrench size	SW	[mm]	13	13			15			21	
Diameter of countersunk	d_h	[mm]	11	18			21			-	
Installation torque – Concrete	T_{inst}	[Nm]	- a)	35	- a)	- a)	45 c)			65	
Installation torque – Solid m, Mz 12	T_{inst}	[Nm]	10	- b)	16	16	- b)	20	20	- b)	- b)
Installation torque – Solid m, KS 12	T_{inst}	[Nm]	10	- b)	16	16	- b)	20	20	- b)	- b)
Installation torque – Aerated concrete	T_{inst}	[Nm]	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 HUS4-HR only





Installation equipment

Anchor size	6	8	10	14
Type HUS4-	HR, CR	HR, CR	HR, CR	HR
Rotary hammer	TE 2 – TE 30			
Drill bit	TE-CX4 (SDS PLUS) 6/17	TE-CX4 (SDS PLUS) 8/17	TE-CX4 (SDS PLUS) 10/22	TE-CX4 (SDS PLUS) 14/22
Socket wrench insert	SI-S 13 ½'' (S)	SI-S 13 ½'' (S) S-NSD 13 ½ (L)	SI-S 13 ½'' (S)	SI-S 13 ½'' (S)
Torx (CR type only)	-	S-SY TX 45	S-SY TX 50	-
Impact screw driver 1)	SIW 6AT-A22 ½'' SIW 4AT-A22 ½'' h_{nom1} – gr.1 h_{nom2} – gr.2 h_{nom3} – gr.3	SIW 6AT-A22 ½'' SIW 4AT-A22 ½'' SIW22T-A ½'', ¾'' (L=55&65mm – long socket) SIW6-22 gr.2 ½'' (L=55&65mm – long socket)	SIW 6AT-A22 ½'' SIW 4AT-A22 ½'' SIW22T-A ½'', ¾'' SIW6-22 gr.2 ½''	SIW22T-A ½'' SIW6-22 gr.2 ½'' SIW8-22 gr.1 ½'' SIW9-22 ¾''

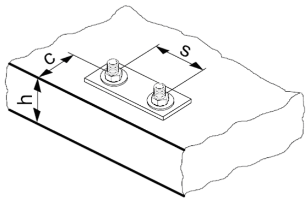
1) Installation with other impact screw driver of equivalent power is possible.

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

Setting parameters

Anchor size			6	8			10			14	
Type		**HUS-**	**HR, CR**	**HR, CR[a)]**			**HR, CR[a)]**			**HR**	
Nominal anchorage depth	h_{nom}	[mm]	55	50	60	80	60	70	90	70	110
Minimum base material thickness	h_{min}	[mm]	100	100	100	120	120	120	140	140	160
Minimum spacing	s_{min}	[mm]	35	45	45	50	50	50	50	50	60
Minimum edge distance	c_{min}	[mm]	35	45	45	50	50	50	50	50	60
Critical spacing for splitting failure	$s_{cr,sp}$	[mm]	135	114	114	192	166	194	256	187	310
Critical edge distance for splitting failure	$c_{cr,sp}$	[mm]	68	57	71	96	83	97	128	94	155
Critical spacing for concrete cone failure	$s_{cr,N}$	[mm]	135	114	114	192	166	194	256	187	310
Critical edge distance for concrete cone failure	$c_{cr,N}$	[mm]	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.

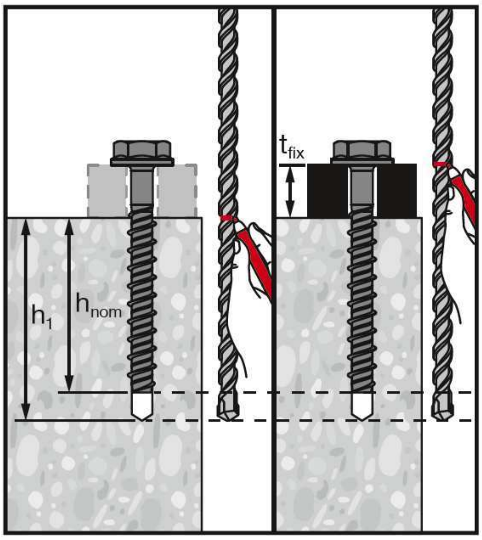


Setting instructions

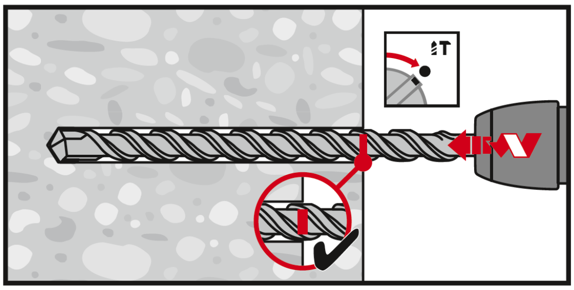
***For detailed information on installation see instruction for use given with the package of the product**

Setting instruction

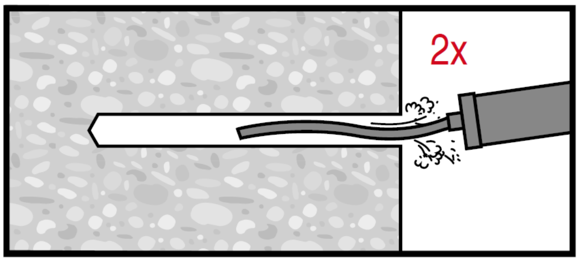
Mark drill-bit length:



1. Hammer drilling:

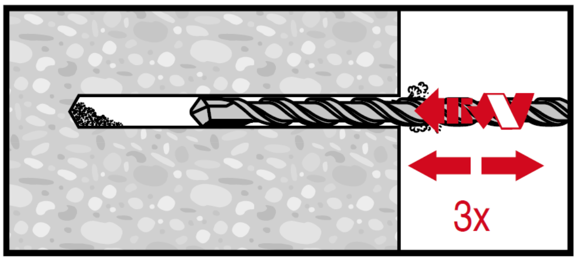


2a. Cleaning:



Cleaning needed in downward and horizontal installation direction with drill hole depth h_{nom} +10mm

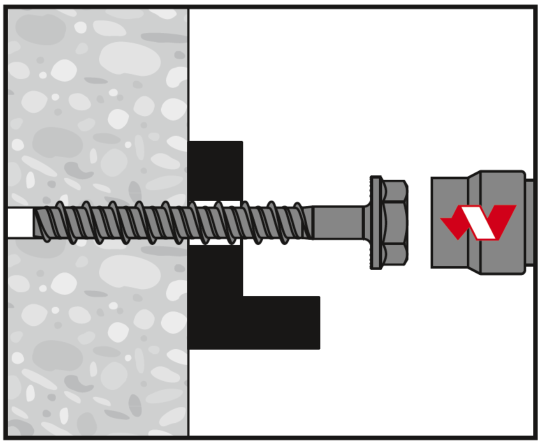
2b. Non-cleaning – 3x ventilation



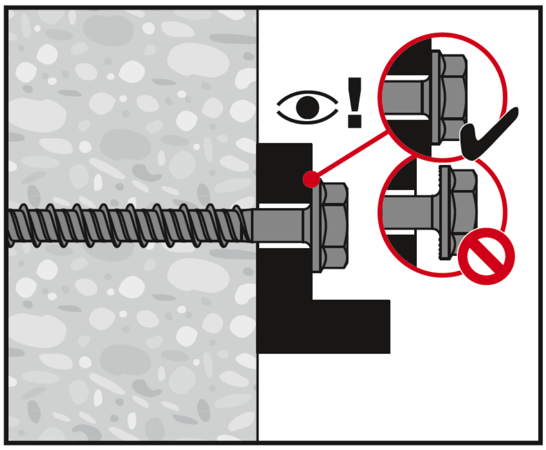
No cleaning is allowed in upward installation direction.
No cleaning is allowed in downward and horizontal installation direction when 3x ventilation[1] after drilling is executed.
Drill hole depth hnom + 10 mm+ 2 * d0

[1] moving the drill bit in and out of the drill hole 3 times after the recommended drilling depth h1 is achieved. This procedure shall be done with both revolution and hammer functions activated in the drilling machine. For more details read the relevant installation instruction (MPII).

3. Setting by impact screw driver



4. Setting check



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 embedment depth

Anchor size			6	8	10
Type		HUS4-	HR	HR	HR, CR
Nominal embedment depth	h_{nom}	[mm]	55	60	70

Recommended loads for HUS4-HR / HUS4-CR

Anchor size					6	8	10
	Solid clay brick Mz 12/2,0 DIN 105 / EN 771-1 f_b a) ≥ 12 N/mm²	Tension	N_{Rec}	[kN]	0,9	1,0	1,1
		Shear	V_{Rec}	[kN]	1,4	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	0,6	1,0
		Shear	V_{Rec}	[kN]	0,9	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	0,2	0,4
		Shear	V_{Rec}	[kN]	0,4	0,4	0,9

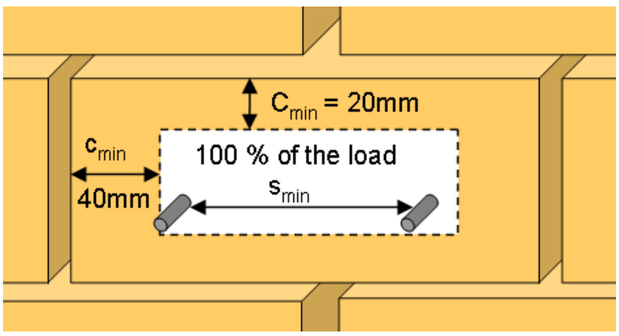
Permissible anchor location in brick and block walls

Edge distance and spacing influence

- The technical data for HUS4-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 HUS4-HR anchor was installed and tested in center of solid bricks as shown. The HUS4-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



HUS3 Screw anchor

Ultimate performance screw anchor for single point fastening

Anchor version


HUS3-H (6)


HUS3-C (6)


HUS3-A (6)


HUS3-I (6)


HUS3-I Flex (6)

Benefits

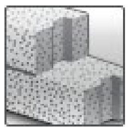
- High productivity - less drilling and fewer operations than with conventional anchors
- ETA approval for cracked and non-cracked concrete
- ETA approval for Seismic C1 and C2
- ETA approval for adjustability (unscrew-rescrew)
- High loads
- Small edge and spacing distance
- abZ (DIBt) approval for reusability in fresh concrete ($f_{ck,\ cube}$ = 10/15/20 Nmm^2) for temporary applications
- Three embedment depths for maximum design flexibility
- No cleaning required
- HUS3-HF with multilayer coatings for additional corrosion protection
- Forged-on washer and hexagon head with no protruding thread
- Through fastening

Base material

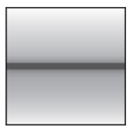

Concrete (non-cracked)

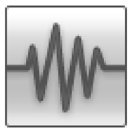

Concrete (cracked)


Solid brick


Autoclaved aerated concrete

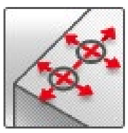
Load conditions


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

DIBt Approval Reusability

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European Technical Assessment	DIBt, Berlin	ETA-13/1038 / 28-07-2020
Fire test report	DIBt, Berlin	ETA-13/1038 / 28-07-2020

a) All data given in this section according ETA-13/1038 issue 28-07-2020.

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

- 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

Static and quasi-static loading data (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, $f_{ck,}$ = 20 N/mm²
- Hilti technical data calculated acc. to EN 1992-4

Anchor size			**6**	
Type	**HUS3-**		**H, C, A, I, I-Flex**	
Nominal embedmenth depth	h_{nom}	[mm]	h_{nom1}	h_{nom2}
			40	55

Characteristic resistance

Anchor size			6	
Type		HUS3-	H, C, A, I, I-Flex	
Non-cracked concrete				
Tension	N_{Rk}	[kN]	7,0	9,0
Shear	V_{Rk}	[kN]	8,1	12,5
Cracked concrete				
Tension	N_{Rk}	[kN]	2,5	6,0
Shear	V_{Rk}	[kN]	5,7	12,5

Design resistance

Anchor size			6	
Type		HUS3-	H, C, A, I, I-Flex	
Non-cracked concrete				
Tension	N_{Rd}	[kN]	3,9	5,0
Shear	V_{Rd}	[kN]	5,4	8,3
Cracked concrete				
Tension	N_{Rd}	[kN]	1,4	3,3
Shear	V_{Rd}	[kN]	3,8	8,3

Recommended[a)] loads

Anchor size			6	
Type		HUS3-	H, C, A, I, I-Flex	
Non-cracked concrete				
Tension	N_{Rec}	[kN]	2,3	3,0
Shear	V_{Rec}	[kN]	2,7	4,2
Cracked concrete				
Tension	N_{Rec}	[kN]	0,8	2,0
Shear	V_{Rec}	[kN]	1,9	4,2

a) With overall global 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

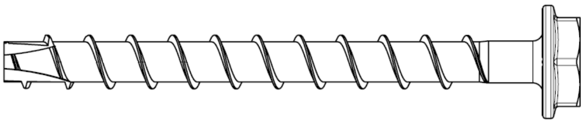
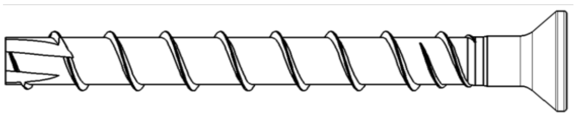
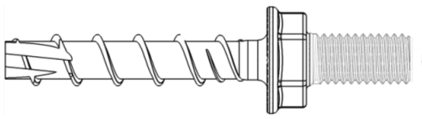
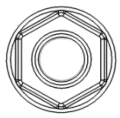
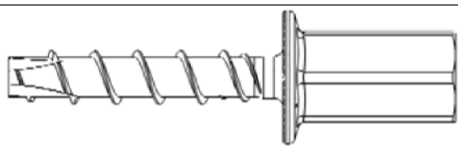
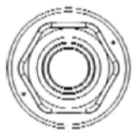
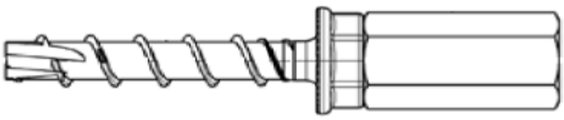
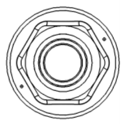
Anchor size			6
Type	HUS3-		H,C,A,I, I-flex,P,PS,PL
Nominal tensile strength	f_{uk}	[N/mm²]	930
Yield strength	f_{yk}	[N/mm²]	745
Stressed cross-section	A_s	[mm²]	26,9
Moment of resistance	W	[mm³]	19,6
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	21

Material quality

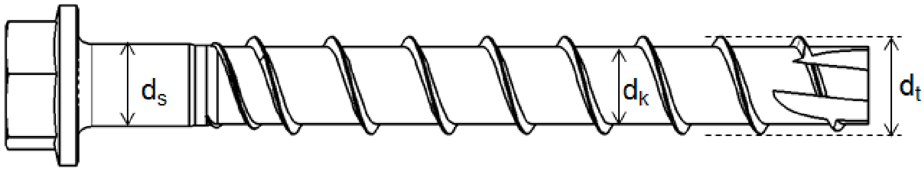
Type	Material
HUS3 - H,A,C, I,I-Flex	Carbon steel, galvanized

a) Multi-layer coating provides a higher corrosion resistance compared to regular hot dip galvanized (HDG) systems with a 40µm coating thickness.

Head configuration

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

Anchor size			6
Type	HUS3-		H,C,A,I, I-flex,P,PS,PL
Threaded outer diameter	d_t	[mm]	7,85
Core diameter	d_k	[mm]	5,85
Shaft diameter	d_s	[mm]	6,15
Diameter of integrated washer	d_i	[mm]	16,50
Stressed section	A_s	[mm^2]	26,9



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[1)]

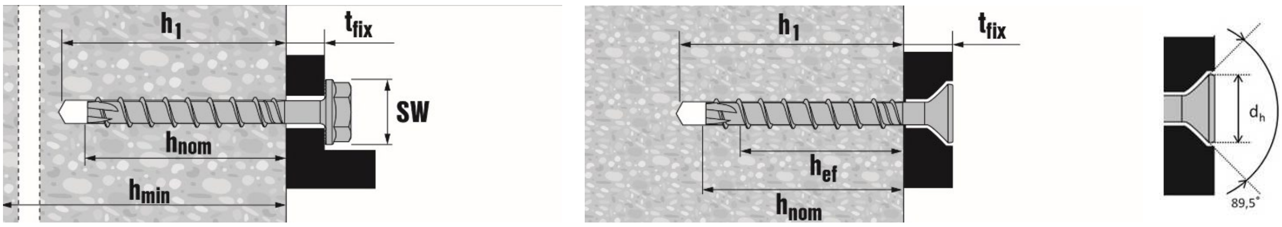
Anchor size		6							
Nominal embedmenth depth [mm]		h_{nom1}				h_{nom2}			
		40				55			
Type		H	C	A	I / I-Flex	H	C	A	I / I-Flex
Thickness of fixture		t_{fix}	t_{fix}	t_{fix}	t_{fix}	t_{fix}	t_{fix}	t_{fix}	t_{fix}
Length of screw [mm]	40	-	-	0	0	-	-	-	-
	45	5	5	5	5	-	-	-	-
	55	-	-	15	15	-	-	0	0
	60	20	20	-	-	5	5	-	-
	70	-	30	-	-	-	15	-	-
	80	40	-	-	-	25	-	-	-
	100	60	-	-	-	45	-	-	-
	120	80	-	-	-	65	-	-	-
	135	-	-	95	-	-	-	80	-
	155	-	-	115	-	-	-	100	-
	175	-	-	135	-	-	-	120	-
	195	-	-	155	-	-	-	140	-

1) Non-standard lengths, in the range 55 mm ≤ L ≤ 195 mm, are also in the scope of ETA-13/1038.

Setting information

Setting details

Anchor size			6			
Type		**HUS3-**	**H**	**C**	**A**	**I, I-Flex**
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	
Countersunk head diameter	d_h	[mm]	-	11,5	-	
Torx size	TX	-	-	30	-	-
Depth of drill fole in floor/wall position	$h_1 \geq$	[mm]	h_{nom} + 10 mm			
Depth of drill hole ceiling	$h_1 \geq$	[mm]	h_{nom} + 3 mm			
Maximum Installation Torque	$T_{inst,\ max}$	[Nm]	25			

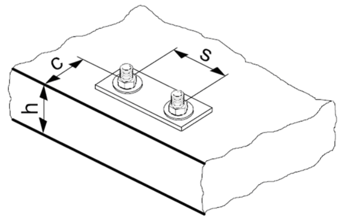


Anchor size	6
Type **HUS3-**	**H,C,A,I, I-flex,P,PS,PL**
Rotary hammer	TE 2 -TE 7
Drill bit for concrete, solid clay brick and solid sand-lime brick	CX 6
Drill bit for aerated concrete	CX 5
Socket wrench insert	S-NSD 13 ½ L
Torx	TX30
Tube for temporary application[1)]	-
Setting tool for cracked and un-cracked concrete	SIW 14 A SIW 22 A
Setting tool for solid brick and aerated concrete	-
Setting tool for hollow core slab	SIW 14 A SIW 22 A

Setting parameters

Anchor size			6	
Type		**HUS3-**	**H,C,A,I, I-flex**	
Nominal embedment depth	h_{nom}	[mm]	40	55
Minimum base material thickness	h_{min}	[mm]	80	100
Minimum spacing	s_{min}	[mm]	35	
			35	
Minimum edge distance	c_{min}	[mm]	35	
Critical spacing for splitting failure	$s_{cr,sp}$	[mm]	120	126
Critical edge distance for splitting failure	$c_{cr,sp}$	[mm]	60	63
Critical spacing for concrete cone failure	$s_{cr,N}$	[mm]	3 h_{ef}	
Critical edge distance for concrete cone failure	$c_{cr,N}$	[mm]	1,5 h_{ef}	

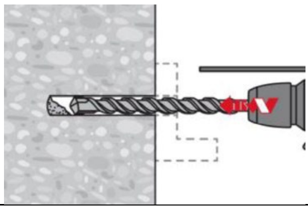
For spacing (edge distance) smaller than critical spacing (critical edge distance) the design loads have to be reduced (see system design resistance).
Critical spacing and critical edge distance for splitting failure apply only for non-cracked concrete. For cracked concrete only the critical spacing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



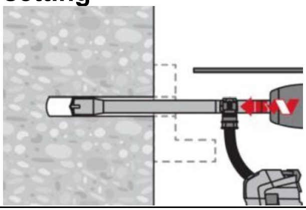
Setting instructions
***For detailed information on installation see instruction for use given with the package of the product**

Setting instruction with adjustment

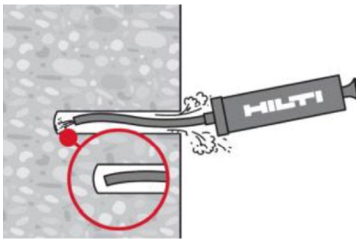
1a. Hammer drilling (HD): Size 6 to 14



1b. Hammer drilling with Hilti hollow drill bit (HDB): Size 14 only. After drilling, proceed to fastener setting



2. Cleaning

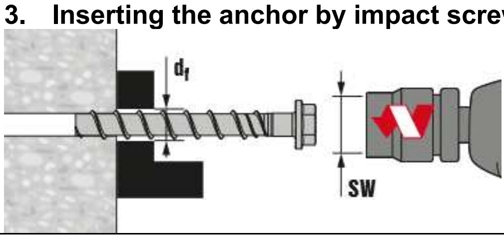


Clean the drill hole. For sizes 6 and 8, hole cleaning is not required when 3x ventilation after drilling is executed and one of the following conditions is fulfilled:
- drilling is in the vertical upwards orientation; or
- drilling is in vertical downwards direction and the drilling depth is increased by additional 3*d_0.

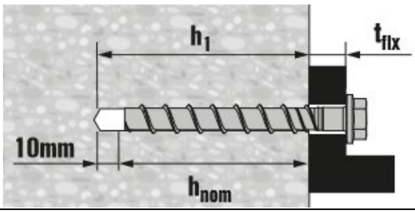
For sizes 10 and 14, hole cleaning is not required when 3x ventilation after drilling is executed and one of the following conditions is fulfilled:
- drilling is in the vertical upwards orientation; or
- drilling is in vertical downwards or horizontal direction and the drilling depth is increased by additional 3*d_0.

1) moving the drill bit in and out of the drill hole 3 times after the recommended drilling depth h_1 is achieved. This procedure shall be done with both revolution and hammer functions activated in the drilling machine. For more details read the relevant MPII.
2) it should be verified that the thickness of the concrete member in which the fastener is installed observes the minimum distance between the drilling end and the opposite end of the member, fulfilling the relation $h > h_1 + \Delta h$ with $\Delta h = \max(2*d_0; 30\text{ mm})$.

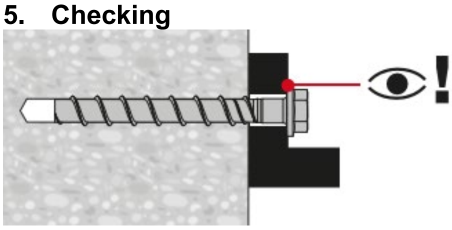
3. Inserting the anchor by impact screw driver



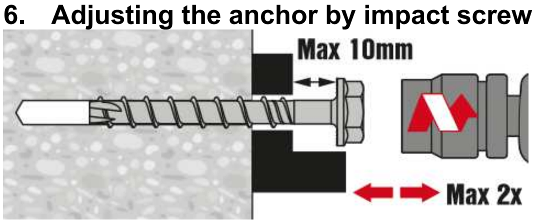
4. Anchor installed



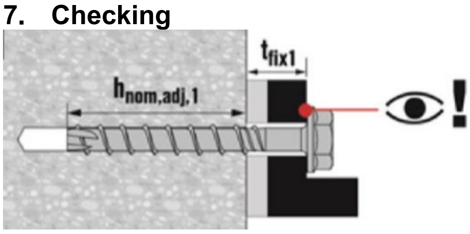
5. Checking



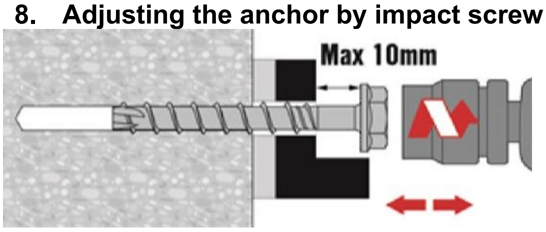
6. Adjusting the anchor by impact screw driver



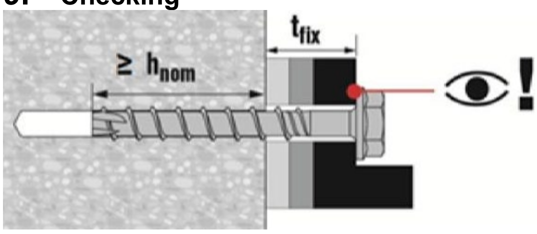
7. Checking



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}.
For size 14 only, hole cleaning is not required under specific conditions. Check instructions for use for more information.

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

Anchor size			**6**
Nominal embedmenth depth	h_{nom}	[mm]	55

Recommended loads for HUS3

Anchor size			**6** **A, H, I, 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
		≥ 16	0,9
		≥ 20	0,9
	Solid sand-lime brick Mz 12/2,0 DIN 106/EN 771-2	≥ 8	0,8
		≥ 10	0,9
		≥ 12	1,0
		≥ 16	1,1
		≥ 20	1,2
	Aerated concrete PPW 6-0,4 DIN 4165/EN 771-4	≥ 6	0,4

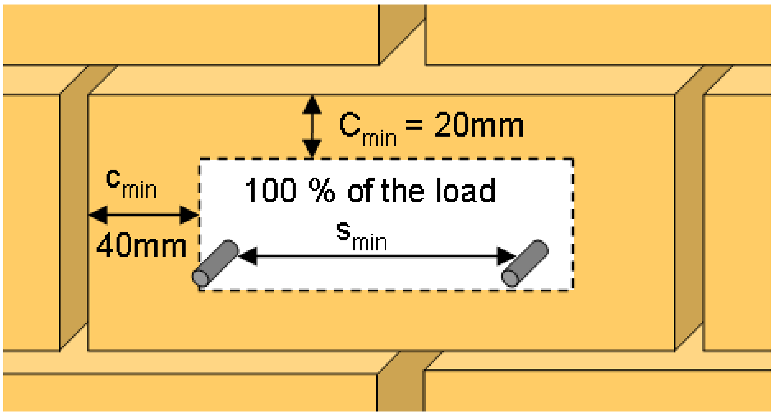
Permissible anchor location in brick and block walls

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)

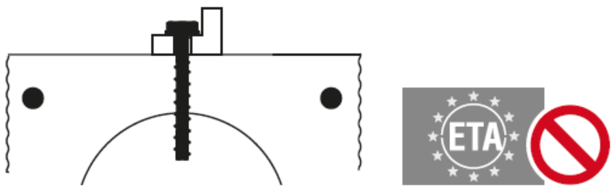


Setting instructions

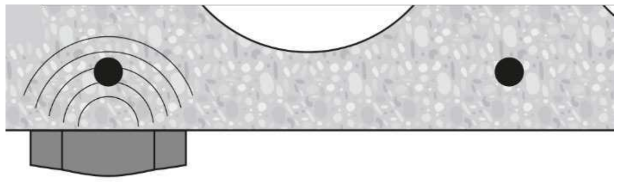
*For detailed information on installation see instruction for use given with the package of the product

Installation in hollow core slabs

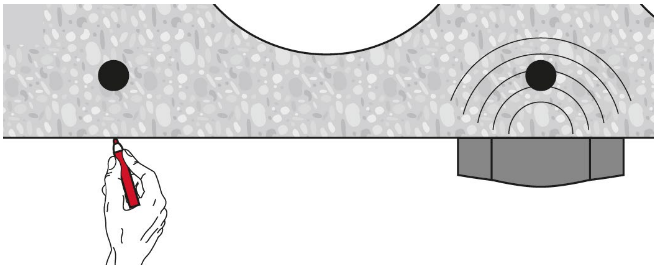
1. Checking the anchor with tube Hilti HSB



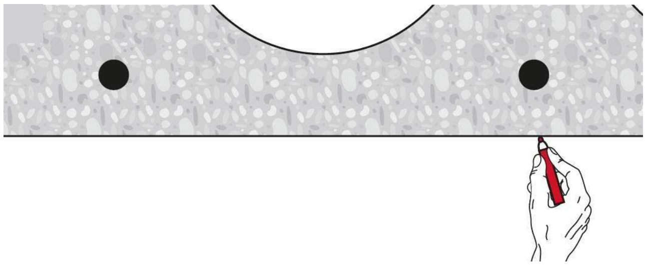
2. Positioning pre-stressed steel



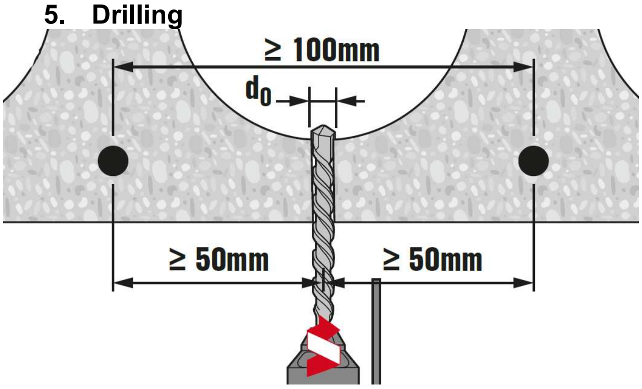
3. Marking pre-stressed steel position



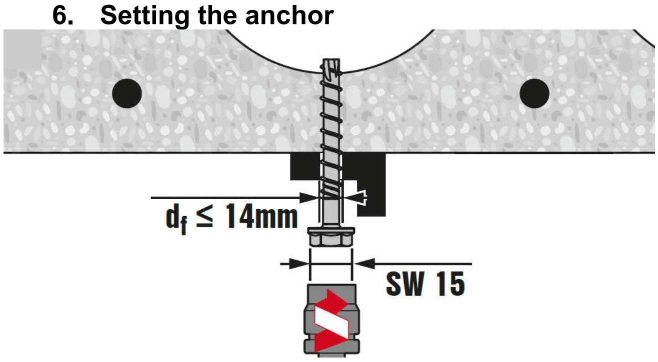
4. Marking pre-stressed steel position



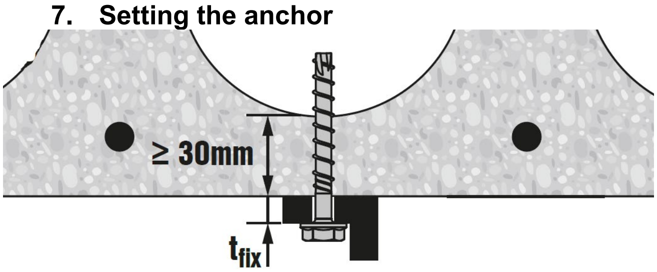
5. Drilling



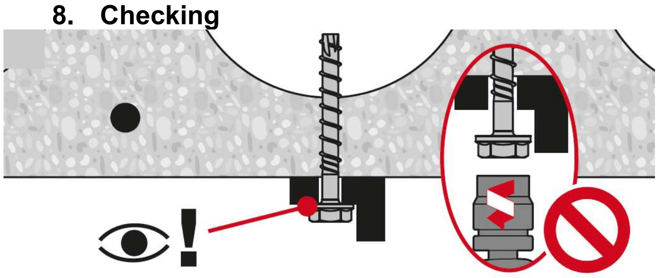
6. Setting the anchor



7. Setting the anchor



8. Checking



HKD Flush anchor

Everyday standard manual set flush anchor for single anchor applications

Anchor version

HKD
(M8-M20)

HKD-SR
(M6-M20)

HKD-ER
(M6-M20)

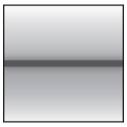
Benefits

- Simple and well proven
- Approved, tested and confirmed by everyday jobsite experience
- Reliable setting thanks to 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

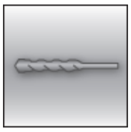
Concrete
(non-cracked)

Load conditions



Static/
quasi-static

Installation conditions



Hammer drilled holes

Other information

European Technical Assessment

CE conformity

PROFIS ENGINEERING

A4
316
Corrosion resistance

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European Technical Assessment a)	CSTB, Marne-la-Vallèe	ETA-02/0032 / 2020-11-04
Hilti technical data	Hilti	

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

- 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

Static resistance

All data in this section 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
- Screw or rod with steel grade 5.8 (carboon steel) and / or A4-70 (stainless steel)

Effective anchorage depth for static

Anchor size			M6	M8	M10	M12	M16	M8	M8	M10	M10	M12	M16	M20
Effective anchorage depth	h_{ef}	[mm]	25	25	25	25	30	30	40	30	40	50	65	80

Characteristic resistance

Anchor size				Hilti technical data				ETA-02/0032, issued 2020-11-04							
				M6x25	M8x25	M10x25	M12x25	M6x30	M8x30	M8x40	M10x30	M10x40	M12x50	M16x65	M20x80
Tension	HKD	N_{Rk}	[kN]	6,1	6,1	6,1	6,1	-	8,1	9,0	8,1	12,4	17,4	25,8	35,2
	HKD-SR, HKD-ER			6,1	-	-	-	8,1	8,1	-	-	12,4	17,4	25,8	35,2
Shear	HKD	V_{Rk}	[kN]	5,0	6,1	6,1	6,1	-	8,6	9,2	10,0	11,0	18,3	33,8	49,5
	HKD-SR, HKD-ER			6,2	-	-	-	6,4	8,4	-	-	10,5	18,7	32,1	51,0

Design resistance

Anchor size				Hilti technical data				ETA-02/0032, issued 2020-11-04							
				M6x25	M8x25	M10x25	M12x25	M6x30	M8x30	M8x40	M10x30	M10x40	M12x50	M16x65	M20x80
Tension	HKD	N_{Rd}	[kN]	4,1	4,1	4,1	4,1	-	5,4	6,0	5,4	8,3	11,6	17,2	23,5
	HKD-SR, HKD-ER			4,1	-	-	-	5,4	5,4	-	-	8,3	11,6	17,2	23,5
Shear	HKD	V_{Rd}	[kN]	4,0	4,1	4,1	4,1	-	6,9	7,3	8,0	8,8	14,6	27,0	39,6
	HKD-SR, HKD-ER			4,1	-	-	-	4,2	5,5	-	-	6,9	12,3	21,1	33,6

Recommended loads [a)]

Anchor size				Hilti technical data				ETA-02/0032, issued 2020-11-04							
				M6x25	M8x25	M10x25	M12x25	M6x30	M8x30	M8x40	M10x30	M10x40	M12x50	M16x65	M20x80
Tension	HKD	N_{Rec}	[kN]	2.0	2.0	2.0	2.0	-	2.7	3.0	2.7	4.1	5.8	8.6	11.7
	HKD-SR, HKD-ER			2.0	-	-	-	2.7	2.7	-	-	4.1	5.8	8.6	11.7
Shear	HKD	V_{Rec}	[kN]	1.7	2.0	2.0	2.0	-	2.9	3.1	3.3	3.7	6.1	11.3	16.5
	HKD-SR, HKD-ER			2.1	-	-	-	2.1	2.8	-	-	3.5	6.2	10.7	17.0

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

Mechanical properties

Anchor size				M6	M8	M10	M12	M16	M20
Nominal tensile strength	HKD	f_{uk}	[N/mm²]	570	570	570	570	640	590
	HKD-SR, HKD-ER			540	540	540	540	-	540
Yield strength	HKD	f_{yk}	[N/mm²]	460	460	460	480	510	470
	HKD-SR, HKD-ER			355	355	355	355	-	355
Stressed cross-section	HKD	A_s	[mm²]	20,7	26,7	32,7	60,1	105	167
	HKD-SR, HKD-ER								
Moment of resistance	HKD	W	[mm³]	32,3	54,6	82,9	184	431	850
	HKD-SR, HKD-ER								
Char. bending resistance for rod or bolt	With 5.8 Gr. Steel	$M^0_{Rk,s}$	[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

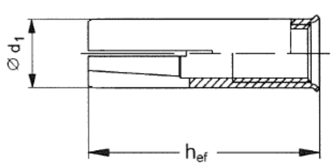
Part		Material
Anchor body	HKD	Cold formed steel / galvanised to min. 5 µm
	HKD-SR, HKD-ER	Stainless steel, 1.4401, 1.4404, 1.4571
Expansion plug	HKD	Cold formed steel
	HKD-SR, HKD-ER	Stainless steel, 1.4401, 1.4404, 1.4571

Anchor dimensions of HKD, HKD-SR, HKD-ER

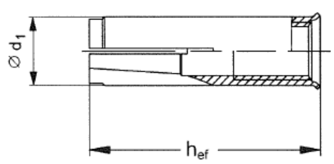
			Hilti technical data				ETA-02/0032, issued 2015-01-07							
Anchor size			M6x25	M8x25	M10x25	M12x25	M6x30	M8x30	M8x40	M10x30	M10x40	M12x50	M16x65	M20x80
Eff. anchorage depth	h_{ef}	[mm]	25	25	25	25	30	30	40	30	40	50	65	80
Anchor diameter	d_1	[mm]	7,9	9,95	11,9	14,9	8	9,95	9,95	11,8	11,95	14,9	19,75	24,75
Plug diameter	d_2	[mm]	5,1	6,35	8,1	9,7	5	6,5	6,35	8,2	8,2	10,3	13,8	16,4
Plug length	l_1	[mm]	10	7	7	7,2	15	12	16	12	16	20	29	30

Anchor body

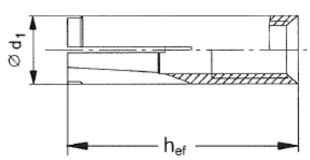
HKD



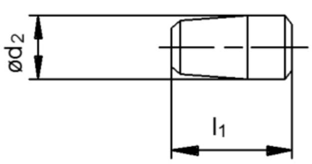
HKD-S and HKD-SR

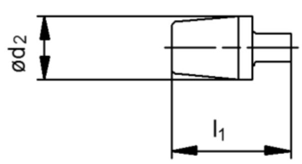


HKD-E and HKD ER



Expansion plugs



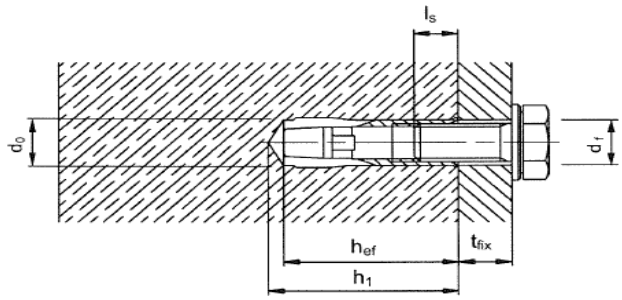


Setting information

Setting details

Anchor size			Hilti technical data				ETA-02/0032, issued 2015-01-07							
			M6x25	M8x25	M10x25	M12x25	M6x30	M8x30	M8x40	M10x30 a)	M10x40	M12x50	M16x65	M20x80
Effective embedment depth	h_{ef}	[mm]	25	25	25	25	30	30	40	30	40	50	65	80
Nominal diameter of drill bit	d_o	[mm]	8	10	12	15	8	10	10	12	12	15	20	25
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	8,45	10,5	12,5	15,5	8,45	10,5	10,5	12,5	12,5	15,5	20,5	25,5
Depth of drill hole	$h_1 \geq$	[mm]	27	27	27	27	32	33	43	33	43	54	70	85
Screwing depth	$l_{s,min}$	[mm]	6	8	10	12	6	8	8	10	10	12	16	20
Thread engagement depth	$l_{s,max}$	[mm]	12	11,5	12	12	12,5	14,5	17,5	12,7	18	23,5	30,5	42
Diameter of clearance hole in the fixture	$d_f \leq$	[mm]	7	9	12	14	7	9	9	12	12	14	18	22
Max. torque moment	T_{inst}	[Nm]	4	8	15	35	4	8	8	15	15	35	60	100

a) With anchor size M10x30 only threaded rod is to be used.



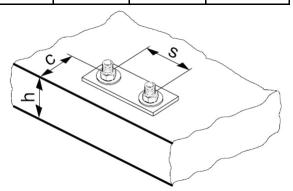
Installation equipment

Anchor size		M6	M8	M10	M10	M12	M16
Rotary hammer for setting		TE 2 – TE 6				TE 6– TE 30	
Machine setting tool	HSD-M	6x25/30	8x25/30	10x25/30	10x40	12x50	16x65
Hand setting tool	HSD-G HSD-M	6x25/30	8x25/30	10x25/30	10x40	12x50	16x65
Other tools		hammer, torque wrench, blow out pump					

Setting paramaters

Anchor size			Hilti technical data				ETA-02/0032, issued 2015-01-07							
			M6x25	M8x25	M10x25	M12x25	M6x30	M8x30	M8x40	M10x30	M10x40	M12x50	M16x65	M20x80
Minimum base material thickness	h_{min}	[mm]	100	100	100	100	100	100	100	100	100	100	130	160
Minimum spacing and minimum edge distance HKD-SR / HKD-ER	s_{min}	[mm]	60	60	60	60	60	60	80	60	80	125	130	160
	c_{min}	[mm]	88	88	88	88	105	105	140	105	140	175	230	280
Minimum spacing HKD	s_{min}	[mm]	80	80	80	80	60	60	80	60	80	125	130	160
	$c \geq$	[mm]	140	140	140	140	105	105	140	105	140	175	230	280
Minimum edge distance HKD	c_{min}	[mm]	100	100	100	100	80	80	140	80	140	175	230	280
	$s \geq$	[mm]	150	150	150	150	120	120	80	120	80	125	130	160
Critical spacing and edge distance for splitting failure HKD	$s_{cr,sp}$	[mm]	200	200	200	200	210	210	280	210	280	350	455	560
	$c_{cr,N}$	[mm]	100	100	100	100	105	105	140	105	140	175	227	280
Critical spacing and edge distance for concrete cone failure HKD / HKD-SR / HKD-ER	$s_{cr,N}$	[mm]	80	80	80	80	90	90	120	90	120	150	195	240
	$c_{cr,N}$	[mm]	40	40	40	40	45	45	60	45	60	75	97	120
Critical spacing and edge distance for splitting failure HKD-SR / HKD-ER	$s_{cr,sp}$	[mm]	176	176	176	176	210	210	280	210	280	350	455	560
	$c_{cr,N}$	[mm]	88	88	88	88	105	105	140	105	140	175	227	280

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

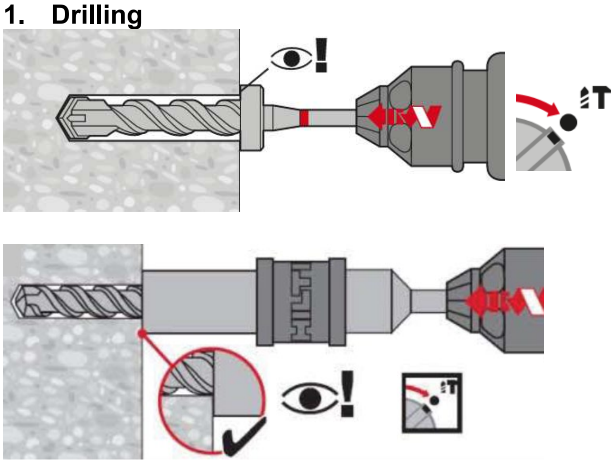


Setting instruction

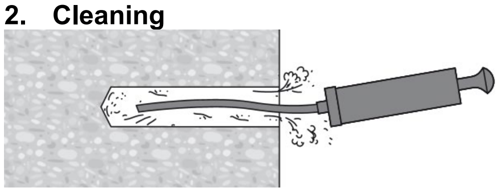
***For detailed information on installation see instruction for use given with the package of the product.**

Setting instruction

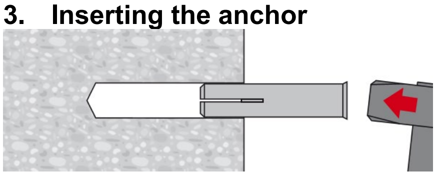
1. Drilling



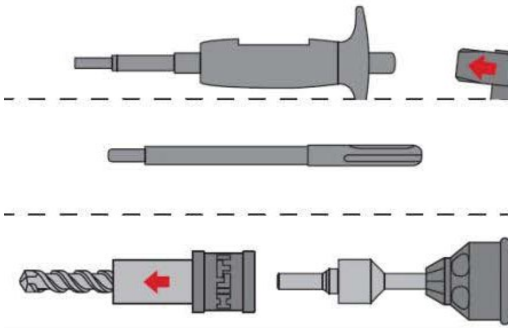
2. Cleaning



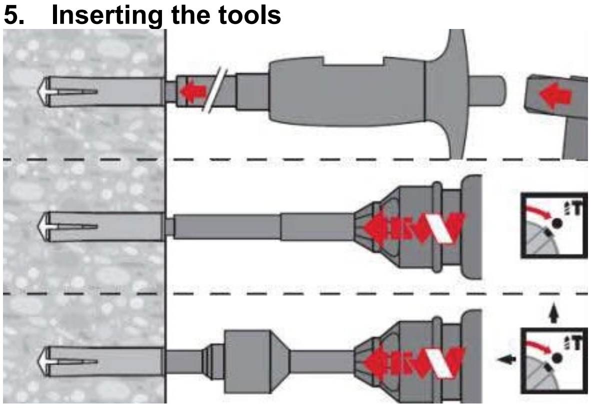
3. Inserting the anchor



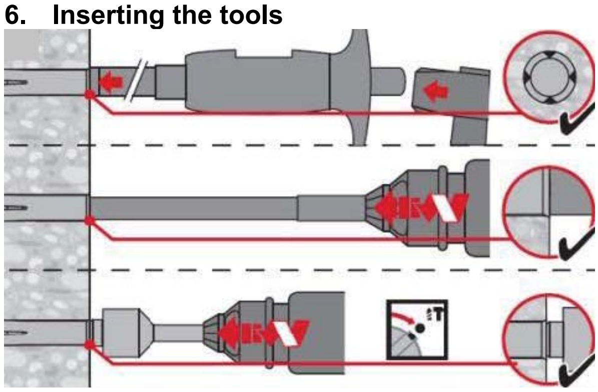
4. Setting tools



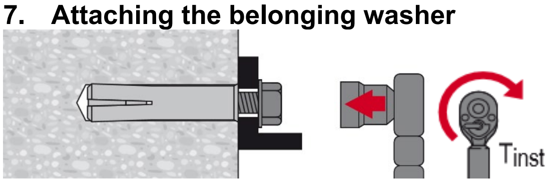
5. Inserting the tools



6. Inserting the tools



7. Attaching the belonging washer



HKV Flush anchors

Economical manual set flush anchor

Anchor version

HKV
(M6-M16)

HKV-R2
(M8-M12)

Benefits

- Simple and well proven
- Approved, tested and confirmed by every day jobsite experience
- Reliable setting thanks to 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

Concrete
(non-cracked)

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/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

HILTI

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/mm²
- Screw or rod with steel grade 5.8 (carboon steel) and / or A4-70 (stainless steel)

Effective anchorage depth

Anchor size	Metric		M6	M8	M10	M10	M12	M16
	Imperial		1/4	5/16	3/8	3/8	1/2	-
Effective anchorage depth	h_{ef}	[mm]	25	30	30	40	50	65

Characteristic resistance

Anchor size	Metric		M6	M8	M10	M10	M12	M16
	Imperial		1/4	5/16	3/8	3/8	1/2	-
Tension	N_{Rk}	[kN]	4,2	5,9	5,9	9,1	12,7	26,5
Shear	V_{Rk}	[kN]	5,0	8,6	10,0	11,0	18,3	33,8

Design resistance

Anchor size	Metric		M6	M8	M10	M10	M12	M16
	Imperial		1/4	5/16	3/8	3/8	1/2	-
Tension	N_{Rd}	[kN]	2,8	3,9	3,9	6,1	8,5	17,6
Shear	V_{Rd}	[kN]	5,0	8,6	8,0	8,0	14,6	27,0

Recommended loads [a)]

Anchor size	Metric		M6	M8	M10	M10	M12	M16
	Imperial		1/4	5/16	3/8	3/8	1/2	-
Tension	N_{Rec}	[kN]	1.4	2.0	2.0	3.0	4.2	8.8
Shear	V_{Rec}	[kN]	1.7	2.9	3.3	3.7	6.1	11.3

a) With overall global 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

Mechanical properties

Anchor size	Metric			M6	M8	M10	M10	M12	M16
	Imperial			1/4	5/16	3/8	3/8	1/2	-
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
Properties for metric anchors versions									
Stressed cross-section		A_s	[mm²]	20,7	26,7	32,7	32,7	60,1	105
Moment of resistance		W	[mm³]	32,3	54,6	82,9	82,9	184	431
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
Properties for imperial anchors versions									
Stressed cross-section		A_s	[mm²]	17,3	27,46	39,9	39,9	70,6	-
Moment of resistance		W	[mm³]	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]	10,4	16,5	23,9	24,5	42,4	

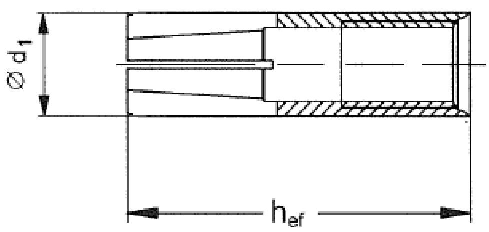
Material quality

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

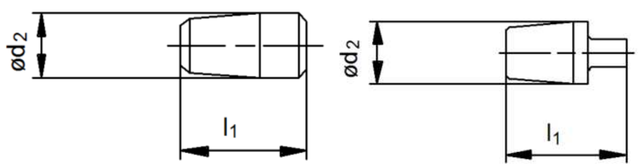
Anchor dimension

Anchor size	Metric			M6	M8	M10	M10	M12	M16
	Imperial			1/4	5/16	3/8	3/8	1/2	-
Effective anchorage depth		h_{ef}	[mm]	25	30	30	40	50	65
Dimensions for metric anchors versions									
Anchor diameter		d_1	[mm]	7,9	9,95	11,8	11,95	14,9	19,75
Diameter of cone bolt		d_2	[mm]	5,1	6,5	8,2	8,2	10,3	13,8
Length of expansion sleeve		l_1	[mm]	10	12	12	16	20	29
Dimensions for imperial anchors versions									
Anchor diameter		d_1	[mm]	7,9	9,9	11,9	11,95	15,85	-
Diameter of cone bolt		d_2	[mm]	5,1	6,35	8,2	7,86	10,2	-
Length of expansion sleeve		l_1	[mm]	10	12	12	16,2	20	-

Anchor body



Expansion plugs

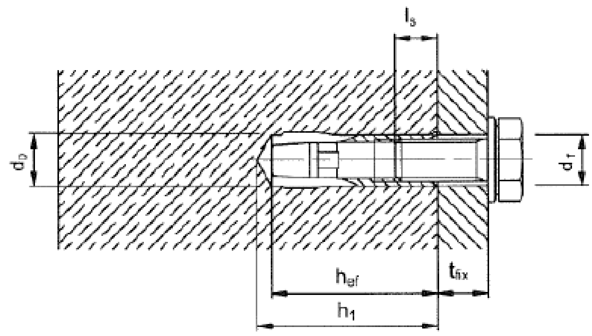


Setting information

Setting details

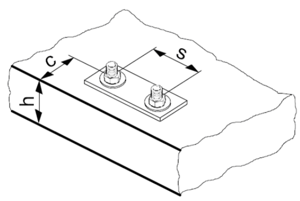
Anchor size	Metric			M6	M8	M10	M10	M12	M16
	Imperial			1/4	5/16	3/8	3/8	1/2	-
Effective anchorage depth	h_{ef}	[mm]		25	30	30	40	50	65
Nominal diameter of drill bit a)	d_0	[mm]		8	10	12	12	15 (16)	20
Cutting diameter of drill bit a)	$d_{cut} \leq$	[mm]		8,45	10,5	13 (12,5)	12,5	15,5 (16,5)	20,5
Depth 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
	$l_{s,max}$	mm]		10	12	10,5	15,5	20,0	25,5

a) Values in brackets are applicable for imperial anchor versions



Setting parameters

Anchor size	Metric			M6	M8	M10	M10	M12	M16
	Imperial			1/4	5/16	3/8	3/8	1/2	-
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	$c_{min} \geq$	[mm]		150	150	150	150	150	195



Installation equipment

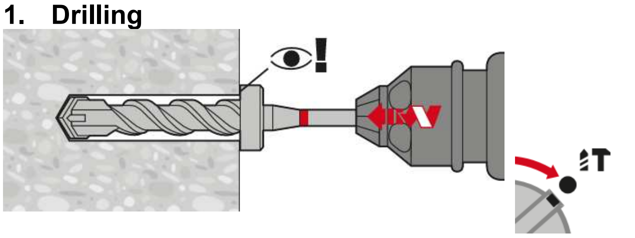
Anchor size	Metric	M6	M8	M10	M10	M12	M16
	Imperial	1/4	5/16	3/8	3/8	1/2	-
Rotary hammer for setting		TE 1 – TE 30				TE 16 – TE 50	
		TE 1 – TE 30					-
Other tools		hammer, torque wrench, blow out pump					
Metric anchors versions							
Machine setting tool	HSD-M	6x25/30	8x25/30	10x25/30	10x40	12x50	16x65
Hand setting tool	HSD-G	6x25/30	8x25/30	10x25/30	10x40	12x50	16x65
Imperial anchors versions							
Machine setting tool	HSD-M	1/4x25	5/16x30	3/8x30	3/8x40	1/2x50	-
Hand setting tool	HSD-G	1/4x25	5/16x30	3/8x30	3/8x40	1/2x50	-

Setting instruction

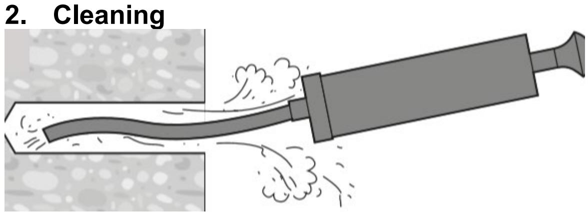
***For detailed information on installation see instruction for use given with the package of the product.**

Setting instruction

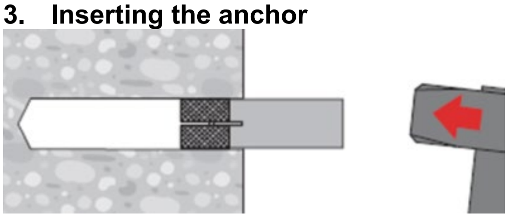
1. Drilling



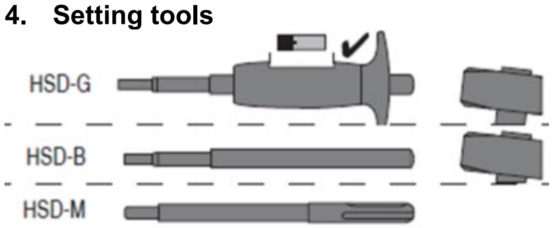
2. Cleaning



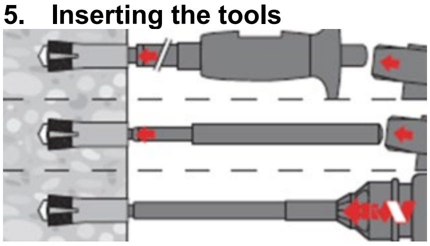
3. Inserting the anchor



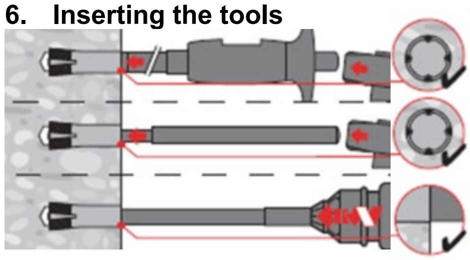
4. Setting tools



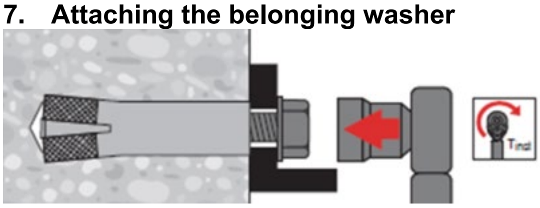
5. Inserting the tools



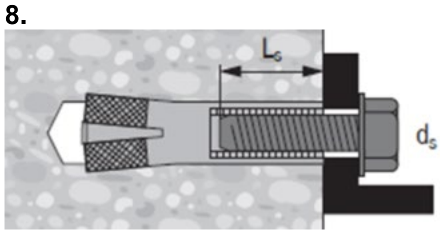
6. Inserting the tools



7. Attaching the belonging washer



8.



HAP 2.5 Hoist Anchor Plate

Hoist Anchor Plate with 2.5 t WLL capacity for elevator shaft operations

Anchor version		Benefits
	HAP 2.5	
	HAP 2.5 + HST3	

Benefits

- 2.5 t WLL capacity according to Machinery Directive 2006/42/EC.
- Anchorage of hoist to be designed with PROFIS Anchor software for cracked and uncracked concrete, ≥ C20/25, according to EC2 and ETAG (No. 001 Annex C/2010).
- Type-examination certificate issued by Liftinstituut B.V.
- Recommended and designed for anchorage with anchors:
  - HST3 M12 (h_{nom}=80mm)
- Delivered pre-assembled (one piece) with combo options available: HAP 2.5 + Anchors (4xHST3).
- Lightweight: One person installation possible at overhead position total weight < 3Kg.
- No rotation of hook point allowed preventing swiveling.
- Large hooking area for easy engagement. Hook point: ø>90mm.
- Compact design for narrow spaces: rigid height < 56mm.
- Printed IFU on the product for immediate clarification.
- < 45º loading allowed in all directions.

Base material


Concrete (non-cracked)


Concrete (cracked)

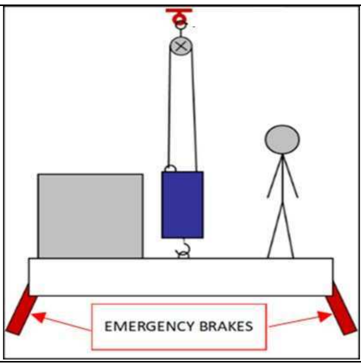
Other information


PROFIS ENGINEERING

Applications

HAP 2.5 is designed to be used as post installed “master hoist point” for installation and/or maintenance in elevator shafts under static and quasi-static loading. In case of fatigue loading see TWU72/18. It can be used with manual or motor hoists and bears a working load up to 2.5 tons in variable directions.

Warning

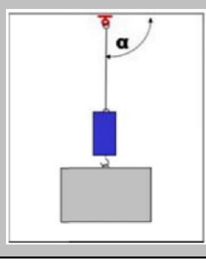
	**Men riding (Car-top Lift-installation Method) (worker and material on top of the cabin)** In case the main hoist point fails, the platform falls ~0.3m until the elevator safety-gears will automatically activate bringing the elevator cabin to a complete stop. Emergency brakes need to be activated.

Basic loading data

Data for max 2.5 t WLL capacity applies to HAP 2.5 only when:

- Correct design of anchorage (see “design of anchorage”)
- Installation and anchor setting according to IFU from HAP 2.5t and corresponding anchor (HST3)
- No shock loading; vibratory dynamic safety factor γ_{dyn} up to 1.8

HAP Working Load Limitation (WLL)[a) b)]

	Load type
	Single Point 
45º < α < 135º WLL_{total} [metric ton]	**2,5**

a) In accordance with machinery safety directive 2006/42/EC the following working coefficients were implemented:
- Working coefficient of all metal components: γ = 4
- Working coefficient of the cables: γ = 5

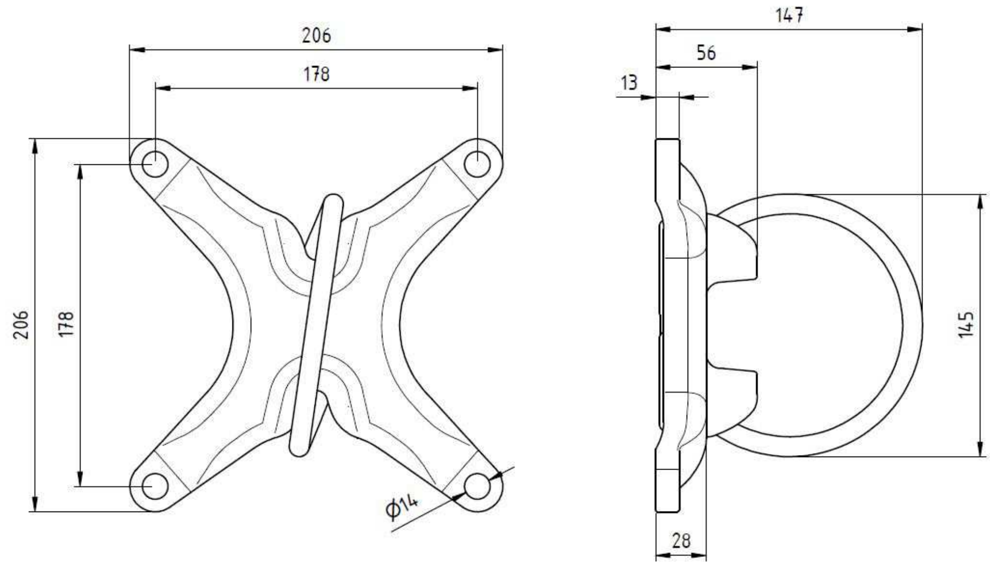
b) Data valid (including hoist and anchors) for static loading and fatigue cycling loading and a number of cycles NcyclesK < 1000 under pure tension or up to a load inclination of 45°, see test report TWU72/18.
Data valid (hoist only) for static loading and fatigue cycling loading and a number of cycles 1000 < NcyclesK < 10000 under pure tension or up to a load inclination of 45°. Anchors must be verified separately. For further details please contact you Hilti account manager and see test report TWU72/18.

Materials

Material quality

Part	Material / Mechanical properties or standard
Carrier plate	Rm 700-900 Mpa – 5 µm Geomet 321A
Wire rope ϕ11x150 – 6x36WS IWRC	Rope: steel 1960 MPa, zinc plated / ferrule: Alu
Holder	Low carbon steel – 5 µm Geomet 321A
Blind rivet DIN EN ISO 15977 – 6.4x18	Stainless steel

Dimensions



Onsite qualification

HAP 2.5 is designed for temporary & permanent application under dry indoor conditions.

Recommended tools to do onsite qualification: Anchor Tester HAT 28-E (#386372) with HAT Kit HAP 2.5 (#2301103).

Installation instructions

1) Install the anchors according to the Hilti Instruction for use. Only HST3 M12 with hnom = 80mm is qualified. Make sure HAP 2.5 is correctly installed, according to the Instruction for use of the HAP 2.5. Set up the HAT 28E according to the manual provided with the anchors tester. Set bridge legs to right heights. (*Image 1)*. Then, connect the ring bolt adapter to steel wire rope. Always use the provide steel disc as shown in *Image 2.* Not using it could result in unallowed bending of the wire. Thus damaging the HAP 2.5. A HAP 2.5 with a bent wire is not safe for use.

Image 1

Image 2

2) Connect HAT 28-E with ring bolt adapter and make sure the bridge of the tester is parallel to the concrete surface as well as to the HAP 2.5 base (*Image 3*). Check if the baseplate can be moved versus the concrete. It needs to be firm. Turn crank in clockwise direction until legs in contact with base material bring the sytem to a still situation (without starting the loading process). Check and make sure pullout force acts parallel to axis of anchors and to the legs of tester. HAP 2.5 must remain centered in the both parallel and perpendicular direction of the tester.

Image 3

3) Set the red handle of the analogue gauge to zero in order to be able to start the measurement. *(Image 4).*

Image 4

4) Hold the HAT 28-E by the grip while increasing the load of the HAP 2.5 by turning the crank (or with spanner wrench on hexagon nut on top of tester) in a clockwise direction. Increase the load until desired proof load is attained. *Image 5.*
Do not exceed the maximum allowable load of the tester of 30kN!

Image 5

5) Keep the proof load on HAP 2.5 for the desired time. Do not keep retightening if the loading relaxes during this time. The displacement is not allowed to increase in this time.

6) (*Image 6*)

Release the load by turning the crank counterclockwise

Image 6

7) Remove HAT 28-E and ring bolt adapter.

8) Perform visual check on HAP 2.5 and base material (*Image 7*).
Check if the baseplate is still firmly pressed to the concrete. If baseplate is lose, re-tight anchors and repeat procedure from the beginning.

We recommend **<u>NOT TO USE</u>** the tested HAP 2.5 when:

- The baseplate is lose also after repeated test.
- If the basematerial shows cracks during and or after the test around the HAP 2.5. It could be the sign of an overload of the concrete.
- If the HAP is damaged or deformed or the cable is bent.

In these cases set a new point in a different position and repeat procedure from the beginning.

Image 7

9) If the testing was successful mark or label the HAP 2.5 according to your requirements.	

Design of anchorage

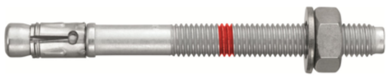
An exemplary calculation under static considerations of a Hoist with different Hilti anchoring products designed with Hilti Profis engineering can be found below while the Input data applies. In case of different design conditions a new clalculation should be performed.

HAP 2.5 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 2.5 must be ensured for varying load conditions (varying directions, dynamic effects, etc.). For this the anchorage for HAP 2.5 has to be designed according to extreme load cases: a concrete anchor can only be considered as suitable for use with the HAP 2.5 hoist point if the approved anchor satisfies the following load scenarios (e.g. by PROFIS calculation) with EC2-4 calculation method. It has to be done in accordance with the relevant codes/ETAs for each application case separately.

HAP 2.5 t + HST3 M12 – Pure tension

N= Action = 2,5t (WLL) x 1,8 (γ_{dyn}) = 45 kN

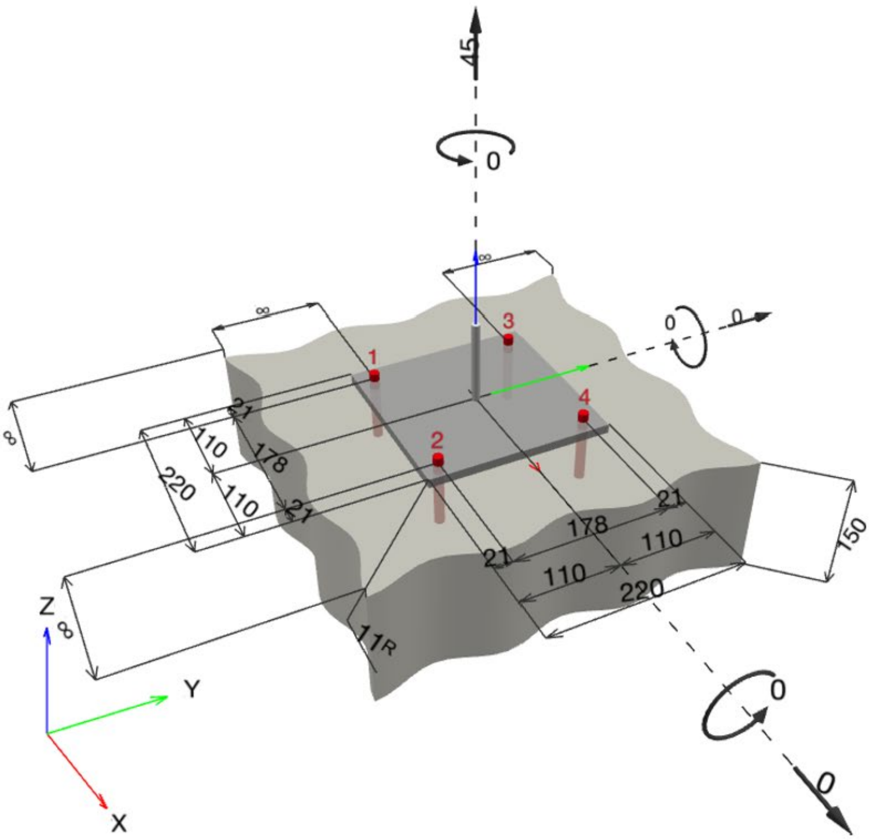
Input data



Anchor type and size:	**HST3 M12 hef2**
Return period (service life in years):	50
Item number:	2105719 HST3 M12x115 40/20
Effective embedment depth:	$h_{ef,act}$ = 70.0 mm ($h_{ef,limit}$ = - mm), h_{nom} = 80.0 mm
Material:	
Approval No.:	ETA 98/0001
Issued I Valid:	04/05/2021 | -
Proof:	Design Method EN 1992-4, Mechanical
Stand-off installation:	e_b = 0.0 mm (no stand-off); t = 11.0 mm
Baseplate[R] :	l_x x l_y x t = 220.0 mm x 220.0 mm x 11.0 mm; (Recommended plate thickness: not calculated)
Profile:	Cylinder, 10; (L x W x T) = 10.0 mm x 10.0 mm
Base material:	cracked concrete, C20/25, $f_{c,cyl}$ = 20.00 N/mm^2; h = 150.0 mm, User-defined partial material safety factor γ_c = 1.500
Installation:	**hammer drilled hole, Installation condition: Dry**
Reinforcement:	No reinforcement or Reinforcement spacing >= 150 mm (any Ø) or >= 100 mm (Ø <= 10 mm) no longitudinal edge reinforcement Reinforcement to control splitting acc. to EN 1992-4, 7.2.1.7 (2) b) 2) present

[R] - The anchor calculation is based on a rigid baseplate assumption.

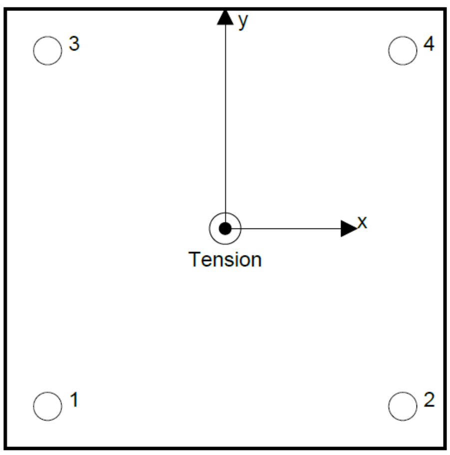
Geometry [mm] & Loading [kN, kNm]



Load combination

Case	Description	Forces [kN] / Moments [kNm]	Seismic	Fire	Max. Util. Anchor [%]
1	Combination 1	N = 45.000; V_x = 0.000; V_y = 0.000; M_x = 0.000; M_y = 0.000; M_z = 0.000;	no	no	99

Load case/Resulting anchor forces



Anchor reactions [kN]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	11.250	0.000	0.000	0.000
2	11.250	0.000	0.000	0.000
3	11.250	0.000	0.000	0.000
4	11.250	0.000	0.000	0.000

max. concrete compressive strain: - [‰]
max. concrete compressive stress: - [N/mm^2]
resulting tension force in (x/y)=(0.0/0.0): 45.000 [kN]
resulting compression force in (x/y)=(0.0/0.0): 0.000 [kN]

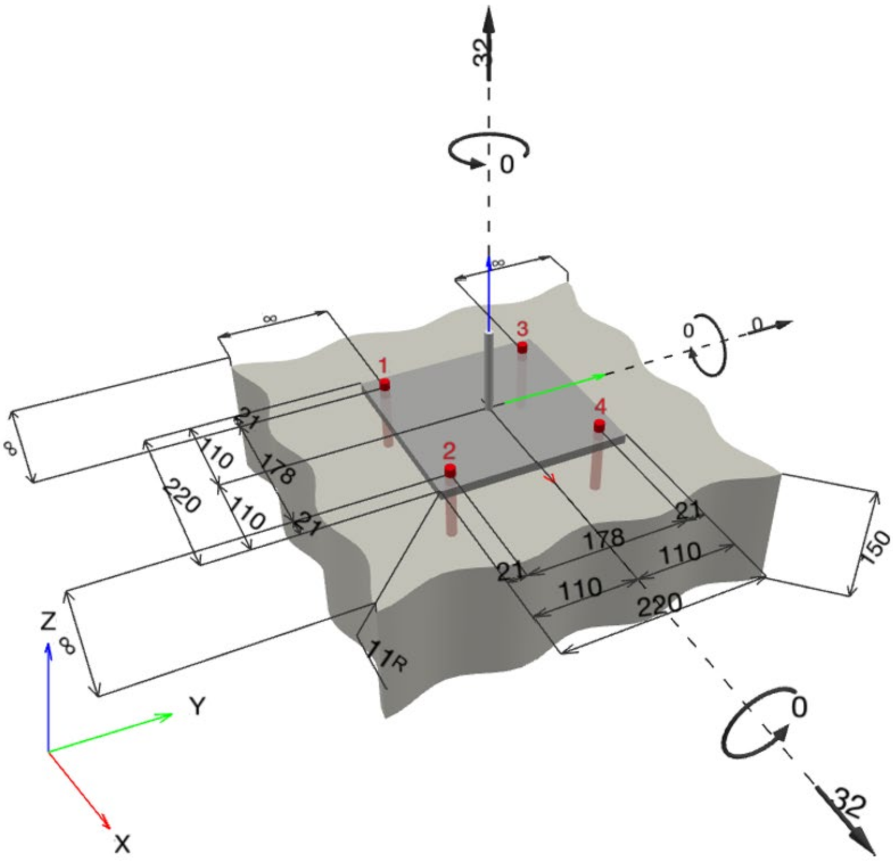
HAP 2.5 t + HST3 M12 – 45º angle
$N = N_t \times sen45º = 32kN$
$Vx = N_t x \cos45º = 32kN$

Input data

Anchor type and size:	**HST3 M12 hef2**
Return period (service life in years):	50
Item number:	2105719 HST3 M12x115 40/20
Effective embedment depth:	$h_{ef,act}$ = 70.0 mm ($h_{ef,limit}$ = - mm), h_{nom} = 80.0 mm
Material:	
Approval No.:	ETA 98/0001
Issued I Valid:	04/05/2021 | -
Proof:	Design Method EN 1992-4, Mechanical
Stand-off installation:	e_b = 0.0 mm (no stand-off); t = 11.0 mm
Baseplate[R] :	$l_x \times l_y \times t$ = 220.0 mm x 220.0 mm x 11.0 mm; (Recommended plate thickness: not calculated)
Profile:	Cylinder, 10; (L x W x T) = 10.0 mm x 10.0 mm
Base material:	cracked concrete, C20/25, $f_{c,cyl}$ = 20.00 N/mm^2; h = 150.0 mm, User-defined partial material safety factor γ_c = 1.500
Installation:	**hammer drilled hole, Installation condition: Dry**
Reinforcement:	No reinforcement or Reinforcement spacing >= 150 mm (any Ø) or >= 100 mm (Ø <= 10 mm)
	no longitudinal edge reinforcement
	Reinforcement to control splitting acc. to EN 1992-4, 7.2.1.7 (2) b) 2) present

[R] - The anchor calculation is based on a rigid baseplate assumption.

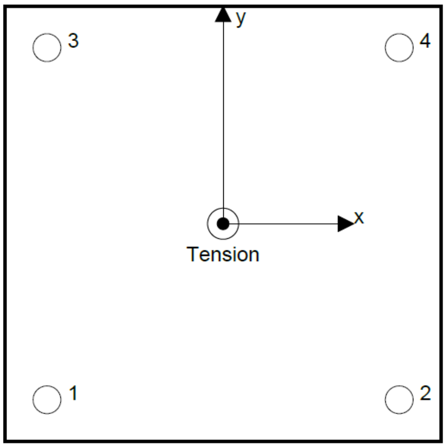
Geometry [mm] & Loading [kN, kNm]



Load combination

Case	Description	Forces [kN] / Moments [kNm]	Seismic	Fire	Max. Util. Anchor [%]
1	Combination 1	$N = 32.000$; $V_x = 32.000$; $V_y = 0.000$; $M_x = 0.000$; $M_y = 0.000$; $M_z = 0.000$;	no	no	71

Load case/Resulting anchor forces



Anchor reactions [kN]
Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	8.000	8.000	8.000	0.000
2	8.000	8.000	8.000	0.000
3	8.000	8.000	8.000	0.000
4	8.000	8.000	8.000	0.000

max. concrete compressive strain: - [‰]
max. concrete compressive stress: - [N/mm^2]
resulting tension force in (x/y)=(0.0/0.0): 32.000 [kN]
resulting compression force in (x/y)=(0.0/0.0): 0.000 [kN]

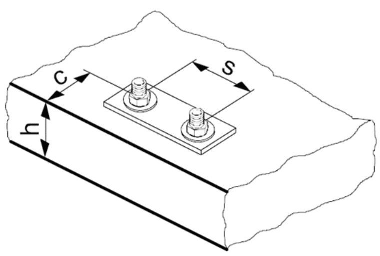
Anchor forces are calculated based on the assumption of a rigid baseplate.

Setting information

Setting parameters

Parameter			HAP 2.5
Minimum base material thickness	h_{min}	[mm]	According to technical data of applied anchors
Spacing (Hoist Anchor Plate)	s	[mm]	178
Edge distance	c	[mm]	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).



Inspection criteria

Caution: The attachment point must be in a good operating condition and undamaged. Broken wires, signs of corrosion, visible distortions or deformations are unacceptable.

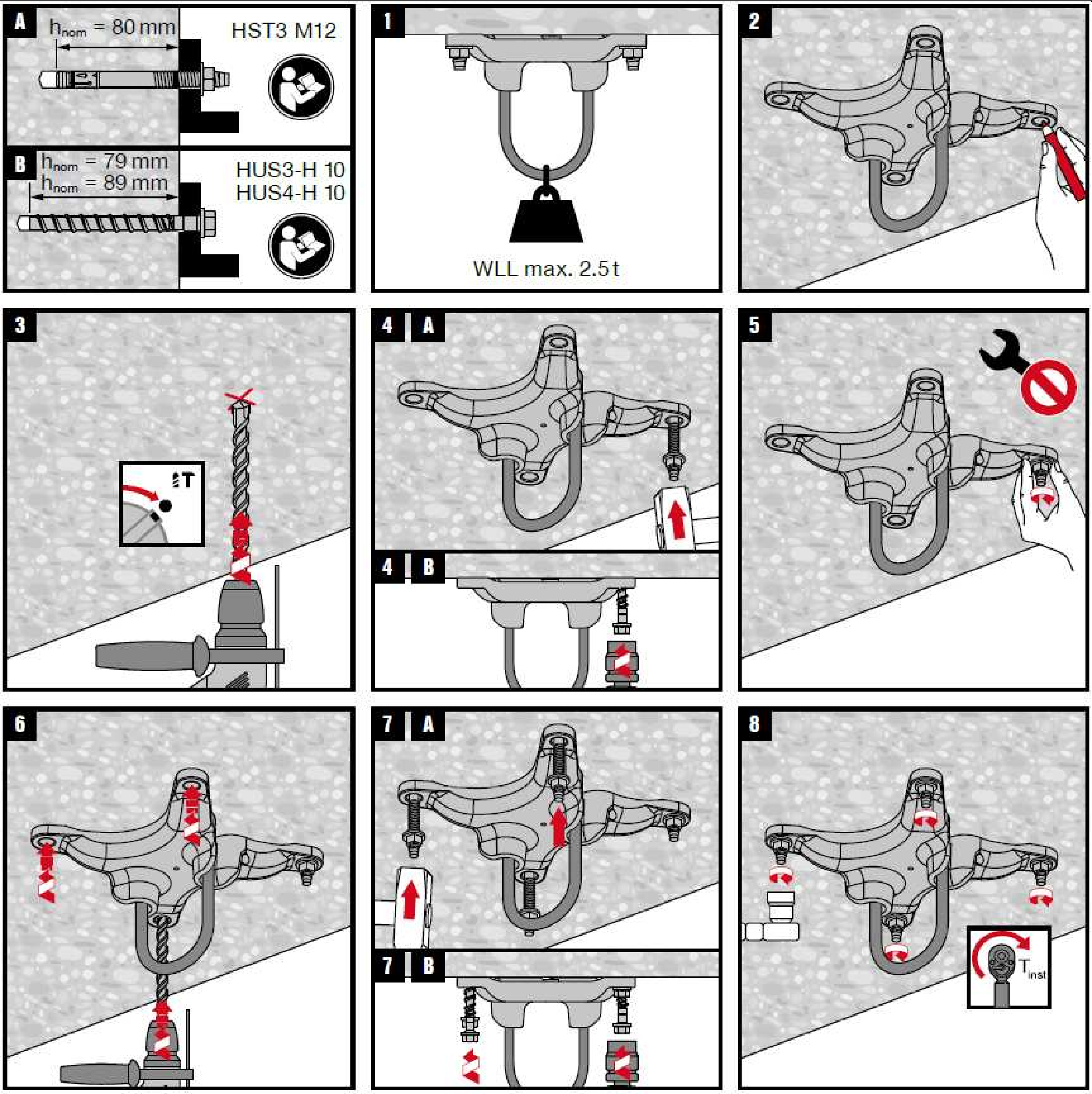
Caution: The shaft ceiling, particularly the concrete, must be in sound condition. Any visible cracking, blow out or signs of corrosion are unacceptable.

Caution: Do not use an attachment point which has an unreadable or missing identification label.

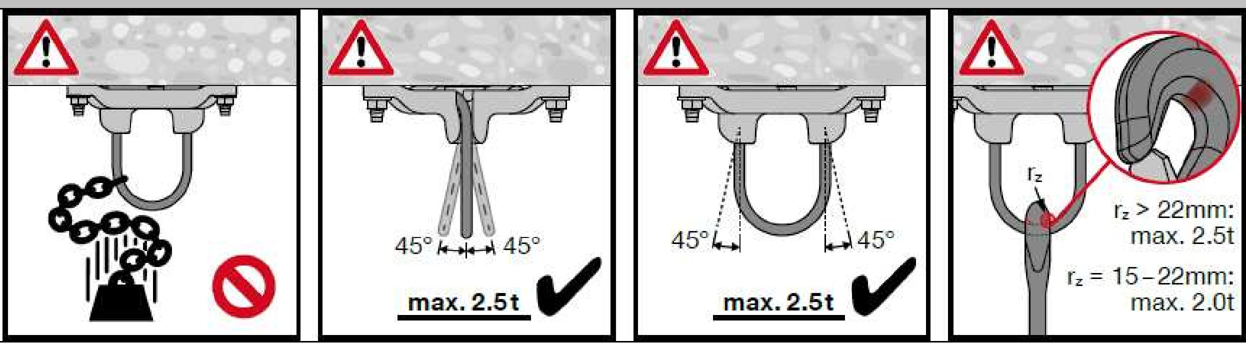
Setting instructions

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

Setting instruction for HAP 2.5



Caution



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 uncracked concrete, ≥ C20/25
- Recommended anchors:
  HST3 M12 (h_{ef}=70mm) or KB-TZ ½" (h_{ef}=3 ¼'')
- 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

Base material


Concrete (non-cracked)


Concrete (cracked)

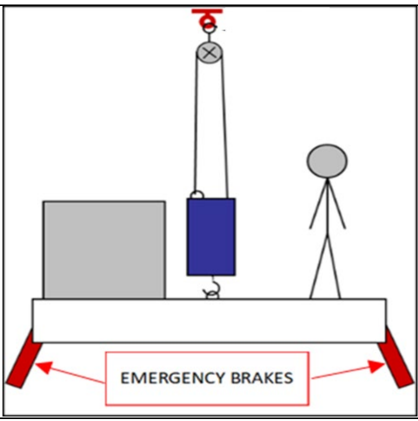
Other information


PROFIS ENGINEERING

Aplications

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.

Warning



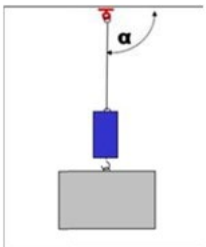
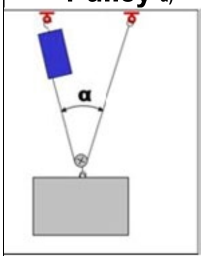
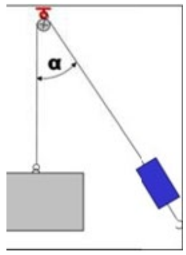
Men riding (Car-top Lift-installation Method) (worker and material on top of the cabin)
In case the main hoist point fails, the platform falls ~0.3m until the elevator safety-gears will automatically activate bringing the elevator cabin to a complete stop. Emergency brakes need to be activated.

Basic loading data

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

HAP 1.15 Hoist Anchor Plate, single and multipoint loads

			Single Point	Single Pulley a)	Fixed motor hoist
					
Anchor system Working Load Limitation (WLL) [a]					
α < 20°	WLL_{total}	[metric ton]	1,15	2,25	0,55
20° < α < 45°	WLL_{total}	[metric ton]	1,15	2,1	0,5
45° < α < 60°	WLL_{total}	[metric ton]	1,15	2,0	0,45
60° < α < 90°	WLL_{total}	[metric ton]	1,15	1,6	0,4
90° < α < 120°	WLL_{total}	[metric ton]	1,15	1,15	Not applicable

[a] In accordance with machinery safety directive 2006/42/EC the following working coefficients were implemented:
- Working coefficient of all metal components: γ = 4
- Working coefficient of the cables: γ = 5

Keep distance of min. 4 x h_{ef} between anchors of the two HAPs

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 calculation[1]) with ETAG or ICC calculation method:

ETAG design

Conditions:

- Base material: acc. to onsite
- Cracked or uncracked 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):

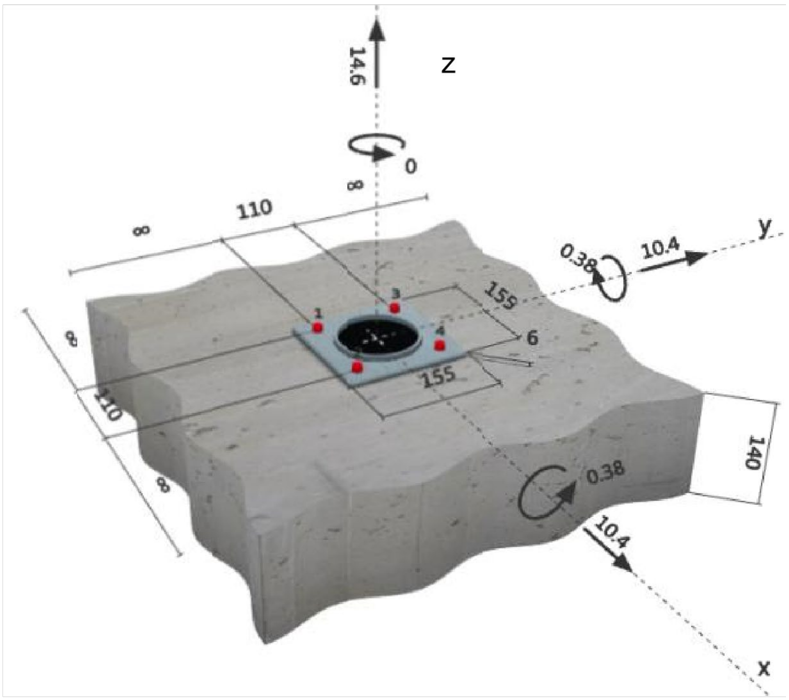
F_z	20.7	kN

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	kNm
M_y			0.54	kNm



Load scenario 2

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

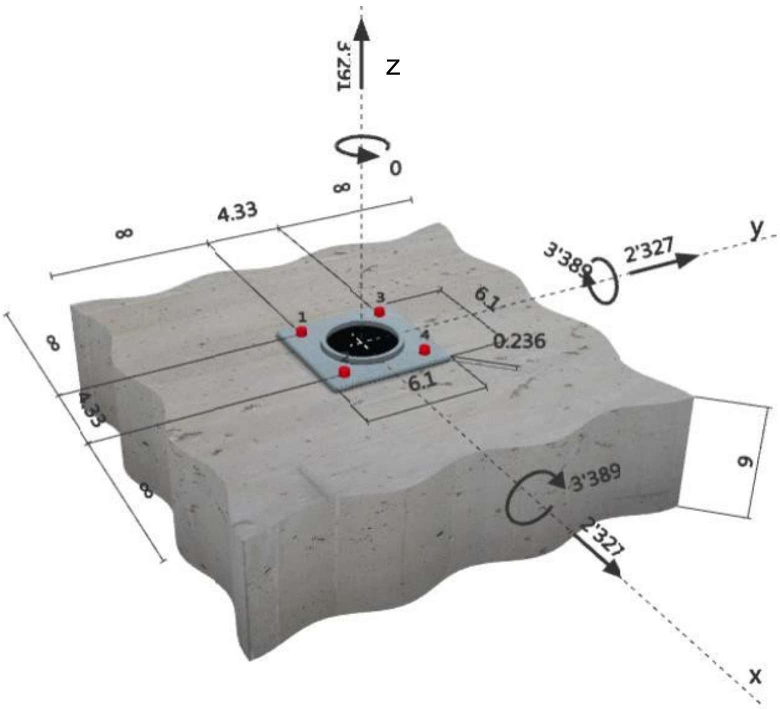
[1] Free download of PROFIS Anchor design software from www.hilti.com Service & Support

[2] Minimum slab thickness according to tech. data of applied anchors

ICC Design (ACI 318-14, Chapter 17)

Conditions:

- Base material: acc. to onsite conditions
- Cracked or uncracked concrete
- Slab thickness: onsite slab thickness[3]
- Dimensions of baseplate see picture
- Partial safety factor for load γ_L= 1.8



Load scenario 1 (pure tension):		
F_z	4654	lbf

Load scenario 2 (diagonal 45°):		
F_z	3291	Lbf
F_x	2327	Lbf
F_y	2327	Lbf
M_x	3389	in~ lbf
M_y	3389	in~ lbf

Load scenario 3 (diagonal shear):		
F_x	3291	lbf
F_y	2391	Lbf
F_x	4793	lbf
M_y	4793	in~ lbf

For use of HAP 1.15 as ICC approved anchorage (WLL = 2585 lbf), Hilti recommends KB-TZ ½ x 3 1/4".

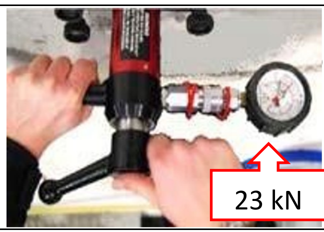
[3] Minimum slab thickness according to tech. data of applied anchors.

Onsite Qualification

Hilti recommends to proof load the installed HAP 1.15 each time after the hoist equipment is installed, adjusted, or changed.

Test procedure (shown with Hilti Anchor Tester HAT 28 (HAT 30))

This procedure will verify the fastening capacity of the anchorage and the base material for HAP 1.15 use

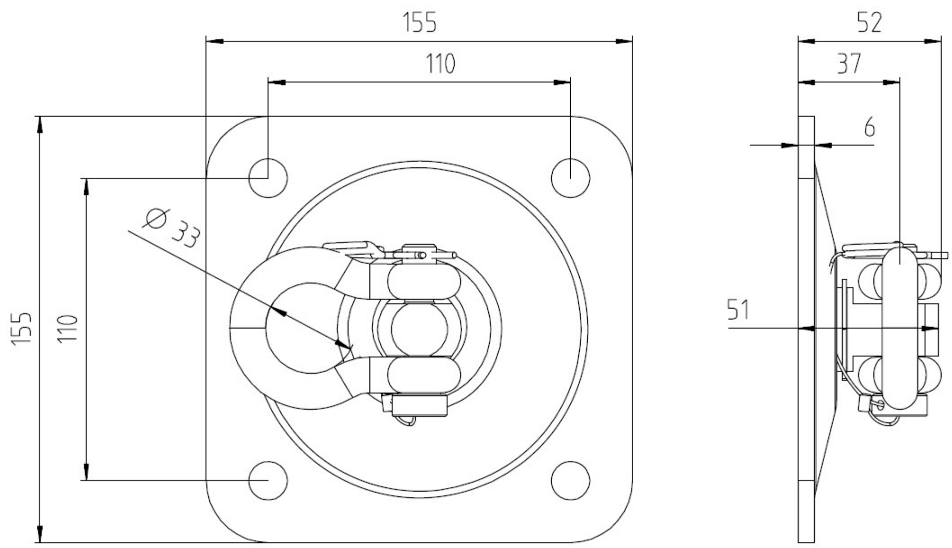
1) Make sure anchors for the HAP 1.15 are correctly installed. Make sure shackle is not attached (de-install shackle if necessary). Connect ring bolt adapter of HAT 28 (HAT 30) to center bolt.	
2) Connect HAT 28 (HAT 30) with ring bolt adapter and position the tester with edges of tester baseplate parallel 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 28 (HAT 30) and HAP 1.15 is centered with HAT 28 (HAT 30).	
3) Set the red handle of the analogue gauge to zero in order to be able to start the measurement.	
4) Hold the HAT 28 (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 23kN is attained.	
5) Keep the proof load on HAP 1.15 for at least 1 minute. Do not keep retightening if the loading relaxes during this time. The displacement is not allowed to increase in this time. Check the load on the HAT 28 (HAT 30) after 1 minute (black hand) and note down the difference to the initially applied proof load (red hand).	

6) Release the load by turning the crank counterclockwise.	
7) Remove HAT 28 (HAT 30) and ring bolt adapter.	
8) Perform visual check on HAP 1.15 and base material (damages, deformations, cracks). Check if the baseplate is still firmly pressed to the concrete. If baseplate is lose, re-tight anchors and repeat procedure from the beginning. 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 23 kN decreased less than 10% during the 1 minute test duration. - No damage or deformation of the HAP 1.15. - No damage (e.g. cracks) in the base material.	
9) 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	

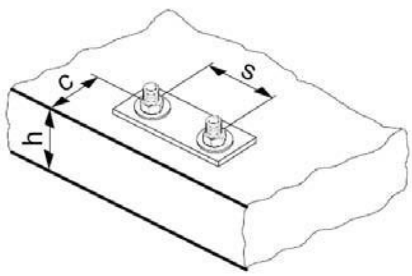
Materials

Part	Material / Mechanical properties or standard
Shackle axis	Galvanized steel R_m > 550N/mm^2
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/mm^2
Base plate	Galvanized steel R_m > 355N/mm^2

Base material thickness and anchor spacing

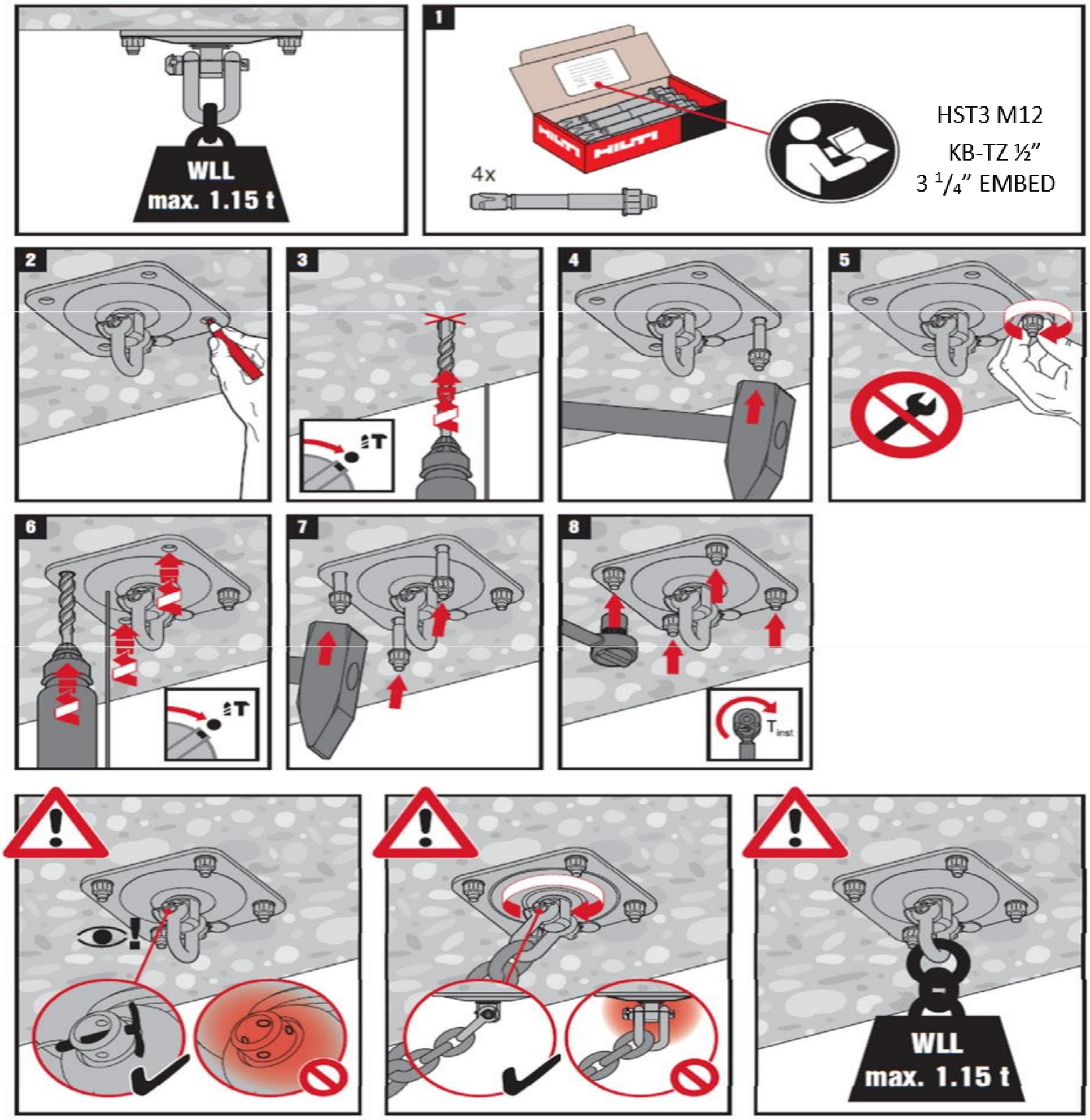


HAP 1.15			
Minimum base material thickness	h_{min}	[mm]	according to technical data of applied anchors
Spacing (Hoist Anchor Plate)	s	[mm]	110
Edge distance	c	[mm]	according to technical data of applied anchors [a)]



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

Setting instructions



PLASTIC / LIGHT DUTY / OTHER METAL ANCHORS

HRD Plastic frame anchors

Everyday standard plastic frame anchor for redundant fastening applications

Anchor version

HRD-C
HRD-CR
(M8)

HRD-C
HRD-CR
(M10)

Benefits

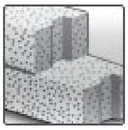
- Innovative screw design for better hold
- Suitable on practically all base materials
- Flexible embedment depth (approved at 50mm and 70mm)
- Suitable for fastening thicknesses up to 260mm
- Available in 4 different materials for optimum suitability in all corrosive environments
- Pre-assembled for optimum handling and fastening quality

Base material

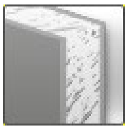
Concrete (non-cracked)

Solid brick

Hollow brick

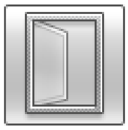


Autoclaved aerated concrete



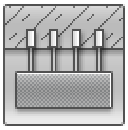
Drywall

Prestressed hollow core slabs



Window frame

Load conditions



Redundant fastening

Fire resistance

Other information

European Technical Approval

CE conformity

Approvals / certificates

Description	Authority / Laboratory	No./ date of issue
European technical approval [a]	DIBt, Berlin	ETA-07/0219 / 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 2017-09-19. 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 for concrete

Anchor size				HRD 8	HRD 10		
		h_{nom}	[mm]	50	50	70	90
Concrete C12/15							
Tension	HRD	N_{Rk}	[kN]	2,0	3,0	6,0	-
	HRD-R			2,0	3,0	6,0	-
Shear	HRD	V_{Rk}	[kN]	6,9	10,6	10,6	-
	HRD-R			6,6	11,1	11,1	-
Concrete C16/20 – C 50/60							
Tension	HRD	N_{Rk}	[kN]	3,0	4,5	8,5	-
	HRD-R			3,0	4,5	8,5	-
Shear	HRD	V_{Rk}	[kN]	6,9	10,6	10,6	-
	HRD-R			6,6	11,1	11,1	-
Thin concrete skins [b] C12/15							
Tension	HRD / HRD-R	N_{Rk}	[kN]	-	2,5	-	-
Thin concrete skins [b] ≥C16/20							
Tension	HRD / HRD-R	N_{Rk}	[kN]	-	3,5	-	-

a) HRD-F 8 is not available in standard portfolio
b) Weather resistant skins of external wall panels) with h=40 mm to 100 mm

Design resistance for concrete

Anchor size				HRD 8	HRD 10		
		h_{nom}	[mm]	50	50	70	90
Concrete C12/15							
Tension	HRD	N_{Rk}	[kN]	1,1	1,7	3,3	-
	HRD-R			1,1	1,7	3,3	-
Shear	HRD	V_{Rk}	[kN]	5,5	8,5	8,5	-
	HRD-R			5,2	8,5	8,5	-
Concrete C16/20 – C 50/60							
Tension	HRD	N_{Rk}	[kN]	1,7	2,5	4,7	-
	HRD-R			1,7	2,5	4,7	-
Shear	HRD	V_{Rk}	[kN]	5,5	8,5	8,5	-
	HRD-R			5,2	8,5	8,5	-
Thin concrete skins [b] C12/15							
Tension	HRD / HRD-R	N_{Rk}	[kN]	-	1,4	-	-
Thin concrete skins [b] ≥C16/20							
Tension	HRD / HRD-R	N_{Rk}	[kN]	-	2,5	-	-

a) HRD-F 8 is not available in standard portfolio
b) Weather resistant skins of external wall panels) with h=40 mm to 100 mm

Recommended [c] loads for concrete

Anchor size				HRD 8	HRD 10		
		h_{nom}	[mm]	50	50	70	90
Concrete C12/15							
Tension	HRD	N_{Rd}	[kN]	0,8	1,2	2,4	-
	HRD-R			0,8	1,2	2,4	-
Shear	HRD	V_{Rd}	[kN]	3,9	6,1	6,1	-
	HRD-R			3,7	6,1	6,1	-
Concrete C16/20 – C 50/60							
Tension	HRD	N_{Rd}	[kN]	1,2	1,8	3,4	-
	HRD-R			1,2	1,8	3,4	-
Shear	HRD	V_{Rd}	[kN]		6,1	6,1	-
	HRD-R				6,1	6,1	-
Thin concrete skins [b] C12/15							
Tension	HRD / HRD-R	N_{Rk}	[kN]	-	1.0	-	-
Thin concrete skins [b] ≥C16/20							
Tension	HRD / HRD-R	N_{Rk}	[kN]	-	1.8	-	-

a) HRD-F 8 is not available in standard portfolio
b) Weather resistant skins of external wall panels) with h=40 mm to 100 mm
c) With overall global 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

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
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	11,1	10,8	21,3	19,9	22,3

Material quality

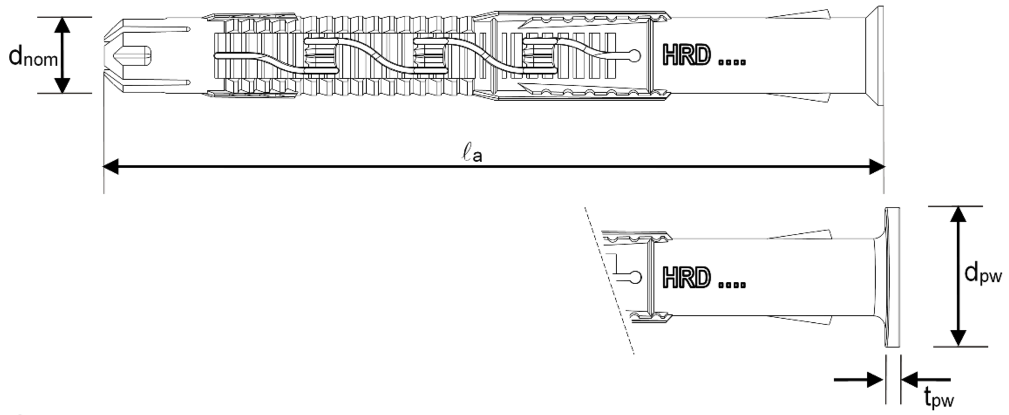
Part		Material
Sleeve		Polyamide, color red
Screw[a)]	HRD-C	Carbon steel, galvanized to min.5 µm
	HRD-CR	Stainless steel, corrosion class III: 1.4362/1.4401/1.4404/1.4571

a) Marking of the screw (HDR) depending on the supply.

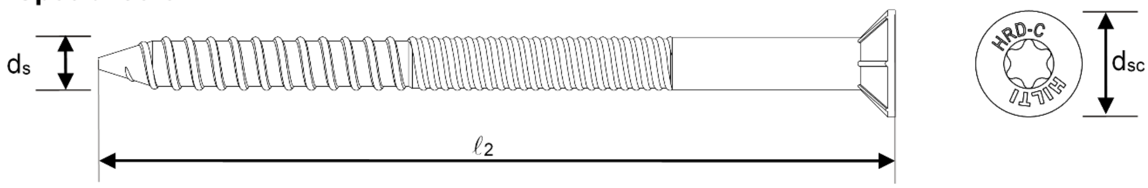
Anchor dimension

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	$\ell_{1,min}$	[mm]	60	60
Maximum length of the sleeve	$\ell_{1,max}$	[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	$\ell_{2,min}$	[mm]	65	65
Maximum length of the screw	$\ell_{2,max}$	[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

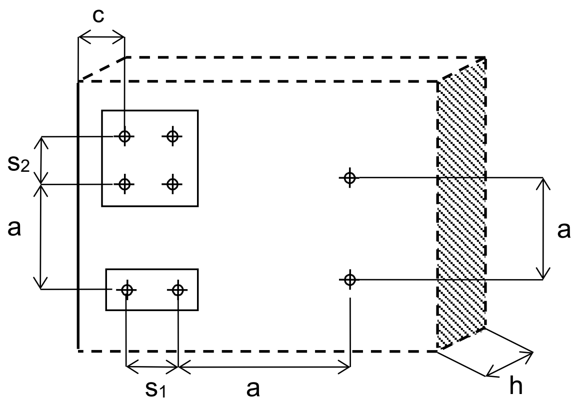
Anchor size			HRD 8	HRD 10
Drill hole diameter	d_o	[mm]	8	10
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	8,45	10,45
Depth of drilled hole to deepest point	$h_{1,1} \geq$	[mm]	60	60
	$h_{1,2} \geq$	[mm]	-	80
	$h_{1,3} \geq$	[mm]	-	100[a)]
Overall plastic anchor embedment depth in base material	$h_{nom,1} \geq$	[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
Diameter of clearance hole in the fixture – 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	-
	Masonry[e)]	h_{min}	[mm]	115-300		
Minimum spacing	Concrete ≥C16/20	s_{min}	[mm]	100	50	
		for $c \geq$	[mm]	50	100 [c)]	
	Concrete C12/15	s_{min}	[mm]	140	70	
		for $c \geq$	[mm]	70	140 [c)]	
	Masonry and AAC	a_{min}	[mm]	250	250	
		s_{min1}	[mm]	200 (120 [d)])	100	
		s_{min2}	[mm]	400 (240 [d)])	100	
Minimum edge distance	Concrete ≥C16/20	c_{min}	[mm]	50	50	
		for $s \geq$	[mm]	100	150 [c)]	
	Concrete C12/15	c_{min}	[mm]	70	70	
		for $s \geq$	[mm]	140	210 [c)]	
	Masonry and AAC	c_{min}	[mm]	100 (60 [d)])	100	
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
d) Only for brick "Doppio Uni" and "Mattone"
e) Minimum base material thickness of masonry depends on brick type; see specification of brick types in the table above
For spacing (edge distance) smaller than critical spacing (critical edge distance) the design loads have to be reduced.



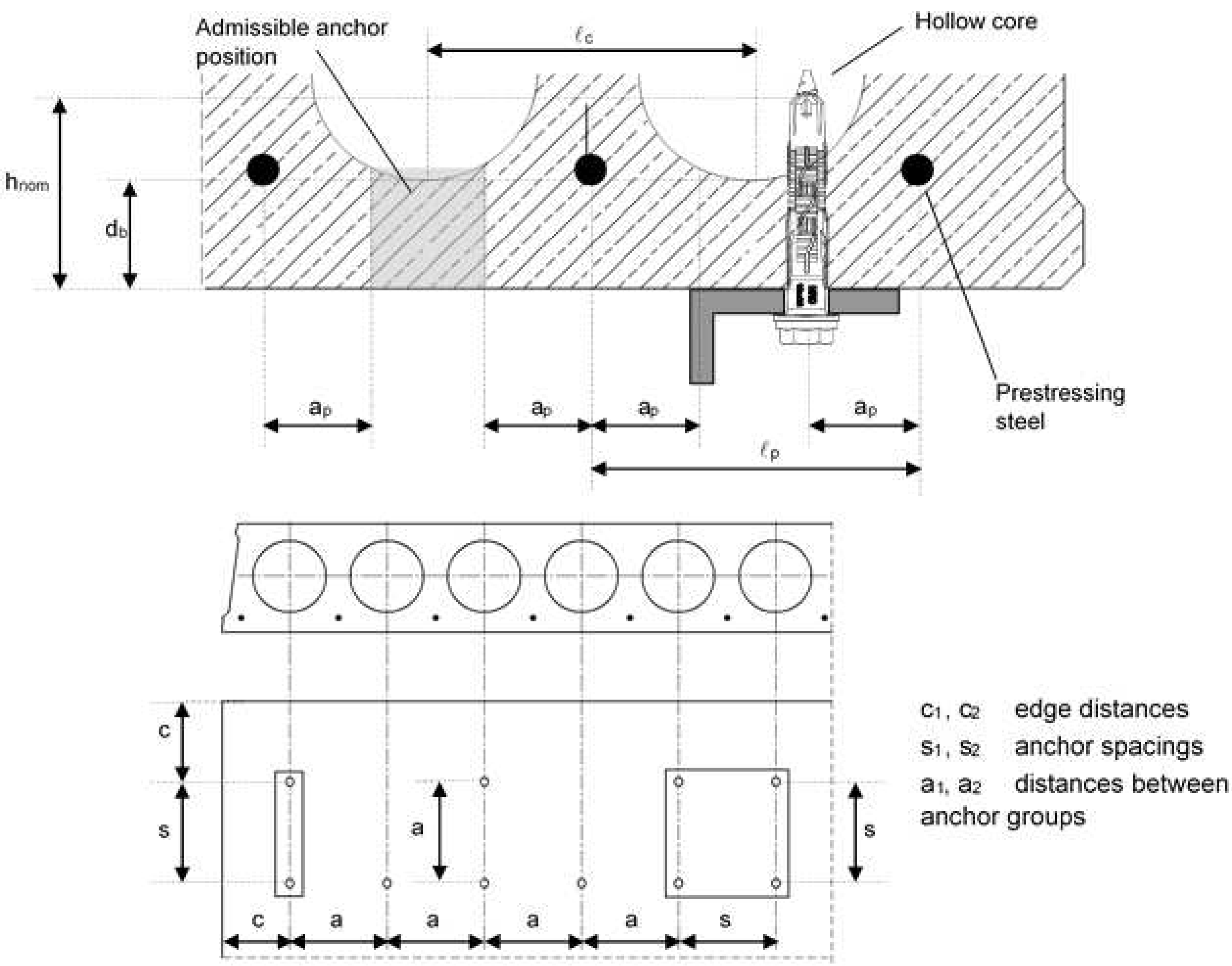
Installation equipment

Anchor size	HRD 8	HRD 10
Rotary hammer	TE 2- TE6	
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	$l_c \geq$	[mm]	-	100
Prestressing steel distance	$l_p \geq$	[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

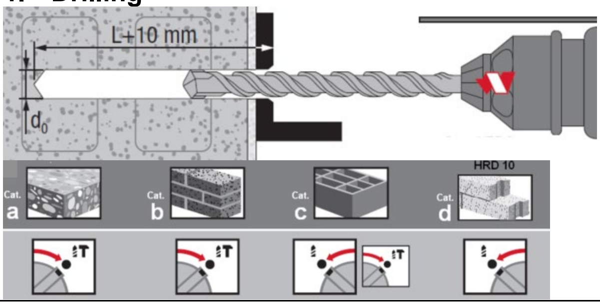


Setting instruction

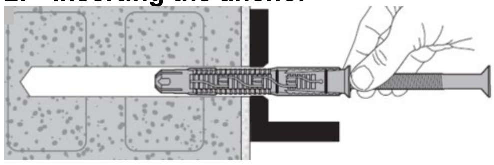
***For detailed information on installation see instruction for use given with the package of the product.**

Setting instruction for HRD

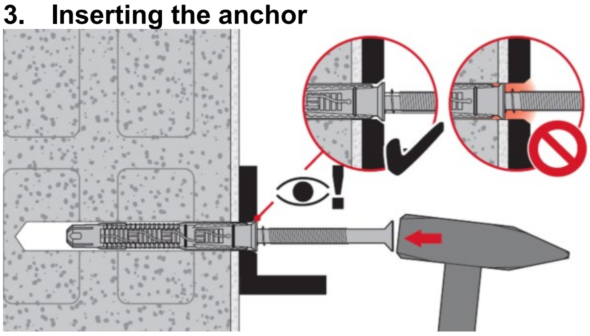
1. Drilling



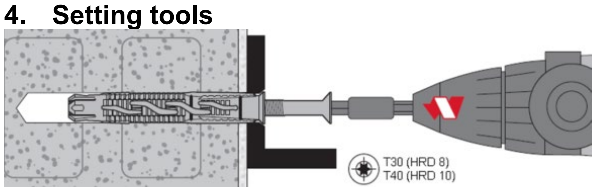
2. Inserting the anchor



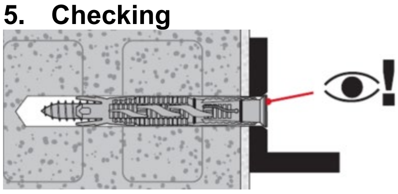
3. Inserting the anchor



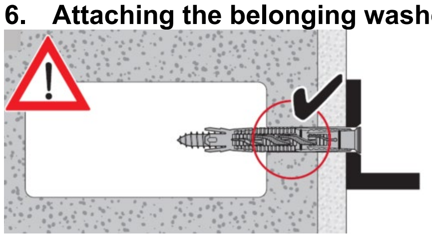
4. Setting tools



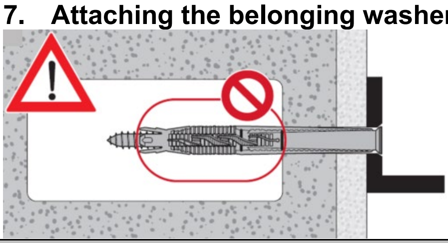
5. Checking



6. Attaching the belonging washer

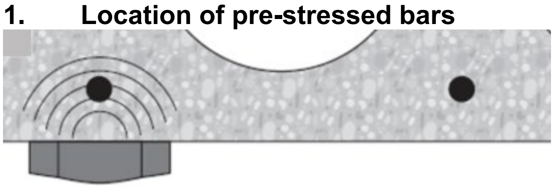


7. Attaching the belonging washer



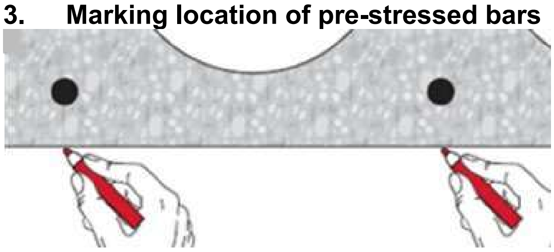
Additional preparation in case of application in precast prestressed hollow core slabs

1. Location of pre-stressed bars

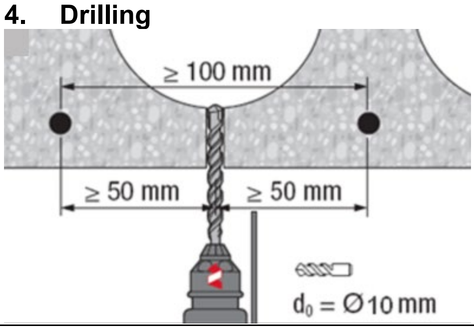


2. Marking location of pre-stressed bars

3. Marking location of pre-stressed bars



4. Drilling



HPS-1 Plastic anchors

Economical plastic impact anchor

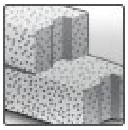
Anchor version		Benefits
	HPS-1 (M4-M8)	- Impact anchor for light frames, battens and profiles on solid base materials - Impact and temperature resistant - High quality plastic

Base material


Concrete (non-cracked)


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

Anchorage depth

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
Nominal embedment depth	h_{nom}	[mm]	25	30	30	40	40	50	50	50

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_{Rec}	[kN]	0,05	0,10	0,15	0,25	0,25	0,30	0,40	0,40
	V_{Rec}	[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
Plastic 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.

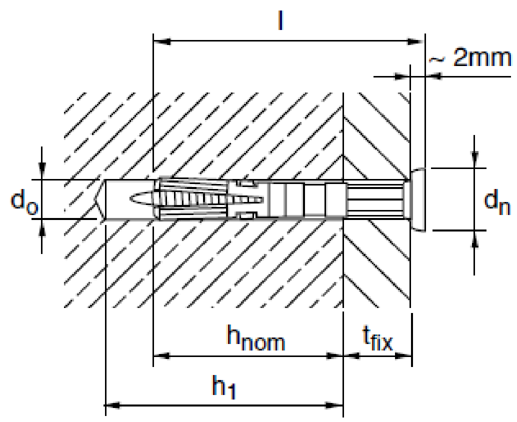
Temperature range	Base material temperature	Max. long term base material temperature	Max. short term base material temperature
Temperature range	-40 °C to +80 °C	+50 °C	+80 °C

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 HPS-1

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
Nominal embedment 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

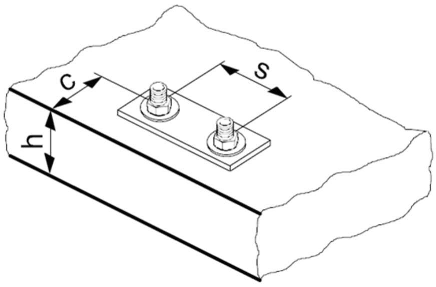


Installation equipment

Anchor	HPS-1 4	HPS-1 5	HPS-1 6	HPS-1 8
Rotary hammer	TE2 - TE6			
Other tools	Screwdriver			

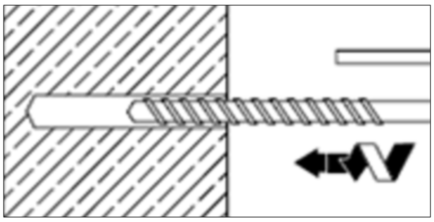
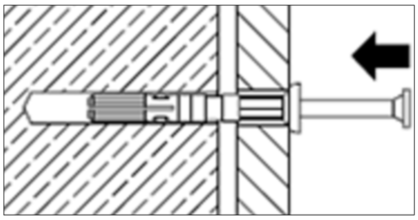
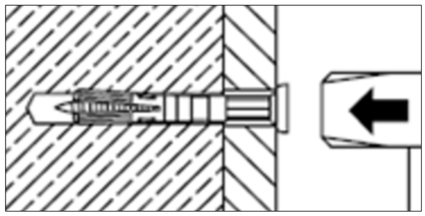
Setting parameters HPS-1

Anchor			HPS-1 4	HPS-1 5	HPS-1 6	HPS-1 8
Minimum spacing	s	[mm]	20	25	30	35
Minimum edge distance	c	[mm]	20	25	30	35



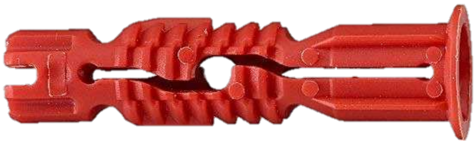
Setting instruction

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

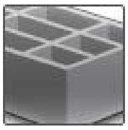
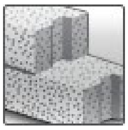
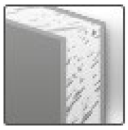
Setting instructions		
1.Drill hole with drill bit 	**2.Install anchor** 	**3.Hammer in anchor** 

HUD-2 Plastic anchor

Economical universal plastic anchor

Anchor version		Benefits
	HUD-2 (5, 6, 8)	- Flat setting - Flexibility of screw length - An anchor for every base material

Base material

				
Concrete (non-cracked)	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

- 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 chipboard screw type
- No edge distance and spacing influence
- Base material as specified in the table
- Minimum base material thickness
- Load data given in the tables is independent of load direction

Anchorage depth

Anchor size			5x25	6x30	8x40
Nominal embedment depth	h_{nom}	[mm]	25	30	40

Characteristic resistance

Anchor size				HUD-2 5x25	HUD-2 6x30	HUD-2 8x40
Screw type				Chipboard screw 4x40 [a]	Chipboard screw 5x50 [b]	Chipboard screw 6x50 [c]
Base material	Drilling mode					
Concrete, uncracked Strength ≥ C16/20	hammer	F_{Rk}	[kN]	0,60	1,2	2,5

a) chipboard screw 4x40: outer diameter 3,9 mm, core diameter 2,4 mm
b) chipboard screw 5x50: outer diameter 4,8 mm, core diameter 2,9 mm
c) chipboard screw 6x50: outer diameter 5,8 mm, core diameter 3,8 mm

Design resistance [d]

Anchor size				HUD-2 5x25	HUD-2 6x30	HUD-2 8x40
Screw type				Chipboard screw 4x40 [a]	Chipboard screw 5x50 [b]	Chipboard screw 6x50 [c]
Base material	Drilling mode					
Concrete, uncracked Strength ≥ C16/20	hammer	F_{Rd}	[KN]	0,33	0,67	1,4

a) chipboard screw 4x40: outer diameter 3,9 mm, core diameter 2,4 mm
b) chipboard screw 5x50: outer diameter 4,8 mm, core diameter 2,9 mm
c) chipboard screw 6x50: outer diameter 5,8 mm, core diameter 3,8 mm
d) with global safety factor factors γ_M = 1,8 for concrete; γ_M = 2,0 for AAC, γ_M = 2,5 for masonry, γ_M = 2,5 for drywall

Recommended loads [d]

Anchor size				HUD-2 5x25	HUD-2 6x30	HUD-2 8x40
Screw type				Chipboard screw 4x40 [a]	Chipboard screw 5x50 [b]	Chipboard screw 6x50 [c]
Base material	Drilling mode					
Concrete, uncracked Strength ≥ C16/20	hammer	F_{rec}	[KN]	0.12	0.24	0.5

a) chipboard screw 4x40: outer diameter 3,9 mm, core diameter 2,4 mm
b) chipboard screw 5x50: outer diameter 4,8 mm, core diameter 2,9 mm
c) chipboard screw 6x50: outer diameter 5,8 mm, core diameter 3,8 mm
d) 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
Plastic sleeve	Polyamide 6

Setting information

Installation temperature
-10°C to +40°C

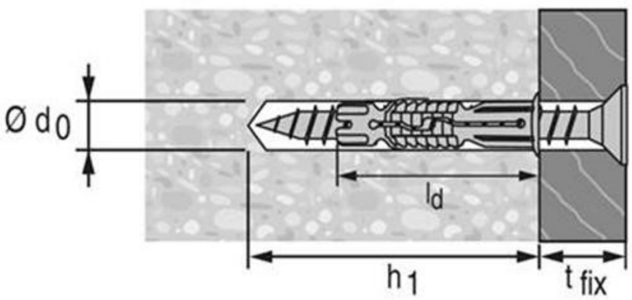
Service temperature range
Hilti HUD-2 universal anchor may be applied in the temperature range given below.

Temperature range	Base material temperature	Max. long term base material temperature	Max. short term base material temperature
Temperature range I	-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.

Installation parameters

Anchor size			5x25	6x30	8x40
Nominal diameter of drill bit	d_0	[mm]	5	6	8
Cutting diameter of the drill bit	$d_{cut} \leq$	[mm]	5,4	6,4	8,45
Nominal embedment depth	l_d	[mm]	25	30	40
Recommended length of screw in base material		[mm]	≥30	≥35	≥45
Drill hole depth	h_0	[mm]	≥ 30	≥ 35	≥ 45
Minimum spacing	s_{min}	[mm]	Not determined		
Minimum edge distance	c_{min}	[mm]	Not determined		

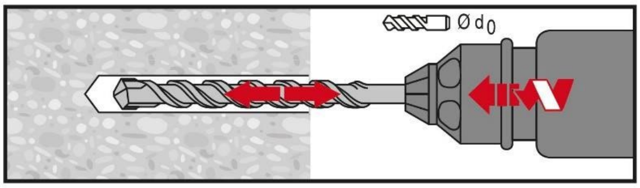
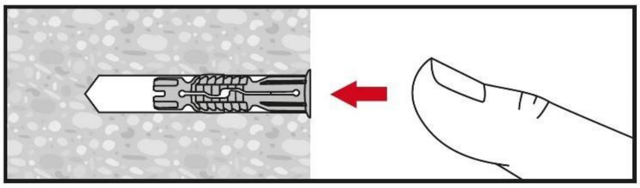
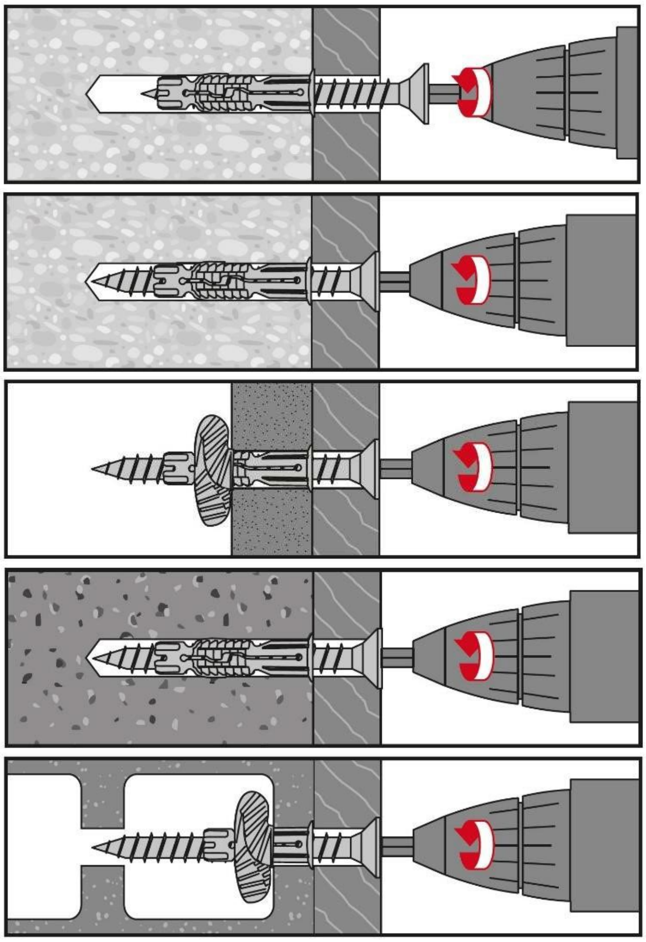


Installation equipment

Anchor size	5x25	6x30	8x40
Rotary hammer	TE 2 - TE6		
Other tools	Screwdriver		

Setting instruction[a)]

***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. Drive screw into anchor**

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

HUD-1 Plastic anchor

Economical universal plastic anchor

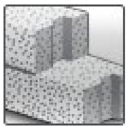
Anchor version		Benefits
	HUD-1 (M10, M12, M14)	- Flat setting - Flexibility of screw length - An anchor for every base material

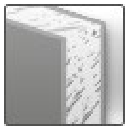
Base material


Concrete (non-cracked)


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 wood screw type
- No edge distance and spacing influence
- Base material as specified in the table
- Minimum base material thickness

Anchorage depth

Anchor size			10x50	12x60	14x70
Nominal anchorage depth	h_{nom}	[mm]	50	60	70

Characteristic resistance

Anchor size			10x50	12x60	14x70
Screw type[d)]			W	W	W
Size			8	10	12
DIN			96	571	571
Concrete ≥ C16/20	N_{Rk}	[kN]	7	10	15
	V_{Rk}	[kN]	11	15	28

a) only with screw diameter 6mm
b) only with screw diameter 8mm
c) only with screw diameter 10mm
d) 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			10x50	12x60	14x70
Screw type[d)]			W	W	W
Size			8	10	12
DIN			96	571	571
Concrete ≥ C16/20	N_{Rd}	[kN]	1,96	2,80	4,20
	V_{Rd}	[kN]	3,08	4,20	7,84

a) only with screw diameter 6mm
b) only with screw diameter 8mm
c) only with screw diameter 10mm
d) 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[e)]

Anchor size			10x50	12x60	14x70
Screw type[d)]			W	W	W
Size			8	10	12
DIN			96	571	571
Concrete ≥ C16/20	N_{Rec}	[kN]	1,4	2	3
	V_{Rec}	[kN]	2,2	3	5,6

a) only with screw diameter 6mm
b) only with screw diameter 8mm
c) only with screw diameter 10mm
d) 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.
e) 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-1 universal anchor may be applied in the temperature range given below.

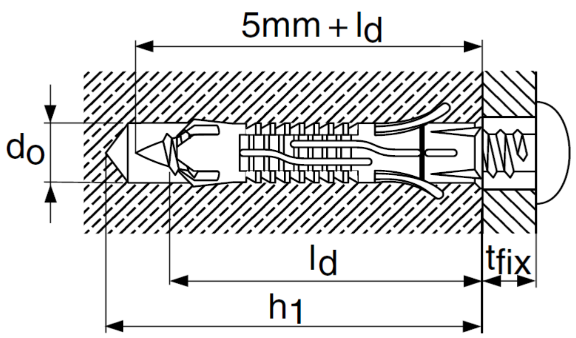
Temperature range	Base material temperature	Max. long term base material temperature	Max. short term base material temperature
Temperature range I	-40 °C to +80 °C	+50 °C	+80 °C

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			10x50	12x60	14x70
Nominal diameter of drill bit	d_o	[mm]	10	12	14
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	10,45	12,5	14,5
Depth of drill hole	$h_1 \geq$	[mm]	65	80	90
Nominal anchorage depth	h_{nom}	[mm]	50	60	70
Anchor length	l	[mm]	50	60	70
Max fixture thickness	t_{fix}	[mm]	Depending on screw length		
Woodscrew diameter [a)]	d	[mm]	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.

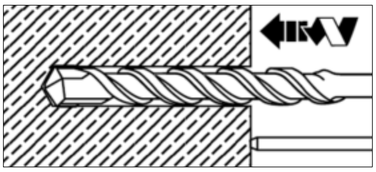
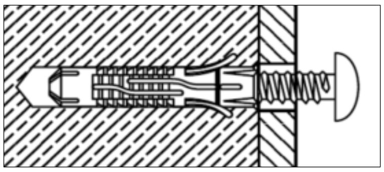
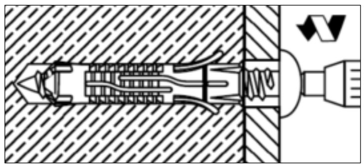
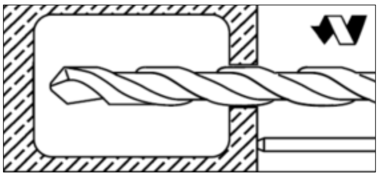
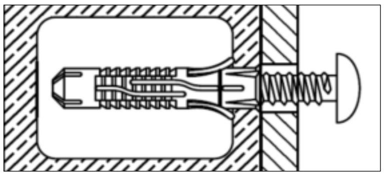
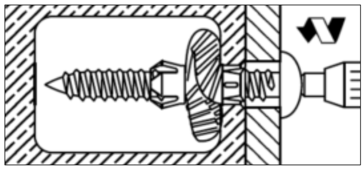


Installation equipment

Anchor size	10x50	12x60	14x70	5x25
Rotary hammer	TE 2 - TE6			
Other tools	Screwdriver			

Setting instruction[a)]

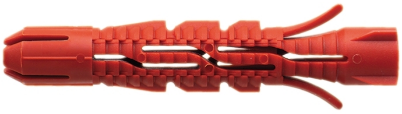
***For detailed information on installation see instruction for use given with the package of the product.**

Setting instruction		
1. Drill hole with drill bit 	**2. Install anchor** 	**3. Drive screw into anchor** 
4. Drill hole with drill bit 	**5. Install anchor** 	**6. Drive screw into anchor** 

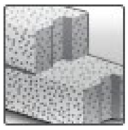
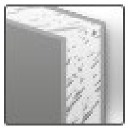
a) Use only for wall and floor applications. Not applicable for ceiling and façade applications.

HUD-L Plastic anchors

Economical universal long plastic anchor

Anchor version		Benefits
	HUD-L (M6-M8)	- Universal plastic anchor for weak base materials and renovation - For many base materials - Daily application - Excellent setting behaviour

Base material

				
Concrete (Non-cracked)	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 $_y$= 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

Anchorage depth

Anchor size			6x50	8x60	10x70
Nominal embedment depth	h_{nom}	[mm]	47	57	70

Characteristic resistance

Anchor size		6x50	8x60	10x70
Screw type c) d)		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) Drilling without hammering
b) Suitable for fitting hexagonal screws by hand
c) Load data are valid for the mentioned woodscrew type, if other types or different screws are used the load capacity may decrease.
d) Screw type: W: Wood-screw

Design resistance

Anchor size		6x50	8x60	10x70
Screw type c) d)		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) Drilling without hammering
b) Suitable for fitting hexagonal screws by hand
c) Load data are valid for the mentioned woodscrew type, if other types or different screws are used the load capacity may decrease.
d) Screw type: W: Wood-screw

Recommended loads e)

Anchor size		6x50	8x60	10x70
Screw type c) d)		W	W	W
Size		4,5x80	5x90	8
DIN		96	96	571
Concrete ≥ C16/20	F_{Rec} [kN]	0,23	0,28	1,8

a) Drilling without hammering
b) Suitable for fitting hexagonal screws by hand
c) Load data are valid for the mentioned woodscrew type, if other types or different screws are used the load capacity may decrease.
d) Screw type: W: Wood-screw
e) 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

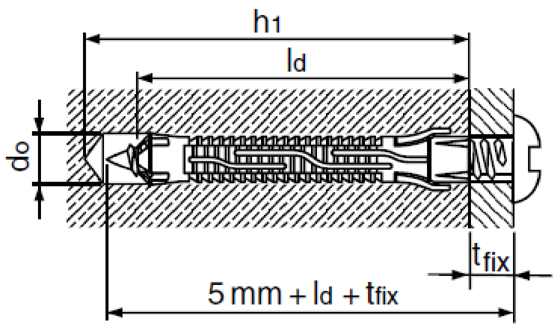
Long-term elevated base material temperatures are roughly constant over significant periods of time.

Setting parameters

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
Nominal embedment depth	h_{nom}	[mm]	47	57	70
Anchor length	l	[mm]	47	57	70
Max fixture thickness [b)]	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.

b) Using this plastic anchor requires self-preparation on the screw anchor.

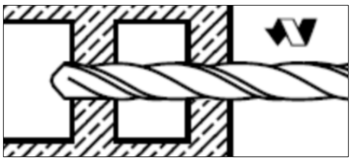
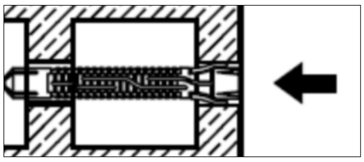
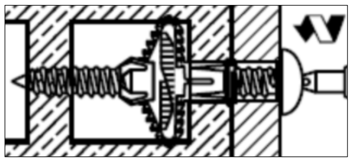
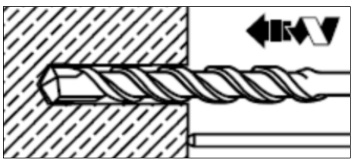
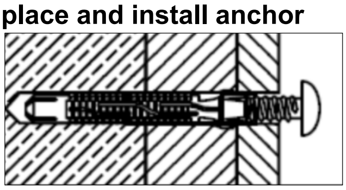
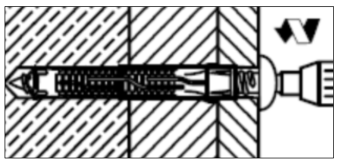


Installation equipment

Anchor size	6x50	8x60	10x70
Rotary hammer	TE 2- TE6		
Other tools	Screwdriver		

Setting instruction [a)]

***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.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.

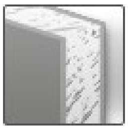
Anchor technology & design
Heavy / medium duty metal anchors
Plastic / light duty / other metal anchors
Chemical anchors
Anchor channels

HLD Plastic anchors

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 detail

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

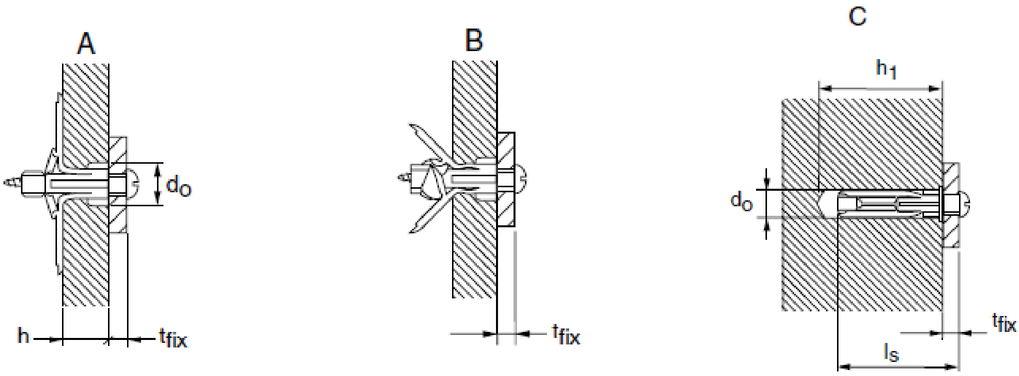
Service temperature range
Hilti HLD universal anchor may be applied in the temperature range given below.

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	[mm]	35	42	50

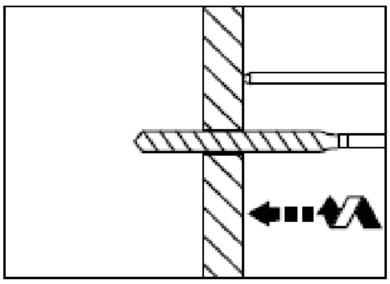
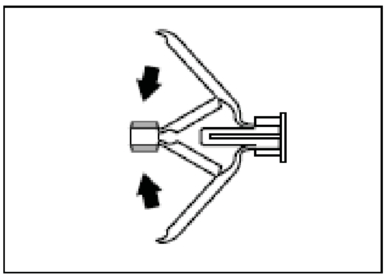
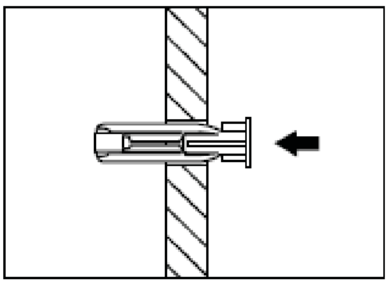
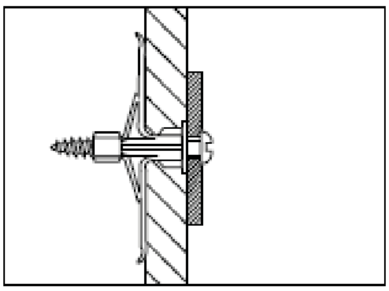


Installation equipment

Anchor size	HLD 2	HLD 3	HLD 4
Rotary hammer	TE 2- TE6		
Other tools	Screwdriver		

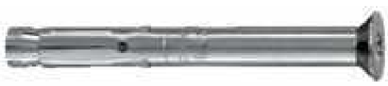
Setting instruction

***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 anchors

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, eyebold closed	
	HLC-EO (M5-M16)	Loop-hanger head, eyebold open	
	HLC-T (M5-M16)	Ceiling hanger	

Base material


Concrete (non-cracked)


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			6,5	8	10	12	16	20
Threaded bolt diameter			**M5**	**M6**	**M8**	**M10**	**M12**	**M16**
Effective anchorage depth	h_{ef}	[mm]	16	26	31	33	41	41

Characteristic resistance

Anchor size			6,5	8	10	12	16	20
Threaded bolt diameter			**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			6,5	8	10	12	16	20
Threaded bolt diameter			**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			6,5	8	10	12	16	20
Threaded bolt diameter			**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) With overall global safety factor for action γ = 3.0.

Materials

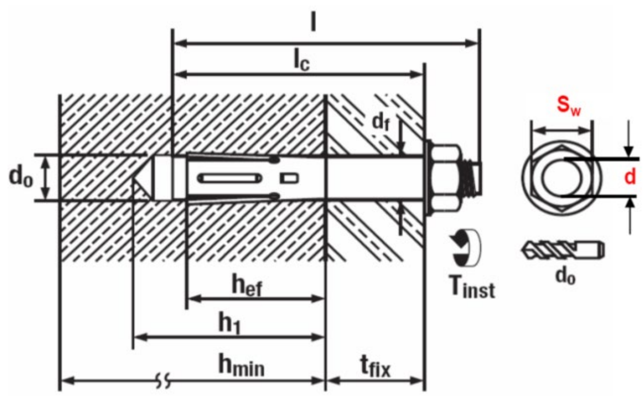
Material quality

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

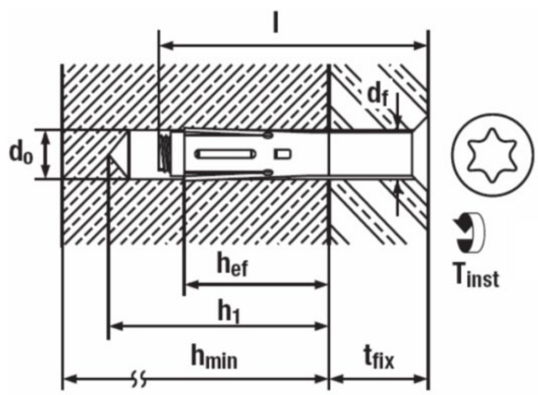
Anchor dimensions

Anchor version	Anchor 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 HLC

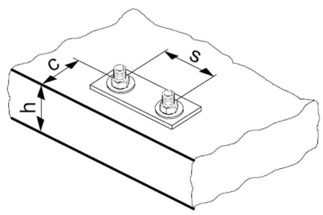
			M5	M6	M8	M10	M12	M16
Nominal diameter of drill bit	d_0	[mm]	6,5	8	10	12	16	20
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	6,4	8,45	10,45	12,5	16,5	20,55
Depth of drill hole	$h_1 \geq$	[mm]	30	40	50	65	75	85
Width across nut flats HLC	SW	[mm]	8	10	13	15	19	24
Width across nut flats HLC-H	SW	[mm]				17		
Width across nut flats HLS-SK	Driver		PZ 3	T 30	T 40	T 40	-	-
Diameter of clearance hole in the fixture	$d_f \leq$	[mm]	7	10	12	14	18	21
Effective anchorage depth	h_{ef}	[mm]	16	26	31	33	41	41
Max. torque moment concrete	T_{inst}	[Nm]	5	8	25	40	50	80
Max. torque moment masonry	T_{inst}	[Nm]	2,5	4	13	20	25	-

Installation equipment

Anchor size	M5	M6	M8	M10	M12	M16
Rotary hammer for setting	TE 2 – TE 16					
Other tools	hammer, torque wrench, blow out pump					

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

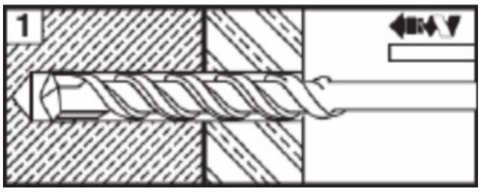


Setting instruction

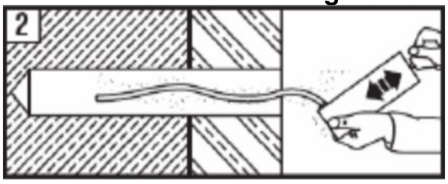
***For detailed information on installation see instruction for use given with the package of the product.**

Setting instruction for HLC

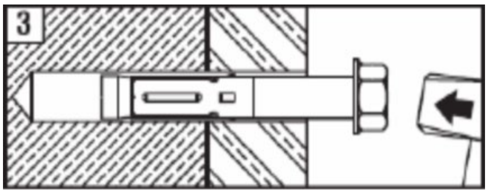
1. Drill hole with drill bit



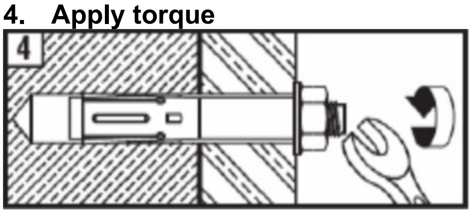
2. Blow out dust and fragments



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

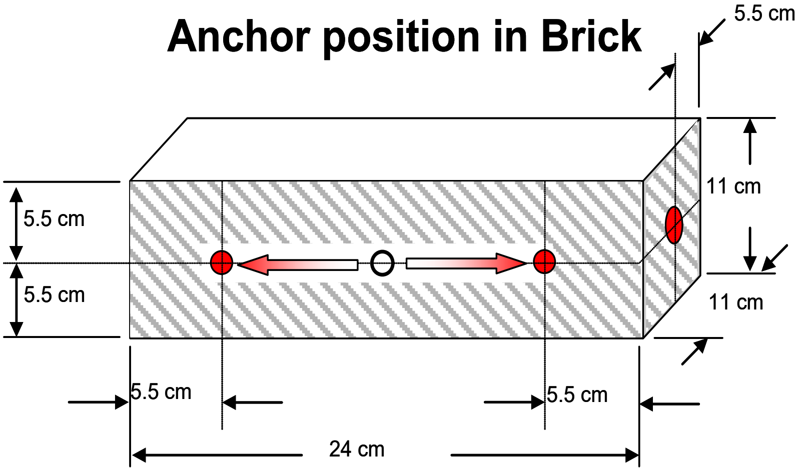
Anchor size			**M5**	**M6**	**M8**	**M10**	**M12**
Effective anchorage depth	h_{ef}	[mm]	16	26	31	33	41

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 sand-lime 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 Mz (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 KS (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 center 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

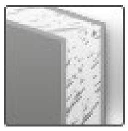
Plaster, graveling, lining or levelling courses are regarded as non-bearing and may not be taken into account for the calculation of embedment depth.

HHD-S Light duty metal anchors

Economical cavity anchor

Anchor version		Benefits
	HHD-S (M4-M8)	- Metal undercut anchor with metric screw, especially 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_{rec}	[kN]	0,1	-	-	-
	V_{rec}	[kN]	0,3	-	-	-
Gypsum board Thickness 10mm	N_{rec}	[kN]	0,2	0,2	0,2	0,2
	V_{rec}	[kN]	0,5	0,5	0,5	0,5
Gypsum board Thickness 12,5mm	N_{rec}	[kN]	0,2	0,2	0,2	0,2
	V_{rec}	[kN]	0,5	0,5	0,5	0,5
Gypsum board Thickness 2x12,5mm	N_{rec}	[kN]	-	0,4	0,3	0,4
	V_{rec}	[kN]	-	1	0,9	1
Fibre reinforced gypsum board Thickness 10mm	N_{rec}	[kN]	0,2	0,3	0,25	0,4
	V_{rec}	[kN]	0,5	0,6	0,8	0,9
Fibre reinforced gypsum board Thickness 12,5mm	N_{rec}	[kN]	0,3	0,5	0,3	0,6
	V_{rec}	[kN]	0,6	1	1	1,2
Fibre reinforced gypsum board Thickness 2x12,5mm	N_{rec}	[kN]	-	0,9	0,8	0,9
	V_{rec}	[kN]	-	1,1	1,8	1,7

a) With overall global safety factor γ = 3 to the characteristic loads and a partial safety factor of γ = 1,4 to the design values.

Materials

Material quality

Part	Material
Sleeve	Carbon steel, galvanised
Screw	Carbon steel, galvanised

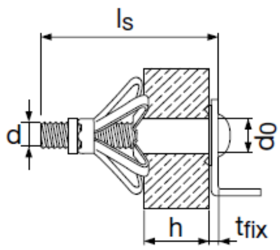
Setting information

Setting details HHD-S

Anchor			M4x4	M4x6	M4x12	M4x19	M5x8	M5x12	M5x25
Nominal diameter of drill	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	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

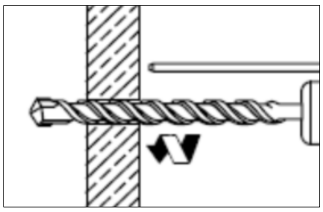
Anchor	M4	M5	M6	M8
Rotary hammer	TE2 - TE6			
Other tools	Screwdriver, HHD-SZ2 expansion tool			

Setting instruction

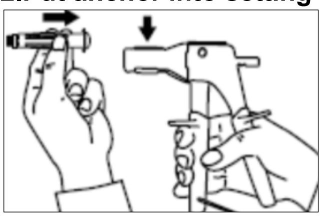
***For detailed information on installation see instruction for use given with the package of the product.**

Setting instructions

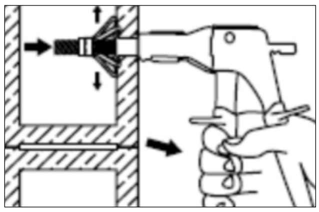
1.Drill hole with drill bit



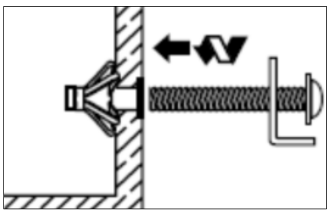
2.Put anchor into setting tool

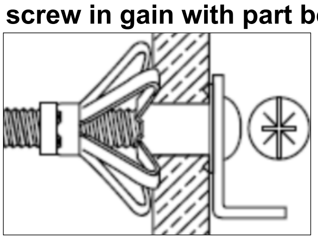


3.Install anchor with setting tool



4. Remove screw from anchor and screw in gain with part being fastened attached

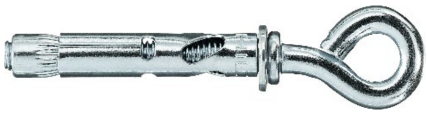




HA 8 NG Light duty metal anchors

Hook and ring anchor

Anchor version


HA 8 NG R1


HA 8 NG H1

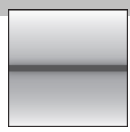
Benefits

- Well proven
- Easy-setting
- Follow-up expansion
- Hook and ring head available

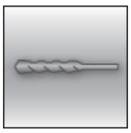
Base material


Concrete
(non-cracked)

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 ($f_{ck,cube}$ = 25 N/mm^2) - C50/60 ($f_{ck,cube}$ = 60 N/mm^2)

Concrete			**Non-cracked**
Tensile	N_{rec}	[kN]	0,8

Materials

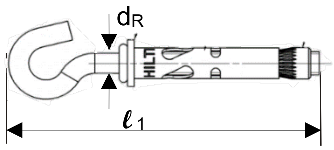
Anchor size			HA 8 NG bolt
Nominal tensile strength	f_{uk}	[N/mm²]	520
Yield strength	f_{yk}	[N/mm²]	450

Material quality

Part	Material
Expansion sleeve	Carbon steel, galvanized to min. 5 µm
Bolt	Carbon steel, galvanized to min. 5 µm

Anchor dimensions

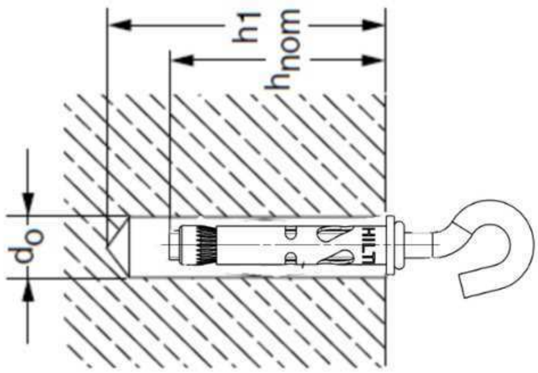
Anchor size			HA 8 NG
Bolt diameter	d_R	[mm]	5.4
Length of the anchor	l_1	[mm]	76



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

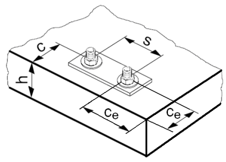


Installation equipment

Anchor size	HA 8 NG
Rotary hammer	TE2 – TE6
Other tools	Hammer, blow out pump

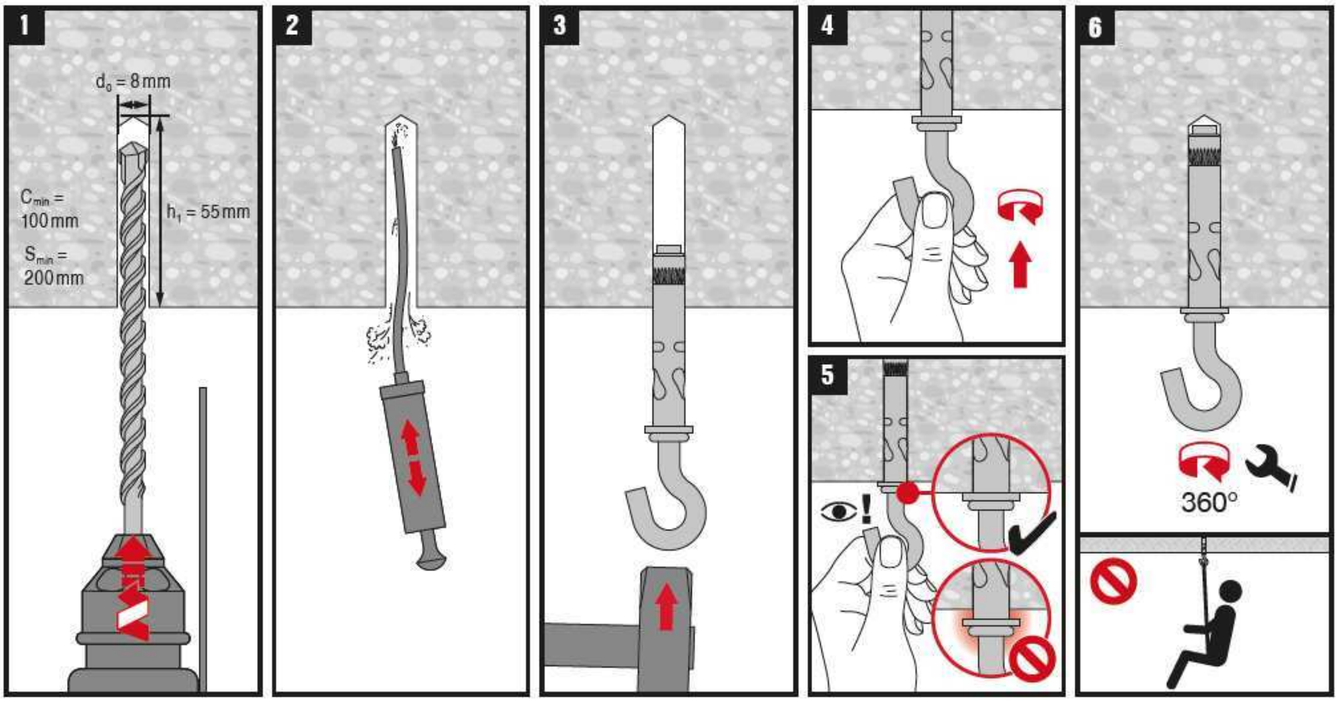
Setting parameters

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



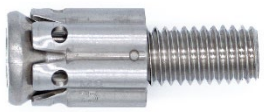
Setting instruction

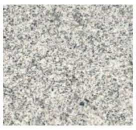
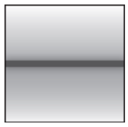
***For detailed information on installation see instruction for use given with the package of the product.**



HSU-R stone undercut anchor

Undercut anchor for the rear fixing of façade panels made of natural stones

Anchor version		Benefits
	HSU-R (M6-M8)	- Performance assessed by European Approval body per the latest standard. - Impossible for damaging spinning lock or undercut elements during installation - Clear visual check for undercut completion (Hilti red line mark for undercut portfolio) - Optimized sleeve size for reducing the possibility of spinning after installation

Base material	Load conditions
 Natural stone	 Static / quasi-static

Other information

European Technical Assessment

Corrosion resistance

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European Technical Assessment	DIBt, Berlin	ETA-16/0784 / 2019-03-13

Basic loading data (for a single anchor)

All data in this section applies to:

- 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 anchor placed into nature stone.
- The resistance in natural stone provided by this technical data manual are valid only for the anchors of the same natural stone 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, which are not listed in this technical data manual, additional tests and evaluation per EAD 330030-00-0601 shall be used by responsible engineer to define the resistance.

Characteristic resistance under tension and shear load for steel failure

Anchor size		M6	M8
Tension $N_{Rk,s}$	[kN]	16,1	29,3
Shear $V_{Rk,s}$	[kN]	9,7	17,6

Design resistance under tension and shear load for steel failure[a)]

Anchor size		M6	M8
Tension $N_{Rd,s}$	[kN]	10,7	19,,5
Shear $V_{Rd,s}$	[kN]	7,8	14,1

a) Safety factor used: $\gamma_{Ms,N}$ = 1,5; $\gamma_{Ms,V}$ = 1,25 per EOTA Technical Report 062 Design of fasteners for façade panels made of natural stone

Characteristic resistance for natural stone panel failure

- All load information relates to the base material information table at the end of this section.
- The resistance is the minimal characteristic value among all failure modes relevant with natural stone panels.
- *Steel failure*

No	Base material[a]	Data	Anchor size	M6					M8		
			Setting depth h_s [mm]	13				15	15		21
			Edge distance a_r [mm]	50[b] 100	70	100	150	150	100	150	150
1	Group I, Granite, Padang Cristallo G603(G3503), China	ETA 16/0784	N_{Rk} [kN]	-	-	4,0[c]	-	-	6,0	-	-
			V_{Rk} [kN]	-	-	6,6[c]	-	-	6,9	-	-
2	Group I, Gabbro, Nero Assoluto, Zimbabwe	ETA 16/0784	N_{Rk} [kN]	-	-	-	11,6	-	-	17,0	-
			V_{Rk} [kN]	-	-	-	*9,7*	-	-	*17,6*	-
3	Group IV, Limestone, Jura Limestone (yellow), Germany	ETA 16/0784	N_{Rk} [kN]	-	-	-	-	6,2	-	-	10,2
			V_{Rk} [kN]	-	-	-	-	8,4	-	-	11,1
4	Group I, Granite, Sesame Grey G3554, China	Hilti Technical Data	N_{Rk} [kN]	-	-	-	9,5	12,1	-	12,4	19,4
			V_{Rk} [kN]	-	-	-	*9,7*	*9,7*	-	13,4	*17,6*
5	Group I, Granite, Sesame Grey G3554, China	Hilti Technical Data	N_{Rk} [kN]	3,7	-	-	-	-	-	-	-
			V_{Rk} [kN]	4,5	-	-	-	-	-	-	-
6	Group III, Basalt, Fuding Black G3518, China	Hilti Technical Data	N_{Rk} [KN]	-	-	-	11,5	14,5	-	14,6	20,8
			V_{Rk} [KN]	-	-	-	*9,7*	*9,7*	-	12,0	*17,6*
7	Group I, Granite, Wulian Leopard Skin G3742, China	Hilti Technical Data	N_{Rk} [KN]	-	-	-	7,3	7,3	-	8,4	13,2
			V_{Rk} [KN]	-	-	-	7,7	7,7	-	7,3	11,1
8	Group I, Granite, Laizhou Sesame White G3765, China	Hilti Technical Data	N_{Rk} [KN]	-	-	-	6,1	6,9	-	8,1	13,9
			V_{Rk} [KN]	-	-	-	*9,7*	*9,7*	-	13,5	13,5
9	Group I, Granite, Cenxi Red G4562, China	Hilti Technical Data	N_{Rk} [KN]	-	-	-	8,6	8,8	-	10,7	15,8
			V_{Rk} [KN]	-	-	-	*9,7*	*9,7*	-	15,0	15,0
10	Group IV, Limestone, Moca Cream, Portugal	Hilti Technical Data	N_{Rk} [KN]	-	1,9	1,9	1,9	-	-	-	-
			V_{Rk} [KN]	-	2,0	2,0	2,7	-	-	-	-

a) Number code for Chinese Stones according to GB 17670-2016
b) Edge distance in horizontal direction a_r = 50 mm, **vertical direction a_r = 100mm**
c) Factor X for stone No. 1 Padang Cristallo and stone No. 3 Jura Limestone X=1,2

Design resistance – in natural stone panels

- Design resistance is the minimal design resistance of all failure modes, by using partial safety factor for γ_M =1,8 for natural stone panel failure and 1.5 in tension and 1.25 in shear for steel failure.
- Design principle

$$\frac{N_{Ed}}{N_{Rd}} \leq 1,0 \quad \text{and} \quad \frac{V_{Ed}}{V_{Rd}} \leq 1,0$$ Equation 1 and 2

$$\frac{N_{Ed}}{N_{Rd}} + \frac{V_{Ed}}{V_{Rd}} \leq X$$ Equation 3

- Combined tension and shear resistance factor X in Equation 3 is 1.0, unless special noted.

No	Base material[a]	Data	Anchor size	M6					M8		
			Setting depth h_s [mm]	13				15	15		21
			Edge distance a_r [mm]	50 b) 100	70	100	150	150	100	150	150
1	Group I, Granite, Padang Cristallo G603(G3503), China	ETA 16/0784	N_{Rd} [KN]	-	-	2,2c)	-	-	3,3	-	-
			V_{Rd} [KN]	-	-	3,6c)	-	-	3,8	-	-
2	Group I, Gabbro, Nero Assoluto, Zimbabwe	ETA 16/0784	N_{Rd} [KN]	-	-	-	6,4	-	-	9.4	-
			V_{Rd} [KN]	-	-	-	6,5	-	-	11,9	-
3	Group IV, Limestone, Jura Limestone (yellow), Germany	ETA 16/0784	N_{Rd} [KN]	-	-	-	-	3,4	-	-	5,6
			V_{Rd} [KN]	-	-	-	-	4,6	-	-	6,1
4	Group I, Granite, Sesame Grey G3554, China	Hilti Technical Data	N_{Rd} [KN]	-	-	-	5,3	6,7	-	6,9	10,7
			V_{Rd} [KN]	-	-	-	5,9	5,9	-	7,4	10,8
5	Group I, Granite, Sesame Grey G3554, China	Hilti Technical Data	N_{Rd} [KN]	2,0	-	-	-	-	-	-	-
			V_{Rd} [KN]	2,5	-	-	-	-	-	-	-
6	Group III, Basalt, Fuding Black G3518, China	Hilti Technical Data	N_{Rd} [KN]	-	-	-	6,4	8,0	-	8,1	11,5
			V_{Rd} [KN]	-	-	-	5,5	5,5	-	6,6	10,7
7	Group I, Granite, Wulian Leopard Skin G3742, China	Hilti Technical Data	N_{Rd} [KN]	-	-	-	4,0	4,0	-	4,7	7,3
			V_{Rd} [KN]	-	-	-	4,3	4,3	-	4,0	6,2
8	Group I, Granite, Laizhou Sesame White G3765, China	Hilti Technical Data	N_{Rd} [KN]	-	-	-	3,4	3,8	-	4,5	7,7
			V_{Rd} [KN]	-	-	-	5,8	5,8	-	7,5	7,5
9	Group I, Granite, Cenxi Red G4562, China	Hilti Technical Data	N_{Rd} [KN]	-	-	-	4,8	4,9	-	5,9	8,8
			V_{Rd} [KN]	-	-	-	6,0	6,0	-	8,3	8,3
10	Group IV, Limestone, Moca Cream, Portugal	Hilti Technical Data	N_{Rd} [KN]	-	1,0	1,0	1,0	-	-	-	-
			V_{Rd} [KN]	-	1,1	1,1	1,5	-	-	-	-

a) Number code for Chinese Stones according to GB 17670-2016
b) Edge distance in horizontal direction a_r = 50 mm, **vertical direction a_r = 100mm**
c) Factor X for stone No. 1 Padang Cristallo and stone No. 3 Jura Limestone X=1,2

Base material information corresponding to the resistance in natural stone panels

No.	Base material[a)]	Characteristic Flexural strength of panel per EN 12372 [MPa]	Anchor size	M6		M8	
			Setting depth h_s [mm]	13	15	15	21
1	Group I, Granite, Padang Cristallo G603(G3503), China	12,4	Edge distance [mm]	100	-	100	-
			Panel thickness [mm]	30	-	30	-
2	Group I, Gabbro, Nero Assoluto, Zimbabwe	26,3	Edge distance [mm]	150	-	150	-
			Panel thickness [mm]	25	-	25	-
3	Group IV, Limestone, Jura Limestone (yellow), Germany	14,1	Edge distance [mm]	-	150	-	150
			Panel thickness [mm]	-	35	-	35
4	Group I, Granite, Sesame Grey G3554, China	15,0	Edge distance [mm]	150	150	150	150
			Panel thickness [mm]	30	30	30	50
5	Group I, Granite, Sesame Grey G3554, China	**17,0**	Edge distance [mm]	50/**100**[b)]	-	-	-
			Panel thickness [mm]	20	-	-	-
6	Group III, Basalt, Fuding Black G3518, China	18,6	Edge distance [mm]	150	150	150	150
			Panel thickness [mm]	50	50	50	50
7	Group I, Granite, Wulian Leopard Skin G3742, China	6,6	Edge distance [mm]	150	150	150	150
			Panel thickness [mm]	30	30	30	50
8	Group I, Granite, Laizhou Sesame White G3765, China	10,3	Edge distance [mm]	150	150	150	150
			Panel thickness [mm]	50	50	50	50
9	Group I, Granite, Cenxi Red G4562, China	12,3	Edge distance [mm]	150	150	150	150
			Panel thickness [mm]	50	50	50	50
10	Group IV, Limestone, Moca Cream, Portugal	6,0	Edge distance [mm]	70 / 100 / 150	-	-	-
			Panel thickness [mm]	30	-	-	-

a) Number code for Chinese Stones according to GB 17670-2016
b) Edge distance in horizontal direction a_r = 50 mm, **vertical direction a_r = 100mm**

All stone groups are applicable

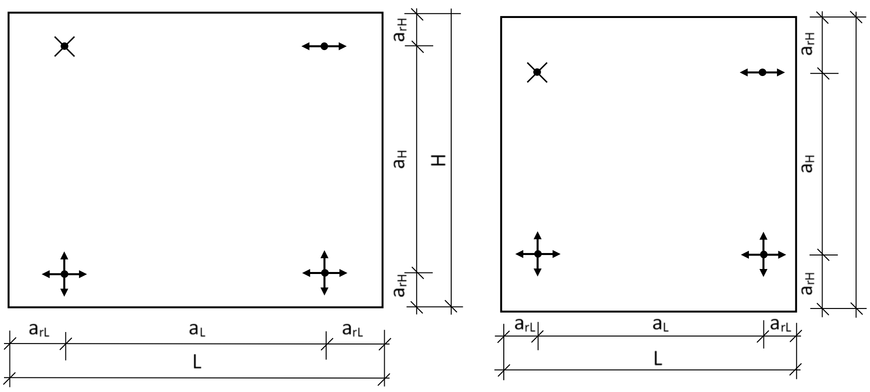
Stone group		Natural stone type	Boundary conditions
I	High-quality intrusive rocks (plutonic rocks)	granite, granitite, tonalite, diorite, monzonite, gabbro, other magmatic plutonic rocks	None
II	Metamorphic rocks with „hard stone characteristics“	quarzite, granulite, gneiss, migmatite	None
III	High-quality extrusive rocks (volcanic rocks)	basalt and basaltlava without harmful ingredients (e.g. sun burner basalt)	Minimum density ρ: basalt: 2,7 kg/dm³ basaltic lava: 2,2 kg/dm³
IV	Sedimentary rocks with „hard stone characteristics“1)	Sandstone, limestone and marble	Minimum density ρ: sandstone: 2,1 kg/dm³

1) 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 %.

Properties of applicable natural stone panels			
Nominal panel thickness (stone group I / II)	h_{nom}	[mm]	20 ≤ h_{nom}
Minimum panel thickness (stone group I / II)	h_{min} 1)	[mm]	h_s + 5 mm
Nominal panel thickness (stone group III / IV)	h_{nom}	[mm]	25 (30)2) ≤ h_{nom}
Minimum panel thickness (stone group III / IV)	h_{min} 1)	[mm]	h_s + 10 mm
Maximum panel size	A	[m²]	3,0
Maximum side length	H und L	[m]	3,0
Number of anchors (rectangular arrangement)	N	[-]	4 or 6
Minimum edge distance3)	$a_{rH,min}$, $a_{rL,min}$	[mm]	50
Maximum edge distance	$a_{rH,max}$, $a_{rL,max}$	[mm]	0,25 · L and 0,25 · H
Minimum spacing3)	a_L and a_H	[mm]	8 · h_s

1) Minimum panel thickness is equal to the lower limit of tolerance.
2) For sandstone, limestone and basaltic lava: panel thickness ⩾ 30 mm, if the panel manufacturer warranted lowest expected value (5 % fractile) of the flexural strength is < 8 N/mm² .
3) For small fitting or fill-in pieces the minimum edge distance or spacing shall be chosen according to the geometrical boundary conditions. In case of design under static loading using FEM, smaller edge distances are allowed.

Figure B1: Façade panel with fixing points



a_{rL}, a_{rH} edge distance of a fastener to the panel edge

a_L, a_H spacing – distance between fasteners

L greater length of the façade panel

H smaller length of the façade panel

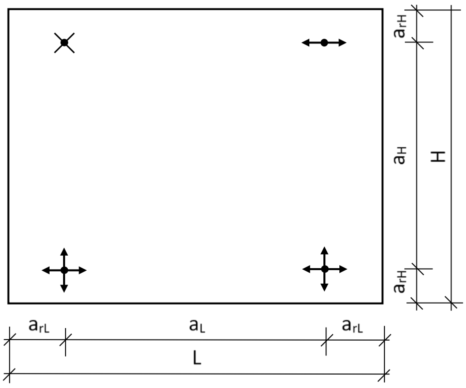
Fixed point

Horizontal skid

Horizontal and vertical skid

Design example

Stone Material Property Information



Stone Material name: Padang Cristallo

flexural strength σ_{rk}: 13 [MPa] characteristic value

Length L: 650 [mm]

Height H: 1200 [mm]

Thickness h: 30 [mm]

Position a_{rH}: 150 [mm]

Position a_{rL}: 100 [mm]

Action on the most loaded anchor:

Tension Load N_{Ed} 1.3 [kN]

Shear Load V_{Ed} 2.1 [kN]

Design

1. Application feasibility check:

   Stone group is No.1.

   Maximum panel size L and H < 3m; OK

   Thickness h > 20mm > h_s + 5mm =18 mm; OK

   Position a_{rL} and a_{rH} > 50mm, a_{rL} < 0.25 X 650 mm, a_{rH} < 0.25 X 1200 mm; OK

   This stone panel is applicable.

2. Design resistance check:

   Stone panel used has a larger edge distance and flexural strength than the data No.1 provided in this FTM, and has the same thickness, therefore the technical data No.1 in this FTM can be used directly for this design.

$$\frac{N_{Ed}}{N_{Rd}} = 1.3/2.2 \leq 1.0 \quad \text{and} \quad \frac{V_{Ed}}{V_{Rd}} = 2.1/3.6 \leq 1.0$$

$$\frac{N_{Ed}}{N_{Rd}} + \frac{V_{Ed}}{V_{Rd}} = 0.59+0.58=1.17 \leq X\ (1.2)$$

Conclusion: HSU-R M6X13 fulfills the requirement

Materials

Mechanical properties

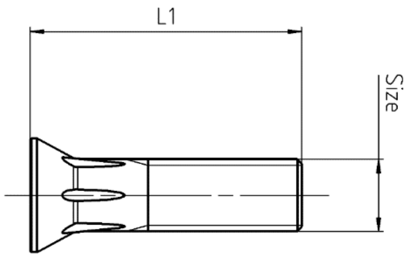
Anchor size		M6	M8
Nominal tensile strength f_{uk}	[N/mm²]	800	800
Stressed cross-section A_s	[mm²]	20,1	36,6

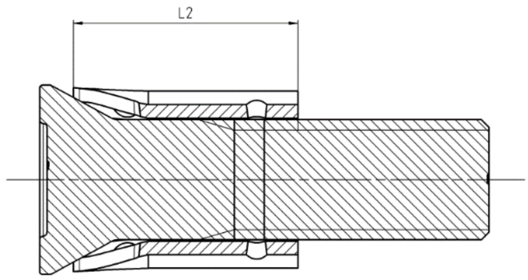
Material quality

Type	Material
HSU-R cone bolt with expansion steel	Stainless steel, grade A4
HSU-R FN serrated flange nut	Stainless steel, grade A4-80
Spring washer	Stainless steel, grade A4-80
Hexagon nut	Stainless steel, grade A4-80

Anchor dimensions

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	44
Length of expansion sleeve	L_2	[mm]	13/15	15/21

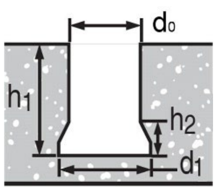




Setting information

Setting details

Anchor size			M6	M8
Setting depth	h_s	[mm]	$(10 \le h_s \le 38)_{+0,4/-0,1}$	
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]	$13,5_{\pm 0,3}$	$15,5_{\pm 0,3}$
Height of undercut	h_2	[mm]	$4,5_{\pm 0,5}$	$4,5_{\pm 0,5}$
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 acc. to ETA 16/0784	t_{fix}	[mm]	10	14
Max. fixture thickness not covered by ETA	t_{fix}	[mm]	10	14



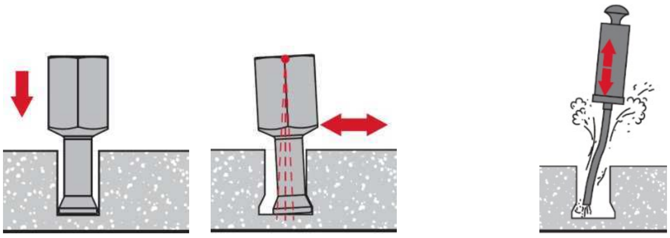
Setting instructions

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

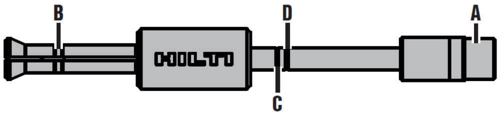
Safety regulations.

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

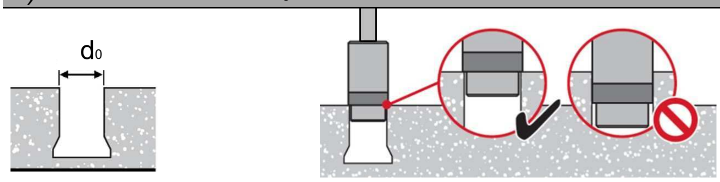
Drilling and cleaning of the undercut drill hole



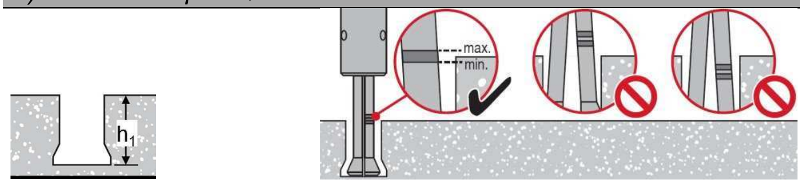
Checking dimensions of drill hole with gauge



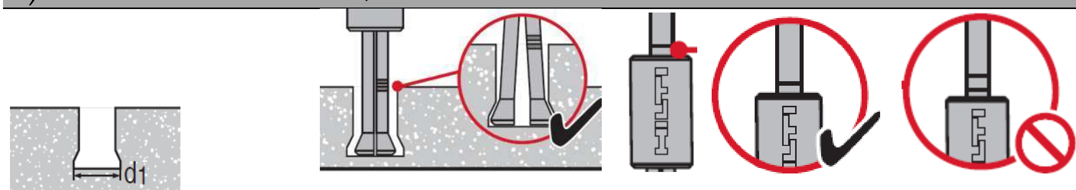
A) Drill hole diameter d_0



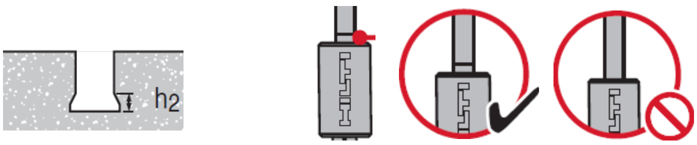
B) Drill hole depth h_1



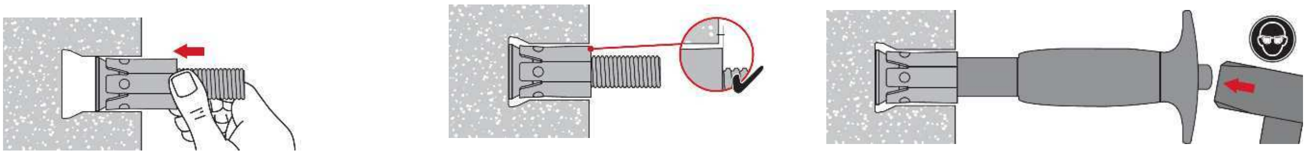
C) Diameter of the undercut d_1



D) Height of the undercut h_2

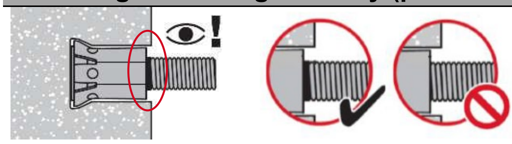


Installation of the undercut anchor

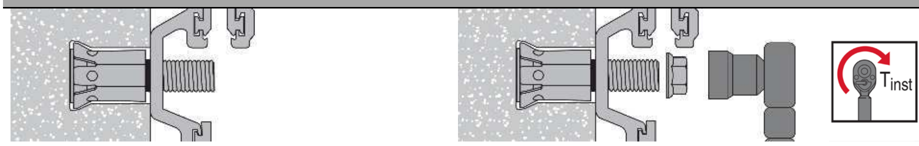


Checking of the setting depth

Checking of red ring visibility (proof of correct expansion)



Installation of the fixture



CHEMICAL ANCHORS

IMPROVE WORKMANSHIP BY SAFESET SYSTEM

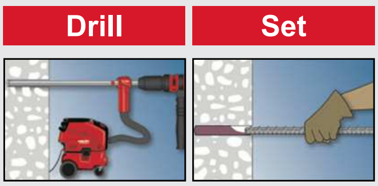
Hilti SafeSet Technology

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 V3 / HIT-RE 100/ HIT-RE 500-V3

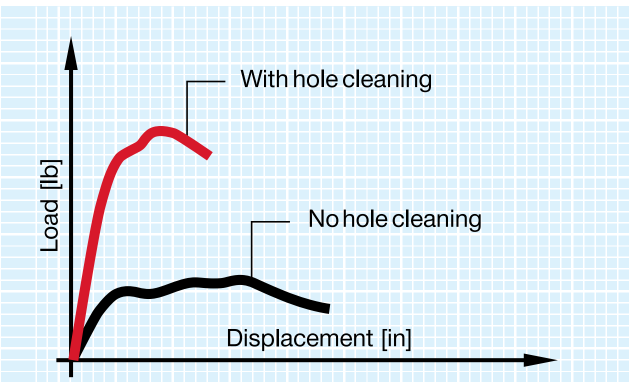
Hilti TE-CD and TE-YD hollow drill bits, in conjunction with HIT-HY 200-R, HIT-RE 100 or HIT-RE 500-V3, make subsequent hole cleaning completely unnecessary. Dust is removed by the Hilti vacuum system while drilling is in progress for faster drilling and a virtually dustless working environment.



Hilti SafeSet Technology
Up to 60% faster!

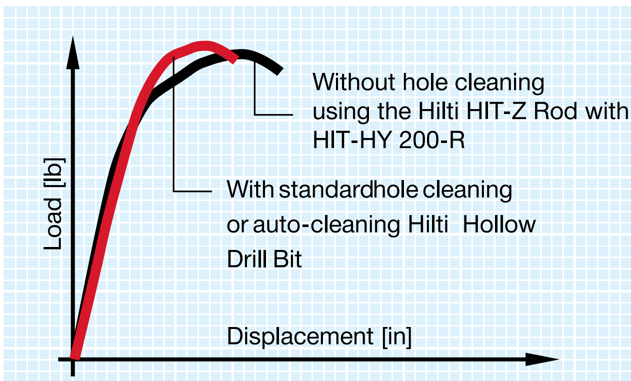
Drill → Done → **Productivity gain**

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.

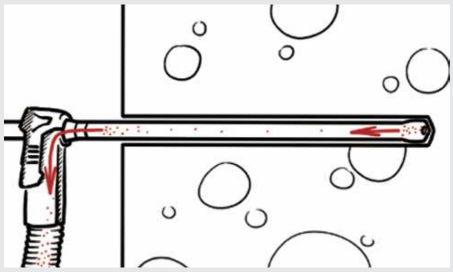
Hilti adhesive with SafeSet Technology

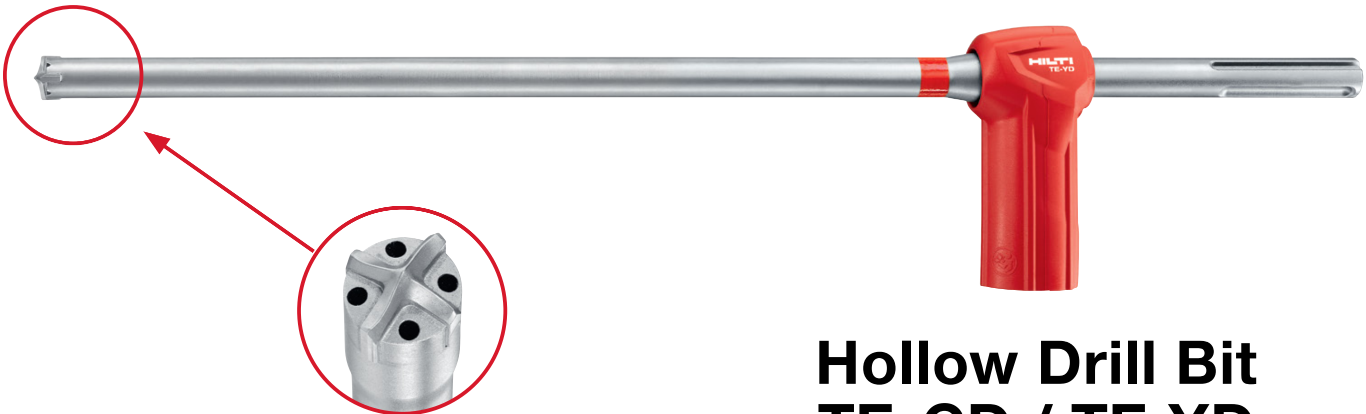


The new SafeSet system featuring HIT-HY 200-R allows a fastening point to take high loads, as if the hole were cleaned using standard hole cleaning methods.

Technical data

Rebar diameter range	Y8 up to Y40
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

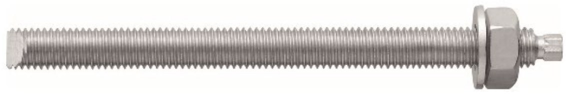
HIT-HY 200-R V3 injection mortar

Anchor design (EN 1992-4) / Rods and Sleeves / Concrete

Injection mortar system

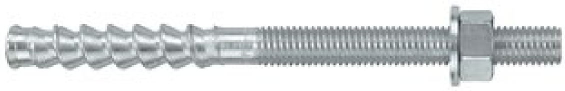
Hilti HIT-HY 200-R V3

500 ml foil pack (also available as 330 ml foil pack)



Anchor rod:
HAS-U
HAS-U HDG
HAS-U A4
HAS-U HCR
(M8-M30)

Internally threaded sleeve:
HIS-N
HIS-RN
(M8-M20)

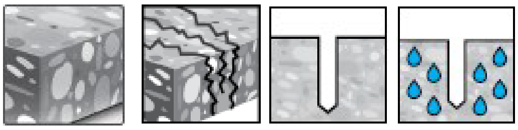


Anchor rod:
HIT-Z
HIT-Z-R
(M8-M20)

Benefits

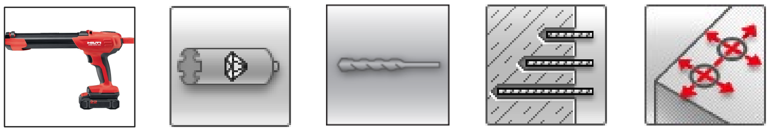
- **SafeSet** technology: Simplified method of borehole preparation using either Hilti hollow drill bit for hammer drilling or Roughening tool for diamond cored applications
- Suitable for uncracked and cracked concrete C 20/25 to C 50/60
- ETA Approved for seismic performance category C1, C2[a)]
- Maximum load performance in cracked concrete and uncracked concrete
- High corrosion / corrosion resistance[b)]
- Small edge distance and anchor spacing possible
- Manual cleaning for borehole diameter up to 20mm and h_{ef}≤10d for uncracked concrete only
- 100 years service lifetime resistance

Base material



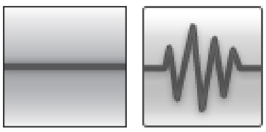
Concrete (uncracked) | Concrete (cracked) | Dry concrete | Wet concrete

Installation conditions



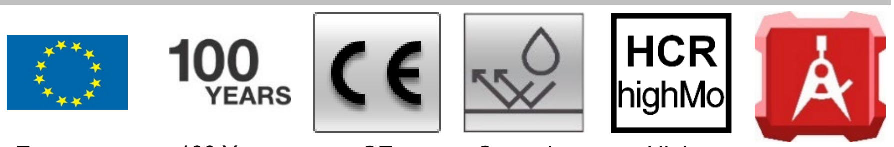
Electrical Dispenser | Diamond drilled holes c) | Hammer drilled holes | Variable embedment depth | Small edge distance and spacing

Load conditions



Static/ quasi-static | Seismic, ETA-C1, C2[a)]

Other information



European Technical Assessment | 100 Years Design Life | CE conformity | Corrosion resistance[b)] | High corrosion resistance[b)] | PROFIS ENGINEERING

a) HIS-N internally threaded sleeves not approved for Seismic.
b) High Corrosion resistant rods available only for HAS-U. Corrosion resistant rods available for HAS-U and HIS-N.
c) Diamond drilling only with Roughening Tool (RT) for HAS-U and HIS-N.

Approvals / certificates

Description	Product	Authority	No. / date of issue
European Technical Assessment	HY 200-R V3	DIBt, Berlin	ETA-19/0601 / 2021-12-02
European Technical Assessment	HY 200-R V3	DIBt, Berlin	ETA-19/0632 / 2020-10-28

a) All data given in this section according to the ETA-19/0601, issue 2021-12-02.
b) All data given in this section according to the ETA-19/0632, issue 2020-10-28.

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.

- 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
- Embedment depth, as specified in the table
- Anchor material, as specified in the tables
- Concrete C 20/25, $f_{ck,cube}$ = 25 N/mm²
- in-service temperature range I

(min. base material temp. -40°C, max. long/short term base material temp.: +24°C/40°C)

- Short term loading. For long term loading please apply ψ_{sus} = 0.74.

For hammer drilled holes, hammer drilled holes with Hilti hollow drill bit:

Embedment depth [1] and base material thickness

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
HAS-U										
Embedment depth	h_{ef}	[mm]	80	90	110	125	170	210	240	270
Base material thickness	h	[mm]	110	120	140	160	220	270	300	340
HIS-N										
Embedment depth	h_{ef}	[mm]	90	110	125	170	205	-	-	-
Base material thickness	h	[mm]	120	150	170	230	270	-	-	-
HIT-Z										
Embedment depth	h_{ef}	[mm]	70	90	110	145	180	-	-	-
Base material thickness	h	[mm]	130	150	170	245	280	-	-	-
HAS-D										
Embedment depth	h_{ef}	[mm]	-	-	100	125	170	-	-	-
Base material thickness	h	[mm]	-	-	130	160	220	-	-	-

1) The allowed range of embedment depth is shown in the setting details.

Characteristic resistance

Anchor size				M8	M10	M12	M16	M20	M24	M27	M30
Uncracked concrete											
Tension	HAS-U 5.8	N_{Rk}	[kN]	18,3	29,0	42,2	68,7	109,0	149,7	182,9	218,2
	HAS-U 8.8			29,3	42,0	56,8	68,7	109,0	149,7	182,9	218,2
	HAS-U A4			25,6	40,6	56,8	68,7	109,0	149,7	182,9	218,2
	HAS-U HCR			29,3	42,0	56,8	68,7	109,0	149,7	182,9	218,2
	HIS-N 8.8			25,0	46,0	67,0	109,0	116	-	-	-
	HIT-Z			24,0	38,0	50,0	85,9	118,8	-	-	-
Shear	HAS-U 5.8	V_{Rk}	[kN]	11,0	17,4	25,3	47,1	73,5	105,9	137,7	168,3
	HAS-U 8.8			14,6	23,2	33,7	62,8	98,0	141,2	183,6	224,4
	HAS-U A4			12,8	20,3	29,5	55,0	85,8	123,6	114,8	140,3
	HAS-U HCR			14,6	23,2	33,7	62,8	98,0	123,6	160,7	196,4
	HIS-N 8.8			13,0	23,0	34,0	63,0	58,0	-	-	-
	HIT-Z			12,0	19,0	27,0	48,0	73,0	-	-	-
Cracked concrete											
Tension	HAS-U 5.8	N_{Rk}	[kN]	15,1	21,2	35,2	48,1	76,3	104,8	128,0	152,8
	HAS-U 8.8			15,1	21,2	35,2	48,1	76,3	104,8	128,0	152,8
	HAS-U A4			15,1	21,2	35,2	48,1	76,3	104,8	128,0	152,8
	HAS-U HCR			15,1	21,2	35,2	48,1	76,3	104,8	128,0	152,8
	HIS-N 8.8			24,7	39,7	48,1	76,3	101,1	-	-	-
	HIT-Z			20,2	29,4	39,7	60,1	83,2	-	-	-
Shear	HAS-U 5.8	V_{Rk}	[kN]	11,0	17,4	25,3	47,1	73,5	105,9	137,7	168,3
	HAS-U 8.8			14,6	23,2	33,7	62,8	98,0	141,2	183,6	224,4
	HAS-U A4			12,8	20,3	29,5	55,0	85,8	123,6	114,8	140,3
	HAS-U HCR			14,6	23,2	33,7	62,8	98,0	123,6	160,7	196,4
	HIS-N 8.8			13,0	23,0	34,0	63,0	58,0	-	-	-
	HIT-Z			12,0	19,0	27,0	48,0	73,0	-	-	-

Design resistance

Anchor size				M8	M10	M12	M16	M20	M24	M27	M30
Uncracked concrete											
Tension	HAS-U 5.8	N_{Rd}	[kN]	12,2	19,3	28,1	45,8	72,7	99,8	121,9	145,5
	HAS-U 8.8			19,5	28,0	37,8	45,8	72,7	99,8	121,9	145,5
	HAS-U A4			13,7	21,7	31,6	45,8	72,7	99,8	80,2	98,1
	HAS-U HCR			19,5	28,0	37,8	45,8	72,7	99,8	121,9	145,5
	HIS-N 8.8			16,7	30,7	44,7	72,7	77,3	-	-	-
	HIT-Z			16,0	25,3	33,3	57,3	79,2	-	-	-
Shear	HAS-U 5.8	V_{Rd}	[kN]	8,8	13,9	20,2	37,7	58,8	84,7	110,2	134,6
	HAS-U 8.8			11,7	18,6	27,0	50,2	78,4	113,0	146,9	179,5
	HAS-U A4			8,2	13,0	18,9	35,2	55,0	79,2	48,2	58,9
	HAS-U HCR			11,7	18,6	27,0	50,2	78,4	70,6	91,8	112,2
	HIS-N 8.8			10,4	18,4	27,2	50,4	46,4	-	-	-
	HIT-Z			9,6	15,2	21,6	38,4	58,4	-	-	-
Cracked concrete											
Tension	HAS-U 5.8	N_{Rd}	[kN]	10,0	14,1	23,5	32,1	50,9	69,9	85,4	101,8
	HAS-U 8.8			10,0	14,1	23,5	32,1	50,9	69,9	85,4	101,8
	HAS-U A4			10,0	14,1	23,5	32,1	50,9	69,9	80,2	98,1
	HAS-U HCR			10,0	14,1	23,5	32,1	50,9	69,9	85,4	101,8
	HIS-N 8.8			16,5	26,5	32,1	50,9	67,4	-	-	-
	HIT-Z			13,4	19,6	26,5	40,1	55,4	-	-	-
Shear	HAS-U 5.8	V_{Rd}	[kN]	8,8	13,9	20,2	37,7	58,8	84,7	110,2	134,6
	HAS-U 8.8			11,7	18,6	27,0	50,2	78,4	113,0	146,9	179,5
	HAS-U A4			8,2	13,0	18,9	35,2	55,0	79,2	48,2	58,9
	HAS-U HCR			11,7	18,6	27,0	50,2	78,4	70,6	91,8	112,2
	HIS-N 8.8			10,4	18,4	27,2	50,4	46,4	-	-	-
	HIT-Z			9,6	15,2	21,6	38,4	58,4	-	-	-

HILTI

Recommended loads b)

Anchor size				M8	M10	M12	M16	M20	M24	M27	M30
Uncracked concrete											
Tension	HAS-U 5.8	N_{Rd}	[kN]	6.1	9.7	14.1	22.9	36.3	49.9	61.0	72.7
	HAS-U 8.8			9.8	14.0	18.9	22.9	36.3	49.9	61.0	72.7
	HAS-U A4			8.5	13.5	18.9	22.9	36.3	49.9	61.0	72.7
	HAS-U HCR			9.8	14.0	18.9	22.9	36.3	49.9	61.0	72.7
	HIS-N 8.8			8.3	15.3	22.3	36.3	38.7	-	-	-
	HIT-Z			8.0	12.7	16.7	28.6	39.6	-	-	-
Shear	HAS-U 5.8	V_{Rd}	[kN]	3.7	5.8	8.4	15.7	24.5	35.3	45.9	56.1
	HAS-U 8.8			4.9	7.7	11.2	20.9	32.7	47.1	61.2	74.8
	HAS-U A4			4.3	6.8	9.8	18.3	28.6	41.2	38.3	46.8
	HAS-U HCR			4.9	7.7	11.2	20.9	32.7	41.2	53.6	65.5
	HIS-N 8.8			4.3	7.7	11.3	21.0	19.3	-	-	-
	HIT-Z			4.0	6.3	9.0	16.0	24.3	-	-	-
Cracked concrete											
Tension	HAS-U 5.8	N_{Rd}	[kN]	5.0	7.1	11.7	16.0	25.4	34.9	42.7	50.9
	HAS-U 8.8			5.0	7.1	11.7	16.0	25.4	34.9	42.7	50.9
	HAS-U A4			5.0	7.1	11.7	16.0	25.4	34.9	42.7	50.9
	HAS-U HCR			5.0	7.1	11.7	16.0	25.4	34.9	42.7	50.9
	HIS-N 8.8			8.2	13.2	16.0	25.4	33.7	-	-	-
	HIT-Z			6.7	9.8	13.2	20.0	27.7	-	-	-
Shear	HAS-U 5.8	V_{Rd}	[kN]	3.7	5.8	8.4	15.7	24.5	35.3	45.9	56.1
	HAS-U 8.8			4.9	7.7	11.2	20.9	32.7	47.1	61.2	74.8
	HAS-U A4			4.3	6.8	9.8	18.3	28.6	41.2	38.3	46.8
	HAS-U HCR			4.9	7.7	11.2	20.9	32.7	41.2	53.6	65.5
	HIS-N 8.8			4.3	7.7	11.3	21.0	19.3	-	-	-
	HIT-Z			4.0	6.3	9.0	16.0	24.3	-	-	-

a) With overall global safety factor for action $\gamma = 3.0$. The partial safery factors for action depend on the type of loading and shall be taken from national regulations.

Mechanical properties for HAS-U

Anchor size				M8	M10	M12	M16	M20	M24	M27	M30
Nominal tensile strength	HAS-U 5.8	f_{uk}	[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	HAS-U 5.8	f_{yk}	[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	HAS-U	A_s	[mm²]	36,6	58,0	84,3	157	245	353	459	561
Moment of resistance	HAS-U	W	[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	HIS-N	f_{uk}	[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	HIS-N	f_{yk}	[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	HIS-(R)N	A_s	[mm²]	51,5	108	169	256	238
	Screw			36,6	58,0	84,3	157	245
Moment of resistance	HIS-(R)N	W	[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	HIT-Z-R	f_{uk}	[N/mm²]	650	650	650	610	595
Yield strength	HIT-Z-R	f_{yk}	[N/mm²]	520	520	520	490	480
Stressed cross-section of thread	HIT-Z-R	A_s	[mm²]	36,6	58,0	84,3	157	245
Moment of resistance	HIT-Z-R	W	[mm³]	31,9	62,5	109,7	278	542

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, hot dip galvanized ≥ 45 µm
Nut	Strength class of nut adapted to strength class of threaded rod. Electroplated zinc coated ≥ 5µm, (HDG) 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 > 12% 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	Strength class 70 for ≤ M24 and strength class 50 for > M24; 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 > 12% 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	Strength class 80 for ≤ M20 and class 70 for > M20, 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
HIS-RN	Int. threaded sleeve	Stainless steel 1.4401,1.4571 EN 10088-1:2014

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-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

Installation temperature:

- -10 °C to +40 °C (for HAS-U, HIS-N)
- +5 °C to +40 °C (for HIT-Z)

In service temperature range

Hilti HIT-HY 200-R V3 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	Maximum long term base material temperature	Maximum 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

Maximum 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.

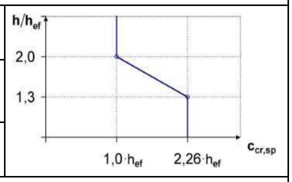
Maximum long term base material temperature
Long-term elevated base material temperatures are roughly constant over significant periods of time.

Curing and working time

Temperature of the base material	HIT-HY 200-R V3	
	Maximum working time	Minimum curing time
T_{BM}	t_{work}	t_{cure}
- 10°C < T_{BM} ≤ - 5°C a)	3 h	20 h
- 5°C < T_{BM} ≤ 0°C a)	1,5 h	8 h
0°C < T_{BM} ≤ 5°C a)	45 min	4 h
5°C < T_{BM} ≤ 10°C	30 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

a) Installation of HIT-Z, HIT-Z-D only in range +5 °C to +40 °C

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
Effective embedment depth (= drill hole depth) a)	$h_{ef,min} = h_0$	[mm]	60	60	70	80	90	96	108	120
	$h_{ef,max} = h_0$	[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]	$t_{fix} - h_{fs}$							
Maximum 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 $2,0 > h / h_{ef} > 1,3$					
			$2,26\ h_{ef}$		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	$c_{cr,N}$	[mm]	$1,5\ h_{ef}$							

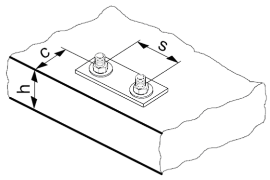
For spacing (edge distance) smaller than critical spacing (critical edge distance) the design loads have to be reduced.

a) $h_{ef,min} \leq h_{ef} \leq h_{ef,max}$ (h_{ef}: embedment depth)

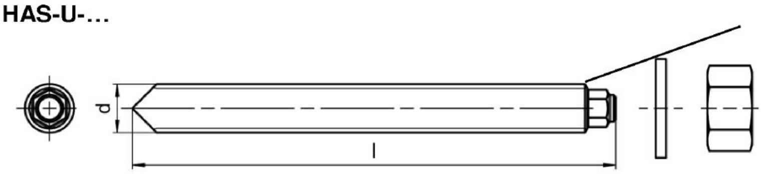
b) Maximum recommended torque moment to avoid splitting failure during instalation with minimum spacing and edge distance

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.



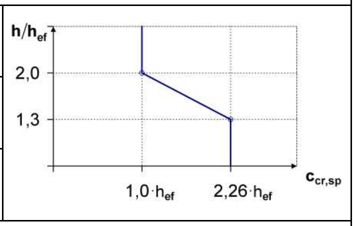
HAS-U-...



Marking:

Steel grade number and length identification letter: e.g. 8L

Setting details for HIS-N

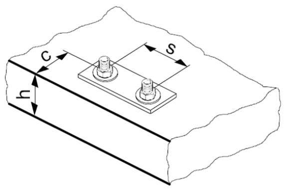
Anchor size			M8	M10	M12	M16	M20
Nominal diameter of drill bit	d_0	[mm]	14	18	22	28	32
Diameter of element	d	[mm]	12,5	16,5	20,5	25,4	27,6
Effective embedment depth (=drill hole depth)	$h_{ef} = h_0$	[mm]	90	110	125	170	205
Minimum base material thickness	h_{min}	[mm]	120	150	170	230	270
Diameter of 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
Maximum torque moment b)	T_{max}	[Nm]	10	20	40	80	150
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 a)	$c_{cr,sp}$	[mm]	$1{,}0 \cdot h_{ef}$	for $h / h_{ef} \geq 2{,}0$			
			$4{,}6\ h_{ef} - 1{,}8\ h$	for $2{,}0 > h / h_{ef} > 1{,}3$			
			$2{,}26\ h_{ef}$	for $h / h_{ef} \leq 1{,}3$			
Critical spacing for concrete cone failure	$s_{cr,N}$	[mm]	$2\ c_{cr,N}$				
Critical edge distance for concrete cone failure	$c_{cr,N}$	[mm]	$1{,}5\ h_{ef}$				

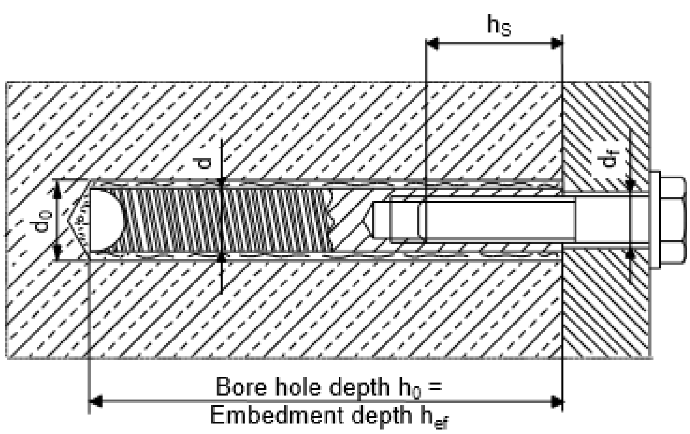
For spacing (edge distance) smaller than critical spacing (critical edge distance) the design loads have to be reduced.

a) Max. recommended torque moment to avoid splitting failure during Instalation with minimum spacing and edge distance

b) h: base material thickness ($h \geq h_{min}$)

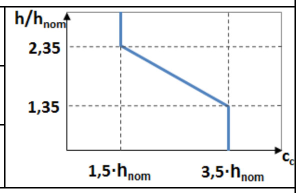
c) The critical edge distance for concrete cone failure depends on the embedment depth h_{ef} and the design bond resistance. The simplified formula given in this table is on the save side.





Setting details for HIT-Z 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 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	
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) HIT-Z	T_{inst}	[Nm]	10	25	40	80	150
Installation torque moment b) HIT-Z-R	T_{inst}	[Nm]	30	55	75	155	215
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 · 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 / hnom ≤ 1,35			
Critical spacing for concrete cone failure	$s_{cr,N}$	[mm]	2 $c_{cr,N}$				
Critical edge distance concrete cone failure	$c_{cr,N}$	[mm]	1,5 h_{nom}				

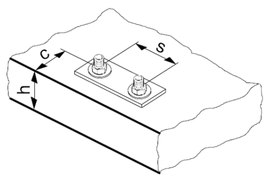


For spacing (edge distance) smaller than critical spacing (critical edge distance) the design loads have to be reduced.

a) $H_{nom,min} \le h_{nom} \le h_{nom,max}$ (h_{nom}: embedment depth).

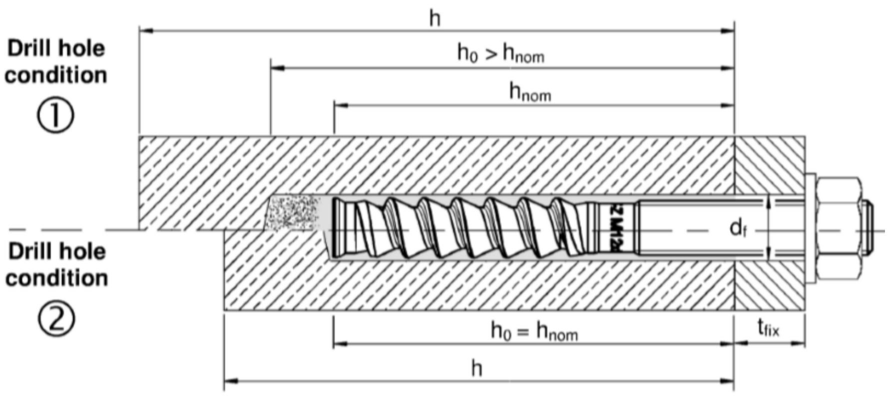
b) Recommended torque moment to avoid splitting failure during instalation with minimum spacing and edge distance.

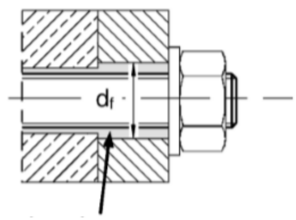
c) h: base material thickness (h ≥ h_{min}).



Pre-setting:
Install anchor before positioning fixture

Through-setting: Install anchor through positioned fixture





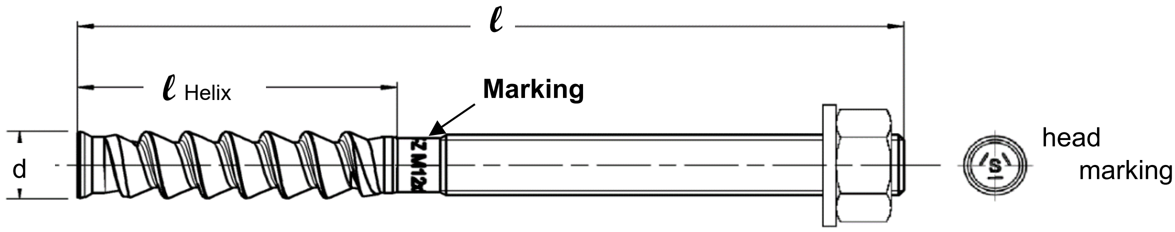
Drill hole condition 1 → non-cleaned borehole
Drill hole condition 2 → drilling dust is completely removed

Annular gap filled with Hilti HIT-HY 200-A

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		120	160	196	420	450
Helix length	ℓ_{Helix}	[mm]	30 or 50	50 or 60	60	96	100

Combine with another table (setting details)



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: $\mathbf{A_{i,req} < A_{i,cal}}$

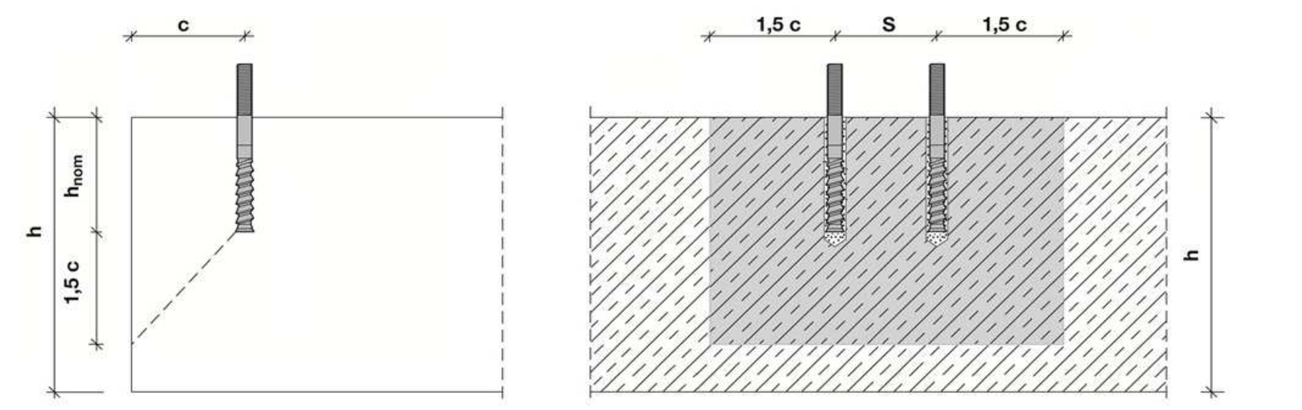
Required interaction area $A_{i,cal}$ for HIT-Z

Anchor size		M8	M10	M12	M16	M20
Cracked concrete	[mm²]	19200	40800	58800	94700	148000
Non-cracked concrete	[mm²]	22200	57400	80800	128000	198000

Combine with another table (setting details)

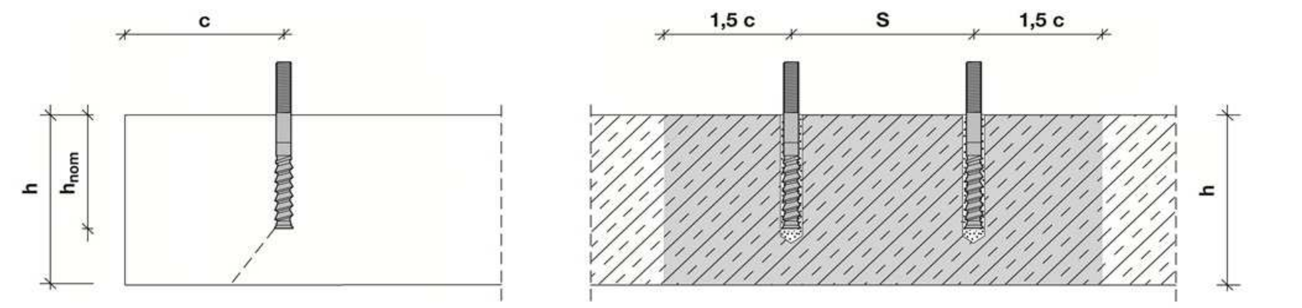
Effective area $A_{i,ef}$ of HIT-Z

Member thickness $h \geq h_{nom} + 1{,}5 \cdot c$



Single anchor and group of anchors with s > 3·c	[mm²]	$A_{i,cal} = (6 \cdot c) \cdot (h_{nom} + 1{,}5 \cdot c)$	with c ≥ 5·d
Group of anchors with s ≤ 3·c	[mm²]	$A_{i,cal} = (3 \cdot c + s) \cdot (h_{nom} + 1{,}5 \cdot c)$	with c ≥ 5·d and s ≥ 5·d

Member thickness $h \leq h_{nom} + 1{,}5 \cdot c$



Single anchor and group of anchors with s >	[mm²]	$A_{i,cal} = (6 \cdot c) \cdot h$	with c ≥ 5·d
Group of anchors with s ≤ 3·c	[mm²]	$A_{i,cal} = (3 \cdot c + s) \cdot h$	with c ≥ 5·d and s ≥

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.

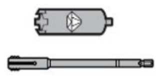
PROFIS Anchor software is programmed to calculate the referenced equations in order to determine the optimized related minimum edge and spacing based on the following variables:

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		blow out pump ($h_{ef} \leq 10 \cdot d$, $d_0 \leq 20$ mm) , compressed air gun, set of cleaning brushes, dispenser Hollow Drill Bit							
		roughening tools TE-YRT							
Additional Hilti recommended tools		DD EC-1, DD 100 … DD 160 a)							

a) In case without roughentning – diamond coring is applicable only for HIT-Z installation

HAS-U	HIT-Z	HIS-N	Drilling				Cleaning and installation	
			Hammer drill (HD)	Hollow Drill Bit (HDB)	Diamond coring: Diamond coring (DD) a)	Diamond coring: With roughening tool (RT)	Brush HIT-RB	Piston plug HIT-SZ
			d_0 [mm]				size [mm]	
								
M8	**M8**	**-**	10	-	10	-	10	-
M10	**M10**	**-**	12	12	12	-	12	12
M12	**M12**	**M8**	14	14	14	-	14	14
M16	**M16**	**M10**	18	18	18	18	18	18
M20	**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

a) Diamond cored holes without roughening can be used only for HIT-Z installation

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

Installation parameters for use of the Hilti Roughening tool TE-YRT

h_{ef} [mm]	Minimum roughening time $t_{roughen}$ [sec] ($t_{roughen}$ [sec] = h_{ef} [mm] /10)	Minimum blowing time $t_{blowing}$ [sec] ($t_{blowing}$ [sec] = $t_{roughen}$ [sec] + 20)
0 to 100	10	30
101 to 200	20	40
201 to 300	30	50
301 to 400	40	60
401 to 500	50	70
501 to 600	60	80

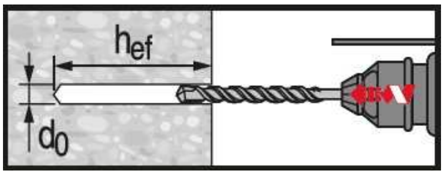
Setting instructions for HAS-U rods and HIS-N internally threaded sleeves

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

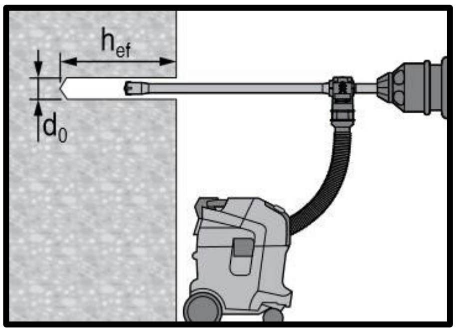
Safety regulations.

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 V3.

Drilling

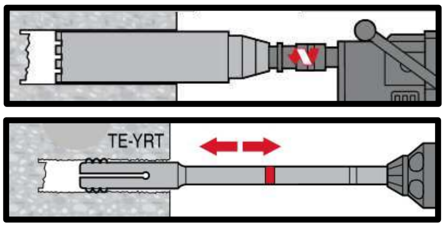


Hammer drilled hole (HD)



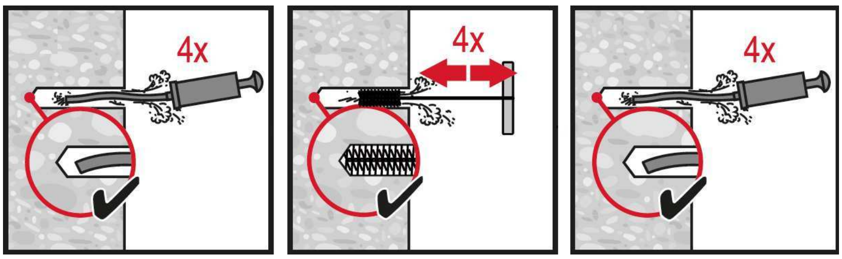
Hammer drilled hole with Hollow Drilled Bit (HDB)

No cleaning required



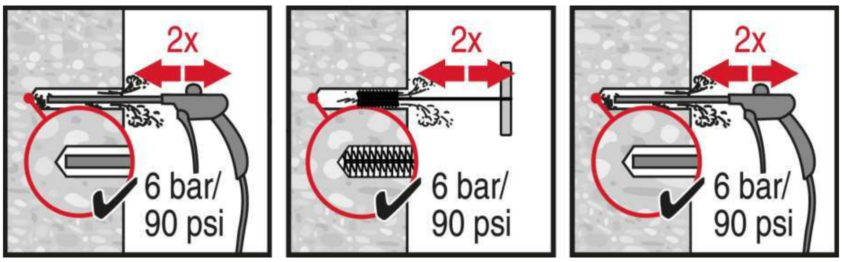
Diamond Drilling + Roughening Tool (DD+RT)

Cleaning



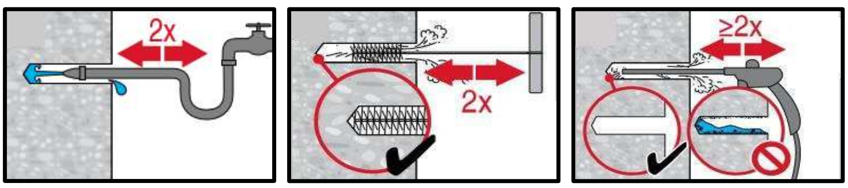
Hammer drilling:

Manual cleaning (MC)
for drill diameters $d_0 \leq 20$ mm and drill hole depth $h_0 \leq 10 \cdot d$.



Hammer drilling:

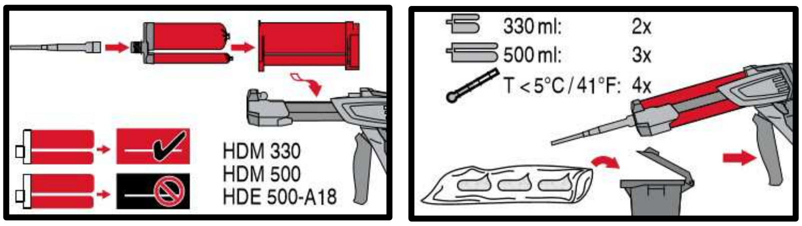
Compressed air cleaning (CAC)
for all drill hole diameters d_0 and drill hole depths $h_0 \leq 20 \cdot d$.



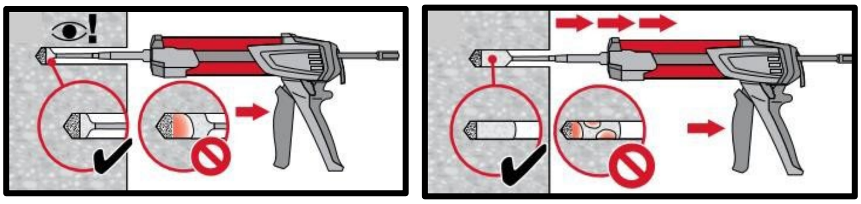
Diamond cored holes with Hilti roughening tool:

For all drill hole diameters d_0 and drill hole depths h_0.

Injection

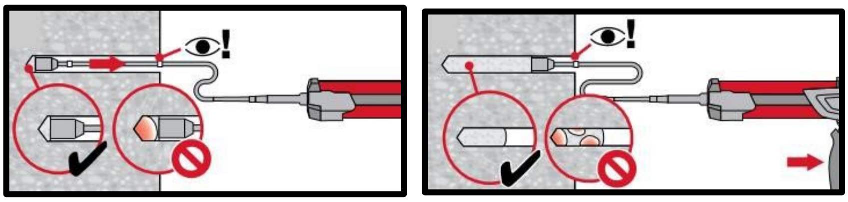


Injection system preparation.



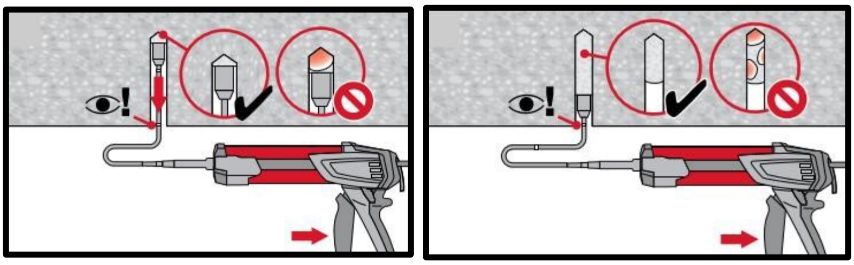
Injection method for drill hole depth

h_{ef} ≤ 250 mm.



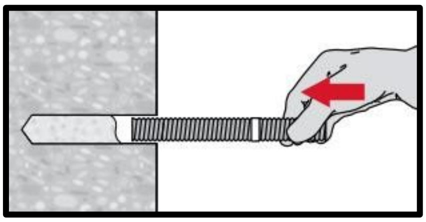
Injection method for drill hole depth

h_{ef} > 250mm.

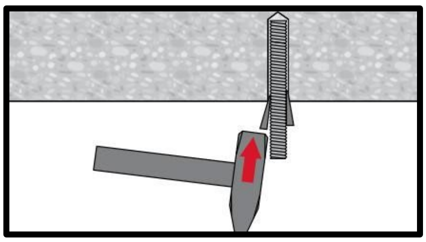


Injection method for overhead application and/or installation with embedment depth > 250 mm.

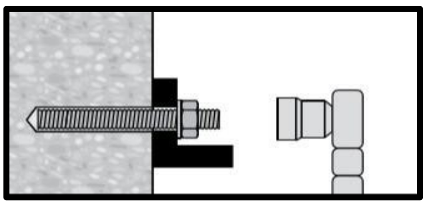
Setting the element



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}

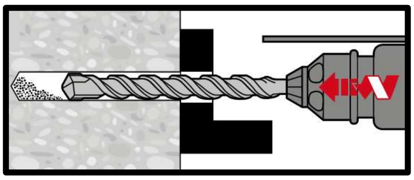
Setting instructions for HIT-Z & HIT-Z-R rods

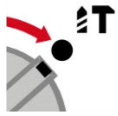
***For detailed information on installation see instruction for use given with the package of the product.**

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 V3

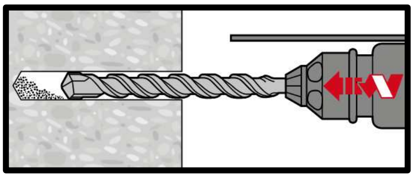
Drilling





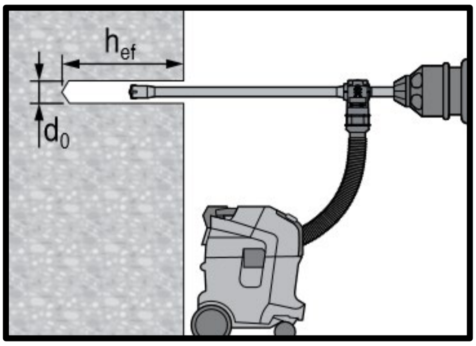
Hammer drilling: Through-setting

No cleaning required



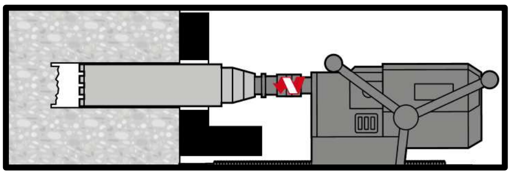
Hammer drilling: Pre-setting

No cleaning required

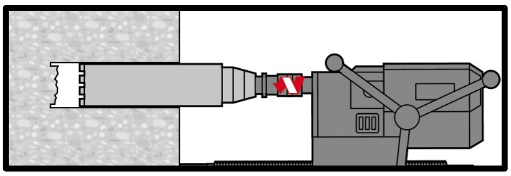


Hammer drilling with hollow drill bit: Through / pre-setting

No cleaning required

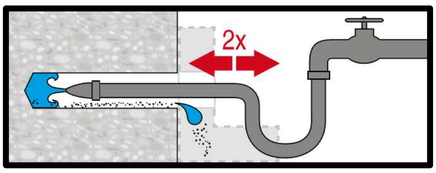


Diamond coring: Through-setting

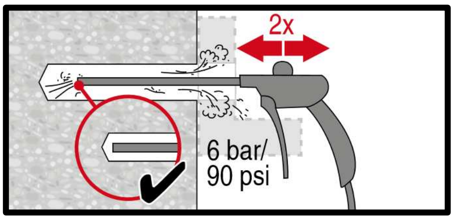


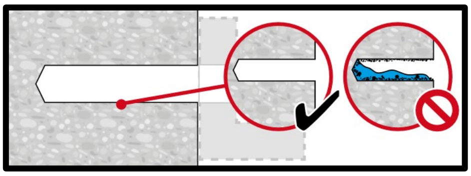
Diamond coring: Pre-setting

Cleaning



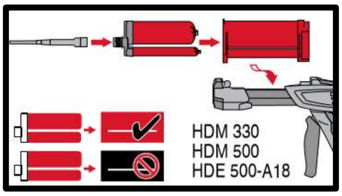
Hole flushing required for wet-drilled diamond cored holes.

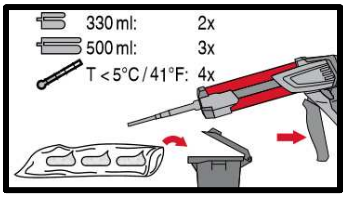




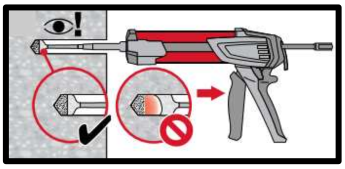
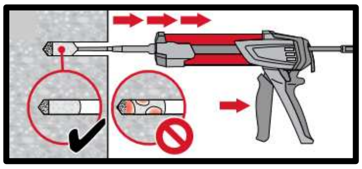
Evacuation required for wet-drilled diamond cored holes.

Injection

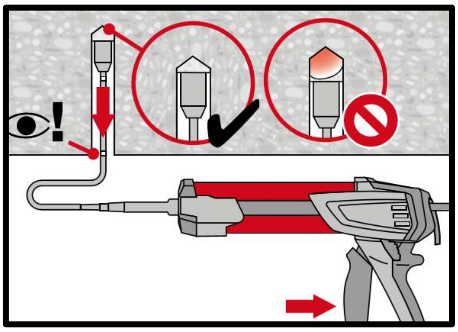




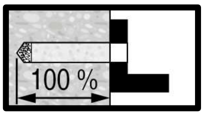
Injection system preparation.

Injection of adhesive from the back of the drill hole without forming air voids.

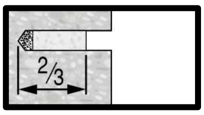


Overhead installation only with the aid of extensions and piston plugs.



Through-setting:

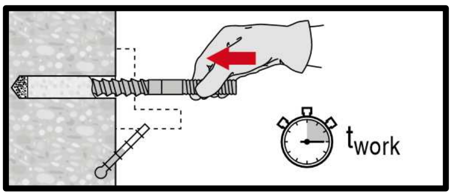
Fill 100% of the drill hole.



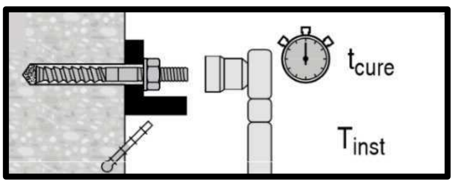
Pre-setting:

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}.

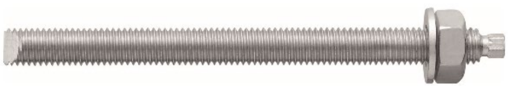
HIT-RE 500 V3 injection mortar

Anchor design (EN 1992-4) / Rods and Sleeves / Concrete

Injection mortar system

Foil pack: HIT-RE 500 V3

(available in 330, 500 cartridges)



Anchor rod:
HAS-U
HAS-U HDG
HAS-U A4
HAS-U HCR
AM 8.8 (HDG)
(M8-M39)

Internally threaded sleeve:
HIS-N
HIS-RN
(M8-M20)

Benefits

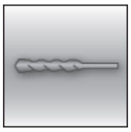
- **SafeSet** technology: Simplified method of borehole preparation using either Hilti hollow drill bit for hammer drilling or Roughening tool for diamond cored applications
- Suitable for cracked/non-cracked concrete C 20/25 to C 50/60
- High loading capacity
- Suitable for dry and water saturated concrete
- Hilti Technical Data for under water application
- High corrosion resistance
- Long working time at elevated temperatures
- Cures down to -5°C
- Odourless epoxy

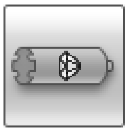
Base material


Concrete (non-cracked)

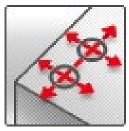

Concrete (cracked)

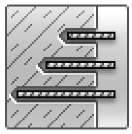
Installation conditions


Hammer drilled holes

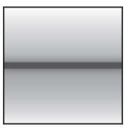

Diamond drilled holes

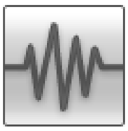

Electrical Dispenser


Small edge distance and spacing


Variable embedment depth

Load conditions


Static/ quasi-static


Seismic, ETA-C1, C2


Fire resistance

Other information


European Technical Assessment

120 Years Design Life


PROFIS ENGINEERING

Corrosion resistance

High corrosion resistance [a)]

a) Applications only with HAS-U anchor rods

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European Technical Assessment [a)]	CSTB	ETA-16/0143 / 2019-05-14
Shockproof fastenings in civil defence installations	Federal Office for Civil Protection, Bern	BZS D 16-601/ 2016-08-31
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 2019-05-14.
b) Fire test report only available for HAS-U 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
- Base material thickness, as specified in the table
- Concrete C 20/25, $f_{ck,cube}$ = 25 N/mm²
- Temperature range I: -40 °C to +40 °C
  (min. base material temperature -40°C, max. long/short term base material temperature: +24°C/40°C)
- Short term loading. For long term loading please apply ψ_{sus}.
  - Hammer drilled holes, hammer drilled holes with hollow drill bit and diamond cored holes with Hilti roughening tool: ψ_{sus} = 0.88

Embedment depth [a] and base material thickness

		ETA-16/0143, issue 2019-05-14								Hilti technical data		
Anchor size		**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**	**M33**	**M36**	**M39**
HAS-U												
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[1] and diamond cored with roughening tool[2]:

Characteristic resistance

			ETA-16/0143, issue 2019-05-14								Hilti technical data		
Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**	**M33**	**M36**	**M39**
Non-cracked concrete													
Tension N_{Rk}	HAS-U 5.8	[kN]	18,0	29,0	42,0	76,9	122	168	205	244	286	330	376
	HAS-U 8.8, AM		29,0	46,0	63,5	76,9	122	168	205	244	286	330	376
	HAS-U A4		26,0	41,0	59,0	76,9	122	168	205	244	286	330	376
	HAS-U HCR		29,0	46,0	63,5	76,9	122	168	205	244	286	330	376
	HIS-N 8.8		25,0	46,0	67,0	121,9	116	-	-	-	-	-	-
Shear V_{Rk}	HAS-U 5.8	[kN]	9,0	15,0	21,0	39,0	61,0	88,0	115	140	174	204	244
	HAS-U 8.8, AM		15,0	23,0	34,0	63,0	98,0	141	184	224	278	327	390
	HAS-U A4		13,0	20,0	30,0	55,0	86,0	124	115	140	174	204	244
	HAS-U HCR		15,0	23,0	34,0	63,0	98,0	124	161	196	174	204	244
	HIS-N 8.8		13,0	23,0	34,0	63,0	58,0	-	-	-	-	-	-
Cracked concrete													
Tension N_{Rk}	HAS-U 5.8	[kN]	15,1	22,6	39,4	53,8	85,3	117	143	171	-	-	-
	HAS-U 8.8, AM		15,1	22,6	39,4	53,8	85,3	117	143	171	-	-	-
	HAS-U A4		15,1	22,6	39,4	53,8	85,3	117	143	171	-	-	-
	HAS-U HCR		15,1	22,6	39,4	53,8	85,3	117	143	171	-	-	-
	HIS-N 8.8		25,0	44,4	53,8	85,3	113	-	-	-	-	-	-
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, AM		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	-	-	-	-	-	-

1) Hilti hollow drill bit available for element size M12-M30.
2) Roughening tools are available for element size M16-M30.

Design resistance

Anchor size			ETA-16/0143, issue 2019-05-14								Hilti tech. data		
			M8	M10	M12	M16	M20	M24	M27	M30	M33	M36	M39
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	142	164	187
	HAS-U 8.8, AM 8.8		19,3	28,0	37,8	45,8	72,7	99,8	122	146	142	164	187
	HAS-U A4		13,9	21,9	31,6	45,8	72,7	99,8	80,4	98,3	121	143	171
	HAS-U HCR		19,3	28,0	37,8	45,8	72,7	99,8	122	146	142	164	187
	HIS-N 8.8		16,7	30,7	44,7	72,7	77,3	-	-	-	-	-	-
Shear V_{Rd}	HAS-U 5.8	[kN]	7,2	12,0	16,8	31,2	48,8	70,4	92,0	112	139	163	195
	HAS-U 8.8, AM 8.8		12,0	18,4	27,2	50,4	78,4	113	147	179	222	262	312
	HAS-U A4		8,3	12,8	19,2	35,3	55,1	79,5	48,3	58,8	73,1	85,7	103
	HAS-U HCR		12,0	18,4	27,2	50,4	78,4	70,9	92,0	112	87,0	102	122
	HIS-N 8.8		10,4	18,4	27,2	50,4	46,4	-	-	-	-	-	-
Cracked concrete													
Tension N_{Rd}	HAS-U 5.8	[kN]	10,1	15,1	26,3	32,1	50,9	69,9	85,4	102	-	-	-
	HAS-U 8.8, AM 8.8		10,1	15,1	26,3	32,1	50,9	69,9	85,4	102	-	-	-
	HAS-U A4		10,1	15,1	26,3	32,1	50,9	69,9	80,4	98,3	-	-	-
	HAS-U HCR		10,1	15,1	26,3	32,1	50,9	69,9	85,4	102	-	-	-
	HIS-N 8.8		16,7	26,5	32,1	50,9	67,4	-	-	-	-	-	-
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, AM 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	-	-	-	-	-	-

1) Hilti hollow drill bit available for element size M12-M30.
2) Roughening tools are available for element size M16-M30.

HILTI

Recommended loads [a)]

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_{Rec}	HAS-U 5.8	[kN]	6.0	9.7	14.0	25.6	40.7	56.0	68.3	81.3	95.3	110.0	125.
	HAS-U 8.8, AM		9.7	15.3	21.2	25.6	40.7	56.0	68.3	81.3	95.3	110.0	125.
	HAS-U A4		8.7	13.7	19.7	25.6	40.7	56.0	68.3	81.3	95.3	110.0	125.
	HAS-U HCR		9.7	15.3	21.2	25.6	40.7	56.0	68.3	81.3	95.3	110.0	125.
	HIS-N 8.8		8.3	15.3	22.3	40.6	38.7	-	-	-	-	-	-
Shear V_{Rec}	HAS-U 5.8	[kN]	3.0	5.0	7.0	13.0	20.3	29.3	38.3	46.7	58.0	68.0	81.3
	HAS-U 8.8, AM		5.0	7.7	11.3	21.0	32.7	47.0	61.3	74.7	92.7	109.0	130.0
	HAS-U A4		4.3	6.7	10.0	18.3	28.7	41.3	38.3	46.7	58.0	68.0	81.3
	HAS-U HCR		5.0	7.7	11.3	21.0	32.7	41.3	53.7	65.3	58.0	68.0	81.3
	HIS-N 8.8		4.3	7.7	11.3	21.0	19.3	-	-	-	-	-	-
Cracked concrete													
Tension N_{Rec}	HAS-U 5.8	[kN]	5.0	7.5	13.1	17.9	28.4	39.0	47.7	57.0	-	-	-
	HAS-U 8.8, AM		5.0	7.5	13.1	17.9	28.4	39.0	47.7	57.0	-	-	-
	HAS-U A4		5.0	7.5	13.1	17.9	28.4	39.0	47.7	57.0	-	-	-
	HAS-U HCR		5.0	7.5	13.1	17.9	28.4	39.0	47.7	57.0	-	-	-
	HIS-N 8.8		8.3	14.8	17.9	28.4	37.7	-	-	-	-	-	-
Shear V_{Rec}	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, AM		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	-	-	-	-	-	-

a) With overall global safety factor for action $\gamma=3.0$. The partial safety factors for action depend on the type of loading and shall be taken from national regulations.

For diamond drilling:

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	76,9	122	167	205	244
	HIS-N 8.8		25,0	46,0	67,0	122	116	-	-	-
Shear V_{Rk}	HAS-U 5.8	[kN]	9,0	15,0	21,0	39,0	61,0	88,0	115	140
	HIS-N 8.8		13,0	23,0	34,0	63,0	58,0	-	-	-

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	32,7	51,9	71,3	87,1	104
	HIS-N 8.8		16,7	24,4	32,7	51,9	68,8	-	-	-
Shear V_{Rd}	HAS-U 5.8	[kN]	7,2	12,0	16,8	31,2	48,8	70,4	92,0	112
	HIS-N 8.8		10,4	18,4	27,2	50,4	46,4	-	-	-

Recommended loads b)

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete										
Tensile N_{Rec}	HAS-U 5.8	[kN]	6.0	9.7	14.0	25.6	40.7	55.7	68.3	81.3
	HIS-N 8.8		8.3	15.3	22.3	40.7	38.7	-	-	-
Shear V_{Rec}	HAS-U 5.8	[kN]	3.0	5.0	7.0	13.0	20.3	29.3	38.3	46.7
	HIS-N 8.8		4.3	7.7	11.3	21.0	19.3	-	-	-

a) With overall global 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

Mechanical properties for HIS-N

Anchor size			ETA-16/0143, issue 2019-05-14				
			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	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 HAS-U

Anchor size			ETA-16/0143, issue 2019-05-14								Hilti Technical data		
			M8	M10	M12	M16	M20	M24	M27	M30	M33	M36	M39
Nominal tensile strength f_{uk}	HAS-U 5.8(F)	[N/mm²]	500	500	500	500	500	500	500	500	500	500	500
	HAS-U 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
	HAS-U A4		700	700	700	700	700	700	500	500	500	500	500
	HAS-U HCR		800	800	800	800	800	700	700	700	500	500	500
Yield strength f_{yk}	HAS-U 5.8(F)	[N/mm²]	400	400	400	400	400	400	400	400	400	400	400
	HAS-U 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
	HAS-U A4		450	450	450	450	450	450	210	210	210	210	210
	HAS-U HCR		640	640	640	640	640	400	400	400	250	250	250
Stressed cross-section A_s	HAS-U AM 8.8	[mm²]	36,6	58,0	84,3	157	245	353	459	561	694	817	976
Moment of resistance W	HAS-U AM 8.8	[mm³]	31,2	62,3	109	277	541	935	1387	1874	2579	3294	4301

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; (F) 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; (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, 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
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 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.

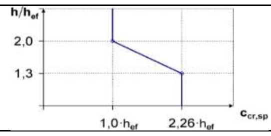
Working time and curing time

Temperature of the base material T	Working time t_{work}	Minimum curing time t_{cure} 1)
-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	12 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

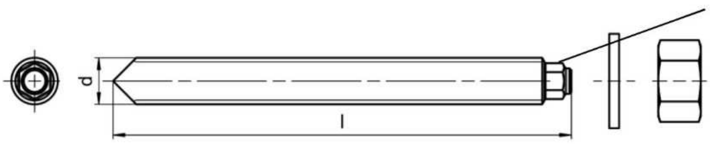
1) The curing time data are valid for dry base material only. In wet base material, the curing times must be doubled.

Setting details for HAS-U

			ETA-16/0143, issue 2019-05-14								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}	[Nm]	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]	$2\ c_{cr,sp}$										
Critical edge distance for splitting failure b)	$c_{cr,sp}$	[mm]	**$1{,}0 \cdot h_{ef}$** for $h / h_{ef} \geq 2{,}0$ **$4{,}6\ h_{ef} - 1{,}8\ h$** for $2{,}0 > h / h_{ef} > 1{,}3$ **$2{,}26\ h_{ef}$** 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]	$1{,}5\ h_{ef}$										



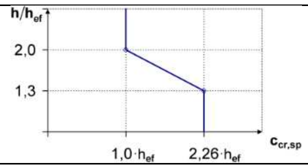
HAS-U-...



Marking:
Steel grade number and length identification letter: e.g. 8 L

Setting details for HIS-N

Anchor size			M8	M10	M12	M16	M20
Nominal diameter of drill	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 $h / h_{ef} \geq 2{,}0$			
			$4{,}6\ h_{ef} - 1{,}8\ h$	for $2{,}0 > h / h_{ef} > 1{,}3$			
			$2{,}26\ h_{ef}$	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]	$1{,}5\ h_{ef}$				
Max. torque moment a)	T_{max}	[Nm]	10	20	40	80	150

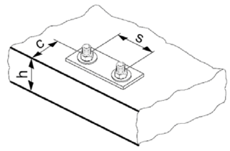


For spacing (edge distance) smaller than critical spacing (critical edge distance) the design loads have to be reduced.

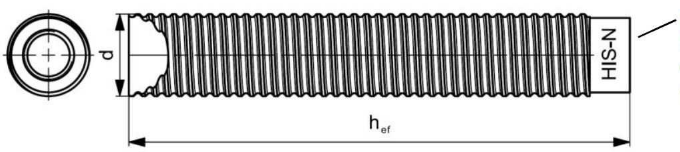
a) $h_{ef,min} \leq h_{ef} \leq h_{ef,max}$ (h_{ef}: embedment depth)

b) h: base material thickness ($h \geq h_{min}$)

c) The critical edge distance for concrete cone failure depends on the embedment depth h_{ef} and the design bond resistance. The simplified formula given in this table is on the save side.



Internally threaded sleeve HIS-(R)N…



Marking:
Identifying mark - HILTI and
embossing "HIS-N" (for zinc coated steel)
embossing "HIS-RN" (for stainless steel)

Installation equipment

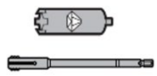
Anchor size		M8	M10	M12	M16	M20	M24	M27	M30	M36	M39
Rotary hammer	HAS-U	TE 2 – TE 16				TE 40 – TE 80				Not available from Hilti	
	HIS-N	TE 2 – TE 16		TE 40 – TE 80			-				
Other tools		compressed air gun, set of cleaning brushes, dispenser									
		roughening tools TE-YRT								-	
Additional Hilti 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

HAS-U	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

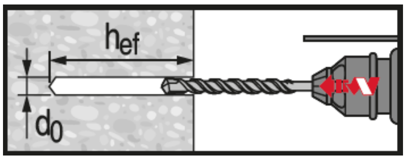
Setting instructions

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

Safety regulations.

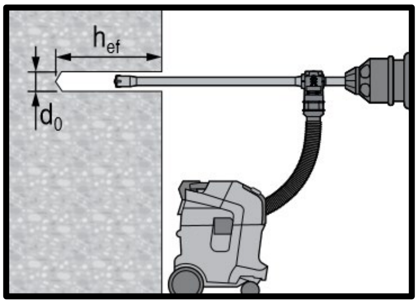
Review the Material Safety Data Sheet (MSDS) before use for proper and safe handling! Wear well-fitting protective goggles and protective gloves when working with Hilti HIT-RE 500 V3.

Drilling



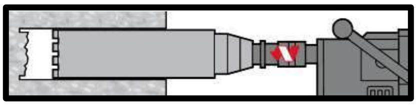
Hammer drilled hole

For dry and wet concrete and installation in flooded holes (no sea water).

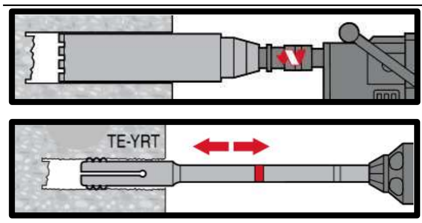


Hammer drilled hole with Hollow Drilled Bit (HDB)

No cleaning required.
For dry and wet concrete, only.

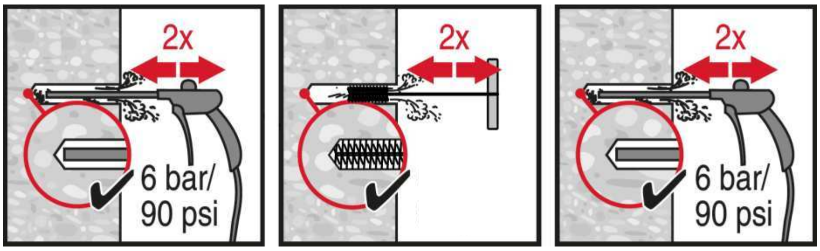


Diamond Coring
For dry and wet concrete, only.



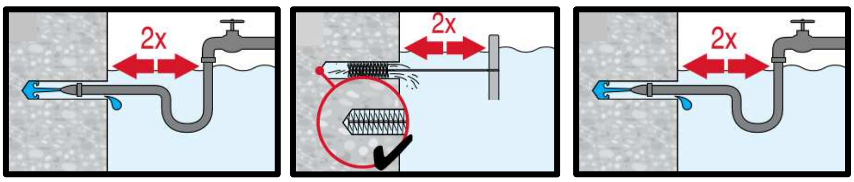
Diamond Coring + Roughening Tool
For dry and wet concrete only.
Before roughening, the borehole needs to be dry.

Cleaning (Inadequate hole cleaning=poor load values.)



Hammer Drilling:

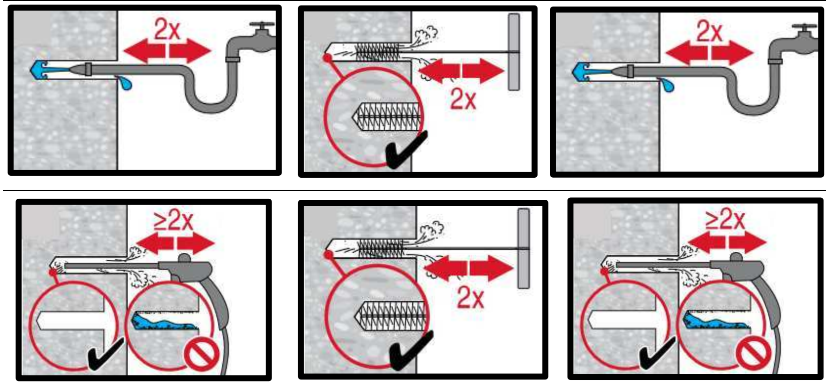
Compressed air cleaning (CAC)
For all drill hole diameters d_0 and all drill hole depths h_0.



Hammer drilling:

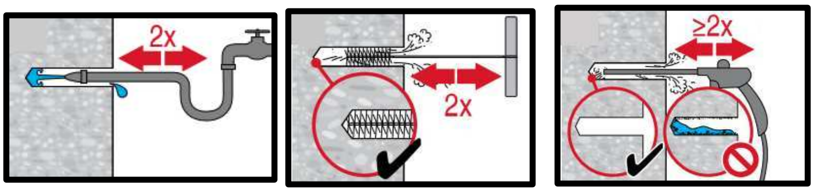
Cleaning for under water:

For all bore hole diameters d_0 and all bore hole depth h_0.



Hammer drilled flooded holes and diamond cored holes:

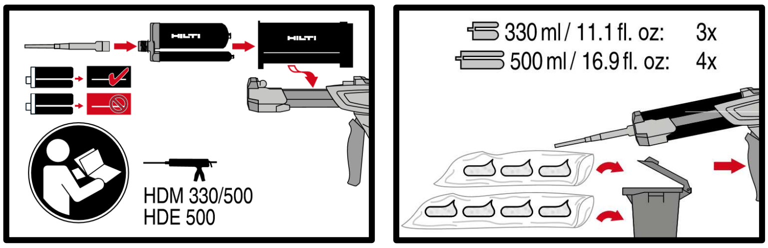
Compressed air cleaning (CAC)
for all drill hole diameters d_0 and drill hole depths h_0.



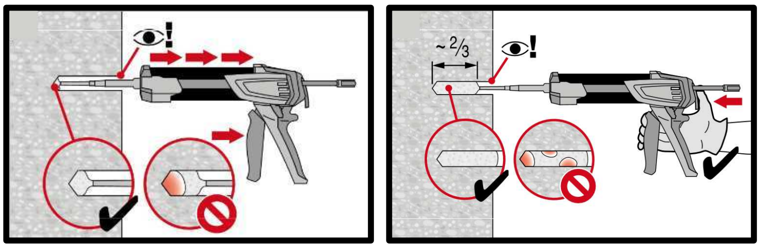
Diamond cored holes with Hilti roughening tool:

Compressed air cleaning (CAC)
for all drill hole diameters d_0 and drill hole depths h_0 .

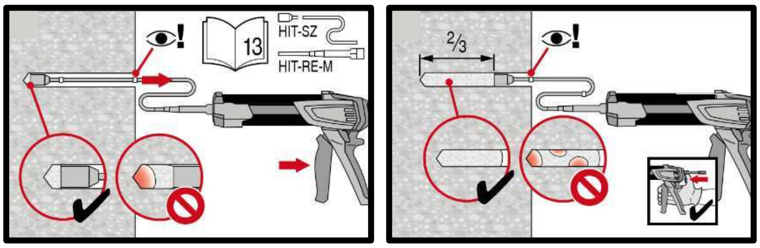
Injection preparation



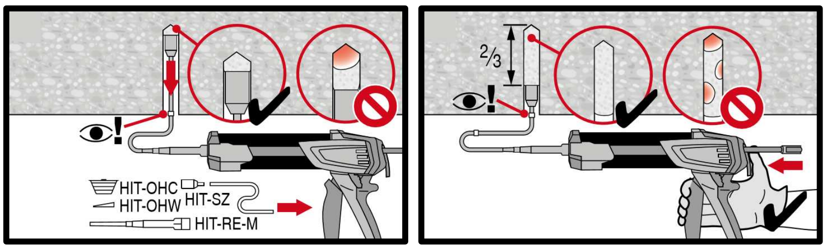
Injection system preparation.



Injection method for drill hole depth $h_{ef} \leq 250$ mm.

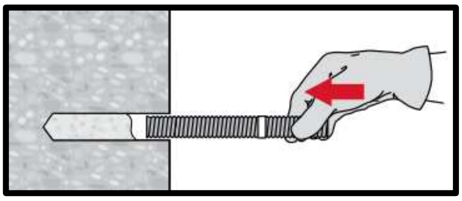


Injection method for drill hole depth $h_{ef} > 250$mm.

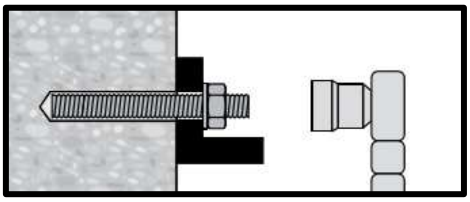


Injection method for overhead application.

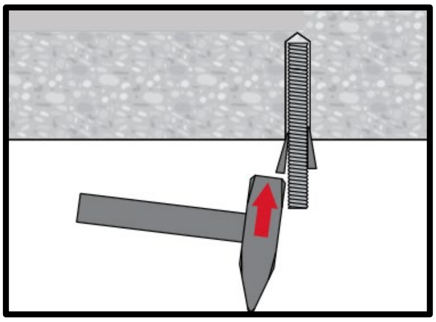
Setting the element



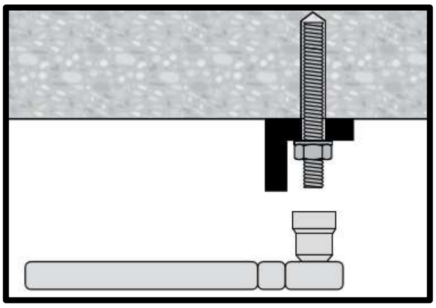
Setting element, observe working time "t_{work}",



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

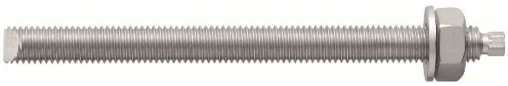
Anchor design (EN 1992-4) / Rods and Sleeves / Concrete

Injection mortar system

Hilti HIT-RE 100

500 ml foil pack

(also available as 330 ml foil pack)



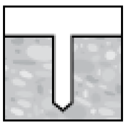
Anchor rods:
HAS-U
HAS-U HDG
HAS-U A4
HAS-U HCR
(M8-M30)

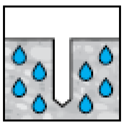
Benefits

- Suitable for 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

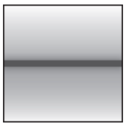
Base material


Concrete (non-cracked)

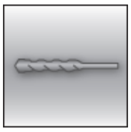

Dry concrete

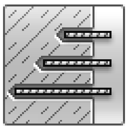

Wet concrete

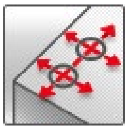
Load conditions


Static/ quasi-static

Installation conditions


Hammer drilling


Variable embedment depth


Small edge distance and spacing

Other informations

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 / 2019-08-30

a) All data given in this section according to ETA-15/0882 issue 2019-08-30.

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.

- 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.

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
- Base material thickness, as specified in the table
- Embedment depth, as specified in the table
- Anchor material, as specified in the tables
- Concrete C 20/25, $f_{ck,cube}$ = 25 N/mm²
- In-service temperate range I
  (min. base material temperature -40°C, max. long term/short term base material temperature: +24°C/40°C)

Embedment depth a) and base material thickness

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Embedment depth	h_{ef}	[mm]	80	90	110	125	170	210	240	270
Base material thickness	h	[mm]	110	120	140	165	220	270	300	340

a) The allowed range of embedment depth is shown in the setting details

Characteristic resistance

Anchor size				M8	M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete											
Tension	HAS-U 5.8	N_{Rk}	[kN]	18,3	29,0	42,2	68,8	109,0	149,7	182,9	218,2
	HAS-U 8.8			29,3	42,0	56,8	68,8	109,0	149,7	182,9	218,2
	HAS-U A4			25,6	40,6	56,8	68,8	109,0	149,7	182,9	218,2
	HAS-U HCR			29,3	42,0	56,8	68,8	109,0	149,7	182,9	218,2
Shear	HAS-U 5.8	V_{Rk}	[kN]	9,2	14,5	21,1	39,3	61,3	88,3	114,8	140,3
	HAS-U 8.8			14,6	23,2	33,7	62,8	98,0	141,2	183,6	224,4
	HAS-U A4			12,8	20,3	29,5	55,0	85,8	123,6	114,8	140,3
	HAS-U HCR			14,6	23,2	33,7	62,8	98,0	123,6	160,7	196,4

Design resistance

Anchor size				M8	M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete											
Tension	HAS-U 5.8	N_{Rd}	[kN]	12,2	19,3	27,0	32,7	51,9	71,3	87,1	103,9
	HAS-U 8.8			14,4	20,0	27,0	32,7	51,9	71,3	87,1	103,9
	HAS-U A4			13,7	20,0	27,0	32,7	51,9	71,3	80,2	98,1
	HAS-U HCR			14,4	20,0	27,0	32,7	51,9	71,3	87,1	103,9
Shear	HAS-U 5.8	V_{Rd}	[kN]	7,3	11,6	16,9	31,4	49,0	70,6	91,8	112,2
	HAS-U 8.8			11,7	18,6	27,0	50,2	78,4	113,0	146,9	179,5
	HAS-U A4			8,2	13,0	18,9	35,2	55,0	79,2	48,2	58,9
	HAS-U HCR			11,7	18,6	27,0	50,2	78,4	70,6	91,8	112,2

Recommended loads [a)]

Anchor size				M8	M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete											
Tension	HAS-U 5.8	N_{Rec}	[kN]	6.1	9.7	14.1	22.9	36.3	49.9	61.0	72.7
	HAS-U 8.8			9.8	14.0	18.9	22.9	36.3	49.9	61.0	72.7
	HAS-U A4			8.5	13.5	18.9	22.9	36.3	49.9	61.0	72.7
	HAS-U HCR			9.8	14.0	18.9	22.9	36.3	49.9	61.0	72.7
Shear	HAS-U 5.8	V_{Rec}	[kN]	3.1	4.8	7.0	13.1	20.4	29.4	38.3	46.8
	HAS-U 8.8			4.9	7.7	11.2	20.9	32.7	47.1	61.2	74.8
	HAS-U A4			4.3	6.8	9.8	18.3	28.6	41.2	38.3	46.8
	HAS-U HCR			4.9	7.7	11.2	20.9	32.7	41.2	53.6	65.5

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

Anchor size				M8	M10	M12	M16	M20	M24	M27	M30
Nominal tensile strength	HAS-U 5.8	f_{uk}	[N/mm²]	500	500	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	700	700
Yield strength	HAS-U 5.8	f_{yk}	[N/mm²]	400	400	400	400	400	400	400	400
	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	400	400
Stressed cross-section	HAS-U	A_s	[mm²]	36,6	58,0	84,3	157	245	353	459	561
Moment of resistance	HAS-U	W	[mm³]	31,2	62,3	109	277	541	935	1387	1874

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
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, 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
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 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 range:
+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	Maximum long term base material temperature	Maximum 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

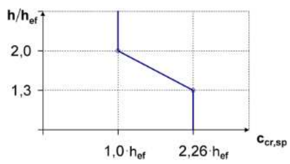
Maximum short term base material temperature
Short term elevated base material temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.
Maximum long term base material temperature
Long term elevated base material temperatures are roughly constant over significant periods of time.

Working time and curing time [a)]

Temperature of the base material	Maximum working time	Minimum curing time
T_{BM}	t_{work}	t_{cure} [a)]
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

a) The curing time data are valid for dry base material only. In wet base material the curing times must be doubled.

Setting details

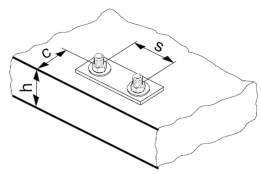
Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Nominal diameter of drill bit	d_0	[mm]	10	12	14	18	22	28	30	35
Diameter of element	d	[mm]	8	10	12	16	20	24	27	30
Effective anchorage depth (=drill hole depth) a)	$h_{ef,min} = h_0$	[mm]	60	60	70	80	90	96	108	120
	$h_{ef,max} = h_0$	[mm]	160	200	240	320	400	480	540	600
Minimum base material thickness a)	h_{min}	[mm]	h_{ef} + 30 ≥ 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
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	$c_{cr,sp}$	[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 for concrete cone failure b)	$c_{cr,N}$	[mm]	1,5 h_{ef}							
Maximum 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) $h_{ef,min} \le h_{ef} \le h_{ef,max}$ (h_{ef}: embedment depth) h: base material thickness ($h \ge h_{min}$)

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.

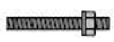
c) This is the maximun recommended torque moment to avoid splitting failure during installation for anchors with minimun spacing and/or edge distance.



Installation equipment

Anchor size	M8	M10	M12	M16	M20	M24	M27	M30
Rotary hammer	TE 2– TE 16				TE 40 – TE 80			
Other tools	Blow out pump (h_{ef} ≤ 10 · d, d_0 ≤ 20 mm), compressed air gun, Set of cleaning brushes, dispenser, piston plug							

Drilling and cleaning parameters

HAS-U	Drilling and cleaning			Installation
	Hammer drill (HD)	Hollow Drill Bit (HDB)	Brush HIT-RB	Piston plug HIT-SZ
	d0 [mm]		size [mm]	size [mm]
				
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

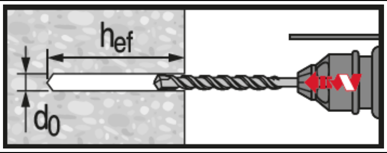
Setting instructions

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

Safety regulations.

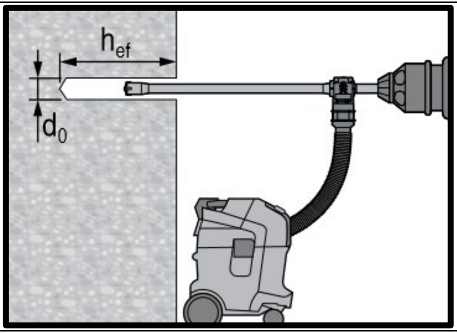
Review the Material Safety Data Sheet (MSDS) before use for proper and safe handling! Wear well-fitting protective goggles and protective gloves when working with Hilti HIT-RE 100.

Drilling



Hammer drilled hole

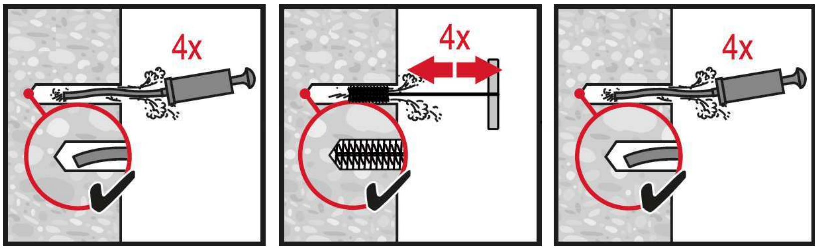
For dry and wet concrete.



Hammer drilled hole with Hollow Drilled Bit (HDB)

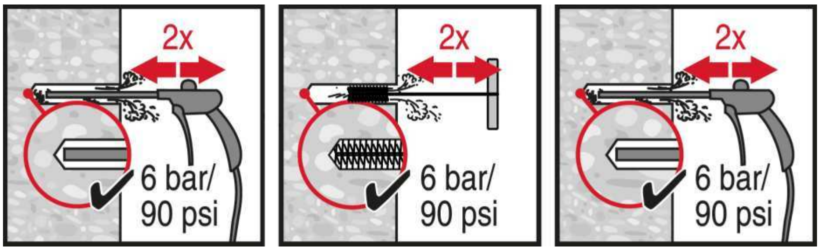
No cleaning required.

Cleaning

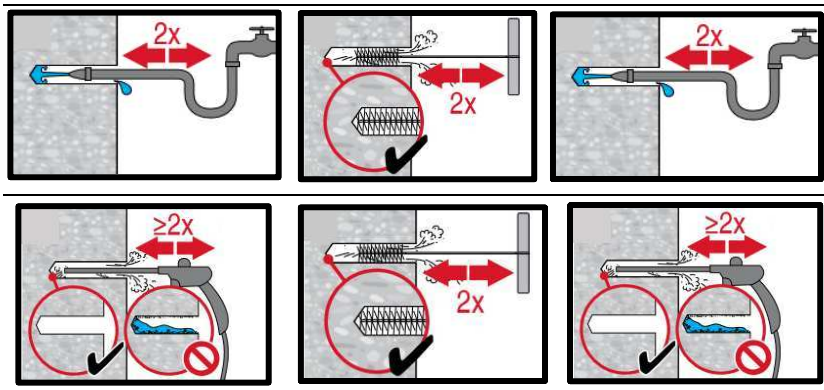


Manual cleaning (MC)
Non-cracked concrete only

for drill diameters $d_0 \leq 20$ mm and drill hole depth $h_0 \leq 10 \cdot d$.



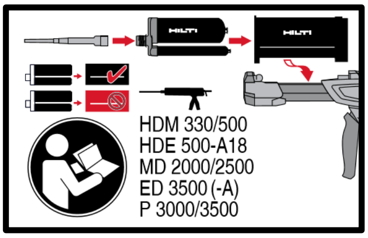
Compressed air cleaning (CAC)
for all drill hole diameters d_0 and drill hole depths $h_0 \leq 20 \cdot d$.

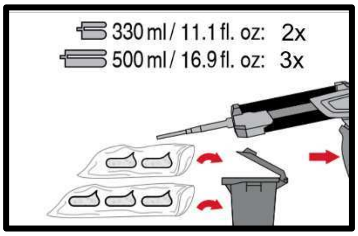


Compressed air cleaning (CAC)
cleaning of flooded holes

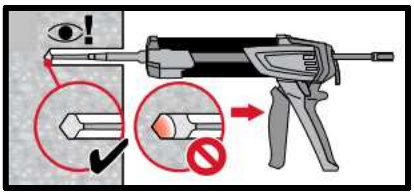
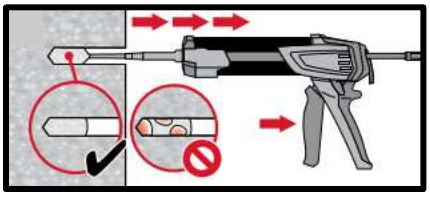
for all drill hole diameters d_0 and drill hole depths h_0 .

Injection system

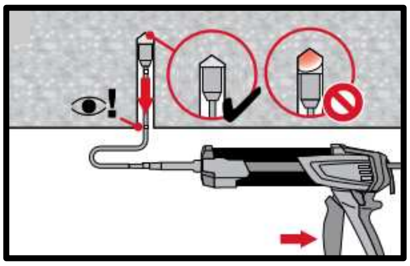
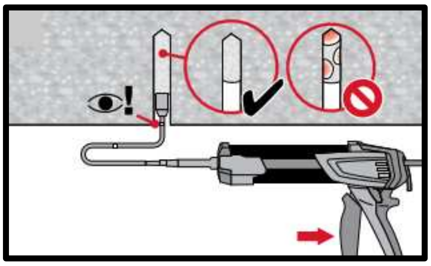




Injection system preparation.

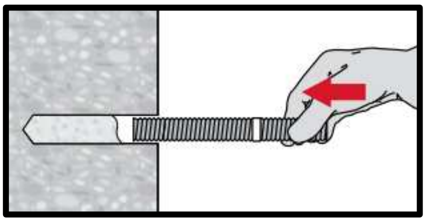



Injection method for drill hole depth $h_{ef} \leq 250$ mm.

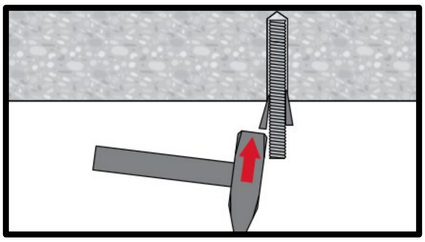



Injection method for overhead application and/or installation with embedment depth $h_{ef} > 250$ mm.

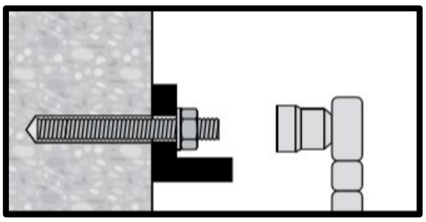
Setting the element



Setting element, observe working time "t_{work}",



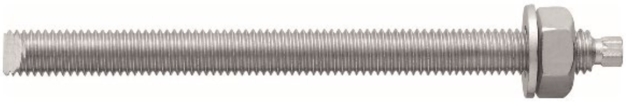
Setting element for overhead applications, observe working time "t_{work}",



Loading the anchor: After required curing time t_{cure} the anchor can be loaded.

HVU2 adhesive capsule

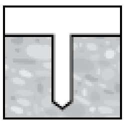
Anchor design (EN 1992-4) / Rods and Sleeves / Concrete

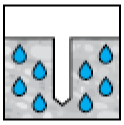
Anchor version		Benefits
	HVU2 Mortar capsule	- **SafeSet** technology: Hilti hollow drill bit for automatic cleaning - Suitable for cracked and non-cracked concrete C20/25 to C50/60 both for hammer drilled and diamond cored holes - Highly reliable and safe anchor for seismic design with ETA C1/C2 approval. Seismic C1 ETA available even for Diamond cored holes. - Clean and fast installation that suits hard jobsite conditions - Suitable for dry and water saturated concrete - High loading capacity - Short curing time - In service temperature range up to 120°C short term / 72°C long term
	Anchor rod: HAS-U HAS-U HDG HAS-U A4 HAS-U HCR AM 8.8 (HDG) (M8-M39)	
	Internally threaded sleeve: HIS-N HIS-RN (M8-M20)	

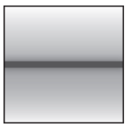
Base material / Load conditions


Concrete (non-cracked)

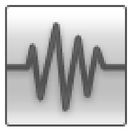

Concrete (cracked)


Dry concrete

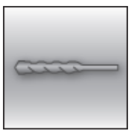

Wet concrete

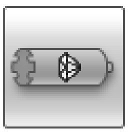

Static/ quasi-static


Fire resistance

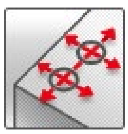

Seismic ETA-C1/C2

Installation conditions / Other information


Hammer drilled holes


Diamond drilled holes


Electrical Dispenser


Small edge distance and spacing

European Technical Assessment

CE conformity

PROFIS ENGINEERING

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-16/0515 / 2022-08-23
Fire test assessment	ING.Thiele, Pirmasens	21735 / 2017-08-01

a) All data given in this section according to ETA-16/0515, issue 2022-08-23.

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 instructions)
- No edge distance and spacing influence
- Steel failure
- Minimum base material thickness
- Concrete C20/25, $f_{ck,cube}$ = 25 N/mm²
- In-service temperature range I: -40 °C to +40 °C
  (max. long term temperature +24 °C and max. short term temperature +40 °C)
- Short term loading. For long term loading please apply ψ_{sus}.
  Hammer drilled holes and Hammer drilled holes with Hollow Drill Bit: ψ_{sus} = 1.00
  Diamond cored holes: ψ_{sus} = 0.78

Embedment depth and base material thickness

Anchor size			M8	M10		M12		M16		M20	M24	M27	M30
HAS-U													
Effective anchorage depth	h_{ef}	[mm]	80	90	135	110	165	125	190	170	210	240	270
Base material thickness	h_{min}	[mm]	110	120	165	140	195	160	230	220	270	300	340
HIS-N													
Effective 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[1]:

Characteristic resistance

Anchor size				M8	M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete											
Tension	HAS-U 5.8	N_{Rk}	[kN]	18,3	29,0	42,2	68,8	109,0	149,7	-	-
	HAS-U 8.8			24,1	42,0	56,8	68,8	109,0	149,7	182,9	218,2
	HAS-U A4			24,1	40,6	56,8	68,8	109,0	149,7	182,9	218,2
	HAS-U HCR			24,1	42,0	56,8	68,8	109,0	149,7	-	-
	HIS-N 8.8			25,0	46,0	67,0	109,0	116,0	-	-	-
	HIS-RN 70			26,0	46,0	59,0	109,0	144,4	-	-	-
Shear	HAS-U 5.8	V_{Rk}	[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	141,2	183,6	224,4
	HAS-U A4			12,8	20,3	29,5	55,0	85,8	123,6	114,8	140,3
	HAS-U HCR			14,6	23,2	33,7	62,8	98,0	123,6	-	-
	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	HAS-U 5.8	N_{Rk}	[kN]	10,1	24,0	35,2	48,1	76,3	104,8	-	-
	HAS-U 8.8			10,1	24,0	35,2	48,1	76,3	104,8	128,0	152,8
	HAS-U A4			10,1	24,0	35,2	48,1	76,3	104,8	128,0	152,8
	HAS-U HCR			10,1	24,0	35,2	48,1	76,3	104,8	-	-
	HIS-N 8.8			23,0	37,1	48,1	76,3	101,1	-	-	-
	HIS-RN 70			23,0	37,1	48,1	76,3	101,1	-	-	-
Shear	HAS-U 5.8	V_{Rk}	[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	141,2	183,6	224,4
	HAS-U A4			12,8	20,3	29,5	55,0	85,8	123,6	114,8	140,3
	HAS-U HCR			14,6	23,2	33,7	62,8	98,0	123,6	-	-
	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	-	-	-

1) 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	HAS-U 5.8	N_{Rd}	[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	121,9	145,5
	HAS-U A4			13,7	21,7	31,6	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	HAS-U 5.8	V_{Rd}	[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	113,0	146,9	179,5
	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	HAS-U 5.8	N_{Rd}	[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	HAS-U 5.8	V_{Rd}	[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	113,0	146,9	179,5
	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	-	-	-

1) Hilti hollow drill bit is available for the element sizes M12 to M30.

Recommended loads[2)]

Anchor size				M8	M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete											
Tension	HAS-U 5.8	N_{Rec}	[kN]	6.1	9.7	14.1	22.9	36.3	49.9	-	-
	HAS-U 8.8			8.0	14.0	18.9	22.9	36.3	49.9	61.0	72.7
	HAS-U A4			8.0	13.5	18.9	22.9	36.3	49.9	61.0	72.7
	HAS-U HCR			8.0	14.0	18.9	22.9	36.3	49.9	-	-
	HIS-N 8.8			8.3	15.3	22.3	36.3	38.7	-	-	-
	HIS-RN 70			8.7	15.3	19.7	36.3	48.1	-	-	-
Shear	HAS-U 5.8	V_{Rec}	[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	47.1	61.2	74.8
	HAS-U A4			4.3	6.8	9.8	18.3	28.6	41.2	38.3	46.8
	HAS-U HCR			4.9	7.7	11.2	20.9	32.7	41.2	-	-
	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	HAS-U 5.8	N_{Rec}	[kN]	3.4	8.0	11.7	16.0	25.4	34.9	-	-
	HAS-U 8.8			3.4	8.0	11.7	16.0	25.4	34.9	42.7	50.9
	HAS-U A4			3.4	8.0	11.7	16.0	25.4	34.9	42.7	50.9
	HAS-U HCR			3.4	8.0	11.7	16.0	25.4	34.9	-	-
	HIS-N 8.8			7.7	12.4	16.0	25.4	33.7	-	-	-
	HIS-RN 70			7.7	12.4	16.0	25.4	33.7	-	-	-
Shear	HAS-U 5.8	V_{Rec}	[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	47.1	61.2	74.8
	HAS-U A4			4.3	6.8	9.8	18.3	28.6	41.2	38.3	46.8
	HAS-U HCR			4.9	7.7	11.2	20.9	32.7	41.2	-	-
	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	-	-	-

1) Hlti hollow drill bit is available for the element sizes M12-M30.
2) With overall global dafety 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.

Diamond cored holes:

Characteristic resistance

Anchor size				M8	M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete											
Tension	HAS-U 5.8	N_{Rk}	[kN]	-	29,0	42,2	68,8	109,0	149,7	-	-
	HAS-U 8.8			-	39,6	56,8	68,8	109,0	149,7	182,9	218,2
	HAS-U A4			-	39,6	56,8	68,8	109,0	149,7	182,9	218,2
	HAS-U HCR			-	39,6	56,8	68,8	109,0	149,7	-	-
	HIS-N 8.8			25,0	46.0	67,0	109,0	116,0	-	-	-
	HIS-RN 70			26,0	41.0	59,0	109,0	144,4	-	-	-
Shear	HAS-U 5.8	V_{Rk}	[kN]	-	14,5	21,1	39,3	61,3	88,3	-	-
	HAS-U 8.8			-	23,2	33,7	62,8	98,0	141,2	183,6	224,4
	HAS-U A4			-	20,3	29,5	55,0	85,8	123,6	114,8	140,3
	HAS-U HCR			-	23,2	33,7	62,8	98,0	123,6	-	-
	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	HAS-U 5.8	N_{Rk}	[kN]	-	19,8	29,0	44,0	74,8	104,8	-	-
	HAS-U8.8			-	19,8	29,0	44,0	74,8	104,8	128,0	152,8
	HAS-U A4			-	19,8	29,0	44,0	74,8	104,8	128,0	152,8
	HAS-U HCR			-	19,8	29,0	44,0	74,8	104,8	-	-
	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	HAS-U 5.8	V_{Rk}	[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	HAS-U 5.8	N_{Rd}	[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	121,9	145,5
	HAS-U A4			-	24,2	31,6	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	HAS-U 5.8	V_{Rd}	[kN]	-	11,6	16,9	31,4	49,0	70,6	-	-
	HAS-U 8.8			-	18,6	27,0	50,2	78,4	113,0	146,9	179,5
	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	HAS-U 5.8	N_{Rd}	[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	101,8
	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	HAS-U 5.8	V_{Rd}	[kN]	-	11,6	16,9	31,4	49,0	70,6	-	-
	HAS-U 8.8			-	18,6	27,0	50,2	78,4	113,0	146,9	179,5
	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	HAS-U 5.8	N_{Rec}	[kN]	-	9.7	14.1	22.9	36.3	49.9	-	-
	HAS-U 8.8			-	13.2	18.9	22.9	36.3	49.9	61.0	72.7
	HAS-U A4			-	13.2	18.9	22.9	36.3	49.9	61.0	72.7
	HAS-U HCR			-	13.2	18.9	22.9	36.3	49.9	-	-
	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	48.1	-	-	-
Shear	HAS-U 5.8	V_{Rec}	[kN]	-	4.8	7.0	13.1	20.4	29.4	-	-
	HAS-U 8.8			-	7.7	11.2	20.9	32.7	47.1	61.2	74.8
	HAS-U A4			-	6.8	9.8	18.3	28.6	41.2	38.3	46.8
	HAS-U HCR			-	7.7	11.2	20.9	32.7	41.2	-	-
	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	HAS-U 5.8	N_{Rec}	[kN]	-	6.6	9.7	14.7	24.9	34.9	-	-
	HAS-U 8.8			-	6.6	9.7	14.7	24.9	34.9	42.7	50.9
	HAS-U A4			-	6.6	9.7	14.7	24.9	34.9	42.7	50.9
	HAS-U HCR			-	6.6	9.7	14.7	24.9	34.9	-	-
	HIS-N 8.8			5.3	8.6	12.1	20.3	26.7	-	-	-
	HIS-RN 70			5.3	8.6	12.1	20.3	26.7	-	-	-
Shear	HAS-U 5.8	V_{Rec}	[kN]	-	4.8	7.0	13.1	20.4	29.4	-	-
	HAS-U 8.8			-	7.7	11.2	20.9	32.7	47.0	61.3	74.7
	HAS-U A4			-	6.8	9.8	18.3	28.6	41.3	38.3	46.7
	HAS-U HCR			-	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	-	-	-

a) With overall global safety factor for action $\gamma = 3.0$. 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	HAS-U 5.8	f_{uk}	[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	HAS-U 5.8	f_{yk}	[N/mm²]	440	440	440	440	400	400	-	-
	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	HAS-U	A_s	[mm²]	36,6	58,0	84,3	157	245	353	459	561
Moment of resistance	HAS-U	W	[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	HIS-N	f_{uk}	[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	HIS-N	f_{yk}	[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	HIS-(R)N	A_s	[mm²]	51,5	108	169	256	238
	Screw			36,6	58,0	84,3	157	245
Moment of resistance	HIS-(R)N	W	[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 M30: 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 high corrosion resistant 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
Metal parts made of zinc coated steel		
HIS-N	Internal threaded sleeve	Electroplated zinc coated ≥5 µm
	Screw 8.8	Strength class 8.8, A5 > 8 % Ductile Steel galvanized ≥ 5 µm
Metal parts made of stainless steel		
HIS-RN	Internal threaded sleeve	Stainless steel A4 according to EN 10088-1:2014
	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 for the standard variation of temperature and rapid variation of temperature after installation.

In service temperature range

Hilti HVU2 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.

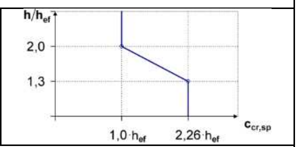
Temperature range	Base material temperature	Maximum long term base material temperature	Maximum short term base material temperature
Temperature range I	-40 °C to +40 °C	+24 °C	+40 °C
Temperature range II	-40 °C to +80 °C	+50 °C	+80 °C
Temperature range III	-40 °C to +120 °C	+72 °C	+120 °C

Maximum 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.
Maximum 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_{BM}	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

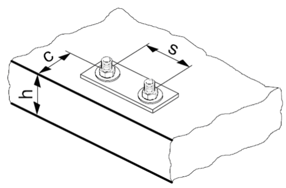
Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Foil capsule HVU2	h_{ef1}	[mm]	**8x80**	**10x90**	**12x110**	**16x125**	**20x170**	**24x210**	**27x240**	**30x270**
	h_{ef2}	[mm]	**-**	**10x135**	**12x165**	**16x190**	**-**	**-**	**-**	**-**
Diameter of element	$d_1=d_{nom}$	[mm]	8	10	12	16	20	24	27	30
Nominal diameter of drill bit		[mm]	10	12	14	18	22	28	30	35
Effective embedment depth (= drill hole depth)	$h_{ef1}=h_{0,1}$	[mm]	80	90	110	125	170	210	240	270
	$h_{ef2}=h_{0,2}$	[mm]	-	135	165	190	-	-	-	-
Maximum diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18	22	26	30	33
Minimum thickness of concrete member	h_{min1}	[mm]	110	120	140	160	220	270	300	340
	h_{min2}	[mm]	-	165	195	230	-	-	-	-
Maximum torque moment a)	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	$s_{cr,sp}$		2 $c_{cr,sp}$							
Critical edge distance for splitting failure b)	$c_{cr,sp}$	[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 for concrete cone failure c)	$c_{cr,N}$	[mm]	1,5 h_{ef}							

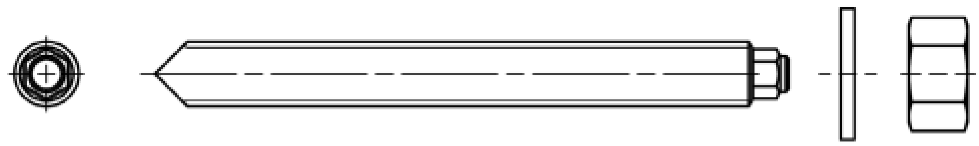
For spacing (edge distance) smaller than critical spacing (critical edge distance) the design loads have to be reduced.

a) Maximum recommended torque moment to avoid splitting failure during installation with minimum spacing and/or edge distance

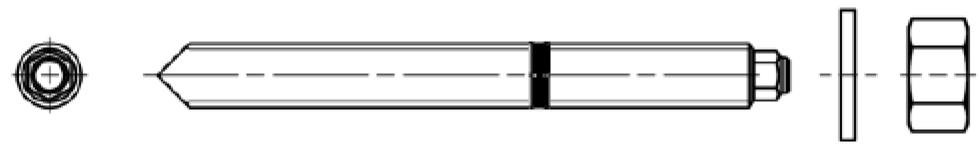
b) h: base material thickness (h ≥ h_{min})

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.



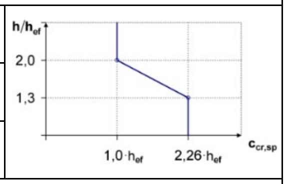


HAS-U-...: M8 to M30 washer nut



HAS-U-...P: M8 to M24 washer nut

Setting details for HIS-N

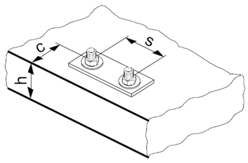
Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**
Foil capsule HVU2			**10x90**	**12x110**	**16x125**	**20x170**	**24x210**
Diameter of element	$d_1=d_{nom}$	[mm]	12,5	16,5	20,5	25,4	27,8
Nominal diameter of drill bit	d_0	[mm]	14	18	22	28	32
Effective embedment depth (= drill hole depth)	$h_{ef}=h_0$	[mm]	90	110	125	170	205
Maximum diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18	22
Minimum thickness of concrete member	h_{min}	[mm]	120	150	170	230	270
Maximum torque moment[a)]	T_{max}	[Nm]	10	20	40	80	150
Thread engagement length min-	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	$s_{cr,sp}$		2 $c_{cr,sp}$				
Critical edge distance for splitting failure [b)]	$c_{cr,sp}$	[mm]	**1,0·h_{ef}** for $h / h_{ef} \geq 2,0$ **4,6 h_{ef}-1,8 h** for $2,0 > h/h_{ef} > 1,3$ **2,26 h_{ef}** for $h / h_{ef} \leq 1,3$				
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}				

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

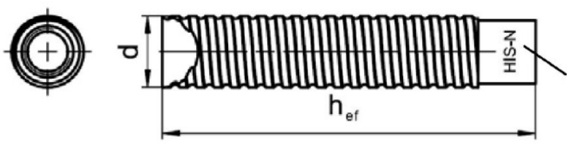
a) Maximum recommended torque moment to avoid splitting failure during installation with minimum spacing and/or edge distance

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 safe side.



Internally threaded sleeve HIS-(R)N...



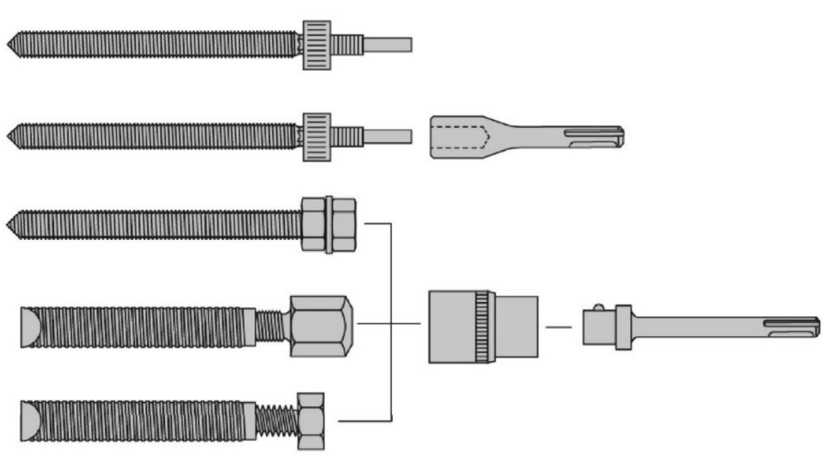
Marking:
Identifying mark - HILTI and
embossing “HIS-N” (for zinc coated steel)
embossing “HIS-RN” (for stainless steel)

Drilling and cleaning parameters

HAS-U	HIS-N	Drilling			Cleaning
		Hammer drilling	Hollow Drill Bit	Diamond coring	Brush HIT-RB
		d_0 [mm]			size [mm]
M8	**-**	10	-	-	-
M10	**-**	12	12	12	12
M12	**M8**	14	14	14	14
M16	**M10**	18	18	18	18
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 tools parameters

HAS	HIS-N	TE (A)	SID 4 A-22	SIW 22T-A	SF(H)	RPM
					or	
M8	**-**	1…7	+	+	2, 6, 8, 10, 14, 22	450…1300
M10	**M8**	1…7	+	+	6, 8, 10, 14, 22	450…1300
M10	**-**	1…40	-	-	6, 8, 10, 14, 22	450…1300
M12	**M10**	1…40	+	+	6, 8, 10, 14, 22	450…1300
M12	**-**	1…40	-	-	6, 8, 10, 14, 22	450…1300
M16	**M12**	1…40	+	-	6, 8, 10, 14, 22	450…1300
M16	**-**	50…80				
M20	**-**	50…60	-	-	-	-
-	**M16**	40…80	-	-	-	-
M24	**-**	50…80	-	-	-	-
-	**M20**	40…80	-	-	-	-
M27	**-**	60…80	-	-	-	-
M30	**-**	60…80	-	-	-	-



Setting tool		Article number	TE (A) 1…40	TE 50…80	SF (H)	SID 4-A22	HIS-S
-		-	-	-	+	-	-
TE-C HVU2		#2181356	+	-	-	-	-
TE-Y HVU2		#2230162…5	-	+	-	-	-
TE-C ½"		#32220	+	-	-	-	+
TE-Y ¾"		#32221	-	+	-	-	+
SI-SA ¼"-½"		#2077174	-	-	+	+	+
SI-SA 7/16"		#2134075	-	-	+	-	+

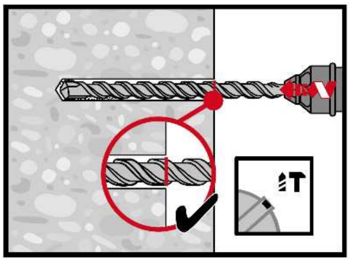
Setting instructions

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

Safety regulations.

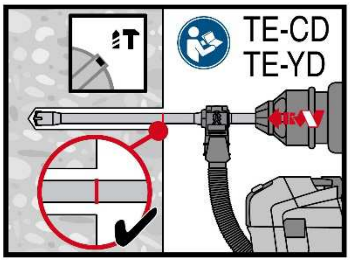
Review the Material Safety Data Sheet (MSDS) before use for proper and safe handling! Wear well-fitting protective goggles and protective gloves when working with Hilti HVU2.

Hole drilling



Hammer drilled hole

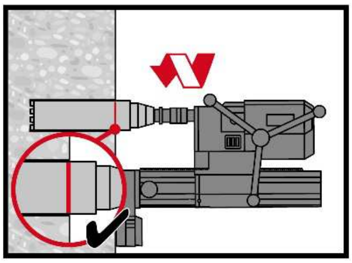
For dry or wet concrete and installation in flooded holes (no sea water).



Hammer drilled hole with Hollow drill bit

For dry and wet concrete, only.

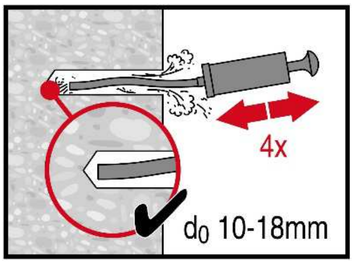
No cleaning required.



Diamond Coring

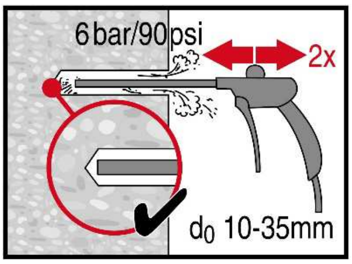
For dry or wet concrete only.

Hole cleaning



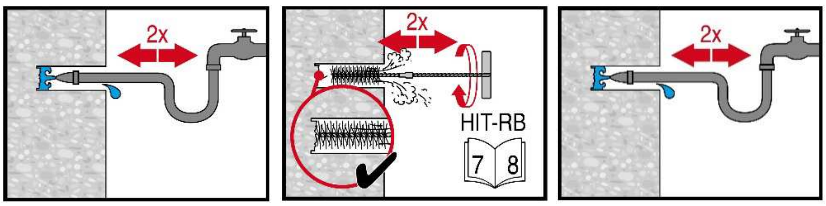
Manual cleaning for hammer drilled hole

for drill hole diameters $d_0 \leq 18$ mm and drill hole depths $h_0 \leq 10 \cdot d$.



Compressed air cleaning (CAC) for hammer drilled hole

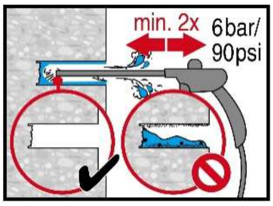
for all drill hole diameters d_0 and all drill hole depths h_0.

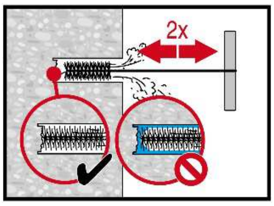


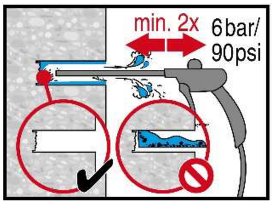
Hammer drilled flooded holes and diamond cored holes:

for all drill hole diameters d_0 and all drill hole depths h_0.

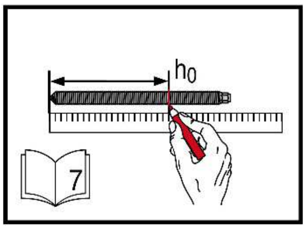
Anchor technology & design
Heavy / medium duty metal anchors
Plastic / light duty / other metal anchors
Chemical anchors
Anchor channels

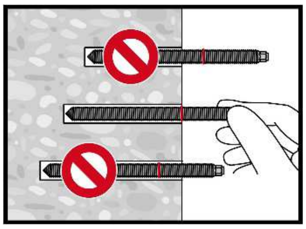




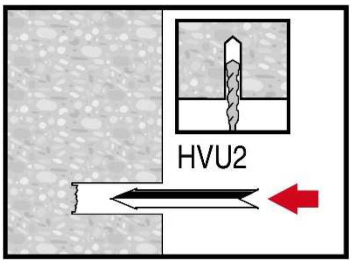


Setting the element

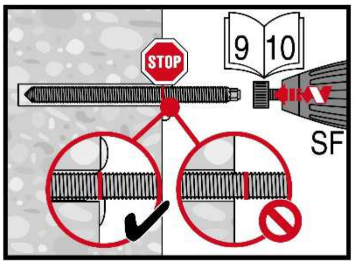


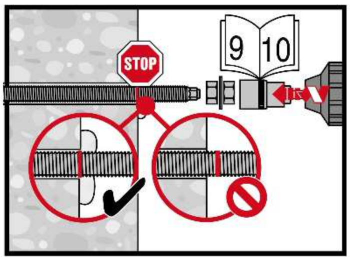


Check setting depth.

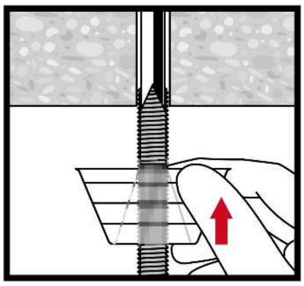


Insert the foil capsule with the peak ahead to the back of the hole.



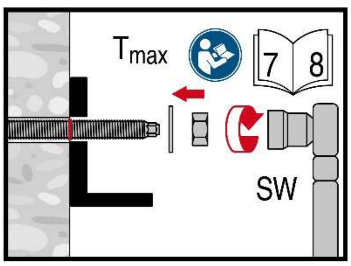


Drive the anchor rod with the plugged tool into the hole.



Overhead installation

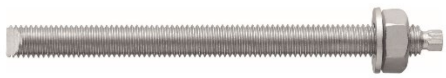
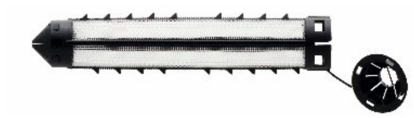
For HVU2 M8 to M24.



Loading the anchor after required curing time t_{cure}.

HIT-HY 270 injection mortar

Anchor design (EOTA TR 054) / Rods and Sleeves / Masonry

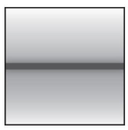
Injection mortar system		Benefits
	Hilti HIT-HY 270 330 ml foil pack (also available as 500 ml foil pack)	- Chemical injection fastening for the most common types of base materials: - Hollow and solid clay bricks, calcium silicate bricks, normal and light weight concrete blocks - Two-component hybrid mortar - Versatile and convenient handling with HDE dispenser - Flexible setting depth and fastening thickness - Small edge distance and anchor spacing - Suitable for overhead fastenings - ETA approved for seismic loads in solid clay bricks (Rosso Vivo, Rosso Classico)
	Anchor rod: HAS-U HAS-U HDG HAS-U A4 HAS-U HCR rods (M6-M16)	
	Sieve sleeves: HIT-SC (12-22)	

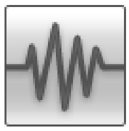
Base material


Solid brick


Hollow brick

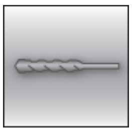
Load conditions

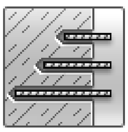

Static/ quasi-static

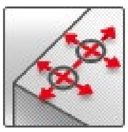

Seismic


Fire resistance

Installation conditions

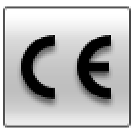

Hammer drilling


Variable embedment depth


Small edge distance and spacing

Other informations


European Technical Assessment



CE conformity

Corrosion resistance

High corrosion resistance

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European technical assessment	DIBt, Berlin	ETA-13/1036 / 2017-12-12
European technical assessment	DIBt, Berlin	ETA-19/0160 / 2019-04-29
European technical assessment	CSTB, Paris	ETA-22/0395 / 2022-08-11
Hilti Technical Data [a)]	Hilti	2019-05-20
Fire test report	MFPA, Leipzig	GS 6.1/19-035-5 / 2020-10-30

a) Hilti Technical Data is based on testing and assessment by Hilti following EAD 330076-00-0604, EOTA TR053 and TR054

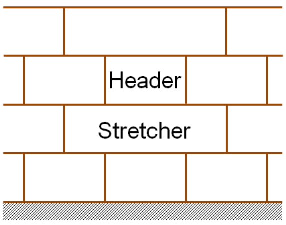
Recommended general notes

* 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

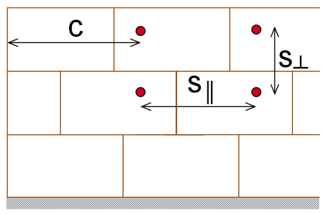
Brick position:



– **Header (H):** The longest dimension of the brick represents the width of the wall

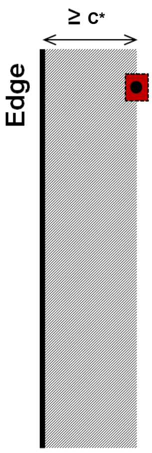
– **Stretcher (S):** The longest dimension of the brick represents the length of the wall

Spacing and edge distance:

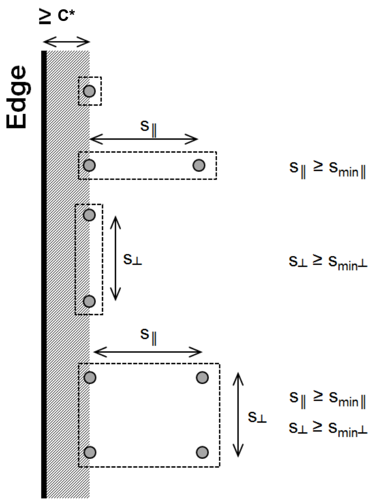


– c - Distance to the edge
– s∥ - Spacing parallel to the bed joint
– s⊥ - Spacing perpendicular to the bed joint

Allowed anchor positions:



- This FTM includes the load data for single anchors in masonry with a distance to edge equal to or greater than **c***.
- **c*** is the distance from the anchor to the edge of the wall, such that the loading capacity of the anchor is not influenced by the edge.
- Minimum spacing between anchors = MAX (3 x h_{ef} ; size of brick in respective direction). This applies for a (conservative) manual design/calculation of a baseplate using the load tables in this manual.
- For an optimized design or cases not covered in this technical data, including anchor groups, please use PROFIS Engineering software or consult ETA-13/1036, ETA-19/0160, or ETA-22/0395.
- Anchor performance subject to on-site testing.



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*				

* For brick types SC6 resistance for h_{ef} up to 350 mm are provided in the ETA-22/0395.

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 and seismic loading are designed in accordance with: EOTA TR054, 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 ≥ c*. For other applications, use Hilti PROFIS Engineering software.
- Correct anchor setting (see instruction for use, setting details)

Anchorages subject to:		**Hilti HIT-HY 270 with HAS-U**	
		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 (HIT-V or HIT-IC) 0° C to +40° C (HAS-U)
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 EOTA TR053. For the evaluation of test results, the characteristic resistances shall be obtained taking into account reduction factors, which consider the different influences of the product. In case of static and quasi-static actions apply the β–factor and in case of seismic actions apply the factors α_N (tension loading) or α_V (shear loading) from the tables below. For fur consult EOTA TR053 and the respective ETA for HIT-HY 270.

Materials

Material quality

Part	Material
Threaded rod HAS-U 5.8 (HDG)	Strength class 5.8, A5 > 8% ductile Electroplated zinc coated ≥ 5 µm; (F), (HDG) Hot dip galvanized ≥ 45 µm
Threaded rod HAS-U 8.8 (HDG)	Strength class 8.8, A5 > 8% ductile Electroplated zinc coated ≥ 5 µm; (F), (HDG) Hot dip galvanized ≥ 45 µm
Threaded rod HAS-U A4	Stainless steel grade A4 A5 > 8% ductile strength class 70, 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362
Threaded rod 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
Sieve sleeve HIT-SC	Frame: Polyfort FPP 20T ; Sieve: PA6.6 N500/200

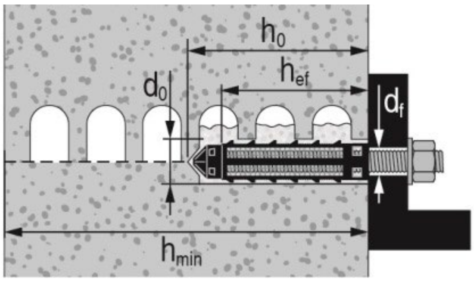
Base materials:

- Solid brick masonry. The resistances are also valid for larger brick sizes and larger compressive strengths of the masonry unit (in case of static and seismic loading)
- Hollow brick masonry (only in case of static loading)
- Mortar strength class of the masonry: M2,5 at minimum according to EN 998-2: 2010.
- For other bricks in solid masonry and in hollow or perforated masonry, the characteristic resistance of the anchor may be determined by on-site tests according to EOTA TR053 under consideration of the β-factor (for static loading) or α-factor (for seismic loading) according to the table on page 21.

Installation parameters

Applications for hollow and solid bricks with sieve sleeves

For installing HAS-U with embedments of 50 and 80 mm, a single sieve sleeve is used.



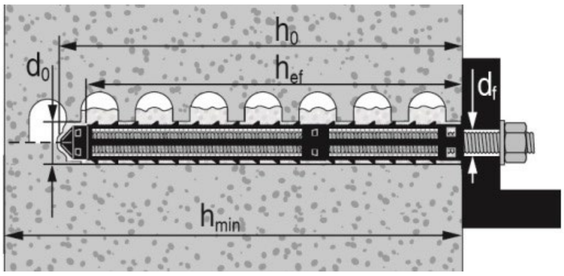
Hollow brick with threaded rod HAS-U or internally a single sieve sleeve HIT-SC

Installation parameters of HAS-U with one sieve sleeve HIT-SC in hollow and solid brick

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
Max. 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 hollow and solid bricks with sieve sleeves (cont.)

For installing HAS-U with embedments of 130 and 160 mm, two attached sleeves are used.



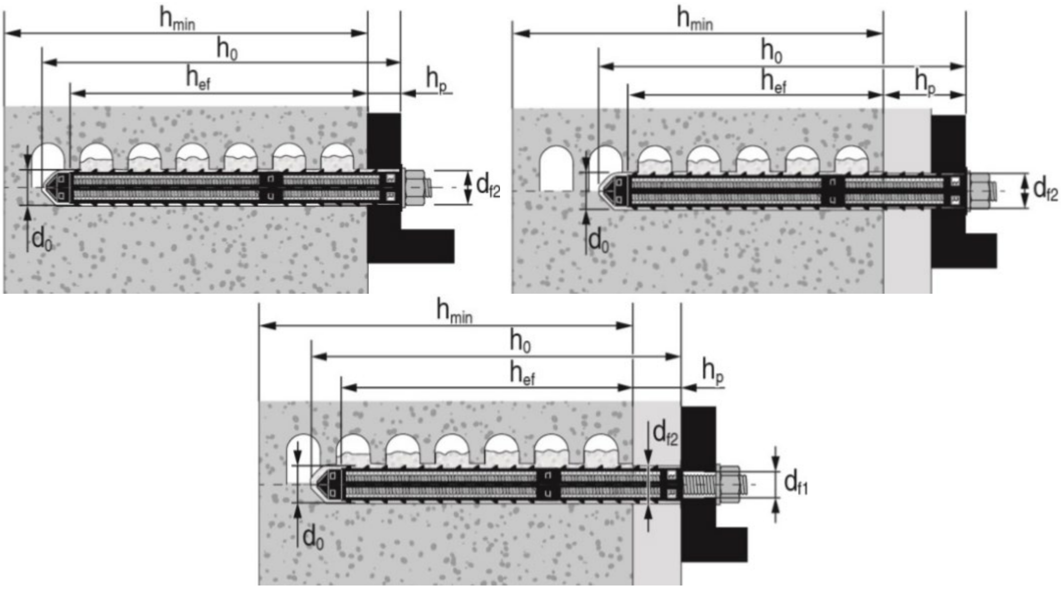
Hollow brick with threaded rod HAS-U and two sieve sleeves HIT-SC for deeper embedment depth

Installation parameters of HAS-U with two attached sleeves HIT-SC in hollow and solid brick

HAS-U			M8		M10		M12		M16	
with HIT-SC			16x50 + 16x85	16x85 + 16x85	16x50 + 16x85	16x85 + 16x85	18x50 + 18x85	18x85 + 18x85	22x50 + 22x85	22x85 + 22x85
Nominal diameter of drill bit	d_0	[mm]	16	16	16	16	18	18	22	22
Drill hole depth	h_0	[mm]	145	180	145	180	145	180	145	180
Effective embedment depth	h_{ef}	[mm]	130	160	130	160	130	160	130	160
Maximum diameter of clearance hole in the fixture	d_f	[mm]	9	9	12	12	14	14	18	18
Minimum wall thickness	h_{min}	[mm]	195	230	195	230	195	230	195	230
Brush HIT-RB	-	[-]	16	16	16	16	18	18	22	22
Number of strokes HDM	-	[-]	4+6	6+6	4+6	6+6	4+8	8+8	6+10	10+10
Number of strokes HDE-500	-	[-]	3+5	5+5	3+5	5+5	3+6	6+6	5+8	8+8
Maximum torque moment	T_{max}	[Nm]	3	3	4	4	6	6	8	8

Applications for hollow and solid bricks with sieve sleeves (cont.)

For through fastenings with HAS-U, two attached sleeves are used.



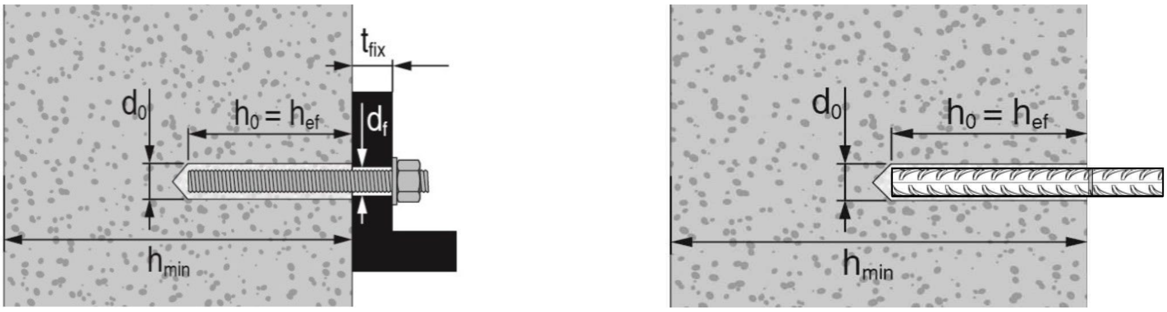
Hollow and solid brick with threaded rod HAS-U with two sieve sleeves HIT-SC for setting through the fixture and/or through the non-loadbearing layer

Installation parameters of HAS-U with two sieve sleeves throught the fixture and/or through the non-loadbearing layer in hollow and solid bricks

HAS-U			M8		M10		M12		M16	
with HIT-SC			16x50 + 16x85	16x85 + 16x85	16x50 + 16x85	16x85 + 16x85	18x50 + 18x85	18x85 + 18x85	22x50 + 22x85	22x85 + 22x85
Nominal diameter of drill bit	d_0	[mm]	16	16	16	16	18	18	22	22
Drill hole depth	h_0	[mm]	145	180	145	180	145	180	145	180
Effective embedment depth	$h_{ef,min}$	[mm]	80	80	80	80	80	80	80	80
Max. thickness of non-loadbearing layer and fixture (through setting)	$h_{p,max}$	[mm]	50	80	50	80	50	80	50	80
Max. diameter of clearance hole in the fixture (pre-setting)	d_{f1}	[mm]	9	9	12	12	14	14	18	18
Max. diameter of clearance hole in fixture (through setting)	d_{f2}	[mm]	17	17	17	17	19	19	23	23
Minimum wall thickness	h_{min}	[mm]	h_{ef}+65	h_{ef}+70	h_{ef}+65	h_{ef}+70	h_{ef}+65	h_{ef}+70	h_{ef}+65	h_{ef}+70
Brush HIT-RB	-	[-]	16	16	16	16	18	18	22	22
Number of strokes HDM	-	[-]	4+6	6+6	4+6	6+6	4+8	8+8	6+10	10+10
Number of strokes HDE	-	[-]	3+5	5+5	3+5	5+5	5+8	8+8	5+8	8+8
Max. torque moment for all brick types except “parpaing creux”	T_{max}	[Nm]	3	3	4	4	6	6	8	8
Max. torque moment for “parpaing creux”	T_{max}	[Nm]	2	2	2	2	3	3	6	6

Applications for solid bricks without sieve sleeves.

Hilti recommends the anchoring in masonry always with sieve sleeve. Anchors can only be installed without sieve sleeves in solid bricks when it is guaranteed that it has not any hole or void.



Solid brick with threaded rod HAS-U or Rebar

Installation parameters of HAS-U in solid bricks

Type of element			HAS-U			
Anchor size			**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…350 a)	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	-	[-]	10	12	14	18
Maximum torque moment	T_{max}	[Nm]	5	8	h_{ef} < 100 mm : 5 $h_{ef} \geq$ 100 mm : 10	10

a) Additional details – see in ETA-22/0395

Working time and curing time for solid bricks

Temperature in the base material	Maximum working time	Minimum curing time
T_{BM}	t_{work}	t_{cure} 1)
5 °C to 9 °C	10 min	2,5 h
10 °C to 19 °C	7 min	1,5 h
20 °C to 29 °C	4 min	30 min
30 °C to 40 °C	1 min	20 min

1) The curing time data are valid for dry base material only. In wet base material, the curing times must be doubled.

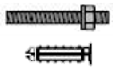
Working time and curing time for hollow bricks

Temperature in the base material	Maximum working time	Minimum curing time
T_{BM}	t_{work}	t_{cure} 1)
-5 °C to -1 °C 2)	10 min	6 h
0 °C to 4 °C	10 min	4 h
5 °C to 9 °C	10 min	2,5 h
10 °C to 19 °C	7 min	1,5 h
20 °C to 29 °C	4 min	30 min
30 °C to 40 °C	1 min	20 min

1) The curing time data are valid for dry base material only. In wet base material, the curing times must be doubled;
2) Only for HIT-V anchor rods acc.to ETA-13/1036

Installation equipment

Type of steel element	HAS-U				
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				

HAS-U [a)]	HAS-U + sieve sleeve	Hammer drill	Brush HIT-RB
		d_0 [mm]	size [mm]
			
M6	-	8	8
M8	-	10	10
M10	-	12	12
M12	-	14	14
-	M8	16	16
-	M10	16	16
M16	M12	18	18
-	M16	22	22

a) Installation without the sieve sleeve HIT-SC can be used only in case of solid bricks.

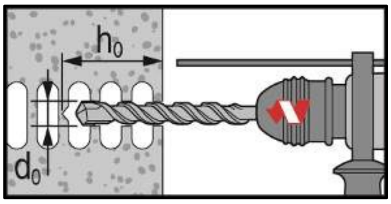
Setting instructions

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

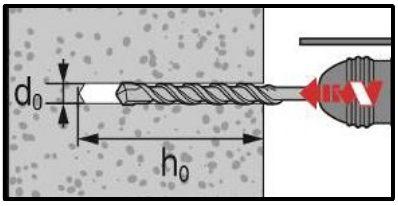
Safety regulations.

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

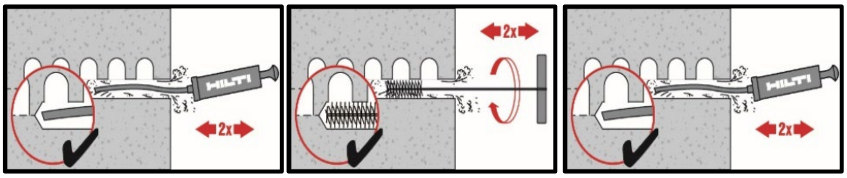


In hollow bricks: rotary mode



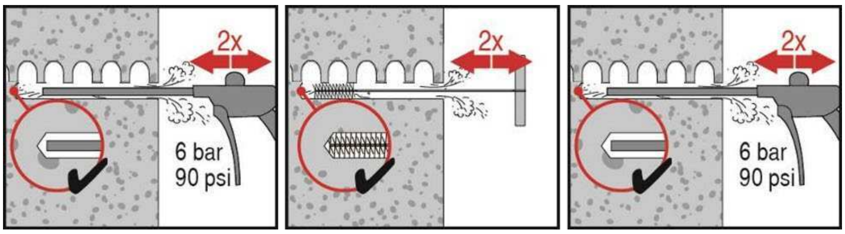
In solid bricks: hammer mode

Cleaning



Manual cleaning (MC)

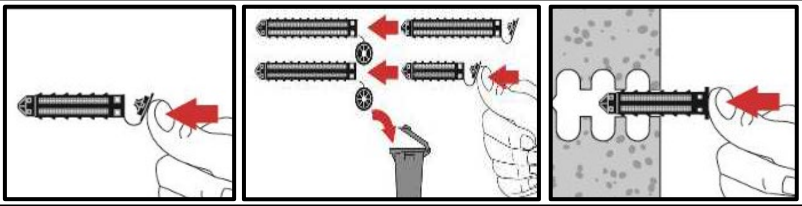
For drill hole diameter $d_0 \leq 18$ mm and drill hole depth $h_0 \leq 100$ mm



Compressed air cleaning (CAC)

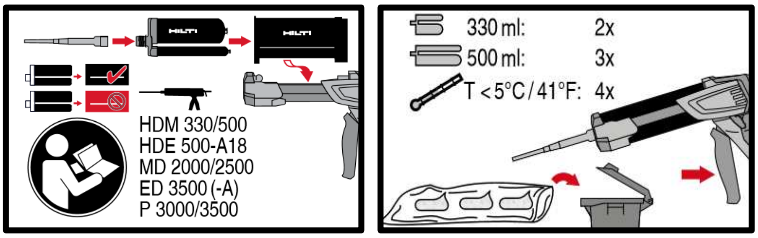
For drill hole depth $h_0 \leq 300$ mm

Injection preparation for hollow and solid bricks with sieve sleeve



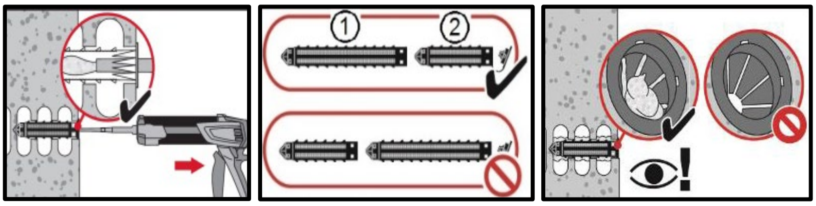
Close lid and insert sieve sleeve manually.

All applications

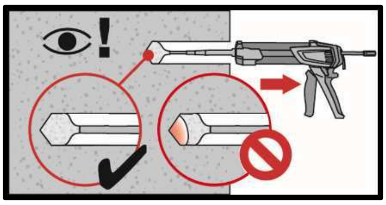


Injection system preparation.

Inject the adhesive without forming air voids

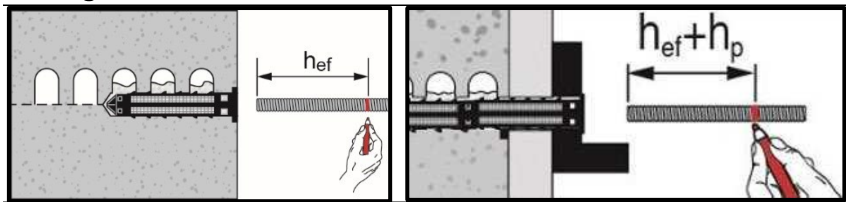


Injection method 1 for Installation with sieve sleeve HIT-SC. Use extension for installation with two sieve sleeves.

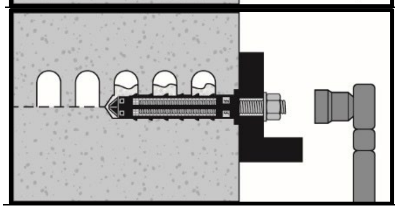


Injection method 2 for installation in solid bricks without sieve sleeve

Setting the element



Marking and setting element,to the required embedment depth, observing working time t_{work}.



Loading the anchor: After required curing time t_{cure} the anchor can be loaded. The applied installation torque shall not exceet the values T_{max}.

ANCHOR CHANNELS

HAC (-V) TCRS Anchor Channel

Cast-in anchor channels for everyday applications

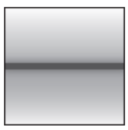
Anchor channel version		Benefits
	HAC (-V) 40 HAC (-V) 50 HAC (-V) 60 HAC (-V) 70	- Heavy-duty solution - designed for high loads and design parameters; - Approved for static, seismic, fatigue and fire loads; - Production with low energy consumption - anchor channels can contribute to the environmental certification of construction projects; - High-precision manufacturing
	HBC-C HBC-C-N	

Base material

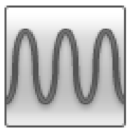
Concrete (non-cracked)

Concrete (cracked)

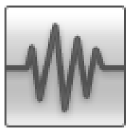
Load conditions



Static/ quasi-static



Fatigue



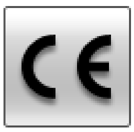
Seismic

Static 2D loading

Static 3D loading

Other information

European Technical Assessment



CE conformity

PROFIS ENGINEERING

Corrosion resistance

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European technical assessment a)	DIBt, Berlin	ETA-11/0006 of 24.10.2022

a) All data given in this section according to ETA-11/0006 of 24.10.2022

Effective anchorage depth

Anchor channel type			HAC (-V)			
Anchor channel size			**40**	**50**	**60**	**70**
Minimum effective anchorage depth	$h_{ef,min}$	[mm]	91	106	148	175
Minimum thickness of concrete member	h_{min}	[mm]	105	125	168	196

Materials

Material quality for anchor channels

Part		Material
Channel profile	HAC (-V) F	Carbon steel according to EN 10025:2004 Hot-dip galvanized ≥ 50 µm [a] or ≥ 70 µm [b] according to EN ISO 1461:2009
Rivet	HAC (-V) F	Carbon steel Hot-dip galvanized ≥ 45 µm according to EN ISO 1461:2009
Anchor	HAC (-V) F	Carbon steel Hot-dip galvanized ≥ 45 µm according to EN ISO 1461:2009

a) For, HAC (-V) 40 F, HAC (-V) 50 F;
b) For HAC (-V) 60 F, HAC (-V) 70 F,

Material quality for channel bolts

Part		Material
Channel bolts	HBC F	Carbon steel grade 4.6 and 8.8 according to EN ISO 898-1:2013 Hot-dip galvanized ≥ 45 µm according to EN ISO 1461: 2009
	HBC A4	Stainless steel grade 50 according to EN ISO 3506-1: 1.4401 / 1.4404 / 1.4571 / 1.4362 / 1.4578 / 1.4439
Plain washer	F	Carbon steel Hardness class A ≥ 200 HV Hot-dip galvanized ≥ 45 µm according to EN ISO 1461: 2009
	A4	Stainless steel Hardness class A ≥ 200 HV 1.4401 / 1.4404 / 1.4571 / 1.4362 / 1.4578 / 1.4439
Hexagonal nut [a]	F	Carbon steel Property class 8 according to EN ISO 898-2: 2012 Hot-dip galvanized ≥ 45 µm according to EN ISO 1461: 2009
	A4	Stainless steel Property class 70 according to EN ISO 3506-2: 2009 1.4401 / 1.4404 / 1.4571 / 1.4362 / 1.4578 / 1.4439

a) Hexagonal nuts according to DIN 934: 1987-10 for channel bolts made from carbon steel (4.6) and stainless steel

Mechanical properties

Part				HAC (-V) / HBC-C(-N)
Nominal tensile strength	Carbon steel 8.8	f_{uk}	[N/mm²]	800 / 830 [a]
	Stainless steel A4-50			500
Yield strength	Carbon steel 8.8	f_{yk}	[N/mm²]	640 / 660 [a]
	Stainless steel A4-50			210

a) Material properties according to EN ISO 898-1

Corrosion class

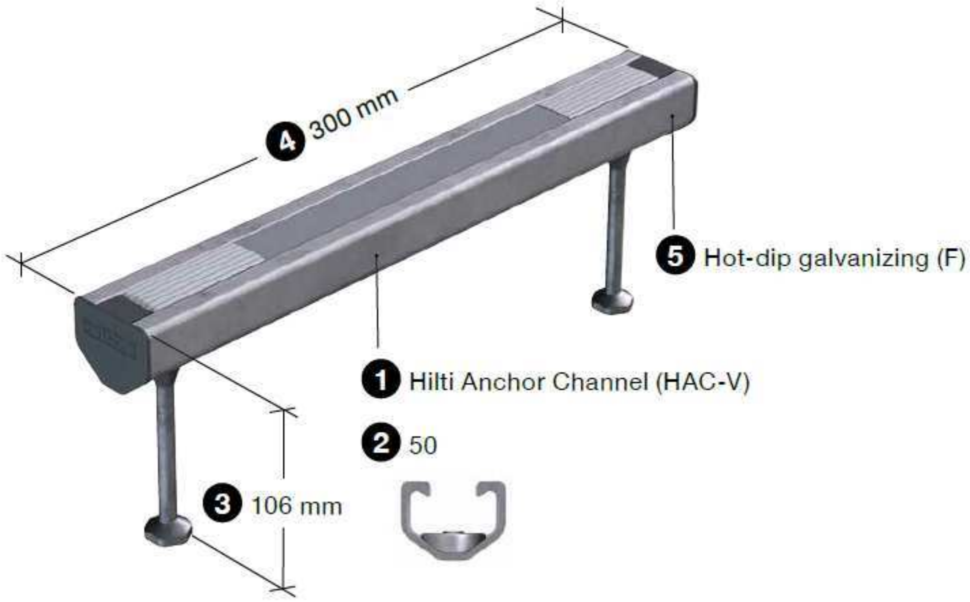
Class / Mark	Material / Coating type
F (HDG)	Carbon steel, hot-dip galvanized
R (A4)	Stainless steel

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

Nomenclature of HAC (-V) anchor channels (example)

Hilti anchor channel type	Profile type and size	Effective embedment depth	Channel length	Finish or material
1	2	3	4	5
HAC (-V)	50	106	300	F (HDG)

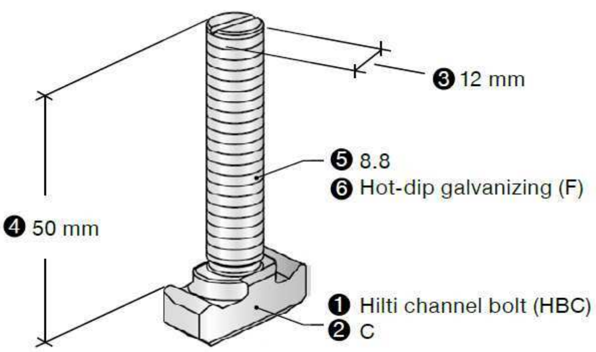
HAC (-V) 50 106/300 F



Nomenclature of HBC channel bolts (example)

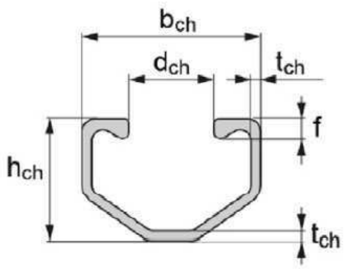
Hilti channel bolt	Bolt type	Diameter	Bolt length	Steel grade	Finish or material
1	2	3	4	5	6
HBC	C	M12	50	8.8	F (HDG)

HBC-C M12x50 8.8 F



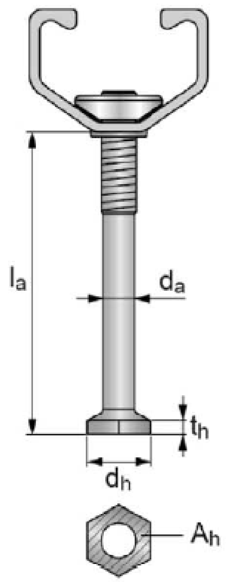
Dimensions of anchor channels

Anchor channel type			**HAC (-V)**			
Anchor channel size			**40**	**50**	**60**	**70**
Channel width	b_{ch}	[mm]	40,9	41,9	43,4	45,4
Channel height	h_{ch}	[mm]	28,0	31,0	35,5	40,0
Nominal thickness	t_{ch}	[mm]	2,25	2,75	3,50	4,50
Width of channel opening	d_{ch}	[mm]	19,5	19,5	19,5	19,5
Height of channel lips	f	[mm]	4,5	5,3	6,3	7,4
Moment of inertia	I_y	[mm^4]	21463	33125	57930	95457

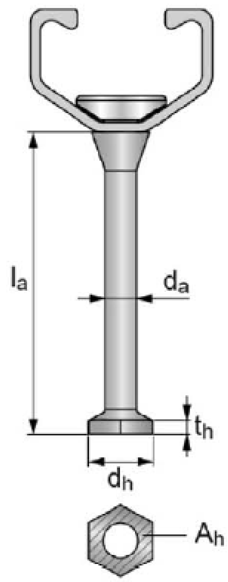


HAC (-V) 40, HAC (-V) 50,
HAC (-V) 60, HAC (-V) 70

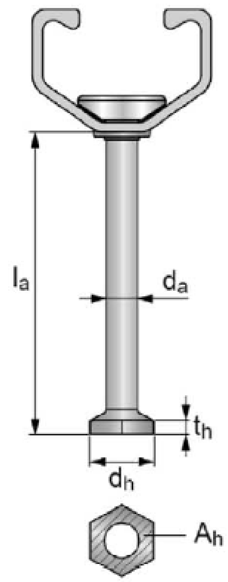
Anchor channel type			**HAC (-V)**			
Anchor channel size			**40**	**50**	**60**	**70**
Minimum anchor length	min. l_a	[mm]	66,0	78,5	117,0	140,0
Diameter of anchor	d_a	[mm]	7,2	9,0	9,0	10,9
Diameter of round anchor head	d_h	[mm]	17,5	19,5	19,5	23,0
Thickness of round anchor head	t_h	[mm]	3,0	3,5	4,5	5,0
Area of round anchor head	A_h	[mm]	209,0	258,0	258,0	356,0



HAC with bolted anchor



HAC (-V) with bolted anchor

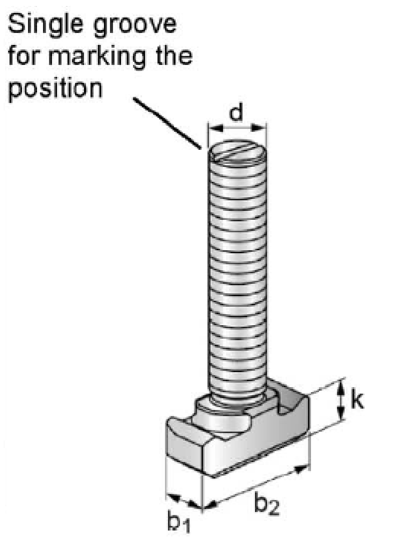


Welded anchor

Dimensions of channel bolts

Dimensions of channel bolts

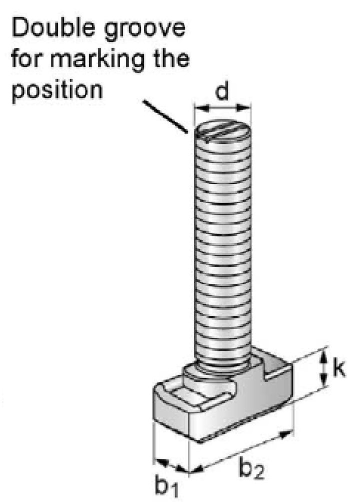
Channel bolt type			HBC-C			
Appropriate anchor channel			HAC (-V) 40 ; HAC (-V)50 ; HAC (-V)60 ; HAC (-V) 70			
Nominal diameter	d	[mm]	10,0	12,0	16,0	20,0
Width (1)	b_1	[mm]	14,0		18,5	
Width (2)	b_2	[mm]	33,0			
Thickness	k	[mm]	10,4		11,4	13,9



HBC-C

Dimensions of channel bolts

Channel bolt type			HBC-C-N		
Appropriate anchor channel			HAC (-V)40 ; HAC (-V)50 ; HAC (-V)60 ; HAC (-V)70		
Nominal diameter	d	[mm]	12,0	16,0	20,0
Width (1)	b_1	[mm]	18,5		
Width (2)	b_2	[mm]	33,0		
Thickness	k	[mm]	11,4		13,9

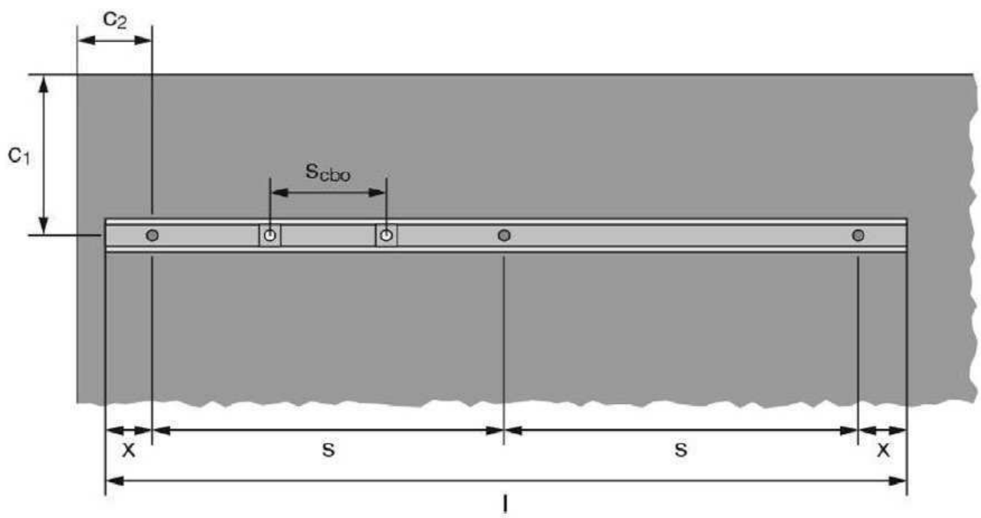


HBC-C-N

Setting information

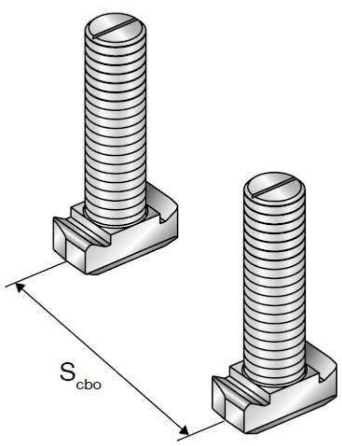
Anchor channel type			HAC (-V)				
Anchor channel size			**40**		**50**	**60**	**70**
Minimum effective embedmdent depth	$h_{ef,min}$	[mm]	91	110	106	148	175
Minimum spacing	s_{min}	[mm]	100		100	100	100
Maximum spacing	s_{max}	[mm]	250		250	250	250
End spacing	x	[mm]	25		25	25	25
Minimum channel length	l_{min}	[mm]	150		150	150	150
Minimum edge distance	c_{min}	[mm]	50		50	75	75
Minimum thickness of concrete member	h_{min}	[mm]	105	125	125	168	196
			$h_{ef} + t_h + c_{nom}$ a)				

a) c_{min} according to EN 1992-1-1:2004 + AC2010

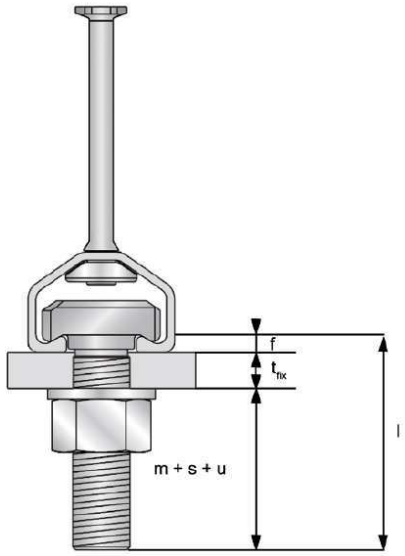


Setting details for channel bolts

Anchor channel size			M10	M12	M16	M20
Minimum spacing between channel bolts	$s_{cbo,min}$	[mm]	50	60	80	100



Anchor channel type				HAC (-V)			
Anchor channel size				**40**	**50**	**60**	**70**
Channel bolt type				**HBC-C**		**HBC-C**	
Height of channel lip		f	[mm]	4,5	5,3	6,3	7,4
Thickness of nut, washer and channel bolt projection	Bolt M10	m + s + u	[mm]	13,9	13,9	13,9	13,9
	Bolt M12			17,3	17,3	17,3	17,3
	Bolt M16			21,8	21,8	21,8	21,8
	Bolt M20			-	27,0	27,0	27,0



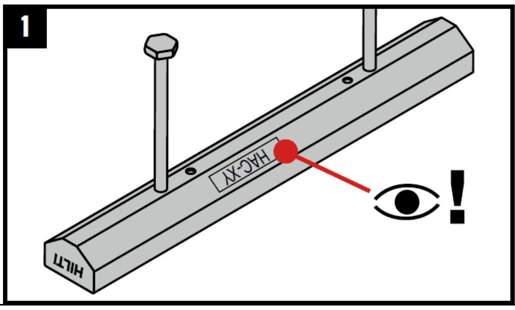
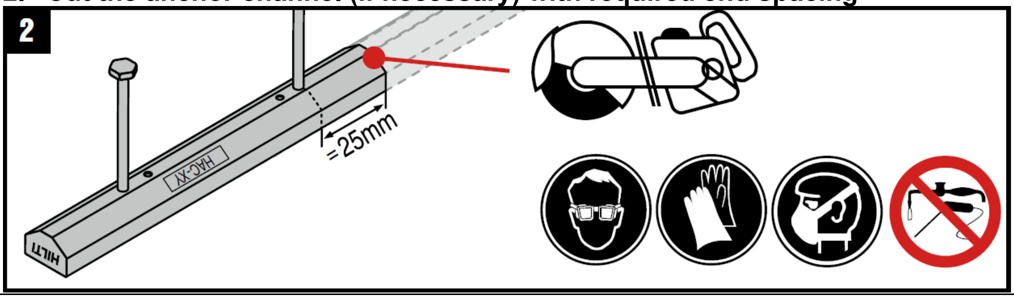
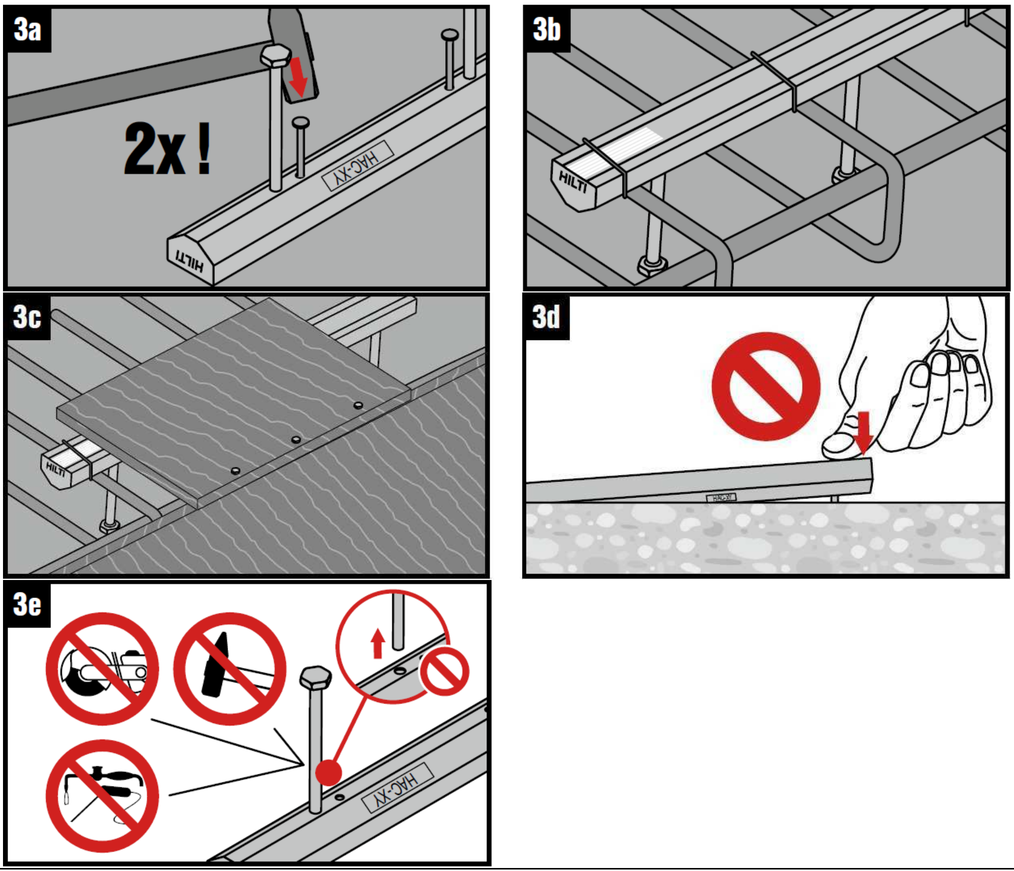
Dimensions

l	[mm]	nominal length of channel bolt
t_{fix}	[mm]	fastenable thickness (thickness of the attached part)
f	[mm]	height of channel lip
m	[mm]	thickness of the nut (ISO 4032)
s	[mm]	thickness of the washer
u	[mm]	channel bolt projection

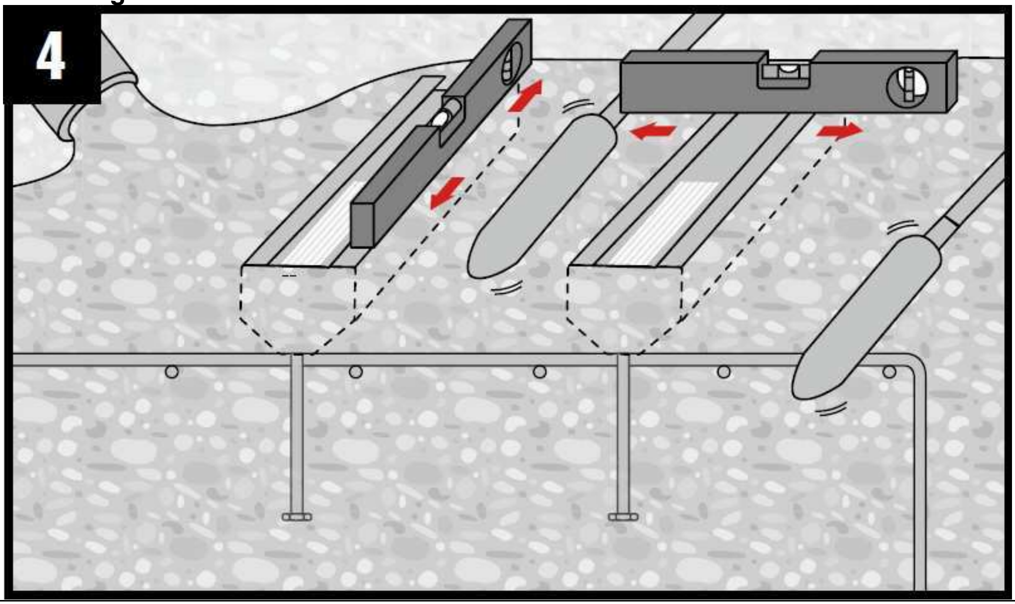
Required T-Bolt length : $l = t_{fix} + f + (m + s + u)$

Setting instructions

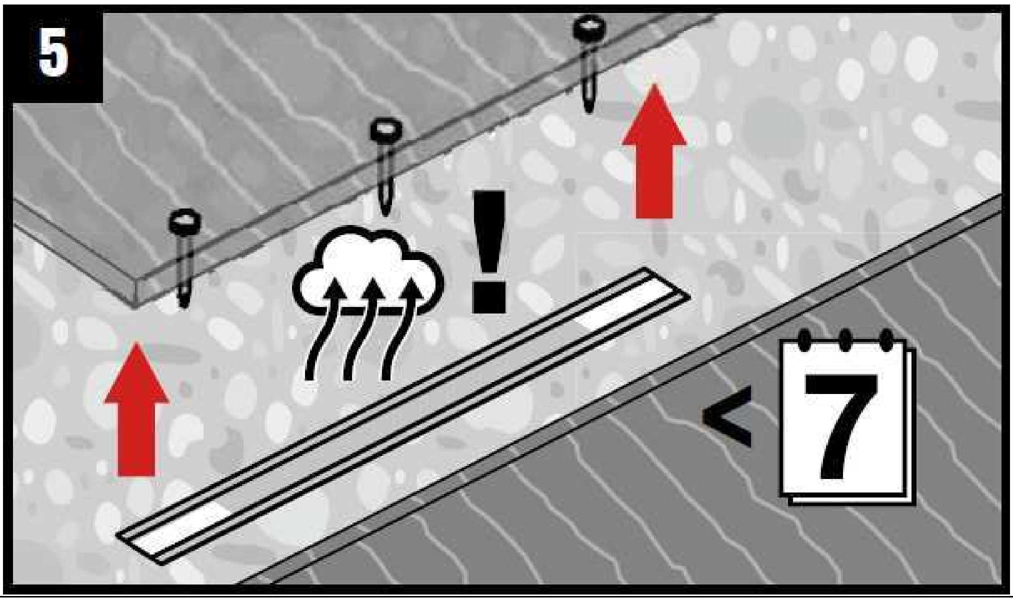
***For detailed information on installation see instruction for use given with the package of the product**

Setting instruction for anchor channel
1. Correct selection of anchor channel 
2. Cut the anchor channel (if necessary) with required end spacing 
3. Position of anchor channel flush with the surface 

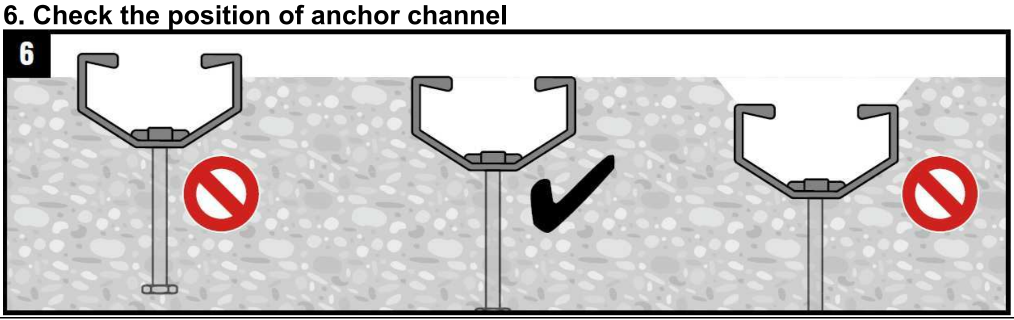
4.Pouring the concrete



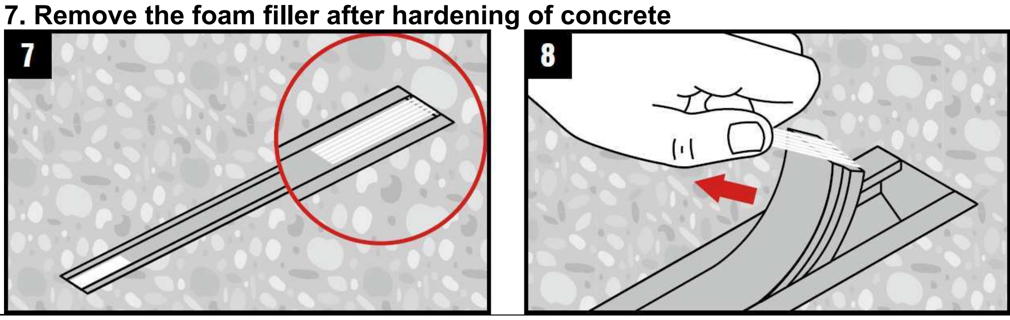
5. Remove the wormwork



6. Check the position of anchor channel



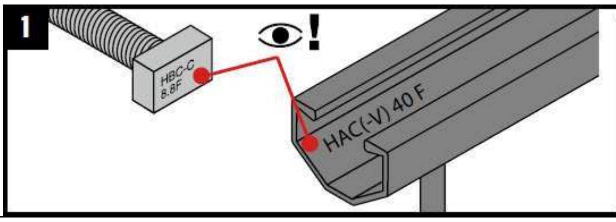
7. Remove the foam filler after hardening of concrete



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

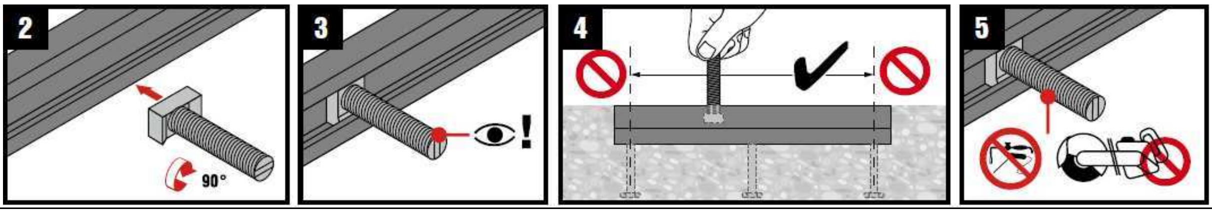
Setting instruction for channel bolts

1. Correct selection of channel bolt

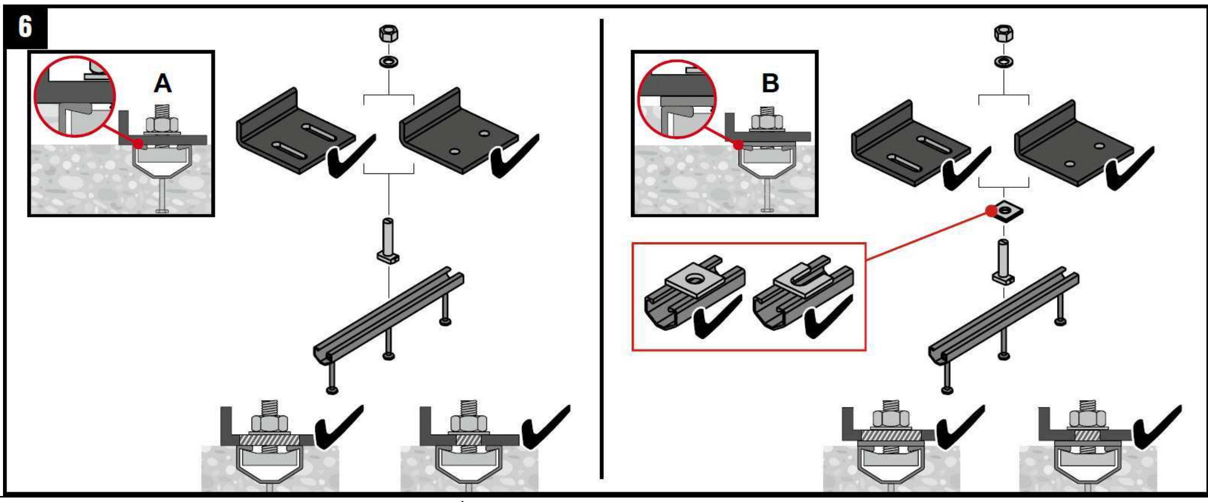


⊥	⊤⊤⊤
HBC-C 4.6	HAC(-V)-35 to HAC(-V)-70
HBC-C 8.8	HAC(-V)-50 to HAC(-V)-70 XT/XTS
HBC-C A4-50	HAC(-V)-40 to HAC(-V)-70 CRFoS
HBC-C-E 8.8	HAC(-V)-40, -50 EDGE (Lite)

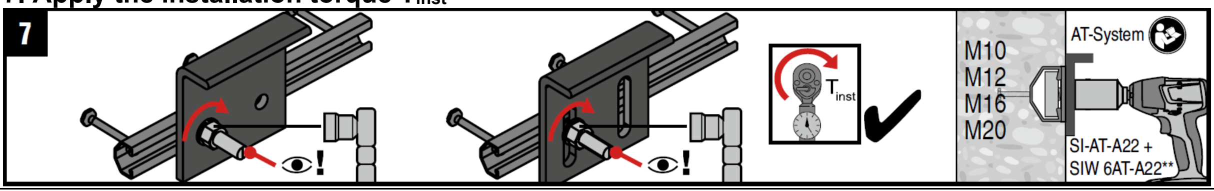
2-5. Installation of the channel bolt



6. Installation of the fixture



7. Apply the installation torque T_{inst} a)



a) Required T_{inst} value and compatibility with SI-AT tool must be checked additionally

HAC-C(-P) Hot-Rolled Anchor Channel

Cast-in anchor channels with increased steel capacity for a variety of applications

Anchor channel version

HAC-C-P 40/22
HAC-C-P 50/30
HAC-C 52/34

HBC-40/22 (-N)
HBC-50/30 (-N)

Benefits

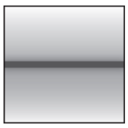
- New resilience - thanks to higher static tensile and shear load values, the same anchor channels can be specified for almost any load
- Personal and software-based technical support - with the Hilti PROFIS Anchor Channel software and the Hilti engineering support team you can optimize your planning and construction
- For even shorter assembly times - end caps with nail holes, ready-to-use filling foam and many other extras support faster and easier assembly of these anchor rails
- Available in stainless steel and hot-dip galvanized versions - for optimal corrosion protection depending on the environmental conditions
- ETA and fire safety documents available

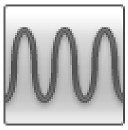
Base material


Concrete (non-cracked)


Concrete (cracked)

Load conditions


Static/ quasi-static


Fatigue


Static 2D loading


Static 3D loading

Other information

European Technical Assessment

CE conformity

PROFIS ENGINEERING

A4 316
Corrosion resistance

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European technical assessment [a]	DIBt, Berlin	ETA-17/0336 of 09.11.2020

a) All data given in this section according to ETA-17/0336 of 09.11.2020

Effective anchorage depth

Anchor channel type			HAC-C-P		HAC-C
Anchor channel size			**40/22**	**50/30**	**52/34**
Minimum effective anchorage depth	$h_{ef,min}$	[mm]	91	106	155
Minimum thickness of concrete member	h_{min}	[mm]	100	120	165

Materials

Material quality for anchor channels

Part		Material
Channel profile	HAC-C	Carbon steel 1.0038, 1.0044, 1.0045 according to EN 10025:2005 Carbon steel 1.0976, 1.0979 according to EN 10139:2013 Hot-dip galvanized ≥50 µm according to EN ISO 10684:2004/AC:2009
	HAC-C A4	Stainless steel 1.4362, 1.4401, 1.4404, 1.4571, 1.4578 according toEN 10088:2005
Anchor	HAC-C	Carbon steel 1.0038, 1.0213, 1.0214 according to EN 10025:2005 Carbon steel 1.5523, 1.5535 according to EN 10263:2002-02 Hot-dip galvanized ≥50 µm according to EN ISO 10684:2004/AC:2009
	HAC-C A4 [a)]	Stainless steel 1.4362, 1.4401, 1.4404, 1.4571, 1.4578 according to EN 10088:2005

a) Anchors made of carbon steel may also be used if they are welded and their concrete cover is more than 50 mm and the tempering colors are removed

Material quality for channel bolts

Part		Material
Channel bolts	HBC F	Carbon steel grade 4.6 and 8.8 according to ISO 898-1:2013 Hot-dip galvanized ≥50 µm according to EN ISO 10684:2004/AC:2009
	HBC A4	Stainless steel grade 50 or 70 according to EN ISO 3506:2009
Plain washer	F	Carbon steel, hardness class A ≥ 200 HV Hot-dip galvanized ≥50 µm according to EN ISO 10684:2004/AC:2009
	A4	Stainless steel 1.4401, 1.4404, 1.4571, 1.4578 according to EN 10088:2005
Hexagonal nut [a)]	F	Property class 5 or 8 according to EN ISO 898-2:2012 Hot-dip galvanized ≥50 µm according to EN ISO 10684:2004/AC:2009
	A4	Property class 50, 70 or 80 according to EN ISO 3506:2009

a) Hexagonal nuts according to DIN 934: 1987-10 for channel bolts made from carbon steel (4.6) and stainless steel

Mechanical properties

Part				HAC-C / HBC(-N)
Nominal tensile strength	Carbon steel 8.8	f_{uk}	[N/mm²]	800 / 830 [a)]
	Stainless steel A4-70			700
Yield strength	Carbon steel 8.8	f_{yk}	[N/mm²]	640 / 660 [a)]
	Stainless steel A4-70			450

a) Material properties according to EN ISO 898-1

Corrosion class

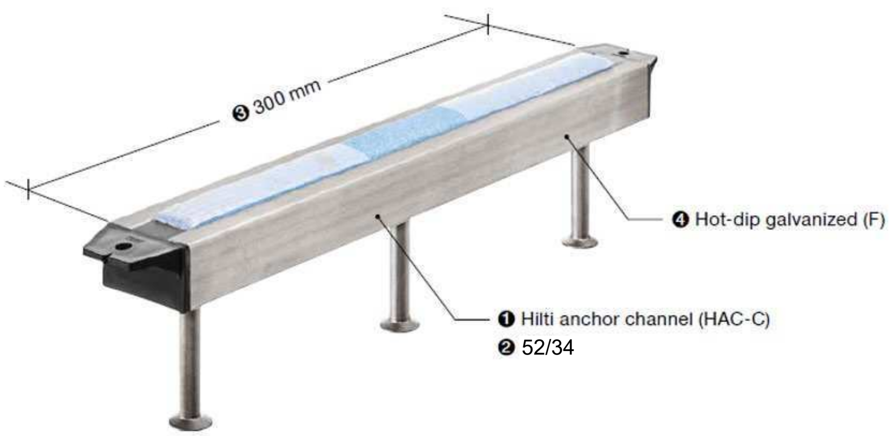
Class / Mark	Material / Coating type
F (HDG)	Carbon steel, hot-dip galvanized
R (A4)	Stainless steel

Nomenclature of HAC-C-P anchor channels (example)

Hilti anchor channel type	Profile type and size	Channel length	Finish or material
❶	❷	❸	❹
HAC-C-P	40/22	300	F (HDG)
HAC-C	52/34	300	F (HDG)

HAC-C-P 40/22 300F

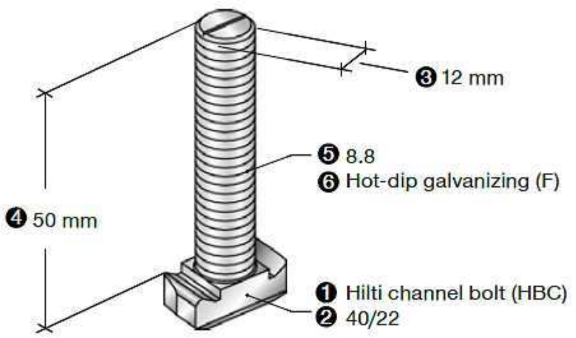
HAC-C-P 52/34 300F



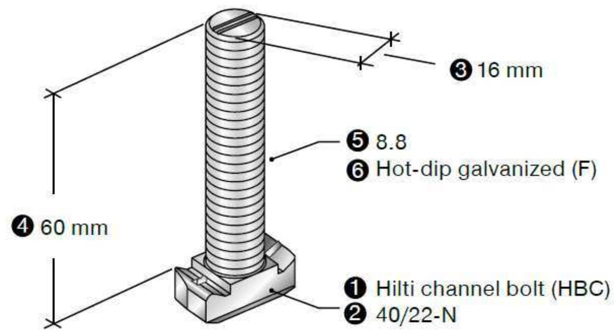
Nomenclature of HBC channel bolts (example)

Hilti channel bolt	Bolt type	Diameter	Bolt length	Steel grade	Finish or material
❶	❷	❸	❹	❺	❻
HBC	40/22	M12	50	8.8	F (HDG)
HBC	40/22-N	M16	60	8.8	F (HDG)

HBC-40/22 M12x50 8.8 F
(standard bolt)



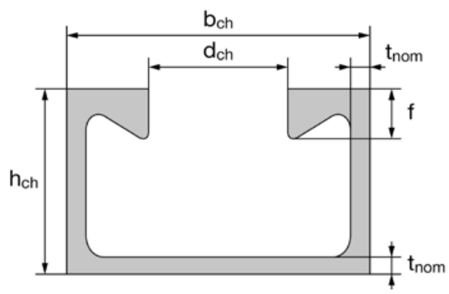
HBC-40/22 M16x60 8.8F
(notched bolt)



Dimensions of anchor channels

Dimensions of channel profile

Anchora channel type			HAC-C-P		HAC-C
Anchor channel size			**40/22**	**50/30**	**52/34**
Channel width	b_{ch}	[mm]	40,1	49,6	52,5
Channel height	h_{ch}	[mm]	23,0	30,0	34,0
Nominal thickness	t_{nom}	[mm]	2,7	3,2	4,0
Width of channel opening	d_{ch}	[mm]	18,0	22,5	22,5
Height of channel lips	f	[mm]	6,0	8,1	11,5
Moment of inertia	I_y	[mm^4]	21504	57781	97606

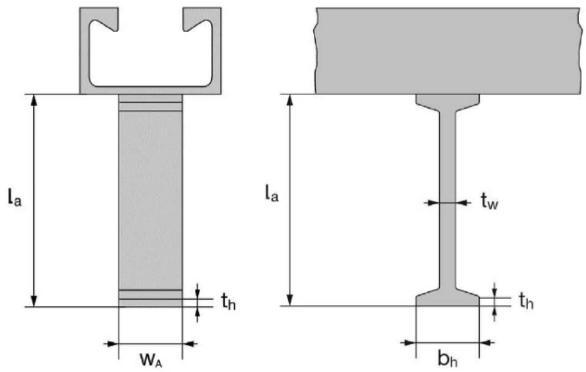


HAC-C-P 40/22 : HAC-C-P 50/30 : HAC-C 52/34

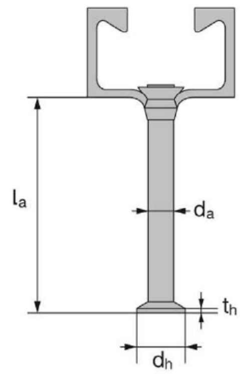
Dimensions of anchors

Anchor channel type			HAC-C-P		HAC-C
Anchor channel size			**40/22**	**50/30**	**52/34**
Version with welded I-anchor					
Minimum anchor length	min. l_a	[mm]	125,0	125,0	125,0
Web thickness	t_w	[mm]	6,0	6,0	6,0
Width of the head	b_h	[mm]	25,0	25,0	25,0
Head thickness	t_h	[mm]	5,0	5,0	5,0
Width (cutting length)	w_A	[mm]	20,0	25,0	40,0
Area of the head	A_h	[mm]	380	475	760
Version with round anchor					
Minimum anchor length	min. l_a	[mm]	70,0	78,0	123,5
Diameter of anchor	d_a	[mm]	10,0	11,0	11,0
Diameter of round anchor head	d_h	[mm]	21,5	26,0	24,3
Thickness of round anchor head	t_h	[mm]	2,2	2,5	2,5
Area of round anchor head	A_h	[mm]	285	436	369

a) Product is not abailable



Version with welded I-Anchor



Version with round anchor

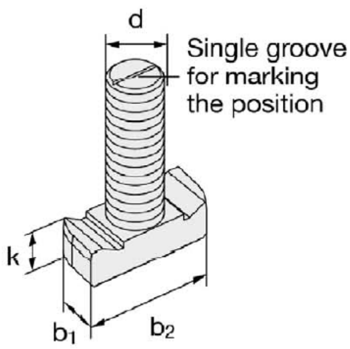
Dimensions of channel bolts

Dimensions of channel bolts

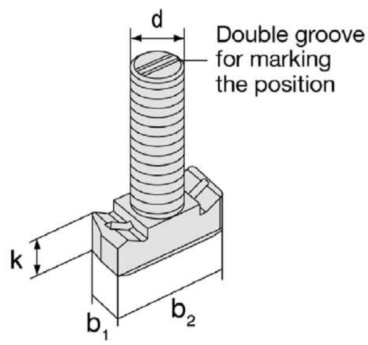
Channel bolt type			HBC-40/22			HBC-40/22-N
Appropriate anchor channel			HAC-C-P 40/22			
Nominal diameter	d	[mm]	10,0	12,0	16,0	16,0
Width (1)	b_1	[mm]	14,0	14,0	17,0	17,0
Width (2)	b_2	[mm]	33,0	33,0	33,0	33,0
Thickness	k	[mm]	10,5	11,5	11,5	11,5

Dimensions of channel bolts

Channel bolt type			HBC-50/30			HBC-50/30-N	
Appropriate anchor channel			HAC-C-P 50/30; HAC-C 52/34				
Nominal diameter	d	[mm]	12,0	16,0	20,0	16,0	20,0
Width (1)	b_1	[mm]	17,0	17,0	21,0	21,0	21,0
Width (2)	b_2	[mm]	42,0	42,0	42,0	42,0	42,0
Thickness	k	[mm]	14,5	15,5	15,5	15,5	15,5



HBC-40/22, HBC-50/30



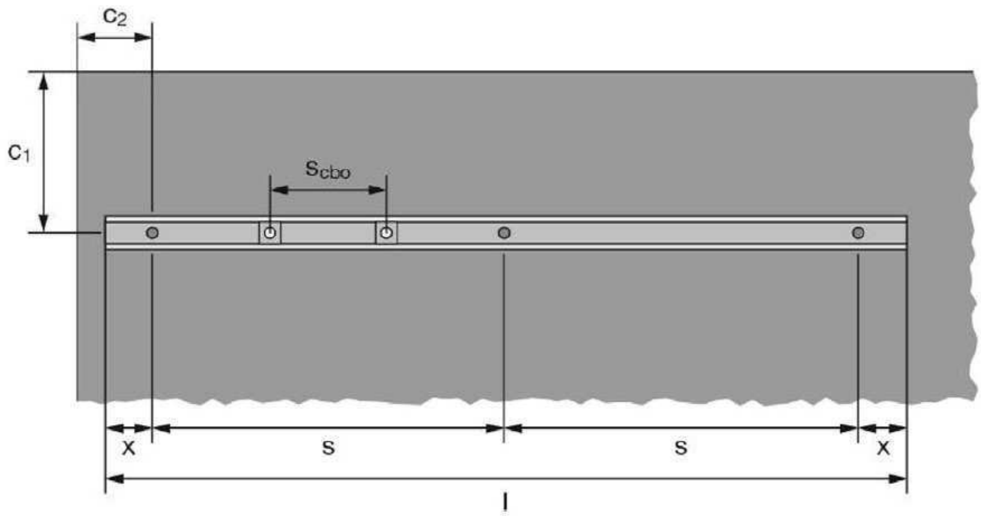
HBC-40/22-N, HBC-50/30-N

Setting information

Setting details for anchor channels

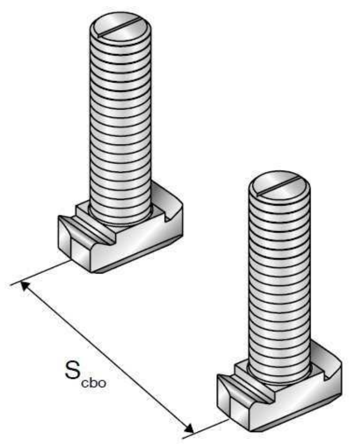
Anchor channel type			HAC-C-P		HAC-C
Anchor channel size			**40/22**	**50/30**	**52/34**
Minimum effective embedmdent depth	$h_{ef,min}$	[mm]	91	106	155
Nominal embedment depth	h_{nom}	[mm]	93,2	108,5	157,5
Minimum spacing	s_{min}	[mm]	50	50 [a)]	100
Maximum spacing	s_{max}	[mm]	250		
End spacing	x	[mm]	25 [b)]		35 [c)]
Minimum channel length	l_{min}	[mm]	100		170 [d)]
Minimum edge distance	c_{min}	[mm]	50	75	
Minimum thickness of concrete member	h_{min}	[mm]	100	120	165

a) s_{min} = 100 mm when used in combination with notched bolts
b) The end spacing may be increased from 25 mm to 35 mm
c) X = 25 mm for welded I-anchors
d) l_{min} = 150 mm for welded I-anchors



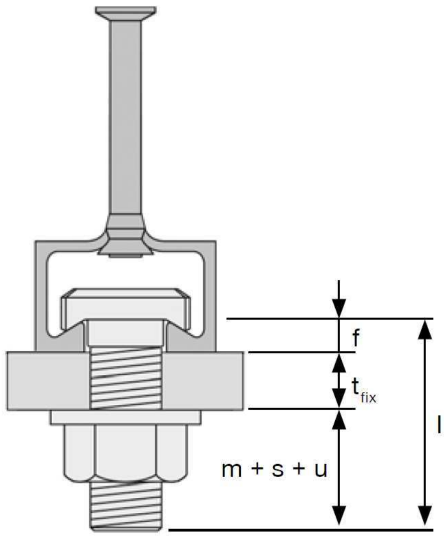
Setting details for channel bolts

Anchor channel size			M10	M12	M16	M20
Minimum spacing between channel bolts	$s_{cbo,min}$	[mm]	50	60	80	100



Determination of the minimum required T-bolt length

Anchor channel type				HAC-C-P				HAC-C
Anchor channel size				**40/22**		**50/30**		**52/34**
Channel bolt type				**HBC 40/22**	**HBC 40/22-N**	**HBC 50/30**	**HBC 50/30-N**	**HBC 50/30**
Height of channel lip		f	[mm]	6,0	6,0	8,0	8,0	11,5
Thickness of nut, washer and channel bolt projection	Bolt M10	m + s + u	[mm]	13,9	-	-	-	-
	Bolt M12			17,3	-	17,3	-	17,3
	Bolt M16			21,8	21,8	21,8	21,8	21,8
	Bolt M20			-	-	27,0	27,0	27,0



Dimensions

l	[mm]	nominal length of channel bolt
t_{fix}	[mm]	fastenable thickness (thickness of the attached part)
f	[mm]	height of channel lip
m	[mm]	thickness of the nut (ISO 4032)
s	[mm]	thickness of the washer
u	[mm]	channel bolt projection

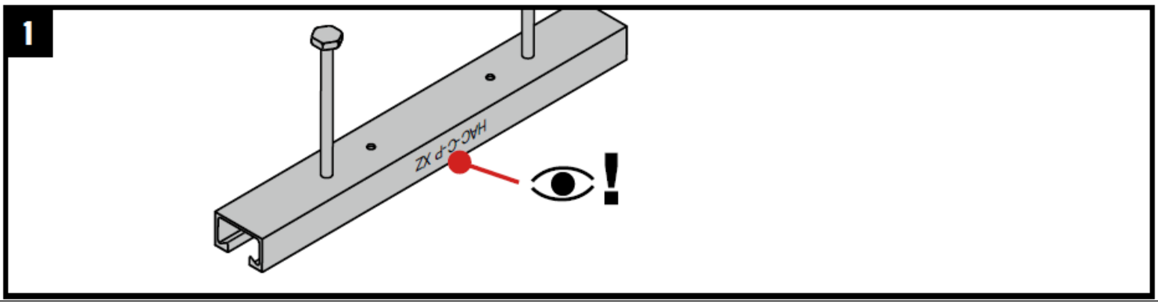
Required T-Bolt length : $l = t_{fix} + f + (m + s + u)$

Setting instructions

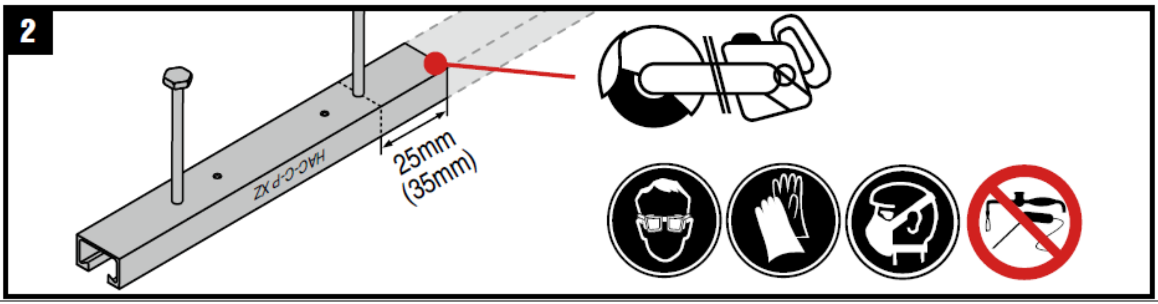
*For detailed information on installation see instruction for use given with the package of the product

Setting instruction for anchor channel

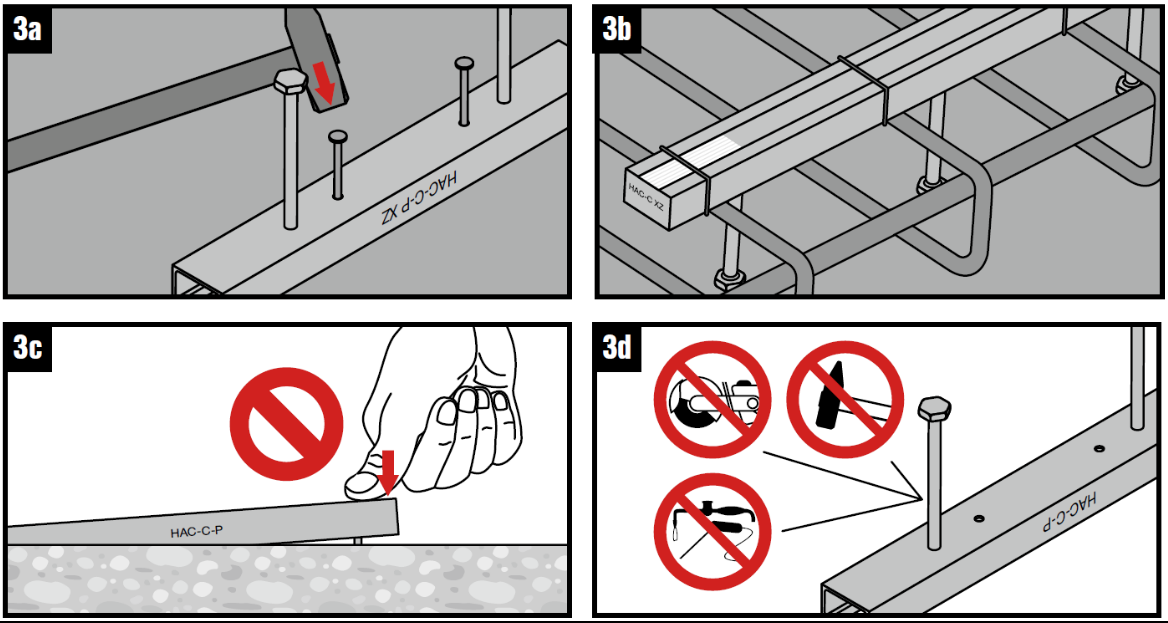
1. Correct selection of anchor channel



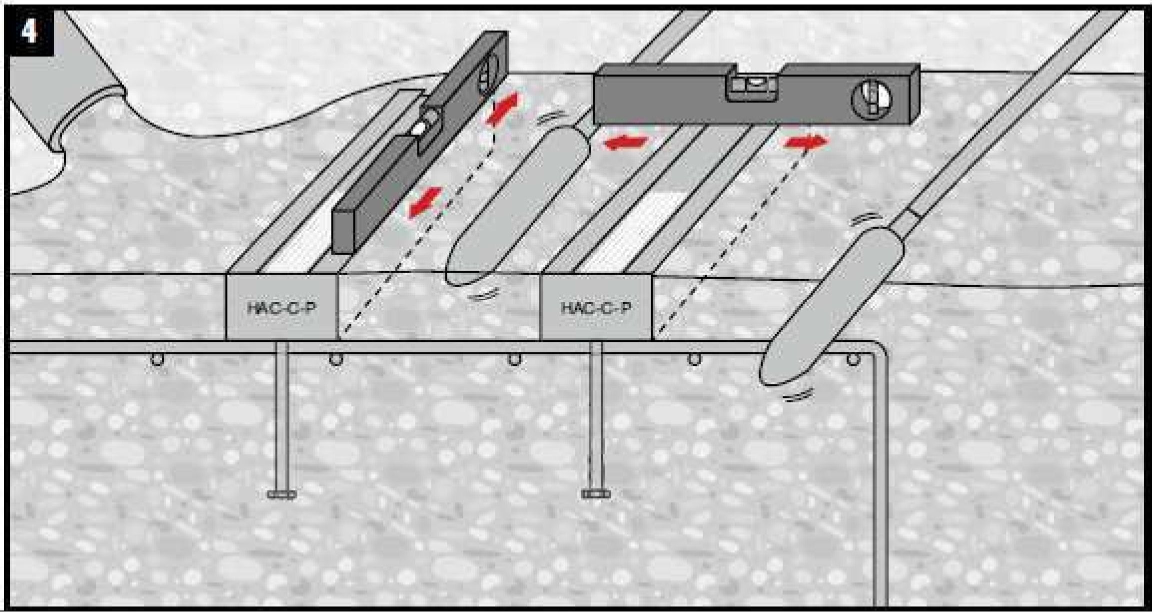
2. Cut the anchor channel (if necessary) with required end spacing



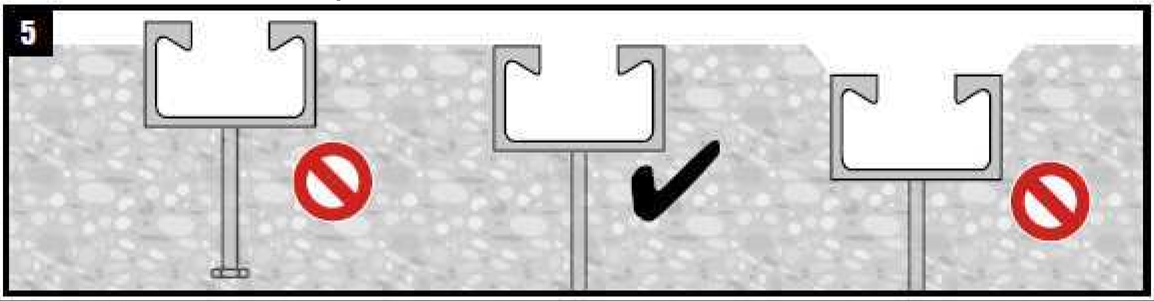
3. Position of anchor channel flush with the surface



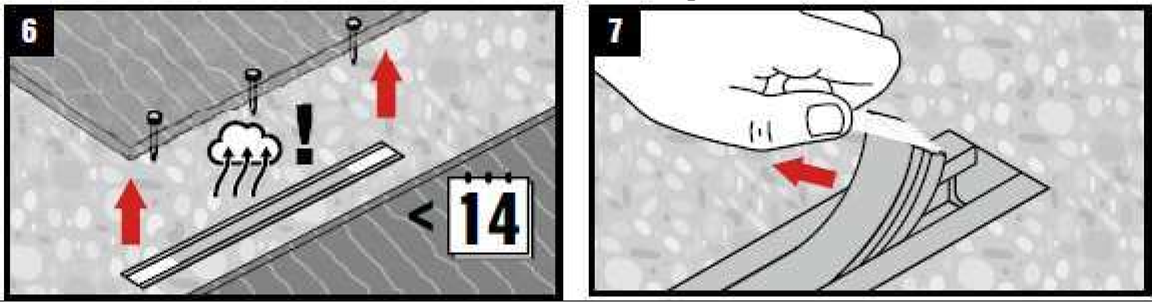
4.Pouring the concrete



5. Check anchor channels position



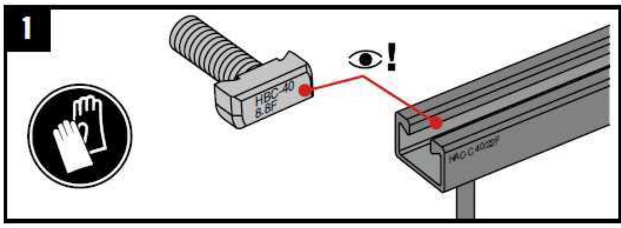
6. Remove the formwork and foam filler after hardening of concrete



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

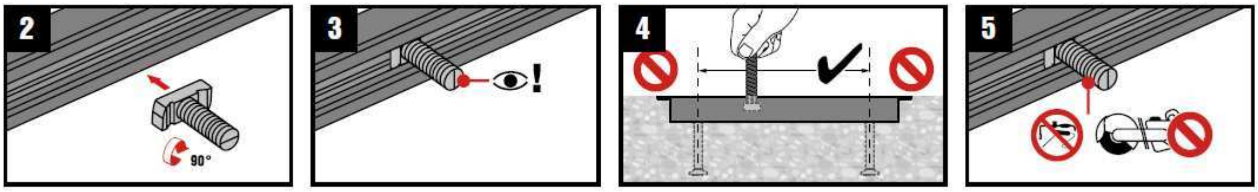
Setting instruction for channel bolts

1. Correct selection of channel bolt

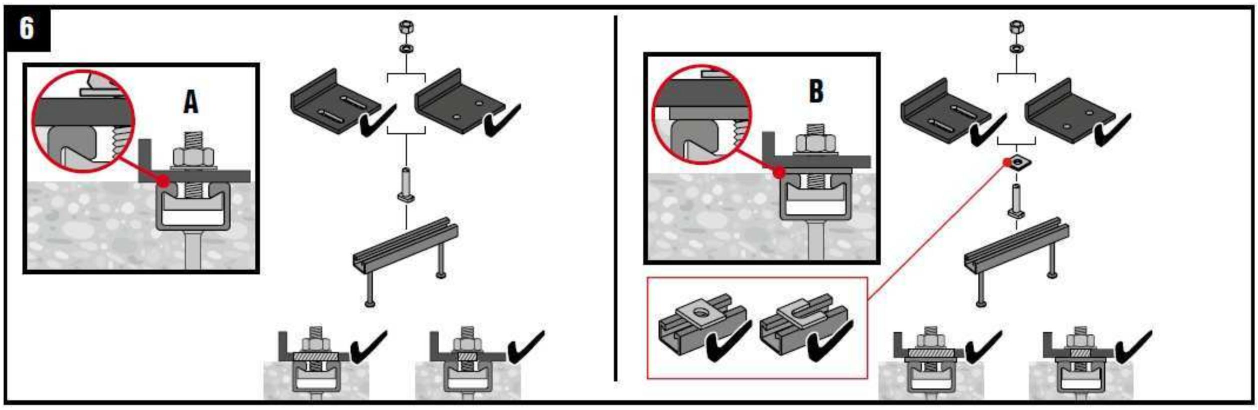


Channel bolt	Anchor channel
HBC-28/15	HAC-C 28/15
HBC-38/17	HAC-C 38/17
HBC-40/22	HAC-C-P 40/22, HAC-C-P 40L, HAC-C 40/22, HAC-C 40/25
HBC-50/30	HAC-C-P 50/30, HAC-C-P 50L, HAC-C 49/30, HAC-C 50/30 HAC-C 52/34, HAC-C 54/33
HBC-52/34	HAC-HW53, HAC-C 52/34

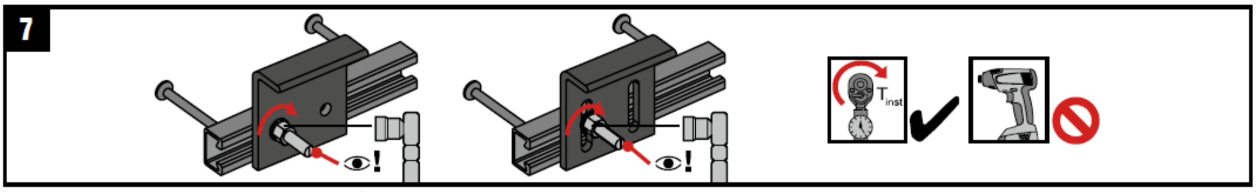
2-5. Installation of the channel bolt



6. Installation of the fixture



7. Apply the installation torque T_{inst}



Channel bolt		T_{inst} [Nm] A: 4.6, 8.8, A4-50, A4-70	T_{inst} [Nm] B: 4.6	B: 8.8	B: A4-50	B: A4-70
HBC-28/15	M8	7		20	7	15
	M10	10	–	40		30
	M12	13		60		50
HBC-38/17	M10	15	13	15		22
	M12	25	–	45		50
	M16	40		100		90
HBC-40/22	M10	15	13	15		22
	M12	25		45	–	50
	M16	30		100		90
HBC-50/30	M12	25	–	45		50
	M16	55		100		130
	M20	55		360		250
HBC-52/34	M20	55		360		–

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Notes