

Approval body for construction products
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and
Laender Governments



European Technical Assessment

ETA-22/0587
of 24 July 2023

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the
European Technical Assessment:

Deutsches Institut für Bautechnik

Trade name of the construction product

Powder-actuated fasteners X-ALH and X-DKH 48
for top fixing of suspended ceilings

Product family
to which the construction product belongs

Power-actuated fastener in concrete and fixtures
for redundant non-structural applications

Manufacturer

Hilti Aktiengesellschaft
Feldkircherstrasse 100
9494 SCHAAN
FÜRSTENTUM LIECHTENSTEIN

Manufacturing plant

Hilti Herstellwerke

This European Technical Assessment
contains

14 pages including 3 annexes which form an integral part
of this assessment

This European Technical Assessment is
issued in accordance with Regulation (EU)
No 305/2011, on the basis of

330083-04-0601, Edition 07/2023

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Specific Part

1 Technical description of the product

The "Powder-actuated fasteners X-ALH and X-DKH 48 for top fixing of suspended ceilings" are powder-actuated fasteners made of galvanised steel which are driven into the concrete with or without previous drilling by use of a powder-actuated tool Hilti DX 5 F8, Hilti DX 460 F8 or Hilti DX 6 F8. They are anchored in the concrete by sintering and mechanical interlock.

The powder-actuated fasteners X-ALH are assembled with fixtures made of zinc coated steel (X-SCH ALH32, X-SCR M6 ALH32, X-SCR M8 ALH32 and X-SCO/N ALH37) and are driven into the concrete without predrilling.

The powder-actuated fasteners X-DKH 48 are assembled with fixtures made of zinc coated steel (X-HS M6 DKH 48 P8 S15, X-HS M8 DKH 48 P8 S15, X-HS M10 DKH 48 P8 S15 and X-CC DKH 48 P8 S15) and are also available as single fasteners with a steel washer (X-DKH 48 P8 S15). The powder-actuated fasteners X-DKH 48 are driven into the concrete with predrilling.

The product description is given in Annex A.

2 Specification of the intended use in accordance with the applicable European Assessment Document

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

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the fastener of at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

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

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic values of resistance and displacements	See Annex B2 and C1

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	No performance assessed

3.3 Aspects of Durability

Essential characteristic	Performance
Durability	See Annex B1

4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

In accordance with EAD No. 330083-04-0601, the applicable European legal act is: 1997/463/EC (EU).

The system to be applied is: 2+

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document

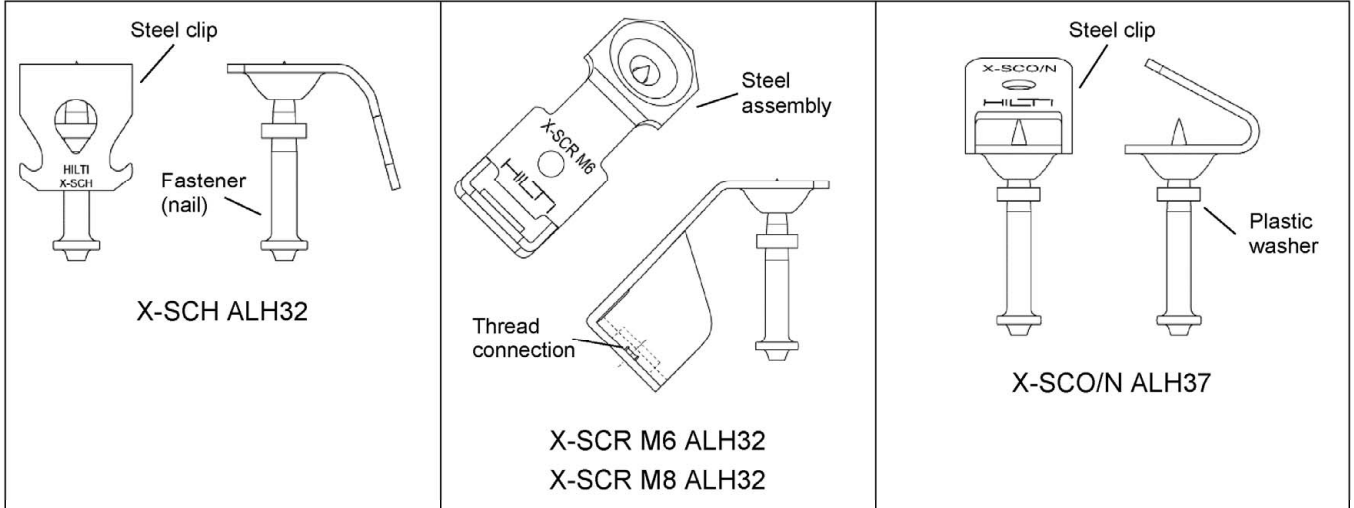
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 24 July 2023 by Deutsches Institut für Bautechnik

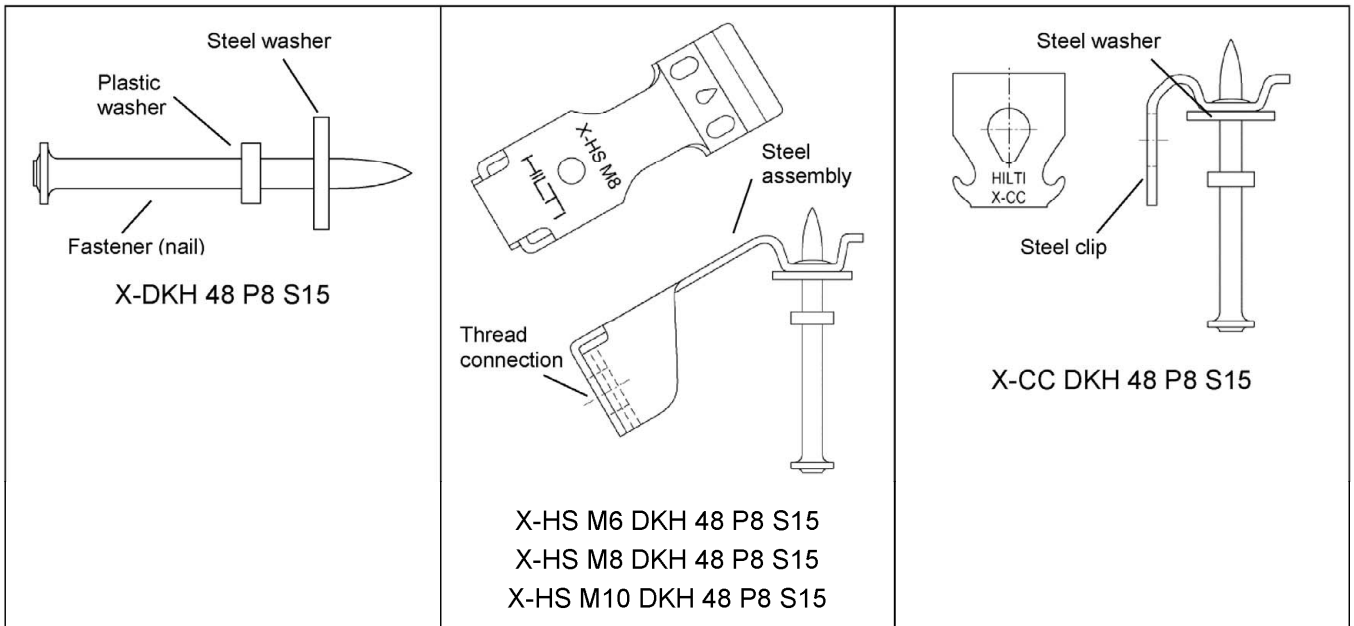
Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Baderschneider

Powder-actuated fastener X-ALH without predrilling assembled with fixtures for top fixing of suspended ceilings



Powder-actuated fastener X-DKH 48 with predrilling as single fastener and assembled with fixtures for top fixing of suspended ceilings

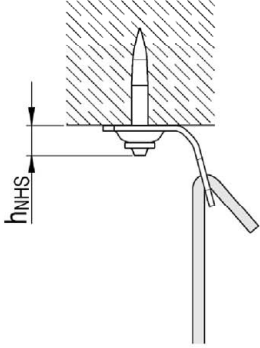
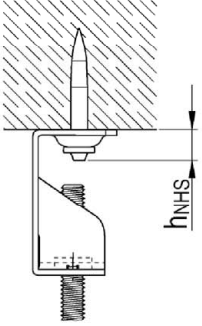
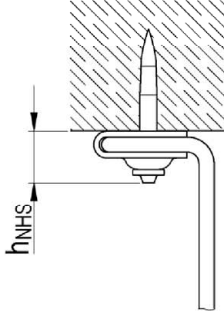
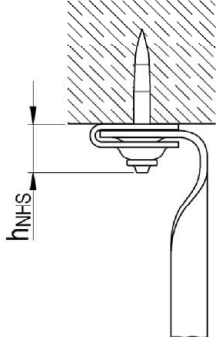
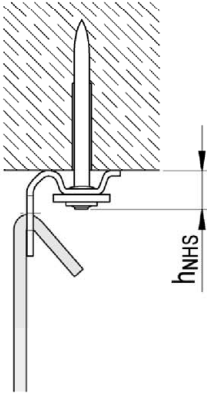
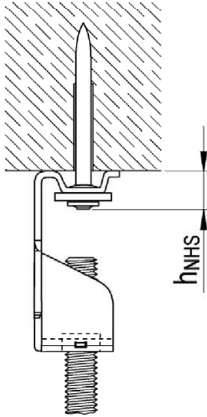
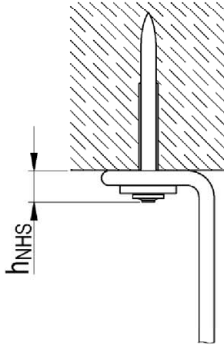
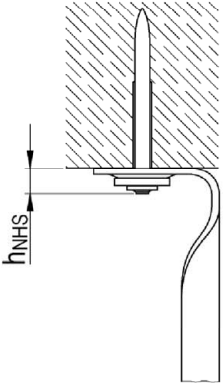


Powder-actuated fasteners X-ALH and X-DKH 48 for top fixing of suspended ceilings

Product

Annex A1

Installed condition

 <p>X-SCH ALH32 for connection of hook hangers</p>	 <p>X-SCR M6/M8 ALH32 for threaded rod connection</p>	 <p>X-SCO/N ALH37 for connection with eyelet wire (d = 4 mm)</p>	 <p>X-SCO/N ALH37 for connection with nonius hanger</p>
 <p>X-CC DKH 48 P8 S15 for connection of hook hangers</p>	 <p>X-HS M6/M8/M10 DKH 48 P8 S15 for threaded rod connection</p>	 <p>X-DKH 48 P8 S15 for connection with eyelet wire (d = 4 mm)</p>	 <p>X-DKH 48 P8 S15 for connection with nonius hanger</p>

Powder-actuated fasteners X-ALH and X-DKH 48 for top fixing of suspended ceilings

Annex A2

Installed condition

Dimensions of powder-actuated fastener X-ALH without predrilling assembled with fixtures for top fixing of suspended ceilings

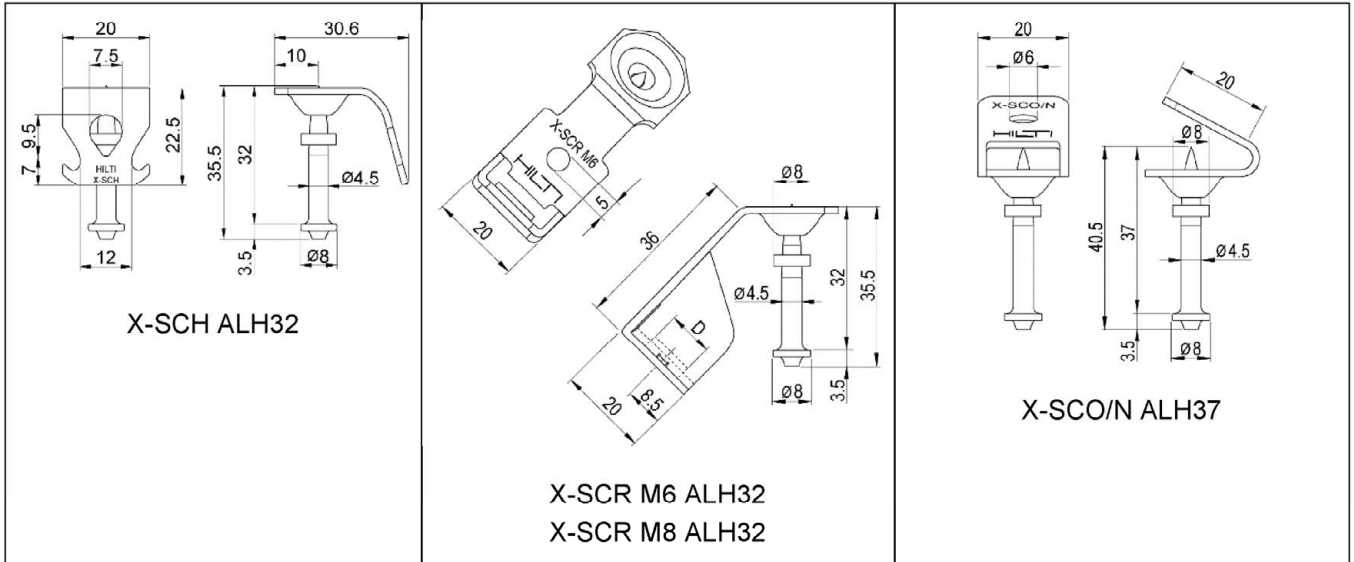


Table 1: Dimensions and materials

Powder-actuated fastener and fixture		X-SCH ALH32	X-SCR M6 ALH32 X-SCR M8 ALH32	X-SCO/N ALH37
Fastener shank length	[mm]	32,0		37,0
Total fastener length L	[mm]	35,5		40,5
Fastener shank diameter	[mm]	4,5		
Fastener head diameter	[mm]	8,0		
Material of fastener	[-]	Tempered carbon steel with a core hardness of 58 HRC		
Coating of fastener	[-]	Zinc plating $\geq 5 \mu\text{m}$		
Thickness of sheet of fixture	[mm]	1,5		
Material and coating of fixture	[-]	S280GD+Z140 per EN 10346:2015		
Plastic washer ¹⁾	[-]	Diameter = 8 mm, propylene		

¹⁾ Plastic washer only used to centre fastener within the fastener guide during installation.

Powder-actuated fasteners X-ALH and X-DKH 48 for top fixing of suspended ceilings

Dimensions and materials – Fasteners without predrilling

Annex A3

Dimensions of powder-actuated fastener X-DKH 48 with predrilling as single fastener and assembled with fixtures for top fixing of suspended ceilings

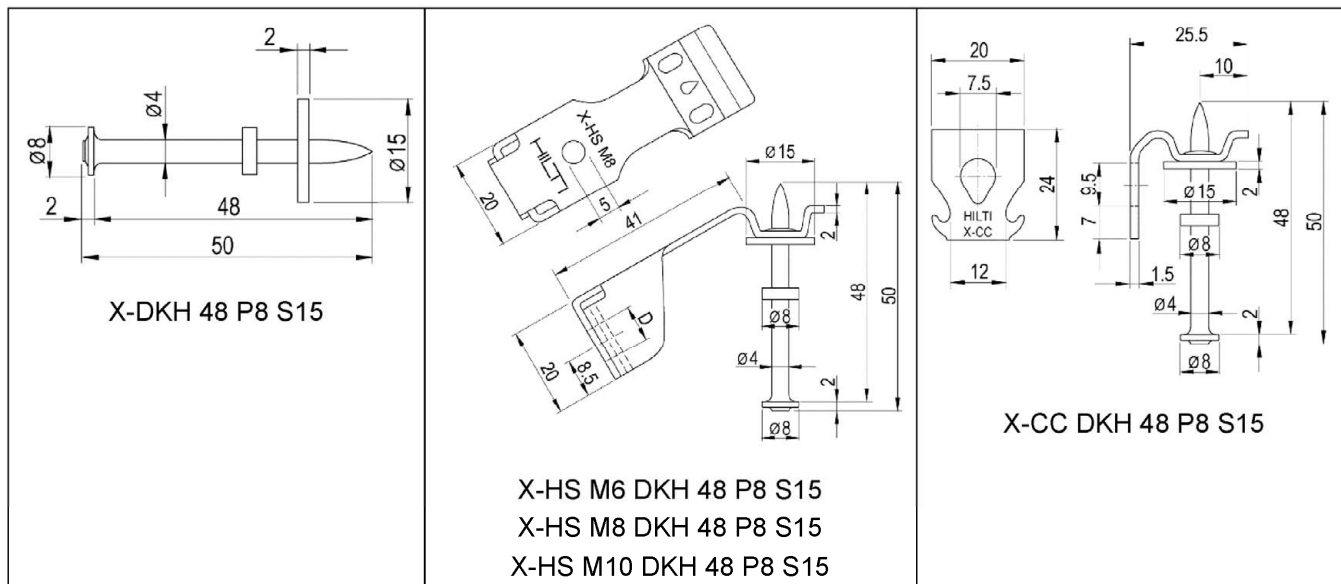


Table 2: Dimensions and materials

Powder-actuated fastener and fixture		X-DKH 48 P8 S15	X-HS M6 DKH 48 P8 S15 X-HS M8 DKH 48 P8 S15 X-HS M10 DKH 48 P8 S15	X-CC DKH 48 P8 S15
Fastener shank length	[mm]	48,0		
Total fastener length L	[mm]	50,0		
Fastener shank diameter	[mm]	4,0		
Fastener head diameter	[mm]	8,0		
Material of fastener	[-]	Tempered carbon steel with a core hardness of 58 HRC		
Coating of fastener	[-]	Zinc plating $\geq 5 \mu\text{m}$		
Steel washer diameter	[mm]	15,0		
Steel washer thickness	[mm]	2,0		
Steel washer material	[-]	DC 01 C390 per EN 10139:2016+A1:2020		
Coating of steel washer	[-]	Zinc plating $\geq 10 \mu\text{m}$		
Thickness of sheet of fixture	[mm]	-	1,5	
Material and coating of fixture	[-]	-	DX 51D+ZA130 EN 10346:2015	HC300LA+ZE75/75 EN 10268:2006+A1:2013
Plastic washer ¹⁾	[-]	Diameter = 8 mm, propylene		

¹⁾ Plastic washer only used to centre fastener within the fastener guide during installation.

Powder-actuated fasteners X-ALH and X-DKH 48 for top fixing of suspended ceilings

Dimensions and materials – Fasteners with predrilling

Annex A4

Specification of intended use

Fasteners and fixtures are intended to be used for redundant non-structural applications specifically for use as top fixings of suspended ceilings.

Anchorage subject to:

- Static and quasi-static tension loads.

Base material:

- Compacted reinforced or unreinforced normal weight concrete without fibres according to EN 206-1:2000.
- Strength classes C20/25 to C40/50 according to EN 206-1:2000 for fasteners without predrilling
- Strength classes C20/25 to C50/60 according to EN 206-1:2000 for fasteners with predrilling
- Cracked and non-cracked concrete.

Use conditions (Environmental conditions):

- Structures subject to dry conditions.

Design:

- The anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete works.
- The anchorages are designed in accordance with EN 1992-4:2018, Method C
- The fasteners without predrilling (Annex A3) are to be used only for multiple use for non-structural applications with following definition:
 - Number of fixing points $n_1 \geq 4$, number of fasteners per fixing point $n_2 = 1$ and design value of actions per fixing point $N_{ED,lim} \leq 0,6$ kN
- The fasteners with predrilling (Annex A4) are to be used only for multiple use for non-structural applications with following definition:
 - Number of fixing points $n_1 \geq 4$, number of fasteners per fixing point $n_2 \geq 1$ and design value of actions per fixing point $N_{ED,lim} \leq 3,0$ kN or
 - Number of fixing points $n_1 = 3$, number of fasteners per fixing point $n_2 \geq 1$ and design value of actions per fixing point $N_{ED,lim} \leq 2,0$ kN.
- The design of the fixture is such that in case of excessive slip or failure of one fastener the load can be transmitted to neighbouring fasteners without significantly violating the requirements on the fixture in the serviceability and ultimate limit state.

Installation:

- Fastener installation carried out by appropriately qualified personnel and after the supervision of the person responsible for technical matters of the site.

Powder-actuated fasteners X-ALH and X-DKH 48 for top fixing of suspended ceilings

Annex B1

Specification of intended use

Table 3: Fasteners without predrilling: Installation parameters

Powder-actuated fastener and fixture		X-SCH ALH32	X-SCR M6 ALH32 X-SCR M8 ALH32	X-SCO/N ALH37
Minimum concrete strength class	[-]	C20/25		
Maximum concrete strength class	[-]	C40/50		
Effective anchorage depth h_{ef}	[mm]	25,5 – 29,5		
Total thickness of fixture t_{fix}	[mm]	6,3		11,8
Nail head standoff h_{NHS}	[mm]	6,0 – 10,0		11,0 – 15,0
Minimum thickness h_{min} of concrete member	[mm]	80		

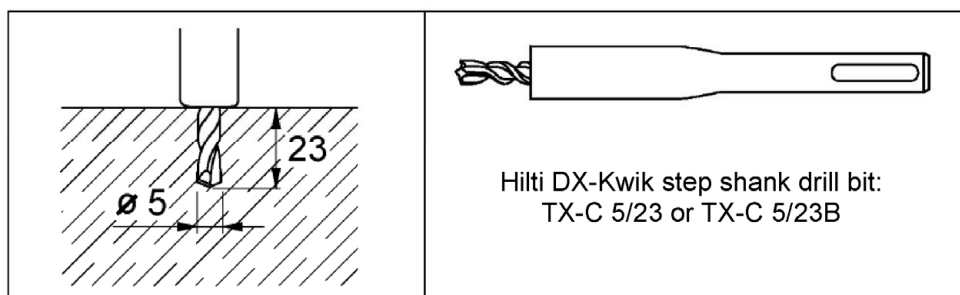
Table 4: Fasteners with predrilling: installation parameters

Powder-actuated fastener and fixture		X-DKH 48 P8 S15	X-HS M6/M8/M10 DKH 48 P8 S15	X-CC DKH 48 P8 S15
Minimum concrete strength class	[-]	C20/25		
Maximum concrete strength class	[-]	C50/60		
Nominal diameter of drill bit	[mm]	5		
Cutting diameter d_{cut} of drill bit	[mm]	5,4		
Depth of predrilling	[mm]	23		
Effective anchorage depth h_{ef}	[mm]	40,0 – 44,0		
Total thickness of fixture t_{fix}	[mm]	(1)	7,0	
Nail head standoff h_{NHS}	[mm]	(2)	6,0 – 10,0	
Minimum thickness h_{min} of concrete member	[mm]	100		

(1) in case of eyelet wire: 4 mm, in case of nonius hanger: 1 to 3 mm

(2) flush installation: in case of eyelet wire: 8 – 9 mm, in case of nonius hanger: 4 to 7 mm (with h_{ef} up to 46 mm)

Predrilling









Powder-actuated fasteners X-ALH and X-DKH 48 for top fixing of suspended ceilings

Concrete strength classes and installation parameters

Annex B2

Powder-actuated fastening tools and cartridges 6.8/11M

DX 5 F8, DX 460 F8		DX 6 F8	
			
Piston: X-5-460-P8 or X-6-5-P8 Fastener guide: X-5-460-F8		Piston: X-6-5-P8 Fastener guide: X-6-F8	
	Power regulation wheel allowing adjustment of the driving energy: Setting 1: Minimum energy Setting 4: Maximum energy		Power regulation wheel allowing wide adjustment of the driving energy: Setting 1: Minimum energy Setting 8: Maximum energy
			
Yellow: Low medium load (energy scale 4) Red: Medium high load (energy scale 6) Black: Extra high load (energy scale 7)		DX 6 cartridge Red (Medium high load – energy scale 6) collated in Titanium plastic strip DX 6 cartridge Black (Extra high load – energy scale 7)	

Recommended cartridges

Fasteners without predrilling	Fasteners with predrilling
DX 5 and DX 460: C20/25 – C25/30: Yellow or Red C30/37 – C40/50: Red or Black	DX 5 and DX 460: C20/25 – C30/37: Yellow or Red C35/45 – C50/60: Red or Black
DX 6: C20/25 – C40/50: DX 6 Cartridge Titanium	DX 6: C20/25 – C50/60: DX 6 Cartridge Titanium

The powder-actuated fasteners are to be driven with a nail head standoff h_{NHS} meeting the values given in Annex B2. The driving energy is adjusted at the fastening tool by means of trial installations. If the energy is not sufficient for the DX 5 (or DX 460) at maximum tool setting (Yellow 4 or Red 4), the next higher cartridge has to be used (Red or Black). If the energy is not sufficient with the DX 6 at maximum tool setting 8 with the Titanium cartridge, the Black DX 6 cartridge has to be used. The following graph shows the energy overlap of the cartridge energies considering the tool setting. For the DX 5 and DX 460 tool, the Red cartridge offers the widest concrete coverage.



Powder-actuated fasteners X-ALH and X-DKH 48 for top fixing of suspended ceilings

Powder-actuated fastening tool and cartridge selection

Annex B3

Instructions for use for fasteners without predrilling

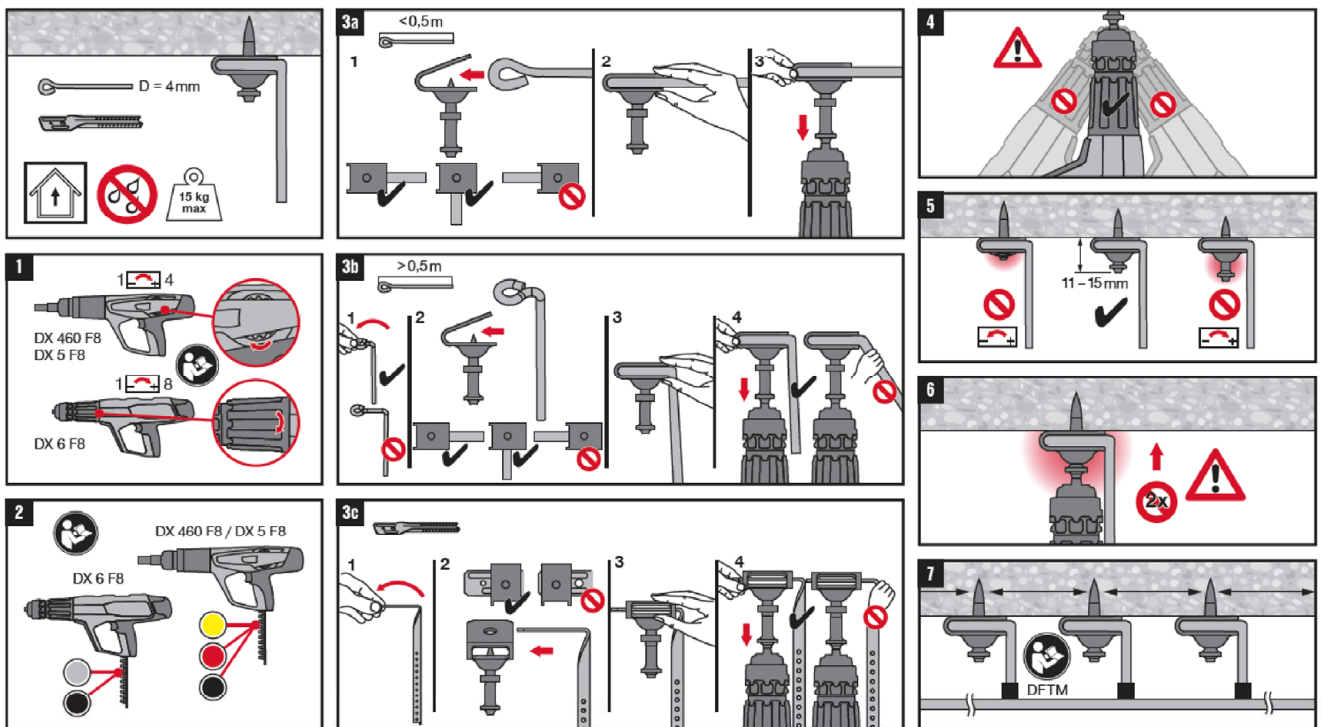
- The powder-actuated fastener is driven directly in the concrete by using the powder-actuated fastening tool DX 6 F8, DX 5 F8 or DX 460 F8 and respective cartridges according to Annex B3.
- The driving energy shall be determined by fine regulation at test settings according to Annex B3 – in relation to the characteristics of concrete (e.g. concrete strength, concrete aggregates). A control by measuring the fastener stand-off h_{NHS} shall be done according to Annex B2.
- The powder-actuated fastener is properly set if the fixture is tightened against the concrete surface and the nail head standoff h_{NHS} is met.
- Powder-actuated fasteners, which don't carry out the required embedment depth must not be loaded.
- The following Figure shows an example of instructions for use which are supplied with every box of fastener.

Example of instruction for use



X-SCO/N ALH37

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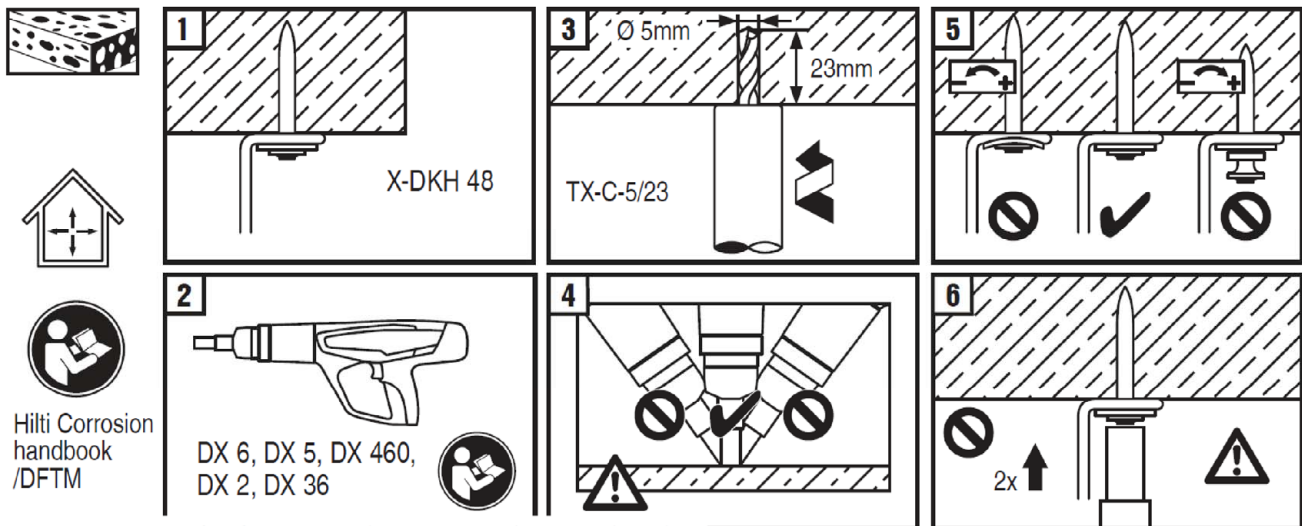
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<p>Powder-actuated fasteners X-ALH and X-DKH 48 for top fixing of suspended ceilings</p>	<p>Annex B4</p>
<p>Instructions for use for fasteners without predrilling</p>	

Instructions for use for fasteners with predrilling

- Holes to be drilled perpendicular to the concrete surface by using the corresponding stop drill according to Annex B2. The depth of the drill hole is reached when the drill bit leaves a visible mark in the surface of the concrete. Nominal diameter of drill bit and cutting diameter of drill bit shall be in accordance with the values in Annex B2.
- Positioning of the drill holes without damaging the reinforcement. In case of aborted drill hole, a new drill hole shall be at the distance of 2 x depth of the aborted hole at minimum. By vertical downwards drill holes a drill hole cleaning is necessary.
- The powder-actuated fastener is driven in a predrilled hole in the concrete by using the powder-actuated fastening tool DX 6 F8, DX 5 F8 or DX 460 F8 and respective cartridges according to Annex B3.
- The driving energy shall be determined by fine regulation at test settings according to Annex B3 – in relation to the characteristics of concrete (e.g. concrete strength, concrete aggregates). A control by measuring the fastener stand-off shall be done according to Annex B2.
- The powder-actuated fastener is properly set if the fixture is tightened against the concrete surface and the nail head standoff h_{NHS} is met.
- Powder-actuated fasteners, which don't carry out the required embedment depth or powder-actuated fasteners without predrilling must not be loaded.
- The following Figure shows an example of instructions for use which are supplied with every box of fastener.

Example X-DKH 48 P8 S15



Powder-actuated fasteners X-ALH and X-DKH 48 for top fixing of suspended ceilings

Annex B5

Instructions for use for fasteners with predrilling

Table 5: Characteristic values for fastener and fixtures without predrilling

X-SCH ALH32, X-SCR M6 ALH32, X-SCR M8 ALH32, X-SCO/N ALH37			
Characteristic tension resistance	N_{Rk}	[kN]	0,34
Partial factor ¹⁾	γ_M	[-]	1,5
Spacing	s_{min}	[mm]	200
Edge distance	c_{min}	[mm]	150
Displacement in tension direction at $N_{Rk}/(\gamma_M \cdot \gamma_F)$	δ_{N0}	[mm]	< 0,1
	$\delta_{N\infty}$	[mm]	< 0,1

¹⁾ In the absence of national regulations.

Table 6: Characteristic values for fastener X-DKH 48 P8 S15 with predrilling

X-DKH 48 P8 S15			
Characteristic tension resistance - for single fastener without fixture	N_{Rk}	[kN]	2,0
Characteristic tension resistance with fixture ¹⁾	N_{Rk}	[kN]	1,2
Partial factor ²⁾	γ_M	[-]	1,5
Spacing	s_{min}	[mm]	100
Edge distance	c_{min}	[mm]	150
Displacement in tension direction at $N_{Rk}/(\gamma_M \cdot \gamma_F)$	δ_{N0}	[mm]	< 0,1
	$\delta_{N\infty}$	[mm]	< 0,1

¹⁾ Eyelet wire with a diameter of 4 mm and nonius hanger with a nominal sheet thickness of 1,0 to 1,2 mm

²⁾ In the absence of national regulations.

Table 7: Characteristic values for fastener and fixture with predrilling

X-HS M6 DKH 48 P8 S15, X-HS M8 DKH 48 P8 S15, X-HS M10 DKH 48 P8 S15, X-CC DKH 48 P8 S15			
Characteristic tension resistance	N_{Rk}	[kN]	1,8
Partial factor ¹⁾	γ_M	[-]	1,5
Spacing	s_{min}	[mm]	100
Edge distance	c_{min}	[mm]	150
Displacement in tension direction at $N_{Rk}/(\gamma_M \cdot \gamma_F)$	δ_{N0}	[mm]	< 0,1
	$\delta_{N\infty}$	[mm]	< 0,1

¹⁾ In the absence of national regulations.

Powder-actuated fasteners X-ALH and X-DKH 48 for top fixing of suspended ceilings

Characteristic and design values

Annex C1