Deutsches Institut für Bautechnik

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Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

Designated according to Article 29 of Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

European Technical Assessment

ETA-16/0301 of 19 December 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	Electrical cable fastener
Product family to which the construction product belongs	Power-actuated fastener in concrete and fixtures for redundant non-structural applications
Manufacturer	Hilti AG Feldkircherstraße 100 9494 Schaan FÜRSTENTUM LIECHTENSTEIN
Manufacturing plant	Hilti AG, Herstellwerke
This European Technical Assessment contains	20 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 10/2022
This version replaces	ETA-16/0301 issued on 8 June 2021

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Specific Part

1 Technical description of the product

The electric cable fastener consists of the power-actuated fastener (Hilti X-P 20 B3 MX, Hilti X-P 24 B3 MX, Hilti X-P 20 B4 MX, Hilti X-P 24 B4 MX, Hilti X-P 20 G3 MX or Hilti X-P 24 G3 MX) made of galvanized steel and the fixture according to Annex A1 made of galvanized steel, polyamide or polyethylene. The power-actuated fasteners are driven in the concrete by using a mechanical fastening tool (Hilti BX3-ME or Hilti BX4-ME) or a gas-actuated fastening tool (Hilti GX3-ME). They are anchored in the concrete by sintering and mechanical interlock.

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
Maximum service loads in non-cracked and cracked concrete	See Annex B3, C1 to C4
Number of fixing points – n_1	$10 \leq n_1 \leq 100$
Uniform span between the fixing points	≤ 1,0 m
Acceptable gaps (number of failure next to each other) for local failure	See Annex C1 to C4
Acceptable gaps (number of failure next to each other) for serviceability limit state	See Annex C1 to C4

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire of fasteners and fixtures made of metal	Class A1
Reaction to fire of fixtures made of polyamide	No performance assessed.
Resistance to fire	No performance assessed.

3.3 Aspects of durability linked with the Basic Works Requirements

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 19 December 2023 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Baderschneider

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Electrical cable fastener consists of the fixture and a power-actuated fastener

Fixture

X-EKS (02) MX	X-ECT MX	X-ECH (02) MX
		
X-EKSC (02) MX 		
X-EKB 8 (02) MX	**X-FC MX**	**X-FB MX**
		
X-DFB MX	**X-ECC MX**	**X-EHS MX**
		

Power-actuated-fastener X-P 20 B3, X-P 24 B3, X-P 20 B4, X-P 24 B4 and X-P 20 G3, X-P 24 G3

Electrical cable fasteners	Annex A1
Product description: Products	

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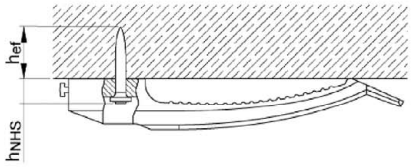
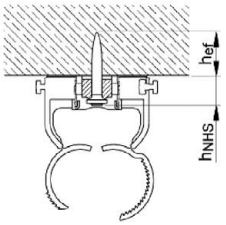
Electrical cable fasteners

Installed condition

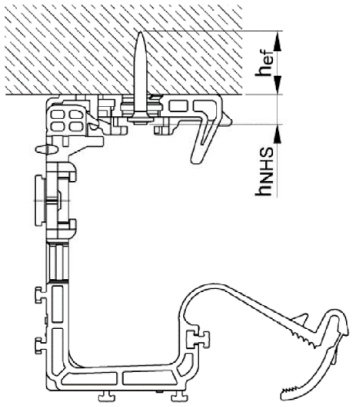
X-EKB 8 (02) MX



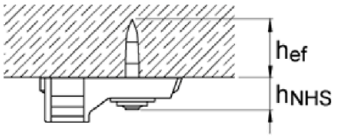
X-FC MX



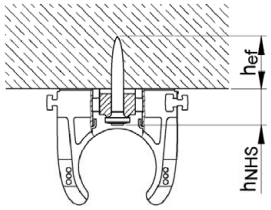
X-ECH (02) MX



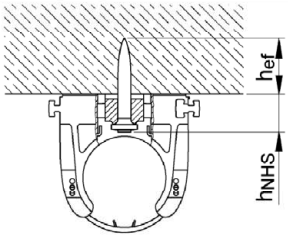
X-ECT MX



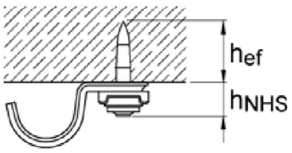
X-EKS (02) MX



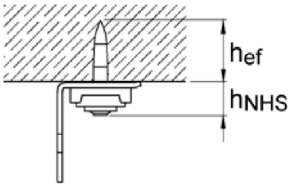
X-EKSC (02) MX



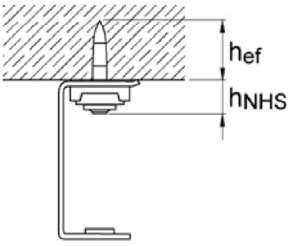
X-FB MX



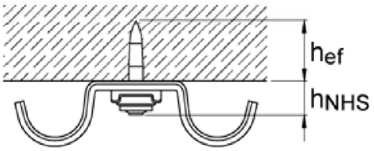
X-ECC MX



X-EHS MX



X-DFB MX



Electrical cable fasteners	Annex A2
Product description: Installed condition	

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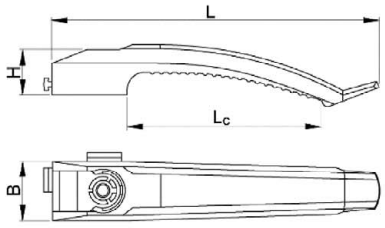
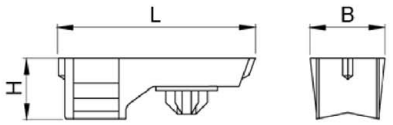
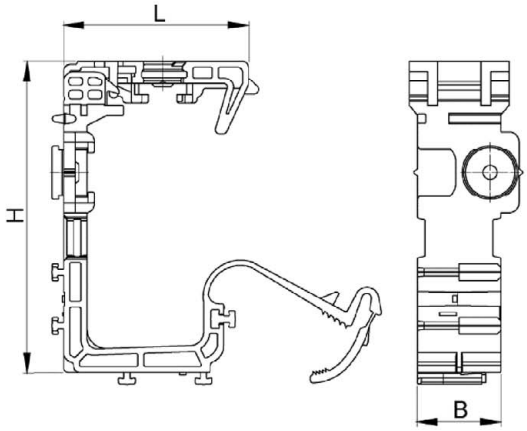
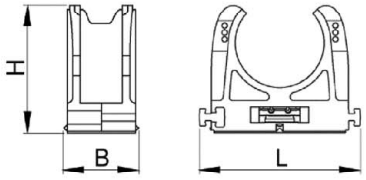
Electrical cable fasteners: dimensions and materials

Table 1: Fixture

	Designation	Dimensions [mm] / Material [-]		
X-EKB 8 (02) MX		L	B	H
	X-EKB 8 (02) MX	132.0	24.4	23.0
		Polyethylene HDPE, light grey		
X-ECT MX		L	B	H
	X-ECT MX	37.4	21.3	12.5
	X-ECT 40 MX (with pre-mounted cable tie)	37.4	21.3	12.5
		Polyamide PA 6.6, light grey or black		
X-ECH (02) MX		L	B	H
	X-ECH 15 (02) MX	48	25.0	90
	X-ECH 30 (02) MX	60	28.0	124.5
	All sizes	Polyethylene HDPE, light grey		
X-EKS (02) MX		L	B	H
	X-EKS 16 (02) MX	35	21.8	26.4
	X-EKS 19 (02) MX	39	21.8	31.3
	X-EKS 20 (02) MX	39	21.8	31.3
	X-EKS 25 (02) MX	45	21.8	35.2
	X-EKS 32 (02) MX	52	21.8	44.3
	All sizes	Polyethylene HDPE, light grey		

Electrical cable fasteners	**Annex A3**
Product description: Dimensions and materials	

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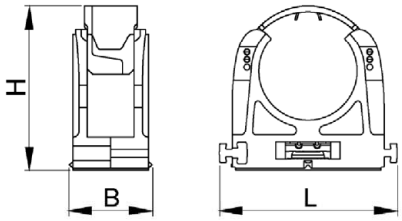
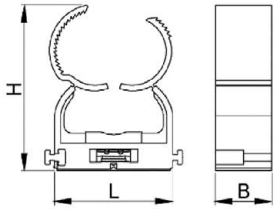
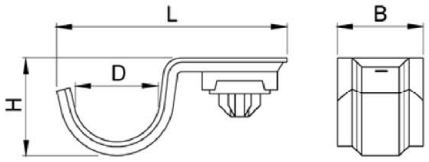
Electrical cable fasteners: dimensions and materials

Table 1: Fixture (continued)

	Designation	Dimensions [mm] / Material [-]			
X-EKSC (02) MX		L	B	H	
	X-EKSC (02) 16 MX	35	21.8	29.9	
	X-EKSC (02) 19 MX	39	21.8	34.2	
	X-EKSC (02) 20 MX	39	21.8	34.2	
	X-EKSC (02) 25 MX	45	21.8	39.4	
	X-EKSC (02) 32 MX	52	21.8	47.5	
	All sizes	Polyethylene HDPE, light grey			
X-FC MX		L	B	H	
	X-FC 16-20 MX	38	20	44.1	
	X-FC 20-25 MX	42	20	50.6	
	X-FC 25-32 MX	50	20	58.4	
	X-FC 32-40 MX	58	20	69.3	
	All sizes	Polyethylene HDPE, light grey			
X-FB MX		L	B	H	D
	X-FB 5 MX	28	17.5	7	5
	X-FB 6 MX	29	17.5	8	6
	X-FB 7 MX	30	17.5	9	7
	X-FB 8 MX	31	17.5	9.5	8
	X-FB 9 MX	32	17.5	11	9
	X-FB 10 MX	33	17.5	11.5	10
	X-FB 11 MX	34	17.5	12.5	11
	X-FB 13 MX	36	17.5	14.5	13
	X-FB 16 MX	44	17.5	17.5	16
	X-FB 20 MX	48	17.5	21.5	20
	X-FB 22 MX	50	17.5	23.5	22
	X-FB 25 MX	53	17.5	28.5	25
	X-FB 28 MX	56	17.5	29.5	28
	X-FB 32 MX	58	17.5	33.5	32
	X-FB 40 MX	69	17.5	41.5	40
	All sizes	≥ 5 µm Galvanized steel			

Electrical cable fasteners	**Annex A4**
Product description: Dimensions and materials	

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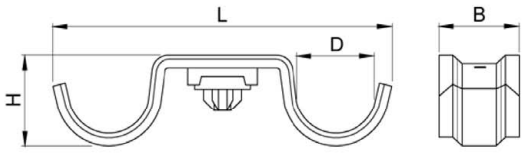
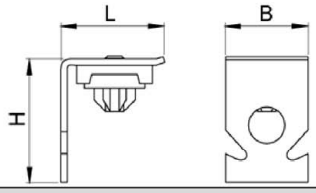
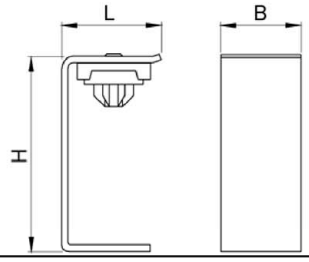
Electrical cable fasteners: dimensions and materials

Table 1: Fixture (continued)

	Designation	Dimensions [mm] / Material [-]			
X-DFB MX		L	B	H	D
	X-DFB 5 MX	46	17.5	7	5
	X-DFB 6 MX	48.5	17.5	8	6
	X-DFB 7 MX	51	17.5	9	7
	X-DFB 8 MX	53.5	17.5	9.5	8
	X-DFB 9 MX	55.5	17.5	11	9
	X-DFB 10 MX	57.5	17.5	11.5	10
	X-DFB 11 MX	60	17.5	12.5	11
	X-DFB 13 MX	64	17.5	14.5	13
	X-DFB 16 MX	70.5	17.5	17.5	16
	X-DFB 20 MX	80	17.5	21.5	20
	X-DFB 22 MX	83.5	17.5	23.5	22
	X-DFB 25 MX	90	17.5	28.5	25
	X-DFB 28 MX	97	17.5	29.5	28
	All sizes	≥ 5 µm Galvanized steel			
X-ECC MX		L	B	H	
	X-ECC MX	21	18	25	
		≥ 5 µm Galvanized steel			
X-EHS MX		L	B	H	
	X-EHS M4 MX	20	18	38	
	X-EHS M6(W6) MX	20	18	38	
	X-EHS M8 MX	20	18	38	
	X-EHS W10 MX	20	18	38	
	All sizes	≥ 5 µm Galvanized steel			

Electrical cable fasteners	**Annex A5**
Product description: Dimensions and materials	

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Table 2: Power-actuated fastener

Power-actuated fastener		**X-P 20 B3 MX** **X-P 20 B4 MX** **X-P 20 G3 MX**	**X-P 24 B3 MX** **X-P 24 B4 MX** **X-P 24 G3 MX**
Shank length	[mm]	20	24
Total length	[mm]	21.8	25.8
Shank diameter	[mm]	3	3
Head diameter	[mm]	6.8	6.8
Material of nail	[-]	Hardened carbon steel, Rockwell hardness 57.5 HRC, galvanized ≥ 5 µm	

Electrical cable fasteners	**Annex A6**
Product description: Dimensions and materials	

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Specification of intended use

Anchorages subject to:

- Dead-loads of uniaxially spanned flexible cables or conduits as well as rigid cables or conduits
  Cables up to an outer diameter of 12 mm are considered flexible (e.g. NYM 3x1.5 or NYM 5x1.5).

Base materials:

- Reinforced or unreinforced normal weight concrete according to EN 206-1:2000.
- Strength classes C20/25 to C35/45 according to EN 206-1:2000.
- Cracked and non-cracked concrete.
- Two-dimensional load-bearing structures (slabs and walls).

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions
- Minimum temperature: -
  Fixture made of Steel: -40 °C
  Fixtures made of plastic: Polyamide: -20 ºC, Polyethylene 0 ºC
- Maximum temperature:
  Fixtures made of steel: +80 °C,
  Fixtures made of plastic: long term temperature +24 °C, short term temperature +40 °C

Design:

- Conditions: Both ends of the chain are fixed supports (e.g. fixation in a cable-terminal box or where cables are led through interior rigid walls).
- Design: $F = g \cdot l \leq F_{s,max}$

with
- F = dead load of the cable or conduit acting on the fixture made of plastic or steel in N
- g = dead load of the cable or conduit in N/m
- l = spacing of the fasteners in m
- $F_{s,max}$ = maximum service load (maximum possible loads) $N_{s,max}$ or $V_{s,max}$ in N according to Annex C1 to C4

Electrical cable fasteners	**Annex B1**
Intended use: Specification	

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Specification of intended use

Notes:

- A potential influence of an eccentric load introduction into the power-actuated nail is taken into consideration in corresponding published loads shown in Annex C1 to C4.
- For Fixtures made of plastic, the long-term effect due to creep is taken into consideration according to EN ISO 899-1:2017.
- The loads given in Annexes C1 to C4 include the required safety against total failure of the global system according to EN 1990:2002 + A1:2005/AC:2010 (Reliability class RC2, ultimate limit state, $\beta \geq 3.8$).
- The loads given in Annexes C1 to C4 include the required safety of the serviceability state according to EN 1990:2002 + A1:2005/AC:2010 (Reliability class RC2, serviceability limit state, $\beta \geq 1.5$).

  The corresponding maximum service loads are valid for potential gaps due to single or maximum 2 fastener failures next to each other (see Annex C1 to C4). The fastener may be used if the cable sagging due to the given gaps have not bad appearance and the designer/user accepts these gaps.
- The loads given in Annexes C1 to C4 include the required safety against local failure according to EN 1990:2002 + A1:2005/AC:2010 (Reliability class RC1, ultimate limit state, $\beta \geq 3.3$).

  The corresponding maximum service loads are valid for potential gaps due single or maximum 4 fastener failures next to each other (see Annex C1 to C4). The fastener may be used if the cable sagging due to the given gaps do not lead to a risk of use and the designer/user accepts these gaps.

Installation:

Fastener installation carried out by appropriately qualified personnel

Damages on the concrete surface, caused by setting defects, have to be repaired according to technical rules, e.g. EN 1504-3:2005. A new fastener is set at a minimum distance away of $\geq$ 150 mm and $\geq 3\ h_{ef}$ of the edge of the damaged surface.

Electrical cable fasteners	**Annex B2**
Intended use: Specification	

Table 3: Concrete parameters

Power-actuated fastener		**X-P 20 B3 MX** **X-P 20 B4 MX** **X-P 20 G3 MX**	**X-P 24 B3 MX** **X-P 24 B4 MX** **X-P 24 G3 MX**
Minimum concrete strength class	[-]	C20/25	
Maximum concrete strength class	[-]	C35/45	
Minimum thickness of concrete member h_{min}	[mm]	80	

Table 4: Installation parameters

Power-actuated fastener	**Fixture**	**Embedment depth h_{ef} [mm]** (see Annex A2)	**Total thickness of the fixture t_{fix} [mm]**	**Fastener standoff h_{NHS}** (see Annex A2)
	X-EKB 8 (02) MX	11-16mm	4	6-11 mm
	X-ECT MX	11-16 mm	4	6-11 mm
X-P 20 B3 MX	X-ECH (02) MX	11-16 mm	4	6-11 mm
X-P 20 B4 MX	X-EKS (02) MX	11-16 mm	4	6-11 mm
X-P 20 G3 MX	X-EKSC (02) MX	11-16 mm	4	6-11 mm
X-P 24 B3 MX	X-FC MX	11-16 mm	4	6-11 mm
X-P 24 B4 MX	X-FB MX	11-15 mm	5	7-11 mm
X-P 24 G3 MX	X-DFB MX	11-15 mm	5	7-11 mm
	X-ECC MX	11-15 mm	4,5	7-11 mm
	X-EHS MX	11-15 mm	4,5	7-11 mm

Electrical cable fasteners	**Annex B3**
Intended use: Concrete strength class and installation parameters	

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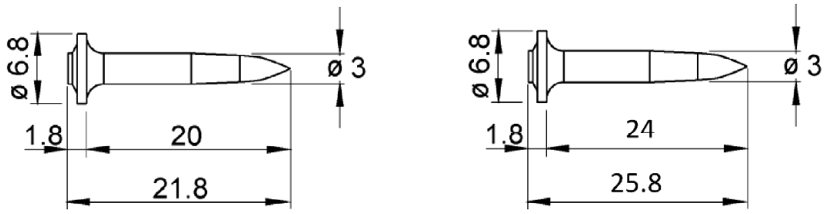
Power-actuated fastening tools

Fastening tool BX3-ME with nails X-P20 B3 MX and X-P24 B3 MX	Fastening tool GX3-ME with nails X-P20 G3 MX and X-P24 G3 MX
 Fastening tool BX3-ME: fully automatic, mechanical driven	 Fastening tool GX3-ME: fully automatic, gas driven
 collated nails X-P20 B3 MX and X-P24 B3 MX	 *collated nails* *X-P20 G3 MX and X-P24 G3 MX*



X-P20 X-P24

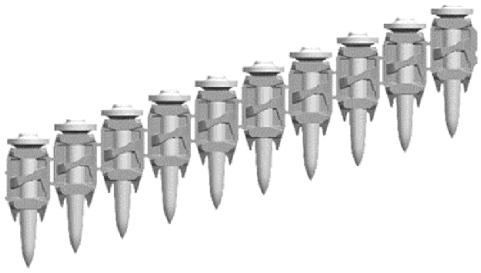
Nails X-P20 and X-P24

Electrical cable fasteners	**Annex B4**
Intended use: Power-actuated fastening tools	

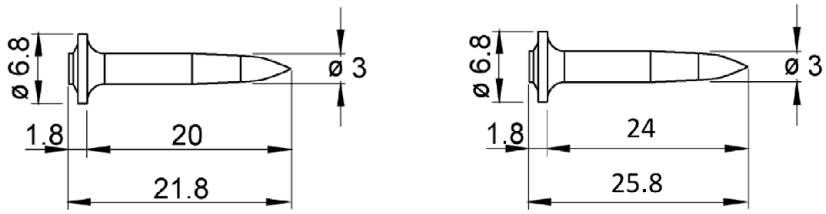
Power-actuated fastening tools (continued)

Fastening tool BX4-ME with nails
X-P20 B4 MX and X-P24 B4 MX

Fastening tool BX4-ME:
fully automatic, mechanical driven



collated nails
X-P20 B4 MX and X-P24 B4 MX



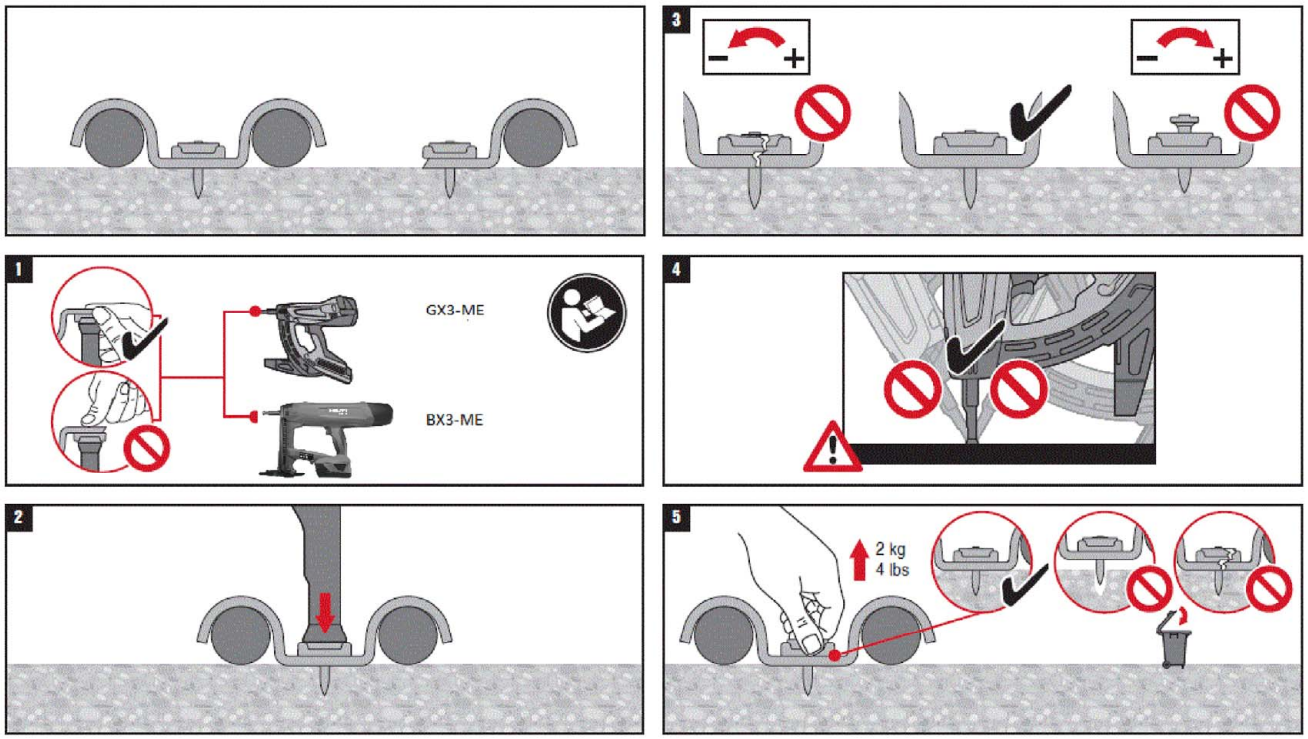
X-P20 X-P24

Nails X-P20 and X-P24

Electrical cable fasteners	Annex B5
Intended use: Power-actuated fastening tools	

Instructions for use

Example X-(D)FB MX



Fastener inspection – fastener stand-off

For the fastener inspection a measurement of the fastener standoff h_{NHS} has to be done, as shown in Annex A2. The recommended values are given in Table 4, Annex B3.

Electrical cable fasteners	Annex B6
Intended use: Instructions for use	

Maximum service loads $F_{S,max}$

The acceptable gap corresponds to the number of failures next to each other.

X-EKB 8 (02) MX		
Number of fixing points n_1 = 100		Maximum tension service load $N_{S,max}$ [N]
		Flexible cables
Acceptable gap for serviceability limit state β ≥ 1.5	1	18.0
Acceptable gap for local failure β ≥ 3.3	3	18.0

X-ECT MX		
Number of fixing points n_1 = 100		Maximum tension and shear service load $N_{S,max} = V_{S,max}$ [N]
		Flexible cables or conduits
Acceptable gap for serviceability limit state β ≥ 1.5	1	40
	2	55
Acceptable gap for local failure β ≥ 3.3	3	40
	4	55

X-EKS (02) MX			
Number of fixing points n_1 = 100		Maximum tension and shear service load $N_{S,max} = V_{S,max}$ [N]	
		Flexible cables	Rigid cables or conduits
Acceptable gap for serviceability limit state β ≥ 1.5	0	8.5	5.5
Acceptable gap for local failure β ≥ 3.3	1	8.5	5.5

X-EKSC (2) MX		
Number of fixing points n_1 = 100		Maximum tension and shear service load $N_{S,max} = V_{S,max}$ [N]
		Flexible cables
Acceptable gap for serviceability limit state β ≥ 1.5	1	37
Acceptable gap for local failure β ≥ 3.3	3	37

Electrical cable fasteners	**Annex C1**
Performances: Service loads	

Maximum service loads $F_{S,max}$ (continued)

The acceptable gap corresponds to the number of failures next to each other.

X-EKSC (02) MX		
Number of fixing points n_1 = 100		Maximum tension and shear service load $N_{S,max} = V_{S,max}$ [N]
		Rigid cables or conduits
Acceptable gap for serviceability limit state β ≥ 1.5	1	22
Acceptable gap for local failure β ≥ 3.3	2	22

X-ECH 15 (02) MX		
Number of fixing points n_1 = 100		Maximum tension and shear service load $N_{S,max} = V_{S,max}$ [N]
		Flexible cables
Acceptable gap for serviceability limit state β ≥ 1.5	1	45
Acceptable gap for local failure β ≥ 3.3	3	45

X-ECH 30 (02) MX		
Number of fixing points n_1 = 100		Maximum tension and shear service load $N_{S,max} = V_{S,max}$ [N]
		Flexible cables
Acceptable gap for serviceability limit state β ≥ 1.5	1	65
Acceptable gap for local failure β ≥ 3.3	3	65

X-FC MX		
Number of fixing points n_1 = 100		Maximum tension and shear service load $N_{S,max} = V_{S,max}$ [N]
		Flexible cables
Acceptable gap for serviceability limit state β ≥ 1.5	1	37
Acceptable gap for local failure β ≥ 3.3	2	37

Electrical cable fasteners	**Annex C2**
Performances: Service loads	

Maximum service loads $F_{S,max}$ (continued)

The acceptable gap corresponds to the number of failures next to each other.

X-FC MX		
Number of fixing points n_1 = 100		Maximum tension and shear service load $N_{S,max} = V_{S,max}$ [N]
		Rigid cables or conduits
Acceptable gap for serviceability limit state β ≥ 1.5	1	22
Acceptable gap for local failure β ≥ 3.3	2	22

X-ECC MX		
Number of fixing points n_1 = 100		Maximum tension service load $N_{S,max}$ [N]
		Flexible cables
Acceptable gap for serviceability limit state β ≥ 1.5	1	35
	2	50
Acceptable gap for local failure β ≥ 3.3	3	35
	4	50

X-ECC MX		
Number of fixing points n_1 = 100		Maximum tension service load $N_{S,max}$ [N]
		Rigid cables or conduits
Acceptable gap for serviceability limit state β ≥ 1.5	1	15
	2	30
Acceptable gap for local failure β ≥ 3.3	2	15
	4	30

Electrical cable fasteners	**Annex C3**
Performances: Service loads	

Maximum service loads $F_{S,max}$ (continued)

The acceptable gap corresponds to the number of failures next to each other.

X-EHS MX		
Number of fixing points n_1 = 100		Maximum tension service load $N_{S,max}$ [N]
		Flexible cables
Acceptable gap for serviceability limit state β ≥ 1.5	1	60
	2	80
Acceptable gap for local failure β ≥ 3.3	3	60
	4	80

X-EHS MX		
Number of fixing points n_1 = 100		Maximum tension service load $N_{S,max}$ [N]
		Rigid cables or conduits
Acceptable gap for serviceability limit state β ≥ 1.5	1	45
Acceptable gap for local failure β ≥ 3.3	3	40
	4	45

X-FB MX and X-DFB MX		
Number of fixing points n_1 = 100		Maximum tension and shear service load $N_{S,max} = V_{S,max}$ [N]
		Flexible cables
Acceptable gap for serviceability limit state β ≥ 1.5	1	30
Acceptable gap for local failure β ≥ 3.3	2	20
	3	30

X-FB MX and X-DFB MX		
Number of fixing points n_1 = 100		Maximum tension and shear service load $N_{S,max} = V_{S,max}$ [N]
		Rigid cables or conduits
Acceptable gap for serviceability limit state β ≥ 1.5	1	20
Acceptable gap for local failure β ≥ 3.3	2	20

Electrical cable fasteners	**Annex C4**
Performances: Service loads	