

DIRECT FASTENING TECHNOLOGY MANUAL 03/2023







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Part 1:

Direct fastening principles and technique







1. Introduction

1.1 Definitions and general terminology

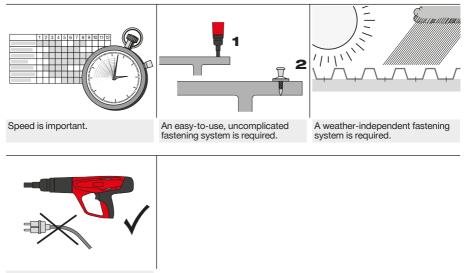
Hilti direct fastening technology is a technique in which specially hardened nails or studs are driven into steel, concrete or masonry by a piston-type tool. Materials suitable for fastening by this method are steel, wood, insulation and some kinds of plastic. Fastener driving power is generated

1.2 Reasons for using direct fastening

"The illustrations below show some of the main reasons why many contractors take

by a power load (a cartridge containing combustible propellant powder, also known as a "booster"), combustible gas or by a battery. During the driving process, base material is displaced and not removed. In Hilti terminology, DX stands for "powderactuated", GX for "gas-actuated" and BX stands for "battery-actuated" systems (i.e. propellant free)."

advantage of the benefits of powder-, gasor battery-actuated fastening.



Electric power is not available or electric cables would hinder the work.





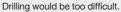


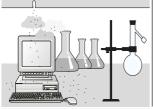




A complete fastening system with assured strength is required.

Drilling is not viable because of noise.





Drilling would cause too much dust.

In addition, there are specific reasons why contractors may use battery-actuated fastening:



Gas cans or combustion systems are not allowed



1.3 Direct fastening applications

Typical applications for powder- or gas-actuated fastening are shown in the illustrations below:

- · Fastening thin metal sheets: roof decking wall liners and floor decking
- Fastening thicker steel members: e.q. metal brackets, clips
- · Fastening soft materials such as wooden

battens or insulation to steel, concrete or masonry

- Threaded studs for suspended ceilings, installing building services, bar gratings or chequer plate floors
- Connections for composite structures: fastening nailed composite shear connectors



Roof decking









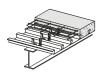
Floor decking



Metal brackets, clips and tracks



Fixtures for mechanical and electrical installations



Shear connectors



Drywall track to concrete and steel

Hangers with threaded



System fortmwork

Wooden battens fastened to steel or concrete



Wall-tie to steel and concrete



Grating fastenings



Mechanical and electrical fixtures



2. The direct fastening system

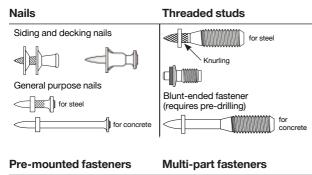
The fastener, tool and driving energy form a fastening system with its own specific characteristics. Examples of Hilti direct fastening system components are shown below.





2.1 Fasteners

Fasteners can be classified in three general types: nails, threaded studs and composite fasteners.



The nails used (also known as drive pins) are of a special type equipped with washers to meet the needs of the application and to provide guidance when driven. Threaded studs are essentially nails with a threaded upper section instead of a head. Composite fasteners are an assembly consisting of a nail with an application-specific fastening component such as a clip, plate or disk made of metal or plastic.

Siding and decking nails can be recognized by their washers which are specially designed to hold down the metal sheets and to absorb excess driving energy. Fasteners designed for driving into steel usually have knurled shanks which increase their pull-out resistance. Fasteners for use on concrete have longer shanks than those for use on steel. Threaded studs may have either a metric (M6, M8 or M10) or Whitworth ($^{1}/_{4}$ ", $^{5}/_{15}$ " or $^{3}/_{6}$ ") thread.

Nails and threaded studs are commonly zinc-plated for resistance to corrosion during transport, storage and construction. As this degree of protection is inadequate for long-term resistance to corrosion, use of these zinc-plated fasteners is limited to applications where they are not exposed to the weather or a corrosive atmosphere during their service life. The zinc layer on





fasteners driven into steel is, in fact, a disadvantage in that it reduces pull-out resistance. For this reason, the thickness of zinc on the fastener must be optimized to ensure good corrosion protection as well as high holding power. During production, tight control of the galvanizing process is necessary to prevent excess zinc thickness and thereby poor fastening performance. Fasteners must be 2 to 3 times harder than the material into which they are driven. The tensile strength of structural steel is commonly between 400 and 600 MPa. Fasteners for use on steel thus require a strength of approximately 2000 MPa. As Rockwell hardness is much easier to measure than strength, but good correlation exists between hardness and strength, this characteristic is used as a parameter in the specification and manufacturing of the fasteners. In the table below, HRC hardness is given for a range of tensile strengths (DIN 50150).

Tensile strength									
(MPa)	770	865	965	1810	1920	1995	2070	2180	2215
HRC	20.5	25.5	30	52.5	54	55	56.5	58	59

2.2 Manufacturing process Standard hardened steel fasteners

Almost all power-actuated fasteners used throughout the world are manufactured from carbon steel wire which is subsequently thermally hardened to provide the strength needed for driving into steel and concrete. In nail manufacturing, shank diameter is determined by the wire diameter used. Threaded studs are made from wire corresponding to the required thread diameter. The manufacturing process, which is summarized in the diagram below, consists of cutting the wire to length, shaping the head, knurling, forging or thermo pulling the point, hardening, galvanizing and assembling with washers. The process of hardening the steel to more than HRC 50 combined with the zinc plating presents a risk of hydrogen embrittlement. This risk is mitigated by heat-treating the

galvanized product at the optimum temperature for the correct time. Galvanized and heat-treated fasteners are subjected to impact bending tests to check the effectiveness of the process. Depending on their intended application, some fasteners are additionally sampled and tested under tension and shear.

Manufacturing Process









Stainless steel fasteners

Hilti introduced the first powder-actuated stainless steel fastener in 1994. These fasteners, which are not thermally hardened, are manufactured from special stainless steel wire with an ultimate tensile strength of 1850 MPa. One effect of using steel of such high strength as a raw material is that the forming and forging processes present greater technical difficulties. These fasteners, on the other hand, suffer no risk of hydrogen embrittlement and their strength decreases only very slightly when subjected to high temperatures such as in a fire.

Manufacturing Process Stainless Steel Fasteners

Cutting to length and head forming

Point forging

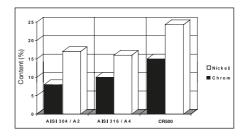
Assembly with washers

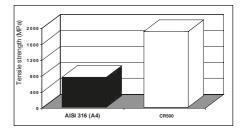
2.3 Fastener raw material

Hilti standard zinc plated fasteners are made from carbon steel wire with an ultimate tensile strength of 590 to 760 MPa.

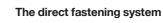
Hilti X-CR / X-BT stainless steel fasteners are made from high-strength nitrogen alloyed stainless steel wire (Hilti designation CR500) or ferritic-austenitic corrosion resistant duplex steel 1.4462. Nickel and chromium are the components of stainless steel that make it resistant to corrosion. CR500 steel is compared to commonly used stainless steels like AISI 304 and 316 (European A2 and A4) in the graph at the right. Note that CR500 steel contains considerably more nickel and chromium than both 304 and 316.

Another comparison of interest is the difference in ultimate tensile strength, as shown in the graph at the right.









2.4 Types of Hilti direct fastening tools

Hilti currently offers three types of direct fastening tools: powder-actuated, gas-actuated and battery-actuated.

2.4.1 Powder-actuated tools



These tools rely on cartridges of different power levels as propellant. When ignited, the cartridge transfers energy to a piston which, in turn, drives the fastener into the base material.

All Hilti powder-actuated tools are classified as low-velocity tools.

Class of powder-actuated tool	test velocity	Maximum single test velocity in m/s [fps]
Low-velocity	100 [328]	108 [354]
Medium-velocity	150 [492]	160 [525]
High-velocity	>150 [492]	>160 [525]







2.4.2 Gas-actuated tools









These tools rely on gas as propellant. Expanding the gas transfers energy to a piston which, in turn, drives the fastener into the base material.



Hilti manufactures gas-actuated tools using two distinct technologies. The first (used notably in models GX 2 and GX 90 WF) uses a fan to mix the propellant with ambient air. The second (used notably in the GX 120 and GX 3) uses a Hilti-designed mechanism requiring no external power to mix the gas and air in the combustion chamber.

2.4.3 Battery-actuated tools



This tool is propellant-free. The energy moving the piston is generated by an electrical motor, two springs and a belt. The only source of energy required is a 22V battery which is interchangeable with other tools from the Hilti 22V platform family.





2.5 Operating principles

All Hilti direct fastening tools feature a piston. There are three ways the piston can come into contact with the fastener when an operator triggers a tool – referred to as operating principles. They are described in the diagram below.

It is important to bear in mind that the operating principle used for a given fastening point modifies the application's limit, particularly when fastening on steel.

Operating principle	Characteristics	
Co-acting operation	 X > 0; Y = 0 Highest application limit Lowest recoil 	X
Impact operation	 X = 0; Y > 0 Lower application limit Higher recoil 	<u>Y</u>
Contact operation	 X = 0; Y = 0 Lowest application limit Highest recoil 	

It should be noted that 100% co-acting operation in Hilti tools can be only achieved by pushing the fastener all the way against the piston with a ramrod or, if the tool is so designed, with a built-in ramrod mechanism. Tools with nail magazines cannot operate with 100% co-action because of the need for clearance between the piston end and the collated nail strip. Some single-shot tools allow the operator to make an impact-type tool work as a co-acting tool by using a ramrod.



2.5.1 Cartridges (power loads, boosters)

Cartridges for powder-actuated fastening tools are available in various standard sizes and each size is available in up to 6 power levels. In the United States, the powder in a cartridge, the sensitivity of the primer, and the cartridge dimensions are governed by technical data published by the Powder-Actuated Tool Manufacturers Institute, Inc. (PATMI). PATMI defines the power level by the velocity measured in a standard test in which a standardized 350 grain [22.7gram] cylindrical plunger is fired from a standardized apparatus. The identification and limitations of use are addressed in ANSI A10.3-2013.

Size	Colour code	Power level	Velocity of 350 grain slug ft./sec. [[m/sec.]		Calculated energy (joules)		
6.8/11	Gray	1	370 ± 45	[113 ± 13.7]	111	144	182
[Cal. 27 short]	Brown	2	420 ± 45	[128 ± 13.7]	148	186	228
	Green	3	480 ± 45	[146 ± 13.7]	200	243	291
	Yellow	4	560 ± 45	[171 ± 13.7]	280	331	386
	Red	5	610 ± 45	[186 ± 13.7]	337	392	452
	Purple / black	6	660 ± 45	[201 ± 13.7]	399	459	524
6.8/18	Green	3	550 ± 45	[168 ± 13.7]	269	319	373
[Cal. 27 long]	Yellow	4	630 ± 45	[192 ± 13.7]	361	419	480
	Blue	4.5	725 ± 45	[221 ± 13.7]	488	554	625
	Red	5	770 ± 45	[235 ± 13.7]	554	625	700
	Purple / black	6	870 ± 45	[265 ± 13.7]	718	798	883

PATMI colour codes, power levels and definition of cartridges

In Europe, the European Standard EN 16264 specifies cartridge dimensions, colour codes and power levels, which are defined in terms of energy delivered when a cartridge is fired in a standardized apparatus. EN 16264 specifies a 80 gram plunger.



EN 16264 colour codes, power levels and energy scale

Colour code	Power level	Energy scale
White/Brown	weakest	2
Green	weak	3
Yellow	medium	4
Blue	heavy	5
Red	very heavy	6
Black	heaviest	7



Health and safety

3. Health and safety

The safety of powder-actuated fastening systems can be clustered into two categories:

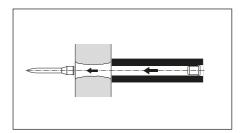
- Operator safety refers to safeguarding the operator and bystanders.
- Fastening safety refers to the adequacy of the in-place fastenings.

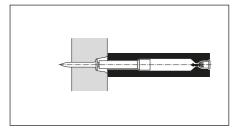
3.1 Operator safety

This refers to the measures taken to ensure that the tool does not endanger the operator and/or bystanders by firing at an overly high velocity, firing under the wrong conditions, generating excessive noise, or being used in the wrong way.

The piston principle

One of the main concerns about the use of powder-filled cartridges is the risks associated with a fastener missing the base material. or with a base material too weak to absorb the nail's energy. The piston principle ensures that the energy from the propellant in the cartridge is transferred to a piston which, in turn, drives the fastener. Because the piston is captive within the tool, it will absorb app. 95% of the driving energy in case a fastener misses the base material or the material is too soft for the fastener. As a consequence, the fastener will exit the tool at a speed that is far lower and less dangerous than that of tools which are not based on a piston.





Tool safety mechanisms

To minimize the potential hazards during tool usage, Hilti has implemented the following safety mechanisms in all of its direct fastening tools.





Health and safety

Drop-firing safety

The drop firing safety mechanism prevents the tool from firing if dropped unintentionally. This mechanism is so designed that the tool, cocked or uncocked, will not fire when dropped at any angle onto a hard surface.

Trigger safety

The trigger in Hilti's DX- and GX-tools is uncoupled from the firing pin mechanism until the tool is fully compressed against the work surface. This mechanism ensures that pulling the trigger alone cannot cause the tool to fire.

Contact pressure safety

Hilti's direct fastening tools can only operate when pressed against the work surface. This requires a force of at least 50 N (5.1 kg, or 11.2 pounds). Tools with large base plates, such as DX 76 and GX 120, feature an additional surface contact pin that must also be pressed to allow the tool to operate.

Unintentional firing safety

Hilti's direct fastening tools will not operate unless first pressed against a work surface and then actioned using the trigger. This Hilti-designed feature ensures that no fastener exits a tool without the operator specifically intending it and focusing on the tool.

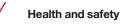












Powder cartridges and operator safety

EN16264 requires submitting each cartridge to overpressure tests in each of the tools for which it is intended. This ensures that the plastic collation strip is of adequate strength. EN16264 also defines the maximum amount of unburnt powder a cartridge may leave after combustion, as this residue may explode and cause injuries to the operators and to bystanders. Meeting this requirement is a prerequisite for CE conformity.

The Hilti cartridges come in packages that address all the norms mentioned above. Each package displays cartridge energy level, marking on US scale and on European scale, in addition to the CE marking and CIP logo, as in the following picture illustrated.



The identification and limitations of cartridge use in the U.S. are addressed in the ANSI/ASSE A10.3 norm.

Always review and follow the Operating Instructions in addition.





Gas cans and operator safety

Norms and standards relevant to gas cans include EN12205 and ISO 11118 as of 2018, which regulate the physical structure of gas cans. They also include the UN 1950 or UN 3150 norms, which define the conditions under which gas can shipping and distributing is considered safe. Regional regulations also apply depending on the operator's location: ADR/RID for Europe and ORM-D for the United States. All Hilti gas cans strictly abide by these norms.

To ensure that Hilti's gas cans are used in the appropriate conditions, each can features safety information in text and pictogram formats. In particular, it displays its expiry date, the maximum temperature it may exposed to, its pressure level, and the "Extremely flammable" logo. The enclosing package also displays this information, in addition to recommended storage conditions. And the accompanying leaflet provides the complete list of potential hazards associated with the gas can.

GC 42 for use with the Hilti GX 3 tool.

For professional use only. Strictly for intended use only. Read the operating instructions and the safety regulations before use Keep out of reach of children. See edge of can for expiration date and lot number. Extremely flammable gas. Contains gas under pressure; may explode if heated. Contains: Isobutane, Propene, Propane. Pressurized container: Do not pierce or burn, even after use. Protect from sunlight. Do not expose to temperatures exceeding 50°C/122°F. Do not spray on an open flame or other ignition Source. Keep away from heal/sparks/open flames/hol surfaces. — No smoking. Store the container in a well ventilated place Recommended storage temperature: 5°C to 25°C (41°F to 77°F).

GC 42 Gasdose zur Verwendung im Gerät Hilti GX 3.

tor v Couldande an evening in each. Berutzung ausschliesslich gemäss Verwendungszweck. Vor der Inbetriebnahme Bedierungsanteilung und die Sicherheitsvorschriften lesen. Darf nicht in die Hände von Kindem gelangen. Verfallsatum und Ablill-Lossliehe Dosernand. Ettrem entzindarbera giss. Enthält Base unter Druck, kann bei Erwärmung exploitierne. Enthält Autimitero serie dissentani. Catteri etilazionales das chief un del verie un del catalinari explorateret. Cumun Stabutan, Propen, Propat. Behalter setti unter Duck chietti durchistehen del verioremen, auti nichi nach del Veriendung. Vor Sonnenbestrahlung schützen und nicht Temperaturen von mehr als 50 °C/122° Raussetzen. Nicht gegen offene Flamme oder andere Zündquelle sprühen. Von HitzeFunkenförfleher Flammeheiten Deeffähen feminatien – Nicht nachen. Nur in gu gelüfteten Bereichen verwenden. Behälter an einem gut gelüfteten Ort aufbewahren. Empfohlene Lagertemperatur 5°C bis 25°C (41°F bis 77°F).

GC 42 nour système Hilti GX 3.

Usage réservé aux professionnels, uniquement dans le cadre d'une utilisation normale. Lire le manuel D'utilisation et toutes les instructions de sécurité avant utilisation. Terrir hors de portée des enfants. Bate d'expiration sur la bordure de la activance. Baz actrémement lindamable. Contentent un gaz soas pression, peut exploser sous réfet de la chaleur. Contenti: Isburdane, Propane. Récipient sous pression: ne pas perforer, ni brûter, même après usage. Protéger du rayonnement solaire. Ne pas exposer à une température suprénieure à 50 °C/122 °FN pas vaporiser sur une flamme neu os uur toute autre source d'ignition. Terrir à ficeart de la chaleur.Contentie source autre donce de sur de source. Ne pas fumer. Stocker les cartouches dans un andreib bieux envelles. Terrentemente sources donce donce 30 ~ 2462 °C / 416 ° un endroit bien ventilés. Température recommandée pour le stockage; 5°C à 25°C (41°F à 77°F).

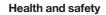


To enable the efficient tracking of any issue, the production lot number is also printed on each gas can and package.

The side illustration shows the typical graphical layout of a Hilti gas can.

The Hilti tools only operate with Hilti gas cans. This ensures that the tool receives gas in the right amount and composition, minimizing safety risks.





Noise-related operator safety

Hilti measures the noise its direct fastening tools emit as per the EN 15895 international standard to help operators and safety engineers plan the work in a way that minimizes risks. However, it should be noted that other ambient construction noises frequently compound with the tool's noise, which warrants additional precautions to protect operators. As a general rule, operators should always wear ear protection when operating the tools.

Vibration-related operator safety

Hilti direct fastening tools are not considered to produce vibrations as defined in international standards. However, as a precautionary measure, it is recommended to use the weakest possible cartridges to perform any given task, as well as to follow the instructions contained in the IFU.

Promoting operator safety through signaling and documentation

To ensure the safety of the operator and of bystanders, it is essential to follow the instructions contained in the Operating Instructions. Safety measures are also featured on pictograms inside the product carrying cases and on the consumables.



Hilti also covers safety measures as part of the operator training modules its local offices offer. The operators completing training receive a certificate of completion and/or an operator ID as required by local regulations. In some countries, the operators also get access to online material that serves as a refresher.



The safety of a fastening point depends for a good part on the manufacturer correctly anticipating the conditions in which its tools and fasteners will be used on jobsites. This involves:

engineering and testing fastening systems within the framework of specific applications
 ensuring that the finished products strictly match their technical specifications
 ensuring that the fastening work on jobsites is performed as it is intended to be

Engineering and testing

Sources of information about the engineering and testing of a fastening system include the manufacturer's technical literature, official approvals and publications in technical journals. Hilti provides all of these for its products.

The use of a non-Hilti fastening system by an operator should be made contingent upon proof that the fastening system has been engineered and tested for the application the operator intends to perform.

Finished product quality

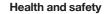
It is important that the manufacturer have a production quality control system. This is necessary for ISO 9001 certification. All Hilti production facilities are 9001 certified.



Health and safety







3.3 Quality of installation

Hilti contributes to the quality of the fastening work in the four following ways:

 It provides application guidelines.
 It provides technical advisory services.
 Each box of nails designed and/or approved for specific applications comes with a plastic gauge enabling the operator to check if the nail's stand-off on the base material is within the acceptable margin
 It manufactures devices enabling the tensile testing of fasteners. Threaded studs and certain decking fasteners can be tested in their final position on a jobsite.
 Other fasteners can be tested using a pull-over test specimen.



Checking the standoff of an ENP2 roof deck fastening with a plastic gauge



Pull-out test of an ENP fastening with a HAT28 tester and X-ENP adapter



Health and safety

As construction professionals demand fastening systems that are dependable without question, Hilti integrates functional reliability into the development, manufacturing, selling and servicing of its fastening systems. It does so paying particular attention to the reliability level required of each system, and the conditions in which it will be used.

During the development phase, Hilti engineers test the reliability of prototypes and system components regularly. In the plant, quality controls take place throughout the manufacturing process to ensure that the products are produced according to specifications.

When the first pilot production lots are delivered, contractors test them on jobsites. Adequate performance by the pilot production lots ensures that the products will be of good quality when massproduced.

Hilti's sales staff gets trained to be in a position to advise customers on which system to use for their application, demonstrate how to use tools, and warn them about potential hazards.

Finally, Hilti's highly skilled tool repair and maintenance staff ensures that the fastening system functions optimally over the long run.







4. Corrosion

For decades, Hilti is concerned about corrosion of fastening systems and has gained a lot of experience in this area based on laboratory- and field tests. Extensive testing and research are conducted in test facilities of Hilti Corporate Research department, located around the world in different climate zones.

Hilti strives to provide the best possible

support to customers for selecting the right product for safe and reliable fastening solutions.

This chapter gives an overview of corrosion protection solutions for Hilti Direct Fastening elements. More details on corrosion are described in the Hilti corrosion brochure "Corrosion handbook 2015".

4.1 Corrosion protection of direct fastening systems

Carbon steel fasteners are subject to corrosion (red rust) when exposed to humidity.

Zinc is the coating most commonly applied on fasteners. Humidity attacks it before it attacks the carbon steel core. Thanks to Zinc's electro-chemical properties, this produces white rust on the coating but delays the formation of red rust on the core material.

Zinc has different removal rates depending on the surrounding environment.

The lifetime of zinc-based protection against corrosion is a function of two parameters: the environment's aggressiveness and the zinc's thickness. Depending on the degree of anticorrosion protection required, additional layers of Zinc can be applied through passivation or organic topcoat.

Different variants of coating systems can be used to prevent fasteners from rusting. They are described in the following paragraphs.

Galvanic zinc coating:

This type of coating is generally suitable for environments with no corrosive potential. It is typically applied via an electrochemical process. Thicknesses up to 20 microns are possible, including passivation layer.

Hot dip galvanizing (HDG):

HDG is applied by dipping the parts to be protected against corrosion in a liquid zinc bath. The coating thickness can reach up to 80-100 microns, offering additional protection compared to galvanic zinc.



Duplex coating:

An alternative to hot dip galvanizing is duplex coating, i.e. the combination of a galvanic zinc layer with an supplemental reactive sealer the zinc in a first period. The equivalence in the protection offered by duplex coating and by HDG has been demonstrated on numerous occasions at Hilti test facilities around the world as well as at independent external labs. Duplex coating is applied to many Hilti grating fasteners, X-FCM-M.

Mechanical zinc plating:

Another alternative to hot dip galvanizing is mechanical plating. In this process, the zinc layer is built from zinc powder that is mechanically pressed onto the surface of the parts to protect. The equivalence in the protection offered by mechanical zinc plating and by HDG has been demonstrated on numerous occasions at Hilti test facilities around the world as well as at independent external labs.

Mechanical plating is applied on some Hilti nails and pins used in direct fastening.

Hydrogen embrittlement:

Hydrogen embrittlement is a specific corrosion phenomenon of zinc plated DX fastening elements, which will occur if three different conditions are present simultaneously:

- High strength carbon steel (>1000 MPa)
- Presence of hydrogen
- Tensile stresses

The combination of these three parameters leads to a decrease in the material's ductility, which may cause a sudden fastener failure even under very low static load.

The strength of fasteners is a function of its design and of the acceptable load in each application. Therefore, it is important to control the presence of hydrogen in the fasteners to prevent embrittlement from occurring. There are two main sources of hydrogen for zinc plated fasteners:

- The production process (primary hydrogen embrittlement): Hilti's power actuated fasteners are thoroughly tested and controlled during the production process to prevent primary hydrogen embrittlement.
- The corrosion process in the application (secondary hydrogen embrittlement): When zinc plated, high-strength fasteners are used in wet atmosphere, hydrogen is formed by the chemical reaction of zinc and water and diffuses into the material. To avoid secondary hydrogen embrittlement during the service life of a fastener, it is essential to follow the recommended application conditions provided for each nail in Hilti technical documents.





Stainless steel

Stainless steel comes in many different types, each of which has different corrosion resistance properties. A stainless steel material used in a wrong environment can lead to pitting corrosion and, subsequently, sudden fastener failure. In such a situation, predicting a fastener's lifetime is not possible.

Hilti power actuated fasteners are manufactured using CR500 and 1.4462 material, similar to A4 (AISI grade 316), which offers high performance in a wide range of applications.

For higher corrosion requirements, fasteners made out of HCR (1.4529) material can be provided. The HCR (High Corrosion Resistance) material can be used in swimming pools and in road tunnels, where the performance of A4 material is not sufficient.

Stainless steel with pitting corrosion, e.g. A4 material used in a road tunnel



Suitable stainless steel used, e.g. HCR material used in a road tunnel



4.2 Fastener selection

Following table (next page) gives a general guideline of commonly-accepted applications in typical atmospheric environments. Suitability of fastening systems for a specific application can be significantly affected by localized conditions, including but not limited to:

- · Elevated temperatures and humidity
- · High levels of airborne pollutants
- Direct contact with corrosive products, commonly found in chemically-treated wood, waste water or salt water, concrete additives, cleaning agents, etc.





- Non-atmospheric corrosion like e.g. direct contact to soil, stagnant water
- Cyclical wetting
- Electrical current
- · Contact with dissimilar metals
- · Physical damage or wear

				Carbon steel		Stainless steel	
				Fastenel Galv. zinc coating	Duplex coating	CR500 or 1.4462 (A4, AISI 316)	HCR 1.4529
				Example X-ENP ¹⁾ ,X-U X-GHP	S X-FCM-M	X-BT, X-CR X-FCM-R	On demand
Environmental conditions Fastened part							
-		Dry indoor	steel (zinc coated, painted), aluminum, stainless steel, wood				
		Indoor with temporary condensation	steel (zinc coated, painted), aluminum, stainless steel, wood	Consult experts for exceptions			
+		Outdoor, non-safety relevant ²⁾	steel (zinc coated, painted), aluminum, wood				
	\leftrightarrow	Outdoor, rural or urban environment with low pollution	steel (zinc coated, painted)	_			
	>10 km		aluminum, stainless steel		Consult experts for exceptions		
+	1-10 km	Outdoor, rural or urban en- vironment with moderate concentration of pollutants and/or salt from sea water	steel (zinc coated, painted)		Consult experts for exceptions		
			aluminum, stainless steel		Consult experts for exceptions		
		Coastal areas	steel (zinc coated, painted), aluminum, wood				
. .	0-1 km	Outdoor, areas with heavy industrial pollution	steel (zinc coated, painted), aluminum, wood				
	0-10 m	Close distance to streets	steel (zinc coated, painted), aluminum, wood				
	Special applications	Road tunnels, indoor swimming pools, special applications in chemical industry	steel (zinc coated, painted), aluminum, wood			Consult experts for exceptions	

= expected lifetime of power actuated fasteners 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 power actuated fasteners is 25 years.

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

1) Outdoor exposure for up to 6 months during construction is permissible for high-strength electro-galvanized siding and decking fasteners such as the X-ENP (see instructions for use for details)

2) The reference to "non-safety relevant" is intended to distinguish applications where failure of the attachment will not create any potential safety risks or significant damage.



Remarks:

- 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 applications conditions.
- This table is based on an average service life for typical applications.
- For metallic coating e.g. zinc layer systems the end of life time is the point where red rust is visible over a large percentage of the product and widespread structural deterioration can occur the initial onset of rust will occur much sooner
- National or international codes, standards or regulations, customer and/or industry specific guidelines must be independently evaluated.
- These guidelines apply to atmospheric corrosion only. Other types of corrosion, such as crevice corrosion or stress corrosion cracking must be independently evaluated.

A typical service life of Hilti GX-WF nails in wood - wood connections is shown below:

Service Classes in accordance with EN 1995 (Eurocode 5):				Service Class 1,2		Service Class 1,2,3	
			No Corrosion Protection	Zinc coated	HDG	A2 ¹⁾	A4
+		Dry indoor	20 to 50 years	up to 50 years	up to 100 years		
		Indoor environments with temporary condensation	_	10 to 50 years	60 to 100 years		
+	>10 km	Outdoor with low pollution	_	5 to 20 years	40 to 100 years		
+	1-10 km	Outdoor with moderate concentration of pollutants	_	2 to 10 years	20 to 40 years		
+	0-1km	Coastal areas	-	up to 5 years	10 to 30 years	—	
+	laa	Outdoor, areas with heavy industrial pollution	_	up to 5 years	10 to 30 years	—	
+	*	Close distance to streets	_				
	Special applications	Special applications	Consult experts for exceptions				

The table above provides typically assumed service life estimations based on corrosion considerations. Other factors determining the service life of fasteners must be evaluated separately.

= expected lifetime of nails made from this material is typically satisfactory in the specified environment based on the typically expected lifetime of a building.

- = nails made from this material are not suitable for the environment or the typical lifetime of a building is not achieved.

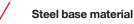
1) For nails made of A2 material, discoloration of nail heads can occur before the service life in the table above is reached. To avoid this, use A4 material.





Remarks:

- The use of certain wood species including, but not limited to, Oak, Douglas-fir or Western Red Cedar, require the use of stainless steel nails, independent of Service Class and environmental conditions.
- The use of certain wood treatments including, but not limited to, fire retardants or preservatives can change the chemical composition of the wood and may require the use of stainless steel nails, independent of Service Class and environmental conditions.
- The evaluation of corrosive environmental conditions depends on many factors and lies within the responsibility of the customer. The planned service life of the buildings or structures can be considered according to local or national building regulations and Eurocode (EN 1990)
- The table does not contain recommendations and Hilti does not assume liability for fastener selection based on its content.
- For the typical service life, it is assumed that the nails are selected, designed, installed and otherwise treated in accordance with Hilti's published literature.
- Local building regulations and trade rules may differ from the table above. The local jurisdiction always needs to be followed.
- Wood to steel connections may require a minimum corrosion protection, independent of the environmental conditions.





5. Steel base material

5.1 Anchoring mechanisms

The following four mechanisms cause a fastener to hold when driven into steel:

- clamping
- keying
- fusing (welding)
- soldering

These mechanisms have been identified and studied by analyzing pull-out test data and by microscopic examination of fastening cross-sections.

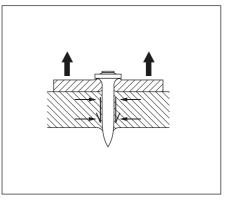
Clamping

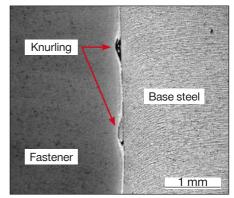
As a fastener is driven, the steel is displaced radially and towards both the entry and opposite surfaces. This results in residual pressure on the surface of the nail, which leads to friction or clamping. Clamping is the primary anchoring mechanism of throughpenetrating fasteners. This is indicated by the fact that when through-penetrating fasteners are extracted, the pull-out force decreases only slowly over several millimeters of displacement.

Keying

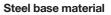
The keying mechanism is possible when the fastener is knurled, that is, it has fine grooves along the shank in which zinc and particles of base steel accumulate during the driving process. Microscopic examination of cross sections has shown that the grooves are not completely filled. Keying is an especially important anchoring mechanism for fasteners that do not penetrate right through the base material.









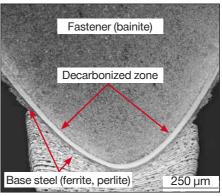


Fusing (welding)

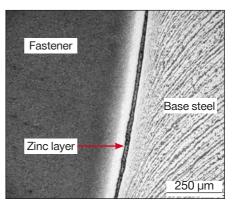
Complete fusing of the fastener with the base steel is indicated by portions of base material clinging to the extracted fastener. Fusing or welding is observed mostly at the point of a fastener where the temperature during driving can be expected to be the highest. For fasteners that do not through-penetrate, this is an important anchoring mechanism. It can be relied upon only if the fastener point is manufactured without cracks and with an appropriate geometry. The thermo pulling process is ideal for achieving an optimized geometry. Control of all steps in the production process is necessary to avoid

Soldering

In the zone further from the point, there is a prominent zinc layer separating the fastener from the base steel. This zinc, soldered to the base steel, also makes a contribution to the pull-out resistance of the fastener.



cracks in the point.



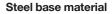
Blunt-tipped fastener X-BT family

The X-BT fastener with a shank diameter of 4.5 mm is driven in a pre-drilled 4.0 mm diameter hole. This leads to displacement of the base material. Part of the base steel is punched down into the pre-drilled hole, generating high temperatures and causing friction welding. Due to elasticity of the base steel, additional clamping effects are also superposed.

Displaced base material can be clearly seen in the photograph. Base material adhering to the fastener shank indicates a welding effect.







5.2 Factors influencing pull-out resistance

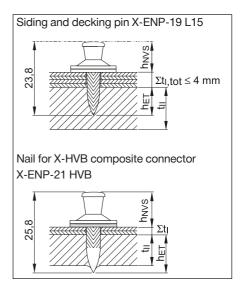
Powder-actuated fastening systems must be designed and manufactured to ensure that pull-out resistance will be adequate for the applications intended. Through understanding of the anchoring mechanisms, experience and testing, factors that influence pull-out strength have been identified. Some of these factors are:

- Depth of penetration in the base material
- Surface characteristics of the fastener
- Coatings on the steel base material
- Driving velocity
- Diameter of the fastener shank

Depth of penetration in the base material The depth of penetration of fasteners in steel is taken as the distance that the point travels below the surface of the base steel, independent of the steel thickness. In other words the depth of penetration h_{ET} can be greater than, equal to or less than the steel thickness.

Resistance to pull-out increases with increasing depth of penetration. This is also true for through-penetrating fasteners where h_{ET} is greater than the steel thickness. The design of a powder-actuated fastener has to take into account the depth of penetration necessary to achieve the pull-out resistance required for the application. Application guidelines published for any fastener include the required nail head stand-off h_{NVS} , which corresponds to the penetration depth.

Knowledge of the influencing factors is vital to the design of fastening systems and is useful for operators in understanding the various application guidelines and restrictions that apply to a fastening system. Some of the influencing factors are discussed in the following section.

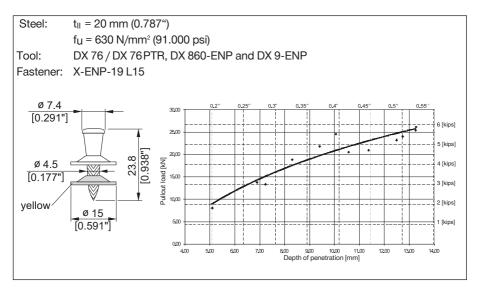




Guide values for the depth of penetration of specific fastener types are as follows:

Galvanized fastener with knurled shank:	h _{ET} = 12 to 18 mm	(shank diameter 4.5 mm)
	h _{ET} = 10 to 14 mm	(shank diameter 3.7 mm)
Galvanized fastener with knurled tip:	h _{ET} = 9 to 13 mm	(shank diameter 4.5 mm)
Galvanized fastener with smooth shank:	h _{ET} = 15 to 25 mm	
Stainless steel fastener with smooth shank:	h _{ET} = 9 to 14 mm	
Blunt-ended fasteners:	$h_{ET} = 4 \text{ to } 5 \text{ mm}$	

The effect of penetration depth on pull-out strength can be demonstrated in experiments in which the driving energy is varied so as to produce varying penetration. The results of a test of this kind are summarized below. The application recommendations for fasteners are based on tests like these and they clearly show the importance of carrying out the fastening installation in accordance with the recommendations of the manufacturer.



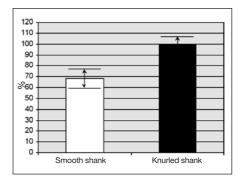


Steel base material

Knurling on the fastener shank

Fasteners for use in steel base material usually have knurling on the shank so as to improve the resistance to pull-out. The effect of the knurling was shown in a test with fasteners that had knurled and unknurled shanks, but were otherwise the same.

The benefit of knurling is clearly seen from the test results. With virtually the same penetration (actually 106 %), the smoothshank fastener had only 68 % of the pull-out strength of the knurled-shank type. Even with the penetration increased to 137 %, the pull-out strength was still only 81 % of that of the knurled-shank fastener. In this test, the steel thickness of 10 mm (0.394") allowed through penetration of the steel. If the steel is too thick for through penetration, the beneficial effect of knurling becomes even more pronounced.



Zinc coating on the fastener shank

Zinc on a fastener shank appears to act as a lubricant that reduces its resistance to penetration into steel. Reduced pull-out strength is the result, because the lower resistance means less heat is generated, thus reducing the welding effect between the shank and the base steel. This was shown in an experiment with fasteners that were identical except for the thickness of zinc coating.

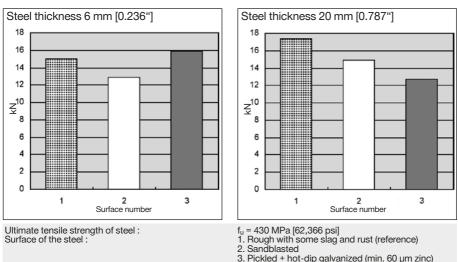
Steel base ma	terial: t _{II} = 2	t _{II} = 20 mm [0.787"],					
	f _u = 4	40 MPa [63,8 [.]	17 psi]				
Zinc	Average penetratio	n	Average ultimate p	ull-out load	Variation		
thickness	h _{ET}	<u>.</u>	N _{u,m}	24	CV		
in mm	mm / [in.]	%	kN / [kip]	%	%		
ca. 10	12.12 [0.477]	100	8.53 / [1.918]	67	25.6		
2–5	11.86 [0.470]	98	12.82 / [2.882]	100	9.3		

Although driving the fastener through sheet metal, as is the case when fastening siding and decking, reduces the negative effect of zinc coating on pull-out strength, the reason for tightly controlling the galvanization process is clear.



Surface of the steel base material

Corrosion protection of structural steel is often achieved by hot-dip galvanizing. Tests have shown that if the fastener penetrates right through the steel, the galvanizing has no significant effect on pull-out strength. In the case of fasteners that do not through-penetrate, pull-out strength is reduced by about 25%. The summary of results from one test is shown below to illustrate these effects.

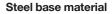


Average ultimate pull-out loads

Several important observations can be made based on these results:

- Pull-out loads in 6 mm (1/4") steel base material are much less affected by the surface condition of the steel than they are in 20 mm (3/4") steel. The reason is that the main anchoring mechanism of through-penetration fastenings is clamping, which is not affected by the surface condition of the steel.
- Hot-dip galvanizing appears to reduce the pull-out strength of non-through-penetrating fastenings by nearly 30%. Note, however, that even with hot-dip galvanizing, the pull-out strength was still 12.5 kN (2.8 kips).
- The negative effect of hot-dip galvanizing is explained by the tendency of zinc on the fastener to act as a lubricant that reduces heat generation during driving. This in turn reduces the tendency of the fastener point to fuse to the base steel. Zinc from the coating on the base steel apparently becomes attached to the fastener as it enters the base steel.
 For applications where tensile strength of the fastening is critical and the steel has a heavy coating, the fastening system can be qualified by carrying out pull-out tests on site. If pullout strength is not adequate, depth of penetration can be increased to improve the situation.



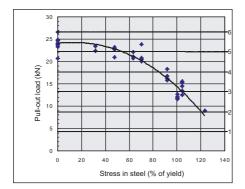


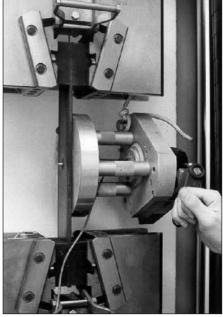
Tensile stress in the steel

The integrity of a powder-actuated fastening is dependent on a relatively smooth pin remaining anchored in structural steel. A large amount of test data, technical assessments, approvals and practical experience with powder-actuated fastenings is available to support use of powder-actuated fastening. Performance of fasteners anchored in the steel under tension was investigated by driving fasteners into unstressed steel plates and extracting them with the plates stressed in tension. The steel plates measured 6x80x455 mm [0.236" \cdot 3.15" \cdot 17.9"] and possessed two different yield stresses - 328.6 MPa [47.7 ksi] and 411.7 MPa [59.7 ksi].

By expressing the steel stress in terms of % of actual yield, it was possible to combine the data for both steel grades and obtain a reasonable curve fit.

Of significance to the designer is the expected decrease in pull-out strength of the fastener at a typical maximum allowable design stress of 60 to 70% of yield. At this stress, the pull-out strength reduction is less than 15%. The absolute value in the experiment was still greater than 2 tons.



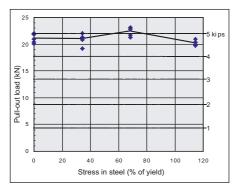




Compressive stress in the steel

Compressive stress in the base steel has no influence on the pull-out strength of the fastener. This was demonstrated by placing fasteners in unstressed 15 mm [0.59"] thick steel plates having a yield strength of 259.3 MPa [37.6 ksi] and extracting them while the plates were compressed in a testing machine.

The minimal variation in pull-out load is simply random variation experienced in testing.



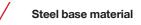


5.3 Suitability of the steel for fastening

There are three main factors determining the suitability of a construction grade steel member for DX fastening:

- Steel thickness
- Ultimate tensile strength
- · Flexibility of the base steel member



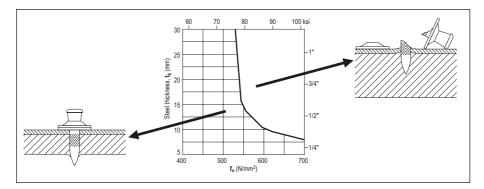


5.4 Application limit diagrams

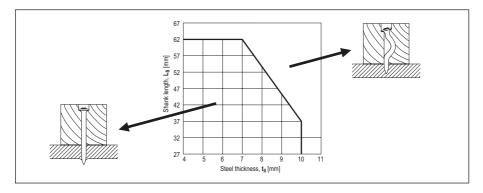
The application limit of a fastening system is a term applied to a combination of the maximum thickness t_{II} and ultimate tensile strength f_u of steel in which fastenings can be made. There are two general types of application limit diagrams:

- Short fasteners (e.g. siding and decking nails and threaded studs)
- · Long fasteners (e.g. nails used to fasten wood to steel)

The application limit line for a short fastener is a plot of steel thickness versus ultimate tensile strength. In situations represented by steel thickness / ultimate tensile strength combinations above and to the right of the line, some of the fasteners may shear off during driving. The failure surface will be roughly at a 45° angle to the shank length.



The application limit lines for long nails used to fasten wood to steel are plots of nail shank length L_s versus steel thickness t_{II} . Each line is valid only for one ultimate tensile strength of steel f_u . Attempts at working to the right of the limit line result in buckled nail shanks.

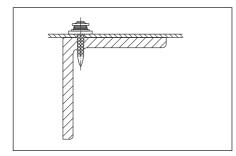


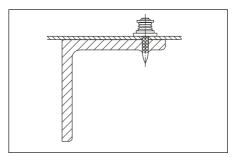




5.5 Thin steel base material

In the context of powder-actuated fastening, steel is considered thin when flange deformation during driving dominates fastener design. When the steel flange is thinner than about 6 mm [0.25"], flange deformation makes use of fasteners with a 4.5 mm [0.177"] shank diameter more difficult and switching to a 3.7 mm [0.145"] shank fastener leads to better results. Use of fasteners with tapered shanks and energy-absorbing washers improves performance and reliability.

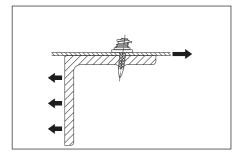


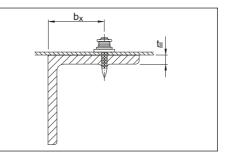


A fastener can penetrate into steel only when the steel (flange) develops a resistance greater than the force required for penetration. This implies the use of energy in excess of that required for penetrating into the steel. In fact, if the driving energy remains constant, fasteners placed closest to the web will be driven deepest. All siding and decking fasteners should have a mechanism to clamp the sheets down tightly over the entire range of allowable standoffs. This is especially critical for fasteners used for fastening to thin steel.

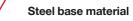
Obviously, under shear loading, failure of the base material is more likely with thin steel than with thick steel. When approving fastening systems for a project, it is important to consider whether the system has actually been tested with thin base steel or not.

Hilti's general recommendation for thin base steel fasteners is to place the fastenings within $b_x = 8 \cdot t_{II}$ of the web.









5.6 Types of load and modes of failure

5.6.1 Shear loads

The shear loads acting on siding and decking fasteners come from:

- · Diaphragm action of the fastened sheets
- · Forces of constraint (for example due to temperature changes)
- · Self-weight of siding material

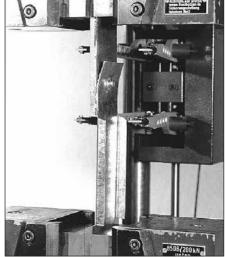
Testing

Shear testing of siding and decking fastenings is done using specimens made up of a strip of sheet metal fastened to a steel plate. Suitable, non-slip fixtures have to be used at either end. In some cases specimens are bent up at the sides to hinder eccentricity.

Failure of the fastened material

The load-deformation curves of shear tests with powder-actuated fasteners show a nearly ideal behavior. After an initial elastic phase during which the clamping force of the washers against the sheet metal is overcome, the sheet metal reaches its yield stress in an area where the fastener bears against it. Then the fastener shank cuts through the sheet metal until the end of the sheet is reached. The large area under the load-deformation curve represents energy absorbed, and this is what makes the fastening method ideal for diaphragms.







Steel base material

Failure of the base steel

If the thickness of the fastened sheet metal is large compared to the base steel thickness, bearing failure of the base material is a possible mode of failure.

Pull-out from the base steel

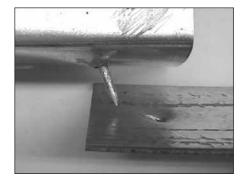
The unavoidable eccentricity in the shear test specimen leads to a tensile load component on the fastener. Thick fastened material and thin base material is also involved in this mode of failure. This failure mode is generally not governing for base material thickness of $t_{II} > 6$ mm.

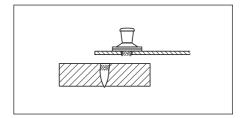
Fracture of the fastener

About 20 kN (4.5 kips) of force is required to shear the Ø 4.5 mm (0.177") shank of an X-ENP-19 L15 fastener. With about 2.5 mm (12 gauge) thick steel sheet as fastened material, a force of this magnitude could be possible. The force needed to break a Ø 3.7 mm (0.145") shank of an X-ENP2K-20 L15 fastener is about 13 kN (2.9 kips). This force can be generated with 1.5 mm (16 gauge) sheet steel. In practice, this failure mode is likely only where expansion joints are not provided to relieve forces of constraint from temperature differences.

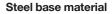
5.6.2 Tensile loads

The most common source of tensile loading on siding and decking fasteners comes from wind suction acting on the roof or wall cladding. In diaphragms, fasteners can be subject to tensile loads in situations where the combination of geometry and thickness of decking fastened leads to prying. In designs with very stiff decking and wide beams or unbalanced spans, prying can also be caused by concentrated loads.





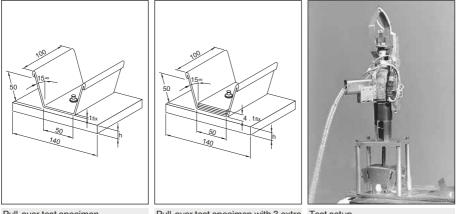




Testing

Tensile testing of siding and decking fastenings is carried out using specimens made up of a trapezoidal-shaped piece of sheet metal fastened to a steel plate. Suitable, vice-like fixtures are used to grip the specimen. This is often referred to as a pull-over test because the common failure mode is the sheet pulling over the washers or the head of the fastener. If the sheet thickness fastened is increased so that pull-over does not govern, pull-out will be the failure mode.

Some fasteners like the Hilti X-ENP have a head that can be gripped and pulled out by a suitable fixture. With these fasteners, a pull-out test can still be done even if pull-over is the original mode of failure. This fastener type has the further advantage of allowing in-place fasteners on a jobsite to be tested.



Pull-over test specimen

Pull-over test specimen with 3 extra Test setup layers to simulate end lap - side lap

Sheet pull-over

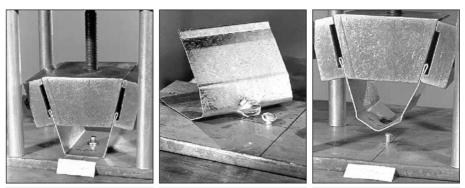
In this failure mode, the sheet tears and is lifted up over the fastener head and washers. Depending on the sheet thickness and tensile strength, the washers may be bent up.

Washer pull-over

Another possible failure mode is that of the washers being pulled up over the head of the nail. Obviously, this happens when the sheet is somewhat stronger and /or thicker than when sheet pull-over occurs. This failure mode is also heavily dependent on fastener design.







Pull-over test specimen at test start Sheet pull-over

Washer pull-over

Pull-out from the base steel

As sheet thickness and number of layers is increased, this failure mode becomes more likely. For a properly driven **X-ENP-19 L15** pull-out from the base steel is not a likely mode of failure. The head and washer design of the **HSN 24** or **X-ENP2K-20 L15** fasteners can allow this failure mode, especially with multiple layers of sheets.

Fracture of the fastener

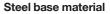
A force of more than 30 kN [6.7 kips] is required to break the Ø 4.5 mm [0.177"] shank of an **X-ENP-19 L15** fastener and, even if sheet or washer pull-over does not govern, pull-out strengths of this magnitude are not very common. This mode of failure will therefore hardly ever occur with these heavy-duty fasteners. The Ø 3.7 mm [0.145"] shank of an **X-HSN 24** or **X-ENP2K-20 L15** fastener may break at about 20 kN [4.5 kips] tension. Since these smaller fasteners will pull out at a force of 8 to 15 kN [1.8–3.3 kips], fractures due to tensile loads are rare. If fractured fasteners of this type are found on a jobsite, the most likely cause is that the application limit has been exceeded (the base steel is too hard and/or too thick for the pin).

Cyclic loading

Siding and decking nails used in wall and roof construction are subject to cyclic loading from wind suction. Cyclic load testing is carried out to determine characteristic resistance and allowable (recommended) loads. The requirements of the European Technical Assessment ETA prepared by DIBt (Deutsches Institut für Bautechnik) govern the design-relevant number of load repetitions (5,000) and the necessary safety factors. Notes in this regard are found on the corresponding product data sheets.

If the fastener will be subjected to a large number of load repetitions and fatigue, we recommend carrying out a design check according to the requirements of Eurocode 3 (or similar



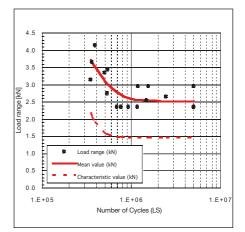


code). Eurocode 3 gives the characteristic fatigue resistance and safety concept for steel construction. To carry out the check according to Eurocode 3 it is necessary to have a statistical analysis of test data obtained under the application conditions. Except for siding and decking fasteners, the applicable product data sheets limit the validity of recommended loads to predominantly static loading. If a design analysis has to be carried out for true fatigue loading, test data can be obtained from Hilti. Examples of such data are shown below.

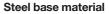
X-EM8-15-14

(standard zinc-plated fastener)

The X-EM8-15-14 has a shank diameter of 4.5 mm and a hardness of HRC 55.5 (f_u = 2,000 MPa). The Δ **F**-N diagram shows the load range ΔF for a lower load of 0.05 kN. The individual test results are displayed as points and the curves show average and characteristic (95% survival probability) values. The failure mode was shank fracture or fracture in the M8 threading. The recommended load for predominantly static loading is 2.4 kN. Comparing this value to the $\Delta \mathbf{F}$ -N diagram will lead to the conclusion that X-EM8-15-14 fastenings designed for 2.4 kN static loading will survive a large number of load repetitions. The fastenings can be said to be robust, even when the actual loading turns out to be in part cyclic.







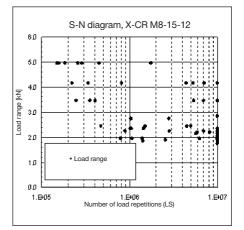
X-CRM8-15-12 (stainless steel fastener)

The X-CRM8-15-12 has a shank diameter of 4.0 mm and a minimum ultimate tensile strength of 1,850 MPa. The Δ **F**-N diagram shows the load range Δ **F** for a lower load of 0.05 kN. The individual test results are displayed as points. The failure mode was shank fracture or fracture just below the head of the stud.

The recommended load for predominantly static loading is 1.8 kN. Comparing this value to the Δ **F**-N diagram will lead to the conclusion that X-CRM8-15-12 fastenings designed for 1.8 kN static loading will survive a large number of load repetitions. The fastenings can be said to be robust, even when the actual loading turns out to be in part cyclic.

Mode of failure under cyclic loading

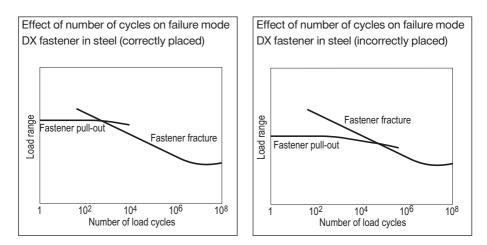
A major finding of cyclic loading tests is that the strength of a DX fastening subject to cyclic loading is not limited by failure of the anchorage. It is only when the number of cycles is very low - i.e. predominantly static loading - that nail pull-out is observed. The two schematic diagrams below show the relationship between failure mode and number of cycles. All tests show that the anchorage of DX fasteners in steel and in concrete is extremely robust with regard to resisting cyclic loading. Fasteners subject to a large number of load repetitions fracture in the shank, head or threading. A condition for obtaining this behaviour is that the fasteners are correctly driven. Fasteners that are not



driven deeply enough exhibit low pull-out strength and in a cyclic loading test may not necessarily fail by fracture.







In older product information and data sheets, this basic suitability of DX fasteners for cyclic loading was emphasized by defining the recommended loads as cyclic recommended loads. At the time that this product information was assembled, a true safety concept for a strict check of DX fastenings subject to fatigue loading was not available. With Eurocode 3, this is today available. If a fatigue design analysis is carried out, it is important – as with static design – that adequate redundancy be provided.

Failure of the sheet

In cyclic load tests, failure of the steel sheet itself is common.







5.7 Effect of fasteners on structural steel

Driving powder-, gas-, or battery-actuated fasteners into a steel member does not remove steel from the cross-section, but rather displaces steel within the cross-section. It is therefore not surprising that tests like those described in following sections show that both drilled holes and screws, either self-drilling or self-tapping, reduce the strength of a cross-section more than powder-actuated fasteners.

The results of the tests can also be used to show that it is conservative to consider a powder-actuated fastener as a hole. This allows the effect of fasteners in a steel member subject to static loading to be taken into consideration.

Fatigue seldom needs to be considered in building design because the load changes are usually minor in frequency and magnitude. Full design wind and earthquake loading is so infrequent that consideration of fatigue is not required. However, fatigue may have to be considered in the design of crane runways, machinery supports, etc. The S-N curves resulting from fatigue tests of steel specimens with fasteners installed are also presented.

5.7.1 Effect on the stress-strain behaviour of structural steel

The effect that powder-actuated fasteners (PAF's) have on the stress-strain behaviour of structural steel was investigated in a systematic test programme using tensile test specimens containing PAF's, self-drilling screws and drilled holes. A control test was carried out using specimens without any holes or fasteners.

Series A:

- ASTM 607, grade 50
- Cross-section 3.42 x 74 mm [0.135 x 2.913"]
- X-EDNK22 powder-actuated fasteners, shank diameter 3.7 mm [0.145"]
- Drilled holes, diameter 3.7 mm [0.145"]
- Self-drilling screws, shank diameter 5.5 mm [0.216"]

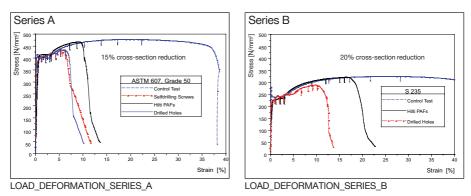
Series B:

- S235 and S355 steel
- Cross-section 6 x 45 mm [0.236 x 1.772"]
- Powder-actuated fasteners, shank diameter 4.5 mm [0.177"]
- Drilled holes, diameter 4.5 mm [0.177"]

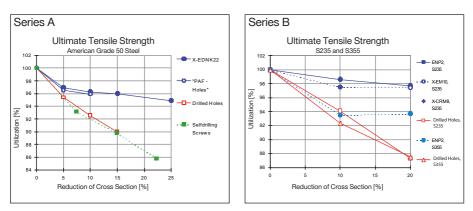


Steel base material

The figures below show representative stress-strain curves for the tests (the plotted stress is based on the gross cross-section). Note that the line for the powder-actuated fasteners follows the control test line more closely than the lines for drilled holes or self-drilling screws.



The test results were evaluated in terms of utilization as a measure of ultimate strength. Utilization is the ultimate load of a sample expressed as a percent of the ultimate load of the control test.



Graphs of the utilization versus cross-section reductions show that:

- The utilization for PAFs is clearly better than that of drilled holes or self-drilling screws.
- The hole left by a removed PAF has the same effect as when the PAF is left in place.
- Increasing the number of PAFs across a section from one to two or more has a proportionally smaller effect on utilization than placement of the first fastener.

More detailed information on the test program and findings is published in the paper





Powder-actuated fasteners in steel construction (and the referenced literature), published in the STAHLBAU-Kalender 2011 (Publisher Ernst & Sohn, 2011, ISBN 978-3-433-02955-8). English Reprints of the paper can be distributed per request.

5.7.2 Effect on the fatigue strength of structural steel

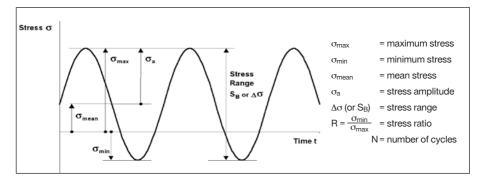
During the late 1970s and early 1980s, a fatigue testing program consisting of 58 tests with over 1,100 specimens was carried out at the University of Darmstadt in Germany. The reason for the research at that time was to support the use of powder-actuated fasteners for attaching noise-dampening cladding to railway bridges in Germany.

Parameters investigated in those tests are shown in following table:

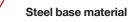
Steel grade	Steel thicknesses	Stress ratio R	Imperfections
S 235 (St 37) /	6, 10, 15, 20,	0.8, 0.5, 0.14,	Fastener:
A36	26.5, 40, 50 mm	-1.0, -3.0	- installed and pulled out,
S 355 (St 52) /	[0.236, 0.394, 0.591,		- inclined installation and pulled out
grade 50	1.043, 1.575, 1.969"]		- inclined installation

Loading conditions

The terminology and notation is shown in the illustration below.

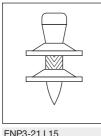






Fasteners tested

The primary fastener used in the tests was the Hilti ENP3-21 L15, the forerunner of the ENP2-21 L15. The difference is in the head shape, which has no effect on interaction with the base steel. Tests were also performed with the ENP2-21 L15, ENP3-21 D12 and the EM8-11-14 threaded stud, all of which have 4.5 mm diameter knurled shanks.



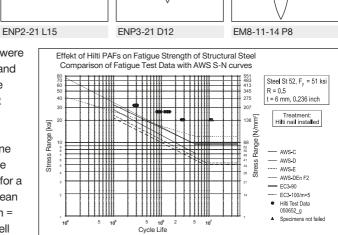






The results of the tests were evaluated by Niessner and Prof. T. Seeger from the University of Darmstadt in accordance with the provisions of Eurocode 3. An example plot of one test series is given at the right. The graph allows for a comparison with European fatigue categories 90 (m = 3) and 100 (m = 5) as well as American categories

according to AWS-provisions.



Conclusions

- The effect of driving a Hilti powder-actuated fastener on the fatigue strength is well known and predictable.
- The constructional detail "Effect of powder-actuated fasteners on base material" (unalloyed carbon steel) was evaluated by Niessner and Seeger from the University of Darmstadt in compliance with Eurocode 3.
- The EC 3 detail category 90 with m = 3 or the detail category 100 with m = 5 is alternatively applicable.
- Wrong fastener installations as popped out or inclined fasteners are covered. Piston marks in the base material due to wrong use of the tool without a fastener or notches due to fasteners failed during the installation have to be removed by appropriate measures.





More detailed information on the evaluation of the test data and the test program is published in the paper "Fatigue strength of structural steel with powder-actuated fasteners according to Eurocode 3" by Niessner M. and Seeger T. (Stahlbau 68, 1999, issue 11, pp. 941-948).

English reprints of this paper can be distributed per request.



6. Concrete base material

6.1 Anchoring mechanisms

The following three mechanisms cause a powder-actuated fastener to hold in concrete:

- Bonding / sintering
- Keying
- Clamping

These mechanisms have been identified and studied by analyzing pull-out test data and by microscopic examination of pulled-out fasteners and the concrete to fastener interface.

Bonding / sintering

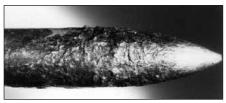
When driving a fastener into concrete, the concrete is compacted. The intense heat generated during driving causes concrete to be sintered onto the fastener. The strength of this sintered bond is actually greater than that of the clamping effect due to reactive forces of the concrete on the fastener. The existence of the sintered bond is demonstrated by examining pulled-out fasteners. The fastener surface, especially in the region of the point, is rough due to sintered-on concrete, which can only be removed by using a grinding tool. When performing pull-out tests, the most common failure mode is breakage of the sintered bond between the concrete and the fastener, especially at and near the point.

Keying

The sintered material forms ridges on the fastener surface. These ridges result in a micro-interlocking of the fastener and the concrete.

This anchoring mechanism is studied by examining pulled-out fasteners under a microscope. As in the case of sintering, keying is primarily active in the region of the fastener point.





Mechanically cleaned point of a pulled-out DX fastener



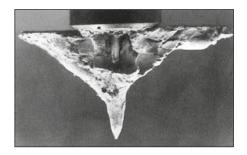
Concrete base material

Clamping

The compressibility of concrete limits the buildup of compressive stress around the driven fastener. This in turn limits the effectiveness of clamping as an anchoring mechanism.

Concrete failure

Concrete cone failure is occasionally observed when using a testing device with widely spaced supports. The fact that the concrete failed indicates that the fastener bond to the concrete was stronger than the concrete. The tendency of stressed concrete to relax further reduces the compressive stress and hence the clamping effect. For these reasons, clamping of the fastener shank contributes only insignificantly to the total pull-out strength.







6.2 Factors influencing resistance to pull-out

Factors that can affect the pull-out strength of fastenings to concrete include:

- Depth of penetration into the concrete
- · Concrete parameter (compressive strength, grain structure, direction of concrete placement)
- Distance to concrete edge and fastener spacing

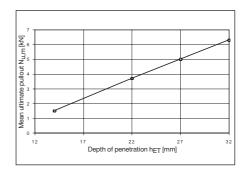
Depth of penetration hET

Fasteners that are driven deeper typically have a higher resistance to pull-out. This relation is best shown by placing groups of fasteners with different driving energy and comparing the results for each group with the others. The result of such a test is shown in the graph at the right. Note that fastener driving failures were not considered in calculation of the average ultimate load, $N_{u,m}$.

The value of increasing the depth of penetration in order to increase pull-out strength is limited by the increasing fastener driving failure rate. Provided that the penetration depth is the same, fastenings in concrete with a higher compressive strength hold better than fastenings in lower strength concrete. The ability to exploit this

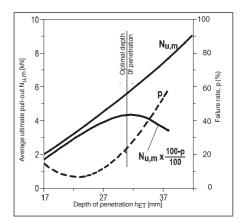
Pull-out strength and fastener driving failure rate both increase with increasing penetration depth. The optimum depth of penetration is taken as the depth at which the yield in terms of pull-out strength begins to decrease. This is within a range of 18–32 mm depending on the grade and age of the concrete as well as the strength of the fastener.

yield =
$$\mathbf{N}_{u,m} \cdot \left(\frac{100 - \mathbf{p}}{100}\right)$$



characteristic is also limited by increased fastener driving failure rate with higher strength concrete.

As could be expected, the depth of penetration at which the failure rate is at a minimum decreases with increasing concrete strength.



Concrete base material

Concrete parameters

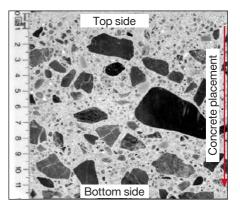
The concrete parameters (such as the type and size of concrete aggregates, type of cement and the location on top or bottom surface of a concrete floor) do affect the fastener driving failure rate, sometimes significantly.

Fastener driving failures are caused by the fastener hitting a hard aggregate, such as granite, located close to the concrete surface. A hard aggregate can deflect the fastener and in a severe case, the fastener may bend excessively,

Overhead fastening is usually associated with a higher rate of fastener driving failure than floor fastening. This is due to the distribution of the aggregates within the concrete. Large aggregates tend to accumulate at the bottom of a floor slab. At the top, there is a greater concentration of small aggregates and fines. leading to concrete fracture in a cone shape and no hold being obtained by the fastener.

In case of slight fastener bending, concrete spalling may occur at the surface. However, because pull-out strength is obtained mostly in the area of the fastener point, concrete spalling has little effect on the permissible load of the fastening.

Softer aggregates such as limestone, sandstone or marble may be completely penetrated when hit by the fastener.



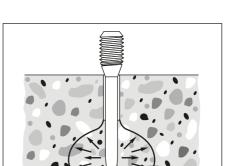


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There are several possible ways of reducing the failure rate when powderactuated fasteners are used for fastening to concrete. There are two basic ideas:

Pre-drilling the concrete (DX-Kwik)

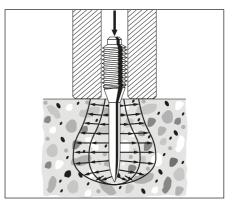
By pre-drilling a very small hole (5mm diameter, 18 or 23 mm deep), the stresses are relocated to greater depth in the concrete. Fasteners placed with DX-Kwik are surrounded by a stress "bulb" located deep in the concrete. With this method, virtually no fastener driving failures occur. one is to reduce concrete tensile stresses near the surface and the other is to delay the effect of these stresses.



Spall stop fastener guide

A spall stop is a heavy steel fastener guide. Its weight and inertia counteract the stresses at the surface for a very short time. This allows redistribution of the stresses to other parts of the concrete.

Changing from a long to a short fastener reduces the magnitude of the stresses and thus improves stick-rate.







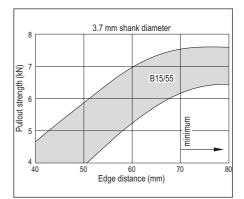
Concrete base material

Edge distance and fastener spacing

If fasteners are placed too close to the concrete edge, pull-out load capacity will be reduced. Minimum edge distances are therefore published with a view to reducing the effect edges have on pull-out strength. The corresponding data has been obtained from tests.

Additional provision is made for fastener spacing when positioned in pairs or where fasteners are placed in rows along a concrete edge.

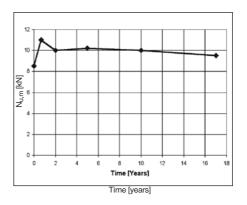
These edge distances and spacing also have the purpose of helping to prevent concrete spalling and/or cracking due to fastening. However, spalling has generally only an insignificant influence on pull-out strength.



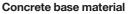
6.3 Effect of time on pull-out resistance

The effect of age on pull-out strength has been investigated in comprehensive tests. The main concern is, in fact, the effect of concrete relaxation in the area around the driven fastener.

This graph provides an overview of tests performed with DX-Kwik fasteners. Since standard DX fastenings have the same anchoring mechanism, this statement is also valid for standard DX fastenings. The test results indicate very strongly that relaxation of the concrete has no detrimental effect on the pull-out resistance of DX fastenings. The test data also shows that sintering and keying are the dominant anchorage mechanisms because they do not rely on friction between the fastener and the concrete.







6.4 Effect on concrete components

Fastenings in the compression zone of the structure have no effect on concrete compressive resistance as long as detailed provisions on edge distance and spacing are complied with.

Fastenings in the tensile zone are subject to the following provisions:

- a. Installations on plain load-bearing components such as concrete walls or ceilings are generally possible without restrictions as the load-bearing behaviour of these components is only negligibly affected by the fasteners. The predominant condition is static loading. This statement is based on experimental investigations carried out at the Technical University of Braunschweig, Germany.
- b. Fastenings in reinforced concrete beams:

If the concrete is too thin, concrete will spall off on the rear surface. The minimum thickness of concrete depends on the shank diameter of the fastener used. it has to be ensured that the main reinforcement steel will not be hit or penetrated by the DX fasteners. This measure of precaution is mainly founded on the reduction of the ultimate strain of the steel reinforcement. Exceptions are possible when the structural engineer responsible for design is consulted.

c. Fastenings in pre-stressed concrete members:

it has to be ensured that the pre-stressing steel reinforcement or cables will not be hit or penetrated by the DX fasteners.

Minimum concrete
thickness
hmin (mm)
60
80
100
100



7. Masonry base material

7.1 General suitability

Direct fastening technology can also be used on masonry. The joints between bricks or blocks and the covering plaster layer on virtually all types of masonry (exception for lightweight aerated concrete blocks) provide an excellent substrate for light-duty and secondary fastenings.

Suitability table. DA laste	ening on mason y		
Masonry material	Unplastered mason Fastenings in mortar joints* (joint width ≥ 10 mm)	ry Fastenings in masonry blocks or bricks	Plastered masonry Fastening in plaster (thickness ≥ 20 mm)
Clay brick			
solid	++	+	++
vertical perforated	++		++
horizontally perforated	++		++
Clay clinker			
solid	++	+	++
vertical perforated	++		++
Sand-lime block			
solid	++	++	++
perforated	++	++	++
hollow	++	++	++
Aerated concrete			
Lightweight concrete			
solid	++	-	++
hollow	++	-	++
Hollow concrete	++	+	++
Slag aggregate			
solid	++	-	-
perforated	++	-	++
hollow	++	-	++
++ suitable	+ limited suitability	– not fully investigated	– not suitable

Suitability table: DX fastening on masonry

*) Joints must be completely filled with mortar

The above table is based on laboratory and field experience. Because of the wide variety of types and forms of masonry in use worldwide, users are advised to carry out tests on site or on masonry of the type and form on which the fastenings are to be made.



8. Temperature effects on the fastening

8.1 Effect of low temperatures on fasteners

Steel tends to become more brittle with decreasing temperature. Increased development of natural resources in Arctic regions has led to the introduction of steels that are less susceptible to brittle failure at subzero temperatures. Most siding and decking fasteners are used to fasten the liner sheets of an insulated structure and are not exposed to extremely low

Low temperature embrittlement

The susceptibility of fasteners to become brittle at low temperatures can be shown by conducting impact bending tests over a chosen temperature range. The ability temperatures during service. Examples of situations where the fastenings are exposed to extremely low temperatures during their service life are:

- Fastenings securing cladding in singleskin construction
- Construction sites left unfinished over a winter
- · Liner sheets in a cold-storage warehouse

of Hilti drive pins to remain ductile over a temperature range from $+20^{\circ}$ C to -60° C is shown clearly by the fact that the impact energy required remains nearly constant throughout this temperature range.

Impact bending test - DSH57 (4.5 mm diameter, HRC 58 ± 1)

•	•	•					
Temperature		Impact energy (foot-pounds)			Impact energy (Joules)		
°F	°C	minimum	maximum	mean	minimum	maximum	mean
1	0	minimum	maximum	Incan	minimum	maximum	mean
68	20	35.1	>36.1	>36.1	47.6	>48.9	>48.9
00	EO	00.1	, 00.1	1 00.1	17.0	- 10.0	10.0
32	0	35.8	>36.1	36.0	48.5	>48.9	48.8
	-						
- 4	-20	31.4	>36.1	34.3	42.6	>48.9	46.5
		• • • •					
-40	-40	34.4	36.5	35.7	46.6	49.4	48.4
		•					
-76	-60	35.6	36.2	35.9	48.2	49.0	48.7

Impact bending test - X-CR (4.0 mm diameter)

Tempe °F	erature °C	Impact ene	ergy (foot-po _I maximum	ounds) mean	Impact ene minimum	ergy (Joules maximum) mean
68	20	14.8	17.0	15.9	20	23	21.6
32	0	17.7	15.5	18.3	24	21	24.8
- 4	-20	14.8	15.9	15.5	20	21.6	21.0
-40	-40	16.2	17.9	16.8	21.9	24.2	22.8
-76	-60	14.2	15.6	15.1	19.2	21.1	20.5





Impact bending te	st - X-CR (3.7	' mm diameter)
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Tempe °F	erature °C		ergy (foot-po _I maximum	ounds) I ^{mean}	Impact ene minimum	ergy (Joules) I maximum	mean
68	20	11.5	14.8	13.2	15.6	20.0	17.9
32	0	12.9	16.3	15.1	17.5	22.1	20.4
- 4	-20	13.1	15.8	14.7	17.8	21.4	19.9
-40	-40	14.2	15.8	14.8	19.2	21.4	20.1
-76	-60	12.3	15.0	13.7	16.7	20.3	18.6

Tests conducted according to DIN EN 10045 parts 1-4

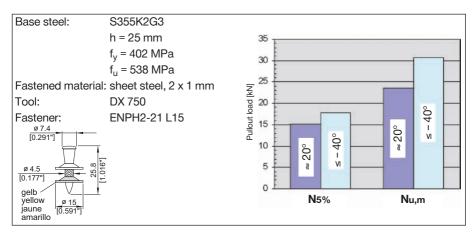
Distance between supports = 22 mm

The symbol ">" indicates no breakage of the specimens. In the other cases, about 50% of the specimens suffered breakage.

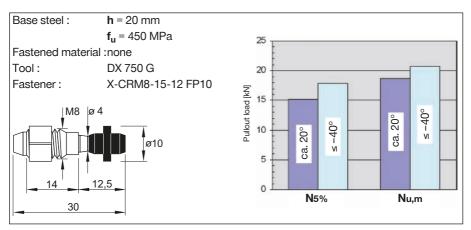
8.2 Effect of low temperatures on fastenings to steel

Effect of low temperatures on pull-out strength

Tests show that very low temperatures tend to increase pull-out strength with both standard zinc-plated fasteners and with the stainless steel. The results of two tests are summarized below. The fasteners were driven at room temperature and tested at -40° C to -70° C. A control sample was tested at 20°C. Explanations for the greater strength at low temperatures include increase in the strength of the zinc that is displaced into the knurling as well as increased strength of the fusing at the point of the fastener.







Two facts stand out from this testing:

- Pull-out strength increased as temperature decreased
- Pull-out from the base steel was the only mode of failure observed. There were no fractures!

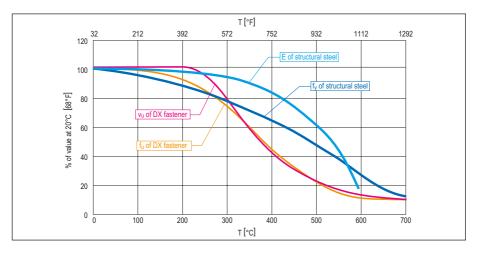




8.3 Fire rating of fastenings to steel Standard zinc-plated, thermally hardened steel fasteners

When subjected to high temperatures as in a fire, both powder-actuated fasteners

and structural steel lose strength. Data for standard zinc-plated, thermally hardened fasteners and structural steel are plotted in the graph below.



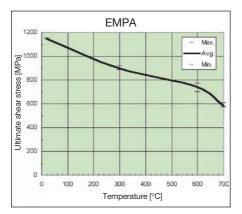
Up to about 300°C [572°F], the strength loss for DX fasteners is roughly proportional to the yield strength loss of structural steel. At 600°C [1112°F], DX fasteners have about 12% of their 20°C [68°F] strength left and structural steel about 26%. Since DX fasteners obtain their high strength through a thermal hardening process, the loss in strength at elevated temperatures is proportionally greater than for structural steel.

The relevance of different strength losses has to be evaluated in the context of the proportion of the material strengths that are actually exploited in a design. In a design calculation, it is conceivable that some steel will actually reach yield stress. The material strengths of an X-ENP-19 L15 fastener is 30 kN [6.74 kips] in tension and 18.6 kN [4.18 kips] in shear respectively. The recommended working load in tension and shear for an X-ENP-19 L15 16 gauge (1.5 mm) fastening is 4.7 kN [1.057 kips] in tension and 4.6 kN [1.034 kips] in shear, respectively. Thus, the exploitation of the X-ENP-19 L15 strength at room temperature is only 16 to 25% compared to about 70% (at recommended stress level) for structural steel.

In a fire, powder-actuated fastenings will not be the governing factor. If the fire protection requirements permit the use of structural steel, then powder-actuated fastening can also be used without negative impact on fire protection.



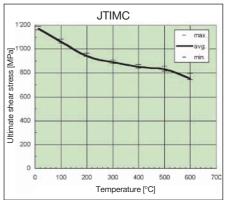
CR500 stainless steel fasteners Hilti X-CR/X-CRM fasteners are much more resistant to loss of strength at high temperatures than standard fasteners. The effect of temperature on ultimate shear stress of stainless fasteners made of CR500 was determined in single lap joint shear



In Japan, similar tests were carried out by JTICM (Japan). These tests were done by driving a 4.5 mm diameter X-CR nail through a 6 mm steel plate into a second 6 mm thick steel plate and shearing the two plates. From the graph it is apparent that the results are nearly the same.

Temperature effects on the fastenings

tests by the Swiss Federal Laboratory for Materials Testing and Research (EMPA). The results are plotted in the diagram below. This test was done by shearing 4.5 mm diameter fasteners that were inserted in steel plates with 4.6 mm diameter drilled holes.



At 600°C, the CR500 material has 64% of its 20°C shear strength left. By comparison, standard fasteners have only 12% and structural steel only about 26%. The excellent fire resistance of the CR500 material alone justifies its use for some applications.





8.4 Fire rating of fastenings to concrete

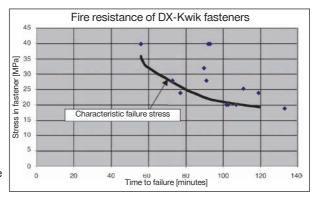
Concrete is weakened and damaged by fire but not as quickly as steel. In ISO-standard fire tests conducted with DX-Kwik fastenings at the Braunschweig Technical University in Germany the only failure mode was fracture of the nails.

The actual test data are shown in the table below:

X-DKH 48 P8S15 DX-Kwik fastener, 4.0 shank				
Tested	Tensile load,	Fire resistance/	Failure mode	
in crack width	F	time to failure		
∆W (mm)	(N)	(minutes)		
0.2	250	103	Nail fracture	
0.2	250	107	Nail fracture	
0.2	350	73	Nail fracture	
0.2	350	91	Nail fracture	
0.2	500	56	Washer pullover	
0.2	500	92	Nail fracture	
0.2	500	93	Nail fracture	
		1	1	

The stress in the fasteners at failure was calculated and plotted so that a plot of stress versus time resulted.

The characteristic failure stress curve from the previous graph can be used to calculate the failure load for various shank diameters with exposure to fire of different lengths of time. The calculated failure loads for 3.7, 4.0 and 4.5 mm shank diameter fasteners after 60, 90 and 120 minutes exposure to fire are shown in the table below.







Failure loads for various shank diameters and fire exposure times				
Shank	Fire exposure time and failure stress			
diameter	60 minutes 90 minutes 120 minutes			
(mm)	32.1 MPa	22.3 MPa	19.1 MPa	
3.7	340 N	240 N	200 N	
4.0	400 N	280 N	240 N	
4.5	510 N	350 N	300 N	

This table can be used to determine recommended loads for the ISO fire resistance required.





9. Design concepts

The recommended working loads N_{rec} and V_{rec} are suitable for use in typical working load designs. If a partial factor of safety design method is to be used, the N_{rec} and V_{rec} values are conservative when used as N_{Rd} and V_{Rd} . Alternatively, the design resistance may be calculated from the recommended loads by multiplying by the factor 1.4, which considers the uncertainties from the load on the fasteners. Exact values

for **N_{Rd}** and **V_{Rd}** can be determined by using the safety factors where given and or reviewing test data. Based on cyclic tests it can be stated that DX fastenings can be said to be robust, even when the actual loading turns out to be in part cyclic. Design loads (characteristic strength, design resistance and working loads) for the **X-HVB** shear connector are listed and specified per design guideline.

The designer may encounter two main fastening design concepts:

Working load concept

$$N_{S} \le N_{rec} = \frac{N_{Rk}}{\gamma_{GLOB}}$$

where $\gamma_{\mbox{GLOB}}$ is an overall factor of safety including allowance for:

- errors in estimation of load
- · deviations in material and workmanship

and $\mathbf{N}_{\mathbf{S}}$ is in general a characteristic acting load.

 $N_S \cong N_{Sk}$

Partial factors of safety

$$N_{Sk} \cdot \gamma_{F} = N_{Sd} \le \frac{N_{Rk}}{\gamma_{M}} = N_{Rd}$$

where:

 $\gamma_{\mathbf{F}}$ is a partial factor of safety to allow for errors in estimation on the acting load and $\gamma_{\mathbf{M}}$ is a partial factor of safety to allow for deviations in material and workmanship.



Design concepts

The characteristic strength is defined as 5% fractile:

$N_{Rk} = N_{u,m} - k \cdot s$

The k factor is a function of the sample size and the accuracy required. The characteristic strength of fastenings to concrete is determined based on a 90% probability while fastenings to steel are based on a 75% probability.

Structural analysis of the fastened part (e.g. roof deck panel or pipe hung from a number of fastenings) leads to calculation of the load acting on a single fastening, which is then compared to the recommended load (or design value of the resistance) for the fastener. In spite of this single-point design concept, it is necessary to ensure adequate redundancy so that failure of a single fastening will not lead to collapse of the entire system. The old saying "one bolt is no bolt" can also be applied to DX fastening.

For standard DX fastenings on concrete, a probability-based design concept based on multiple fastening is applied in order to allow for fastener driving failures and the large scatter in holding power observed. This concept applies to tensile as well as shear loading and is described in following chapter.



10. Determination of technical data for fastening design

The determination of technical data is based on the following tests:

- Application limits
- Tensile tests to determine pull-out and pull-over strength
- Shear tests to determine bearing capacity of the attached material and the base material.

These tests are described in more detail in the sections "Steel and other metal base material" and "Concrete base material".

10.1 Fastenings to steel

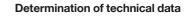
Failure loads in tension and in shear are normally distributed and the variation coefficient is <20%. The test data for each test condition are evaluated for the average and characteristic values. The characteristic value is based on the 5% fractile for a 75% probability.

The application range of the fastener is determined by application limit test where fasteners are set on steel plates of thickness ranging from the minimum recommended thickness $t_{II,min}$ to full steel (\geq 20 mm) and varied plate strength.

The application limit is reached when 1 shear off failure with 30 fasteners tested occurs, or if a detrimental effect on the load values (resistance) occurs.

Due to the small scatter in failure loads fastenings in steel can thus be designed as single points, although good engineering practice should be kept in mind. System redundancy must be always ensured.





10.2 Profile sheet fastenings

In addition to general fastenings to steel, specific data applies to profile sheet fastenings:

Cyclic loading

Profile sheet fastenings are subjected to repeated loading to simulate wind effects. Cyclic pull-through tests are additional optional tests where the failure load at 5,000 cycles is determined.

The design value of the pull-through resistance for repeated wind loads is the design value of the static pull-through resistance multiplied by a reduction factor of $\alpha_{\text{cvcl.}}$.

• If cyclic tests are carried out:

```
α<sub>cycl</sub> = 1.5 (N<sub>Rk,cycl</sub>/ N<sub>Rk,sta</sub>) ≤ 1
```

(The factor 1.5 takes the different safety levels for fatigue and predominately static design into account)

• If no cyclic tests are carried out:

```
\alpha_{cycl} = 0.5
```

Sheet bearing capacity

Profile sheet fastenings may be subjected to shear stresses from building movements or thermal dilatation of the sheets. Tests are undertaken to prove the suitability of the fastenings to support the deformations imposed.

For this, shear tests are carried out using a substrate of the minimum and maximum thickness and 2 layers of profile sheet of the thickness specified.

The fastening is considered suitable if an elongation of 2 mm is achieved without the sheet coming loose or showing an excessive reduction in pull-out load capacity. In this case, no consideration of forces of constraint is required since sufficient ductility is provided by the fastening due to hole elongation.

Standardization

The pull-over strength of profiled sheet fastenings is given with reference to core sheet thickness. Ultimate load data is standardized to the minimum sheet thickness and strength as specified by the relevant sheet standard. The correction applied is as follows:

$$\mathbf{F}_{\mathbf{u}'} = \mathbf{F}_{\mathbf{u}} \cdot \frac{\mathbf{t}_{\min}}{\mathbf{t}_{act}} \cdot \frac{\mathbf{f}_{u,\min}}{\mathbf{f}_{u,act}}$$



10.3 Fastenings to concrete (standard DX / GX / BX)

The failure loads in tension and shear show a large scatter with a variation coefficient of up to 60%. For specific applications, fastener driving failures may be detected and the fasteners replaced (e.g. threaded studs). For others, however, detection may not be possible (e.g. when fastening wooden battens) and this must be taken into consideration.

The design resistance is therefore determined for:

- failure loads without considering fastener driving failures
- failure loads considering a 20% rate of fastener driving failure

Evaluation of technical data and design according to the single point design approach based on fractiles and a safety factor is not feasible for such systems. The characteristic value would become zero at a variation coefficient of about 50%.

The evaluation of the data and the determination of the design resistance is therefore based on a multiple fastening, i.e. a redundant design, in which the failure probability not of a single, but of a number of fasteners supporting a structure is calculated. By this system, load may be transferred between the fasteners, if slip or failure of one or more of the fasteners occurs.

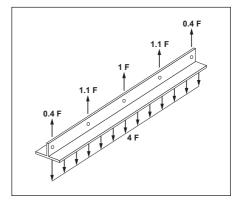
Test data

The test data for the fastener is consolidated to form a master pullout load distribution.

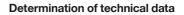
Static system

Two static systems are examined

- A suspended beam allowing unrestrained flexure of the beam
- A beam directly attached to the surface, which shows restrained flexure

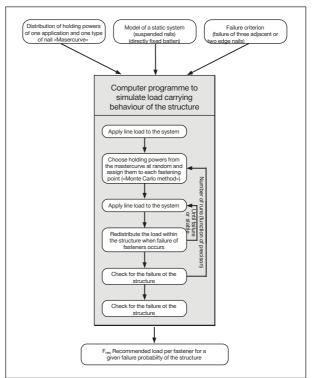






Calculation method

The calculation method used is the Monte Carlo method. by which holding values taken stochastically from the master distribution are attributed to the individual fasteners of the system and the system is checked to determine whether the imposed line load can be supported. By performing a large number of such simulations, statistical information on the failure probability of a system under a given line load is obtained. Hidden setting failures can also be considered with this method.



Design parameters

The design is based on the following parameters:

- Failure probability: 1 · 10⁻⁶
- Number of fasteners:
- Line load uniformly distributed
- Failure criterion: 2 edge or 3 central fastenings

5

The result is expressed in recommended load per fastening.





Effect on a fastening design

The overall condition for a fastening design in practice is that redundancy of the complete system has to be ensured. The effect of the Monte Carlo approach on a design is illustrated with two examples below.

Example:

Fastening of a plumbing with five ceiling hangers.

1. Due to the stiffness (EI) of the plumbing a redistribution of the dead load (g) to the remaining hangers is given in case of two neighbouring hangers failing.

(Fixing of each hanger with one nail is sufficient.

 The plumbing is not stiff enough to redistribute the dead load to the neighbouring hangers in case of one fastener failing.

(Each hanger has to be fastened with five nails.

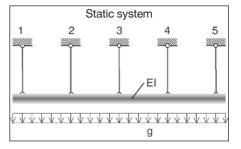
10.4 DX fastenings to concrete (DX-Kwik)

Failure loads in tension and shear are log-normally distributed and the variation coefficient is <20%. The test data is evaluated to yield the 5% fractile based on a 90% probability. The recommended working loads are obtained by applying a global safety factor of 3 for tension and shear.

The determination of technical data for cracked concrete (tensile zone) is based on tensile tests. Shear tests in cracked and uncracked concrete give similar results and are therefore not performed.

Failure loads in cracked concrete show a higher variation coefficient. Test data is also evaluated to yield the 5% fractile. The recommended load for the tensile zone is taken as the smaller of the following values:

- N_{rec} = N_{Rk}/ γ_{GLOB} γ_{GLOB} = 3.0 for 0.2 mm crack width
- N_{rec} = N_{Rk}/ γ_{GLOB} γ_{GLOB} = 1.5 for 0.4 mm crack width.





The application range of the fastener is determined by application limit test where fastenings are made on concrete of varying strength and age according to the application conditions specified (pre-drilling and setting). The attachment height is kept at the lower end of the range specified. The application limit is reached, if the failure rate exceeds 3% or the pull-out values strongly deviate from a lognormal distribution. The sample size is 30 per condition.

10.5 Fastener design in the USA and Canada

Testing of powder-actuated fasteners is carried out according to the ICC-ES AC 70 acceptance criteria and ASTM E 1190 standard test method. The test procedure covers tensile and shear testing in steel, concrete and masonry.

The determination of the allowable (recommended) load is shown below. The recommended working load is derived from the test data by taking the average failure load or the calculated characteristic load divided by a global safety factor.

$$P_a = V_a = F_{all} = \frac{F \cdot R \cdot R_f}{\Omega}$$
(3-1)

where:

- F = Average ultimate load [lbf (N)] of the test series.
- Ω = Safety factor determined in accordance with Section 3.3.2.
- R = Most severe base material reduction factor determined in accordance with Section 3.3.3.1, 3.3.3.2, or 3.3.3.3, as applicable.
- R_f = Fastener based reduction factor, determined in accordance with Section 3.3.3.4, as applicable.

Exception: When testing satisfies the alternate sample size described in Section 8.1 of ASTM E1190 (the COV from ten tests is 15 percent or greater), *F* shall be taken as the lowest ultimate load of the ten tests and Ω shall be taken as 5.

3.3.2 Safety Factor, Ω : The safety factor shall be determined using Equation 3-2.

$$\Omega = \frac{3.5}{(1 - 2COV)} \ge 5 \tag{3-2}$$





Fastener selection guide

Part 2:

Fastener selection guide





1. Selecting the right fastener

These considerations are used to determine suitable powder-actuated (DX), gas-actuated (GX) or battery-actuated (BX) fasteners for a given application.



Detailed technical information for the selected fastener family can be found on its product data sheet on the displayed pages.

For some applications, two or more fastener families are listed as suitable. The final selection is influenced by specific application requirements, available tools and technical data can be found on the product sheets.

Regional differences in building methods, materials, trade preferences, available tools, etc. also influence fastener selection. Therefore, designers and specifiers are advised to consult the local Hilti website and make use of the local Hilti technical advisory service.





1.1 Selection based on the type of concrete

What determines nail performance

Hilti Direct Fastening systems are designed to achieve maximum performance in a wide range of applications. But there is a large variety of nails types and elements for various direct fastening concrete applications. To select the appropriate nail for a given application, some important influencing parameters need to be considered:

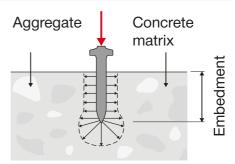
- a) concrete properties,
- b) nail design and features
- c) fastening system used
- d) nail embedment depth
- e) fastening tools and energy level

a) Concrete properties

A nail penetrating concrete needs to create a hole for the shank by crushing and compacting the concrete and also needs to withstand hitting hard aggregates. The resulting holding value achieved by the nail is linked to its diameter and embedment depth.

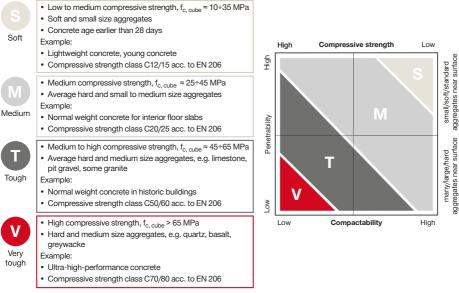
High penetrability and compactability lead to high stick rates and holding values.

Note: Concrete compressive strength alone is not decisive for nail performance.





Four concrete types can be roughly distinguished:



Note: f_{c. cube} = compressive strength of concrete cube (150 mm edge length)

b) Nail design and features

Penetrability and compactability, i.e. a nail's ability to penetrate and compact the concrete, are strongly influenced by three nail design features:

Point type

The point type and the reduction of the diameter in the area of the tip allows a significantly improved penetration behaviour in concrete.



Nail geometry

Length and diameter also affect how easily the nail penetrates the concrete.

Nail hardness

A harder nail is easier to drive into tougher concrete. However, if the nail is too hard, it can break instead of bending when it hits a hard aggregate in the concrete.





Fastener selection guide

c) Fastening systems used

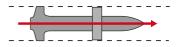
Hilti Direct Fastening Systems help to ensure that nails are correctly driven by achieving maximum nail perpendicularity, good nail guidance and thorough use of the appropriate driving energy.

Perpendicularity

Hilti Direct Fastening tools help to keep nails perpendicular to the working surface, thus reducing failures caused by nails driven at an angle. During the fastening process, Hilti Direct Fastening tools have be maintained perpendicular to base material as much as possible. Please refer the respective instructions for use and tool operation manuals for details.

Nail guidance

Due to excellent nail guidance in the tool and the use of solid washers, the nail leaves the tool at the intended angle.



d) Nail embedment depth

Another factor that influences nail performance is embedment depth. A nail that can be driven deeper in the concrete has the ability to achieve higher load performance. However, there are two side effects if a nail needs to be driven deeper.

stick rate can decrease

• higher driving energy is required as the nail must penetrate further into the concrete

e) Fastening tools and energy levels

Nail driving energy released by a Hilti tool is precisely controlled to help achieve the desired embedment depth reliably.

Powder-actuated tools (DX)

Embedment depth of a nail can be influenced by selecting the right cartridge color and adjusting the power setting on the tool, where applicable.

Hence, it is crucial to understand how the different tools in combination with the various cartridges, vary in terms of energy generation. Use that knowledge to pick the right tool and the right cartridge to help achieve the required embedment depth and reach the optimum nail load performance.

Gas-actuated tools (GX)

Embedment depth can be influenced by adjusting the slider in the front of the tool to "+" or "-" position.

Battery-actuated tools (BX)

Embedment depth can be influenced by selecting a different nail length.





Choice of a nail for use on concrete

Three main factors define the nail selection on concrete:

- speed of installation
- stick rate
- holding values

Speed of installation

All system technologies, powder-actuated tool (DX), gas-actuated tool (GX) and batteryactuated tool (BX) offer a very high installation speed.

Stick rate



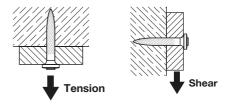
The stick rate indicates the percentage of nails that are driven correctly to carry a load.

Generally, stick rate can often be improved by combination of:

- using shorter nails (on condition that required load can still be achieved with shorter embedment)
- selecting nails from a higher nail class (nail classes are described later in this chapter)
- · using more energy by combination of tools, cartridges and energy setting
- using different technologies and nails from a higher nail class, i.e. switching from gas-actuated (GX) or battery-actuated tools (BX) to powder-actuated tools (DX)
- pre-drilling, see chapter Kwik

Holding values

Holding values provide a measure of a nail's load-bearing capacity which ensures the reliable use in practical applications, consistent with their diameter and embedment depth. Nails are typically subject to static or quasi-static loads, which act as tensile, shear or combined tensile and shear forces.







Nail types

Different nails have been developed for various applications and conditions.

Medium duty Class I and II nails are used for load-sensitive high performance applications in tough concrete, while medium duty Class III nails are for versatile use in soft, medium and tough concrete. Medium duty Class I, II and III nails are generally fastened with powder-actuated tools (DX).

Light duty Class IV and V nails, generally fastened with gas-actuated (GX) and battery actuated tools (BX), are typically used for applications that have lower load requirements, hence requiring shorter embedment depth. In general, Class V nails present the most economical solution as they are the least costly.

Cost is directly related to the manufacturing technologies involved as well as the material from which the nails are made.

Under harsher conditions, each nail class performs better than the one below, and the manufacturing costs, and thus the price of the nail, increase with each nail class.

		-	Nail featur	ed			
	Nail Class	Ø	Hard- ness [HRC]	Tip	Concrete Class	Nail examples	Applications
ıty	Class I	> 4.0 mm	> 58	Helical, long conical	s T M	X-X X-AL-H ¹⁾	Best performance in tough concrete.
Medium duty	Class II	4.0 mm	Up to 60	Ballastic or better	S T	X-P X-U	High performance in tough concrete.
	Class III	3.5 to 3.7 mm	Up to 58	Mostly cut	S	X-C	High performance in medium concrete.
Light duty	Class IV	3.0 to 3.2 mm	Up to 58	Ballastic or better	S () M	X-P G2/G3/B3	Use in soft, medium and some tough concrete with shorter embedment, e.g. for track fastening to slab underside.
Ligh	Class V	2.6 to 3.0 mm	Up to 57	Mostly cut	S	X-C G2/G3/B3	Use in soft and medium concrete with shorter embed- ment, e.g. for track fastening.

1) X-AL-H nail is pre-mounted to X-CX ceiling fasteners

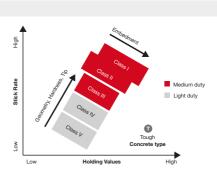




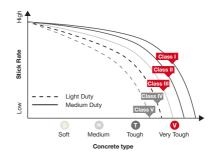
Nail class versus concrete type

Stick rate versus holding values of nail classes

Nail classes are clearly differentiated when faced with tough concrete. Depth of embedment, nail geometry, hardness and tip shape vary between nail classes.



Stick rate of nail classes in different concrete types Nail performance varies depending on the toughness of the concrete and the distribution of its aggregates. Nails of all classes perform similarly in soft concrete, but as the concrete gets tougher, the stick rate varies.







Select the right nail for concrete

Here are four simple steps to help guide you to the right nail

- 1. Understand the application
- 2. Be specific about important application requirements
- 3. Get to know the Hilti range of nails
- 4. Then choose the right nail based on application requirements



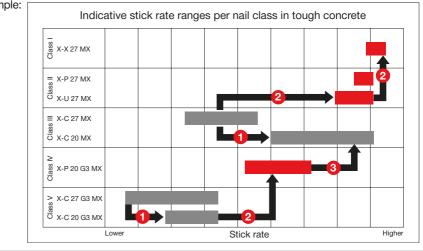
Following these four steps will help you:

- Maximize the stick rate.
- Achieve the required holding values.
- Select the most cost-efficient nail.
- Achieve optimum embedment depth based on selecting the appropriate cartridge and adjusting the power setting.

Improving the stick rate can be done in three different ways:

- 1. Use a shorter nail (if required embedment / load still can be reached with shorter nail)
- 2. Select a nail from a higher nail class (move from Nail Class III to II)
- 3. Use more energy (energy setting) / select different technology

Example:



- no power and cartridge selection required for GX and BX systems.
- Important: other application relevant requirements, e.g. environmental conditions, corrosion resistance, etc., must be considered.





1.2 Selection based on environmental conditions

Corrosion may have a major influence on the suitability of a fastener for an application and therefore also on fastener selection. In order to provide a basis for judging the suitability of fasteners, it is useful to categorise applications in three classes:

- Non-safety relevant, temporary fastenings (e.g. fastenings of wooden kickers in concrete formwork)
- Non-safety relevant, permanent fastenings (e.g. metal track fastenings for drywall)
- Safety relevant, permanent fastenings (e.g. profiled metal sheet fastenings in roof and walls)

Non-safety-relevant, **temporary and permanent fastenings:** zinc-plated fasteners made of normal carbon steel can be used without restriction. Corrosion and related damages can, however, reduce the capacity of fasteners.

Safety-relevant, permanent fastenings: the restrictions described below apply:

- In any case where there is a restriction to use galvanized carbon steel fasteners if they
 are exposed to weather or if they are inside and subject to repeated wetting as from
 condensation. The galvanization (typically in a range from 5 to 20 microns of Zn) provides
 corrosion protection during transport and construction, during which exposure to weather
 can never be completely prevented. If the fastenings are exposed to repeated wetting or
 weather during their service life, the use of galvanized carbon steel fasteners is prohibited
 and stainless steel fasteners must be used. This safety measure must be observed without
 exception because the corrosion of galvanized steel fasteners leads not just to material
 loss but also to hydrogen embrittlement. Hydrogen embrittlement can easily result in
 fracture of the fastener at very low load.
- Referring to the above-mentioned example of profiled metal sheet fastening for roofs and walls, the use of galvanized steel fasteners is allowable only where wetting of the fastener is not to be expected. This applies in general to inside skins of two skin, insulated roofs and walls enclosing dry and closed rooms. This is the classic application area for X-ENP19 galvanized fasteners.
- For special applications like swimming pools or tunnels, highly corrosion-resistant resistant stainless steel materials are recommended. See also Part 4, Chapter 4. Please consult Hilti in such cases





Contact corrosion is taken into consideration by observing common rules concerning acceptable material combinations. Parts made of less noble metals are subject to increased corrosion if they are in electrochemical contact with a larger part made of a more noble metal, provided of course that an electrolyte is present. Fasteners that are used in wet areas must be at least as noble or better nobler than the fastened part. The effect of contact corrosion is shown in the table below. This information is especially applicable to stainless steel fasteners, like X-CR, X-ST-GR and X-R, because these are suitable for safety-relevant, permanent application in outdoor areas or areas otherwise exposed to corrosion.

	Power-actuated fastener	
Fastened material	Zinc-plated carbon steel	Stainless steel
Construction steel (uncoated)	S	S
Galvanized steel sheet	S	S
Aluminum alloy	d	S
Stainless steel sheet	d	S

s = Negligible or no corrosion of fastener, d = Heavy corrosion of fastener

Accelerated corrosion of a fastener due to contact corrosion can take place only in the presence of an electrolyte (moisture from precipitation or condensation). Without this electrolyte – e.g. in dry inside rooms – zinc-plated fasteners can be used in connection with more noble metals.





2. Design concepts

The recommended working loads (N_{rec} and V_{rec}) are suitable for use in typical working load designs. If a partial safety factor design method is to be used, the N_{rec} and V_{rec} values are conservative when used as N_{Rd} and V_{Rd}. Exact values for N_{Rd} and V_{Rd} can be determined by using the safety factors where given and/or by reviewing test data. Design loads (characteristic strength, design resistance and working loads) for the X-HVB shear connector are listed as per design guideline.

Worldwide the designer may encounter two main fastening design concepts:

Working load concept

 $N_{S} \leq N_{rec} = \frac{N_{Rk}}{\gamma_{GLOB}}$

where γ_{GLOB} is an overall factor of safety including allowance for:

- errors in estimation of load
- deviations in material and workmanship

and $N_{\mbox{\scriptsize S}}$ is, in general a characteristic acting load.

N_S ≅ N_{Sk}

Partial factors of safety

$$N_{Sk} \cdot \gamma_F = N_{Sd} \le \frac{N_{Rk}}{\gamma_M} = N_{Rd}$$

where:

 $\begin{array}{l} \gamma_{\text{F}} \text{ is a partial factor of safety to allow for} \\ \text{errors in estimation on the acting load.} \\ \gamma_{\text{M}} \text{ is a partial factor of safety to allow for} \\ \text{deviations in material and workmanship.} \end{array}$

Structural analysis of the fastened part (e.g. roof deck panel or pipe hung from a number of fastenings) leads to calculation of the load acting on a single fastening, which is then compared to the recommended load (or design value of the resistance) for the fastener. In spite of this single point design concept, it is necessary to ensure that there is sufficient redundancy that the failure of a single fastening will not lead to collapse of the entire system. The old saying "one bolt is no bolt" applies also to Direct fastening.





3. Nomenclature/symbols

Following is a table of symbols and nomenclature used in the technical data.

Fastener test data a	and performance		
N and V	Tensile and shear forces in a general sense.		
F	Combined force (resulting from N and V) in a general sense.		
N_s and V_s	Tensile and shear forces acting on a fastening in a design calculation.		
Fs	Combined force (resulting from N_s and V_s) in a design calculation.		
N_u and V_u	Ultimate tensile and shear forces that cause failure of the fastening;		
	statistically, the reading for one specimen.		
$N_{u,m}$ and $V_{u,m}$	Average ultimate tensile and shear forces that cause failure of the		
	fastening, statistically, the average for a sample of several specimens.		
S	The standard deviation of the sample.		
$N_{test,k}$ and $V_{test,k}$	Characteristic tensile and shear resistance of test data, statistically,		
	the 5 % fractile.		
$N_{\mbox{\scriptsize Rk}}$ and $V_{\mbox{\scriptsize Rk}}$	Characteristic tensile and shear resistance of the fastening used for		
	fastening design; statistically, the 5 % fractile. For example, the		
	characteristic strength of a fastening whose ultimate strength can be		
	described by a standard Gauss type distribution is calculated by:		
	$N_{Rk} = N_{u,m} - k \cdot S$ where k is a function of the sample		
	size n and the desired confidence		
	interval.		
N_{Rd} and V_{Rd}	Tensile and shear design resistance of the fastening		
	$N_{Rd} = \frac{N_{Rk}}{\gamma_M}$ and $V_{Rd} = \frac{V_{Rk}}{\gamma_M}$ where γ_M is a partial safety factor for the resistance of the fastening.		
N_{rec} and V_{rec}	Recommended tensile and shear force of the fastening		
	$N_{rec} = \frac{N_{Rk}}{\gamma_{GLOB}}$ and $V_{rec} = \frac{V_{Rk}}{\gamma_{GLOB}}$ where γ_{GLOB} is an overall factor of safety.		
M _{rec}	Recommended working moment on the fastener shank		
	$M_{rec} = \frac{M_{Rk}}{\gamma_{GLOB}}$ where M_{RK} is the characteristic moment resistance of the fastener shank and γ_{GLOB} is an overall factor of safety. Unless otherwise stated on the product data sheets, the M_{rec} values in this manual include a safety factor of "2" for static loading.		





Fastening details

h _{ET}	Penetration of the fastener point below the surface of the base material.
h _{NVS}	Nail head standoff above the surface fastened into (with nails, this is the
	surface of the fastened material, with threaded studs, the surface of the
	base material).
t _{II}	Thickness of the base material.
tl	Thickness of the fastened material.
Σt _l	Total thickness of the fastened material (where more than one layer is
	fastened).

Characteristics of steel and other metals			
fy	Yield strength of steel.		
f _u	Tensile strength of steel.		

Characteristics of concrete and masonry

f _c	Compressive strength of cylinder (150 mm diameter, 300 mm height).
f _{cc}	Compressive strength of cube (150 mm edge length).
f _{c,100} /f _{c,200}	Compressive strength of 100 mm diameter cylinder / cube with 200 mm
	edge length.

Approvals, technical assessments and design guidelines are given on the product information sheets as abbreviations of the names of the issuing institutes or agencies. Following is a list of abbreviations:

Abbreviation	Name of institute or agency / description	Country	
FM	Factory Mutual (insurers' technical service)	USA	
UL	Underwriters Laboratories (insurers' technical service)	USA	
ICC	International Code Council	USA	
SDI	Steel Deck Institute (technical trade association)	USA	
CSTB	Centre Scientifique et Technique du Bâtiment		
	(approval agency)	France	
DIBt	Deutsche Institut für Bautechnik (approval agency)	Germany	
SOCOTEC	SOCOTEC (insurers' technical service)	France	
ÖNORM	Österreichische Norm / Austrian National Standard	Austria	
SCI	Steel Construction Institute	Great Britain	
ABS	American Bureau of Shipping (international classification		
	society for ship and marine structures).		
LR	Lloyd's Register (international classification		
	society for ship and marine structures).		
DNV GL	International classification society for the marine and energy industry.		



Tips for users

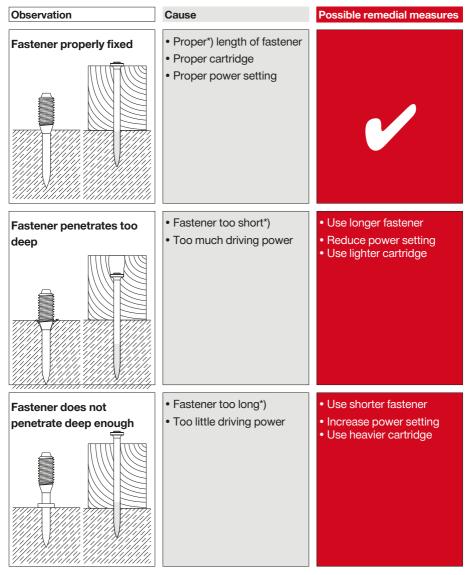
4. Tips for users





Tips for users ("Trouble Shooting")

DX fastenings on concrete



*) Rule of thumb: The higher the compressive strength of concrete, the shorter the fastener Proper length (mm): $L_s = 22 + t_l$ (compare, "Fastening Technology Manual" Part Product section)



DX fastenings on concrete

Observation	Cause	Possible remedial measures
Nail is bending	 Hard and/or large aggregate in concrete Rebar close to surface of concrete Hard surface (steel) 	 Use shorter nail Use DX-Kwik (predrill) Use stepped shank nail X-U 15 Change cartridge
Base material is spalling	 High strength concrete Hard and/or large aggregate in concrete Old concrete 	 Stud application: Use spall stop X-460-F8SS / - F10SS Nail application: Use shorter nail Use DX-Kwik (predrill) Use X-U 15 (for highstrength precast concrete)
Damaged nail head	 Too much driving power Wrong piston used Damaged piston 	 Reduce power setting Use lighter cartridge Check nail-piston- combination Change piston

Wrong pistons can cause all the above faults: match pistons to nails!

Fastener	Piston	Piston tip
Х-U, Х-С, Х-Р	Use piston X-460-P8	





DX fastenings on steel

Observation	Cause	Possible remedial measures
Nail does not penetrate surface	 Too little driving power Application limit exceeded (very hard surface) Unsuitable system 	 Try higher power setting or heavier cartridge Short nail application: Try X-U 15 Long nail application: Try X-U Use co-acting principle/ fastener guide Switch to heavy system like DX 76 PTR
Nail does not hold in base material	• Excess driving energy in thin steel base material (3 to 4 mm steel)	 Try different power setting or different cartridge Try X-ENP2K or X-EDNK22 THQ 12 for fastening sheet metal
Nail is breaking	 Too little driving power Application limit exceeded (very hard surface) 	 Try higher power setting or heavier cartridge Use shorter nail Use X-ENP19 Use stronger nail (XH) Use stepped shank nail: X-U 15



DX fastenings on steel

Observation	Cause	Possible remedial measures
Nail head penetrates through material fastened (metal sheet)	• Too much driving power	 Reduce power setting Use lighter cartridge Use nail with Top Hat Use nail with washer e.g. X-US12
Damaged nail head	Too much driving power	 Reduce power setting Use lighter cartridge
	Wrong piston used	Check nail-piston- combination
	Worn-out piston	• Change piston

Wrong pistons can cause all the above faults: match pistons to nails!

Fastener	Piston	Piston tip
X-U, X-P, X-S	Use piston X-460-P8	









Nail and stud designation

5. Nail and stud designation



Nail designation

	X-C	32	2	P
Applicatio			Weeher	turne V (in
Applicatio				type X (ir
X-ENP X-ENP2K	Siding and Decking Nails		Ρ	Plastie e.g. P
X-HSN	Diaphragm Decking Nails		S	Steel
NPH	Siding and Decking Nails to Concrete		D	e.g. S Two w
X-U	Universal Nails		L	Two d
X-P	High Performance Nail for Fastening to Concrete		TH THQ	Top H Top H
X-C	Nails for Concrete and Sand lime-Masonry		MX	Collat faster
X-S	Drywall and electrical fasteners to Steel		MXR T	Collat For tu
X-EGN X-GHP X-GN	Gas Nails for GX 120		MXR T	Collat For tu
DS	Heavy Duty Nails for Concrete and Steel		B_ G_	For ba
EDS	Heavy Duty Nails for Fastening Steel to Steel		- Dimens	ions:
X-R	Stainless Steel Nail for Fastening			nk length product da
X-CR	Stainless Steel Nails for Concrete, Sand lime Masonry and Steel. And Steel only.			
X-CT	Nails for Forming or other Temporary uses			
DNH X-DKH	DX-Kwik Nails for Concrete (pre-drilled)			

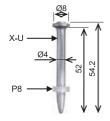
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2	P8 S23 T			
147 1 1				
wasner typ	be X (in mm):			
Р	Plastic washer			
	e.g. P8 = plastic washer Ø 8			
S	Steel washer			
	e.g. S36 = steel washer Ø 36			
D	Two washers			
L	Two domed washers			
TH	Top Hat			
THQ	Top Hat and high shear washer			
MX	Collated for DX tool/ collated			
	fasteners for GX/BX			
MXR	Collated for DX 860-ENP			
Т	For tunneling applications			
MXR	Collated for DX 860-ENP			
Т	For tunneling applications			
B_	For battery tools, e.g. B3			
G_	For gas tools, e.g. G3			

Nail shank length in mm (For details, please refer to product data)

Examples:





X-U 52 MX





Threaded stud designation

	Х	-M6H	10	-37	FP8
	,				
Application:			Washer type and X (in mm):		
X-M6H X-M8H	DX-Kwik Thread Concrete (pre-d	rilled)		Р	Plastic washer e.g. P8 = plastic washer X 8
X-M6 X-W6 X-F7	Threaded Studs	for Concrete		S	Steel washer e.g. S8 = steel washer X 8
X-M8 M10				D F	Two washers
W10				F SN12-R	Plastic guidance sleeve Stainless steel washer for
X-EM6H	6H Threaded Studs for Steel				sealing purposes
X-EW6H				B_	For battery tools, e.g. B3
X-EF7H X-EM8H X-EM10H X-EW10H				G_	For gas tools, e.g. G3
X-BT	Stainless Steel	Threaded Stud	ds	_ Dimensions:	
X-CRM X-ST	Stainless Steel ⁻ for Concrete and		ds	Thread Length and Shank Length in mm	
where M, W, F refer to the thread type:					
М	Metric				

Examples:

W

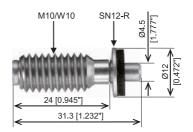
F

X-BT W10-24-6 SN12-R

Whitworth

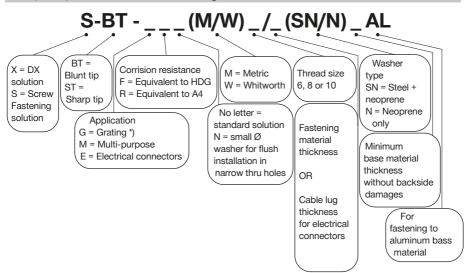
French

X-BT M10-24-6 SN12-R





X-BT, X-ST, S-BT Threaded studs designation



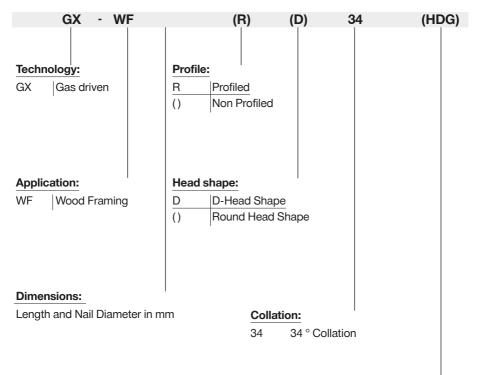
*) X-ST-GR stainless steel threaded studs may also be used for multi-purpose applications.

Examples

- S-BT-MR M10/15 SN 6 AL
- S-BT-GR M8/7 SN 6
- X-BT-MF M10/10 SN 4
- X-BT-ER M8/6 SN 4



Wood nail designation



Designation of corrosion protection on the box/label			
Suffix	Type of protection	Service Class (EN 1995-1-1)	
"Bright"	no coating	1	
"Galv"	12 µm zinc	1,2	
"HDG"	55 µm hot dip galvanized	1, 2, 3	
"Stainless"	A2 or A4	1, 2, 3	







Part 3:

Accessories and consumables compatibility









DX 2 Semi-automatic powder-actuated tool for fastening single nails



Fastener:	
X-X	
X-P	
X-U	
X-C	
X-CR	
X-CT	
X-M6/W6/F7/M8	
X-FS	
X-SW	
X-FB	
X-DNH	
X-DKH	
X-M6H, X-M8H	
X-HS	
X-CC	
X-CRM	

Cartridges:	
6.8/11M –	
red, yellow, green	





DX 351 Powder-actuated tool for interior finishing applications



Fastener:	
X-P_MX	
X-U_MX	
X-C_MX	
X-S 13 MX	

Piston: X-P 8S-351

Cartridges: 6.8/11M – red, yellow, green, white

DX 351-F8 Powder-actuated tool for interior finishing, mechanical and electrical applications



Fastener:
X-P_P8
X-C_P8/TH/THP
X-U15 P8TH
X-CC-UP8
X-HSU_P8S15

Cartridges:	
6.8/11M –	
red, yellow, green, white	

Fastener guide:		
X-FG 8L-351		
narrow access fastener		
guide		

Piston:	
X-P 8L-351	
-	



X-FG 8ME-351 standard fastener guide



Piston: X-P 8S-351





DX 351-BT Powder-actuated tool for fastening X-BT threaded studs



Fastener:
X-BT M10-24-6 SN12-R
X-BT M10-24-6-R
X-BT W10-24-6 SN12-R
X-BT W10-24-6-R
X-BT M6-24-6 SN12-R
X-BT W6-24-6 SN12-R
X-BT-ER M10/3 SN4
X-BT-ER W10/3 SN4
X-BT-ER M8/7 SN4
X-BT-ER M6/7 SN4
X-BT-ER W6/7 SN4
X-BT-MF M/W 10

Piston: X-351 BT P 1024

Fastener guide:

BT FG M1024 (M10) BT FG W1024 (W10) Fastener Guide dimensions $b \times d \times L = 17.5 \times 22 \times 29.5$ mm

Cartridges:

6.8/11M – high precision - brown

DX 351-BTG Powder-actuated tool for fastening gratings



 Fastener:

 X-BT M8-15-6 SN12-R

 X-BT M8-15-6-R

Piston:

X-351 BT P G

Fastener guide:

X-352 BT FG G (M8) Fastener Guide dimensions $b \times d \times L = 17.5 \times 22 \times 56$ mm

Cartridges:

6.8/11M – high precision - brown

DX 351-CT Fully automatic powder-actuated tool for fastening ceiling fasteners to concrete or steel



Fastener:	
X-CW	
X-CC	
X-HS	
X-U	
X-C	

Piston: X-P8-351 CT

Cartridges:

6.8/11M -

red, yellow, green

Fastener guide:

X-351-F8CT





Powder-actuated tool

DX 450 Powder-actuated tool - standard



Fastener guide:	
45/F1	

Fastener:
X-CR 14 D12
X-CR 16 S12
X-CR 18 S12
X-CR 21 S12
X-CR 24 S12

Piston:	
45/NK	
Baseplate:	
45/S1	

Cartridge:

6.8/11 M yellow, red



• Tool is not offered by Hilti anymore.

DX 450-FA Powder-actuated tool - facade



Fastener guide:

45/F5

:	Fastener:
	X-R_P8
	X-CR 14 P8
	X-CR 16 P8
	X-CR 18 P8
	X-CR 21 P8

Piston:

45/DNI-B

Baseplate: 45/S5

Cartridge:

6.8/11 M yellow, red





DX 460-MX Powder-actuated tool for fastening collated nails



Fastener:
X-P_MX
X-U_MX
X-C_MX
X-CT_MX
X-ET_MX
X-ECT_MX
X-EKS_MX,
X-FB_MX
X-FS_MX,
X-SW_MX
X-HS_MX
X-CC_MX
X-HS-W_MX
X-EKB_MX

Piston:	
X-6-5-P8	
X-6-5-P8W	

for fastening wood

Cartridges: 6.8/11M -

black, red, yellow, green

DX 460-F8 Powder-actuated tool for fastening single nails



Fastener:
X-P_P8
X-U_P8 / P8 TH
X-C_P8
X-CR_P8/ P8S12
X-CR M8
X-CT_DP8
X-FS, X-SW
X-FB
X-EM6HFP8
X-EW6HFP8
X-EF7HFP8
X-M6/W6FP8
X-EM8HP8
X-M8P8
X-HS, X-CC
X-HS-W_P8

Piston:

X-6-5-P8 X-6-5-P8W for fastening wood

Cartridges:

6.8/11M – black, red, yellow, green





Accessories and consumables compatibility

Piston: X-6-5-PKwik

DX-Kwik method:
pre-drilling into concrete

Fastener:
X-M6H37 FP8
X-M8H37 P8
X-CRM842

Fastener: X-DNH 37 P8S15 X-DKH 48 P8S15

Piston:	
X-6-5-P8	

Fastener guide:

X-5-460-F8N15 Narrow access fastener guide (Ø 15.2 mm×53.2 mm)



. .

Piston:	
X-6-5-P8	

Fastener guide:
X-5-460-F8N10
Narrow access fastener
guide
(b×d×L 10.4×25.9×50 mm)



Fastener guide: X-5-460-F8GR Grating fastener guide



Fastener guide: X-5-460-F8S12 S12 fastener guide



Fastener:	
X-P_P8	
X-U_P8	
X-C	
X-CR_P8	
X-CRM_P8	

Piston: X-6-5-P8

Fastener:	
X-GR	
X-PGR-RU	
X-STM8_P8	
X-EM 8H	

Piston: X-6-5-PGR

Fastener:	
X-U_S12	

Piston: X-6-5-P8





Accessories and consumables compatibility

Fastener guide:
X-5-460-F8SS
8 mm stop spall fastener
guide

Fastener:	
X-M6FP8	
X-W6FP8	
X-F7FP8	
X-M8P8	

Piston:	
X-6-5-P8	



Fastener:	
M10 (possible)	

Piston: X-6-5-P10

Fastener	dinqe.
laotonoi	guiaci

Fastener guide:

X-5-460-F10

X-5-460-F10SS 10 mm stop spall fastener guide



Fastener: M10 (possible) **Piston:** X-6-5-P10

Fastener guide:

X-5-460-FIE-XL



Fastener:

X-IE

Insulation fastener

Piston:

X-6-5-PIE-XL





DX 460-SM Powder-actuated tool for fastening metal decks



Fastener:
X-EDNK22-THQ12M
X-EDN19-THQ12M
X-HSN 24

Piston:

X-5-460-PSM

Cartridges:

6.8/11M – black, red, yellow





DX 5 MX Digitally enabled powder-actuated tool for fastening collated nails



Fastener:
X-X_MX
X-P_MX
X-U_MX
X-C_MX
X-CT_MX
X-ET_MX
X-ECT_MX
X-EKS_MX
X-FB_MX
X-FS_MX
X-SW_MX
X-HS_MX
X-CC_MX
X-HS-W_MX
X-EKB_MX

Piston:
X-6-5-P8
X-6-5-P8W
for fastening wood
Cartridges:
6.8/11M -

black, red, yellow, green

DX 5 F8 Digitally enabled powder-actuated tool for fastening single nails



Fastener:
X-X_P8
X-U_P8 / P8 TH
X-C_P8
X-CR_P8/ P8S12
X-CR M8
X-R_P8
X-ST-GR M8_P8
X-CT_DP8
X-FS, X-SW

X-FB
X-EM6H/EW6HFP8
X-EF7H/FP8
X-M6/W6FP8
X-EM8HP8
X-M8P8
X-HS, X-CC
X-HS-W_P8

Piston: X-6-5-P8

X-6-5-P8W for fastening wood

Cartridges:
6.8/11M -
black, red, yellow, green





Accessories and consumables compatibility

Piston: X-6-5-Pkwik

DX-Kwik method:
pre-drilling into concrete

Fastener:
X-M6H37 FP8
X-M8H37 P8
X-CRM842

Fastener: X-DNH 37 P8S15 X-DKH 48 P8S15

Piston:	
X-6-5-P8	

Fastener guide:

X-5-460-F8N15 Narrow access fastener guide (Ø 15.2 mm×53.2 mm)



Fastener:
X-P_P8
X-C
X-CR_P8
X-CRM_P8
X-ST-GR M8_P8

Piston:	
X-6-5-P8	

Fastener guide:
X-5-460-F8N10
Narrow access fastener
guide
(b×d×L 10.4×25.9×50 mm)



Fastener guide: X-5-460-F8GR Grating fastener guide



Fastener guide: X-5-460-F8S12 S12 fastener guide



Fastener:	
X-P_P8	
X-U_P8	
X-C	
X-CR_P8	
X-CRM_P8	

Piston: X-6-5-P8

Fastener:	
X-GR	
X-PGR-RU	
X-EM 8H	

Piston:	
X-6-5-PGR	

Fastener: X-U_S12

Piston: X-6-5-P8





Accessories and consumables compatibility

Fastener guide:
X-5-460-F8SS
8 mm stop spall fastener
guide

Fastener:	
X-M6FP8	
X-W6FP8	
X-F7FP8	
X-M8P8	

Piston:	
X-6-5-P8	



Fastener guide:

Fastener guide:

X-5-460-F10

guide

X-5-460-F10

Fastener:	
M10 (possible)	

Piston: X-6-5-P10

X - 400 F 10	
--------------	--

Fastener:
M10 (nossible

Piston: X-6-5-P10



10 mm stop spall fastener

M10 (possible)

Fastener guide:

X-5-460-FIE-XL



Fastener:

X-IE

Insulation fastener

Piston:

X-6-5-PIE-XL





DX 5 IE Powder-actuated tool for fastening insulation



 Fastener:

 X-IE

 insulation fasteners

Piston: X-6-5-PIE-XL

Cartridges: 6.8/11M – red, yellow, green

DX 5 GR Powder-actuated tool for fastening gratings



Fastener:	
X-GR	
X-PGR-RU	
X-EM 8H	

Piston:	
X-6-5-PGR	

Cartridges: 6.8/11M – black, red

DX 5 SM Powder-actuated tool for fastening metal decks



Piston: X-5-460-PSM

Cartridges:

6.8/11M black, red, yellow

DX 5 F10 Powder-actuated tool for fastening threaded studs



Fastener:	
DS_P10	
X-EM8H-15-12 FP10	
X-EM10H-24-12 P10	

Piston:

X-6-5-P10

Cartridges:

6.8/11M – black, red, yellow, green





DX6 MX Digitally enabled powder-actuated tool for fastening collated nails



Fastener guide:	
X-6-MX72	



Fastener:
X-X_MX
X-P_MX
X-U_MX
X-C_MX
X-CT_MX
X-FS_MX
X-SW_MX
X-ET_MX
X-ECT_MX
X-EKS_MX
X-FB_MX
X-HS_MX
X-HS-W_MX
X-ECC_MX
X-ECH_MX
X-EKB_MX

Piston:

X-6-5-P8 X-6-5-P8W

for wood fastening

Cartridge:

6.8/11 M 10 for DX 6 titanium, black





DX6F8 Digitally enabled powder-actuated tool for fastening single nails



Standard fastener guide

Fastener guide:

X-6-F8



Fastener:
X-X_P8
X-P_P8
X-U_P8
X-U_P8 TH
X-C_P8
X-CR_P8
X-CR_P8S12
X-CR M8
X-R_P8
X-ST-GR M8_P8
X-CT_DP8
X-FS
X-DFS
X-SW
X-FB
X-EM6HFP8
X-EW6HFP8
X-EF7HFP8
X-M6FP8
X-W6FP8
X-F7FP8
X-EM8HP8
X-M8P8
X-HS
X-CC
X-HS-W_P8

Piston:	
X-6-5-P8	

X-6-5-P8W

for wood fastening

X-6-5-P8AL

Cartridge:

6.8/11 M 10 for DX 6 titanium, black





DX-Kwik fastener guide (DX-Kwik method/pre-drilled concrete)

Fastener guide:

X-6-F8



Fastener:	
X-M6H37 FP8	
X-M8H37 P8	
X-CRM842	

 Fastener:

 X-DNH 37 P8S15

 X-DKH 48 P8S15

Piston: X-6-5-PKwik

Cartridge:

6.8/11 M10 for DX 6 titanium, black

Piston:

X-6-5-P8

Cartridge: 6.8/11 M10 for DX 6

titanium, black

Narrow access fastener guide (Ø: 15.2 mm, h: 53.2 mm)

Fastener guide: X-6-F8N15



Fastener:
X-P_P8
X-U_P8
X-C_P8
X-CR_P8
X-CRM_P8
X-ST-GR M8_P8

Piston:

X-6-5-P8

Cartridge: 6.8/11 M10 for DX 6 titanium, black

Narrow access fastener guide (w × t × h: 10.4 × 25.9 × 50 mm)

Fastener guide:

X-6-F8N10



Fastener:	
X-P_P8	
X-U_P8	
X-C_P8	
X-CR_P8	
X-CRM_P8	

Piston: X-6-5-P8

Cartridge:

6.8/11 M10 for DX 6 titanium, black





Grating fastener guide

Fastener guide:	Fastener:	Piston:
X-6-FGR	X-GR	X-6-5-PGR
	X-PGR-RU	
	X-EM 8H	Cartridge:



Fa	stener:	
X-(GR	
X-F	PGR-RU	
X-E	EM 8H	

6.8/11 M10 for DX 6 titanium, black

M10 fastener guide

Fastener guide: X-6-F10



Piston: X-6-5-P10

Cartridge: 6.8/11 M10 for DX 6 titanium, black

Insulation fastener guide (up to 140 mm insulation thickness)

Fastener guide:

X-6-FIE-L



Fastener: X-IE XI-FV

Piston:

X-6-5-PIE-L

Cartridge: 6.8/11 M10 for DX 6 titanium

Insulation fastener guide (up to 200 mm insulation thickness)

Fastener guide:

X-6-FIE-XL

Fastener: X-IE XI-FV

Piston:

X-6-5-PIE-XL

Cartridge:

6.8/11 M10 for DX 6 titanium





DX6 IE Digitally enabled powder-actuated tool for fastening insulation



Fastener guide:X-6-FIE-XL

 Fastener:

 X-IE

 XI-FV

Piston: X-6-5-PIE-XL



Cartridge: 6.8/11 M10 for DX 6 titanium

DX6 GR Digitally enabled powder-actuated tool for fastening grating



Fastener guide: X-6-FGR



Fastener:	
X-GR	
X-PGR-RU	
X-EM 8H	

Piston:

X-6-5-PGR

Cartridge: 6.8/11 M10 for DX 6 titanium, black

DX6 F10 Digitally enabled powder-actuated tool



Fastener guide: X-6-F10



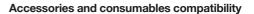
Piston:

X-6-5-P10

Cartridge:

6.8/11 M10 for DX 6 titanium, black





DX 76 PTR Powder-actuated tool for fastening metal decks with collated nails

	Fastener:	Piston:
	X-ENP-19 L15 MX	X-76-P-ENP-PTR
E		Piston brake:
		X-76-PB-PTR
		Cartridges:
		6.8/18M - black, red, blue
	Fastener:	Piston:
	X-ENP2K-20 L15 MX	X-76-P-ENP2K-PTR
		Piston brake:
		X-76-PB-PTR
		Cartridges:
		6.8/18M – red, blue, green
DX 76 PTR Powder-actuated to	ool for fastening metal decks wi	th single nails
	Fastener:	Piston:
	X-ENP-19 L15	X-76-P-ENP-PTR
	Fastener guide:	Piston brake:

Fastener guide: X-76-F-15-PTR



Fastener: X-ENP2K-20 L15

Fastener guide:X-76-F-15-PTR



Cartridges: 6.8/18M – black, red, blue

Piston: X-76-P-ENP2K-PTR

Piston brake: X-76-PB-PTR

X-76-PB-PTR

Cartridges: 6.8/18M – red, blue, green





DX 76 PTR Powder-actuated tool for fastening metal decks on concrete – DX-Kwik



Fastener:	
NPH2-42 L15	_

Fastener guide:X-76-F-Kwik-PTR



Piston: X-76-P-Kwik-PTR

Piston brake: X-76-PB-PTR

Cartridges: 6.8/18M – blue, yellow

DX 76 PTR Powder-actuated tool for fastening HVB shear connectors



Fastener:X-ENP-21 HVB

Connector: X-HVB shear connectors

Fastener guide: X-76-F-HVB-PTR X-76-P-HVB-PTR

Piston stop: X-76-PS

Piston:

Cartridges: 6.8/18M – black, red







DX 76 PTR Powder-actuated tool for fastening gratings and checker plates



Grating fastener:
X-CRM8-15-12 P8
X-EM8H_P8
X-ST-GR M8_P8

Chequer plate fastener X-CRM8-15-12 P8 X-CRM8-9-12 P8 X-ST-GR M8_P8

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Fastener guide: X-76-F-8-GR-PTR (Δ 19 mm×58 mm) Piston: X-76-P-8-GR-PTR

Piston brake: X-76-PB-PTR

Cartridges:
6.8/18M -
blue, yellow
For X-GR and X-GRRU:
red, blue, yellow



DX 76 PTR Powder-actuated tool for fastening heavy duty applications



Fastener:
EDS 19 P10, EDS 22 P10
X-EM10H-24-12 P10
X-EM8H-15-12 FP10
X-CR M8-15-12 FP10
X-CR M8-9-12 FP10
DS27 – 37 P10

Fastener guide:X-76-F-10-PTR

(Δ 19 mm×58 mm)



Piston:

X-76-P-10-PTR

Piston brake: X-76-PB-PTR

Cartridges:

6.8/18M -

black, red, blue





DX 76 MX Powder-actuated tool for fastening metal decks with collated nails



Piston: X-76-P-ENP

> Cartridges: 6.8/18M – black, red, blue

Fastener: X-ENP2K-20 L15 MX

Piston: X-76-P-ENP2K

Cartridges: 6.8/18M – red, blue, yellow, green

DX 76 Powder-actuated tool for fastening metal decks with single nails



Fastener: X-ENP-19 L15

Fastener guide: X-76-F-15



Fastener: X-ENP2K-20 L15

Fastener guide: X-76-F-15



Piston: X-76-P-ENP2K

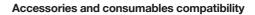
Piston: X-76-P-ENP

Cartridges:

Cartridges: 6.8/18M – red, blue, yellow, green

6.8/18M - black, red, blue





DX 76 Powder-actuated tool for fastening metal decks on concrete – DX-Kwik



Fastener:	
NPH2-42 L15	

Fastener guide: X-76-F-Kwik



Piston: X-76-P-Kwik

Cartridges: 6.8/18M – blue, yellow

DX 76 Powder-actuated tool for fastening HVB shear connectors



Fastener: X-ENP-21 HVB

Connector: X-HVB shear connectors

Fastener guide:

X-76-F-HVB



X-76-PS Cartridges:

Piston:

X-76-P-HVB

Piston Stop:

6.8/18M – black, red





DX 76 Powder-actuated tool for fastening gratings and checker plates



Grating fastener:		
X-CRM8-15-12 FP10		
X-EM8-15-12 FP10		

Checker plate fastener X-CRM8-15-12 FP10 X-CRM8-9-12 FP10

Fastener guide:

X-76-F-10



Piston: X-76-P-GR

Cartridges: 6.8/18M – black, red, blue, yellow, green

DX 76 Powder-actuated tool for fastening heavy duty applications



Fastener: (for nail) EDS 19 P10, EDS 22 P10

Fastener: (for stud)X-EM10-24-14 P10

Fastener guide: X-76-F-10 for nails and studs



Piston: (for nail) X-76-P-10

Piston: (for stud) X-76-P-GR

Cartridges: 6.8/18M – black, red, blue, yellow, green





DX 860-ENP Powder-actuated tool for fastening metal decks



DX 860-HSN Powder-actuated tool for fastening metal decks



Fastener:	
X-EDNK22-THQ12M	
X-EDN19-THQ12M	
X-HSN 24	

Piston:

X-860-P10

Cartridges:

6.8/11M40 – black, red, yellow





DX 9-ENP Digitally enabled powder-actuated tool for fastening metal decks



Fastener:X-ENP-19 L15 MXR

Nail Magazine: MX 9 - ENP packed Piston:

Piston X-9-ENP kit

Cartridges: 6.8/18M40 – black, red, blue

DX 9-HSN Digitally enabled powder-actuated tool for fastening metal decks



Fastener: X-EDNK22-THQ12M X-EDN19-THQ12M X-HSN 24

Nail Magazine:

MX 9 - HSN packed

Piston:

X-9-HSN kit

Cartridges:

6.8/11M40 black, red, yellow



Cartridges - Propellants for powder-actuated tools

The table below provides an overview of the main Hilti cartridges and their characteristics. For more information about cartridges and power levels, please refer to section **2.5.1 Cartridges (power loads, boosters)**.

Cartridge	Color	Energy	Fastening tools			
	code*	scale*	DX 2,	DX 450, DX 460, DX 462.	DX 351	DX 860-HSN ¹
			DX 36	DX 402, DX 5		DX 9-HSN1
6.8/11M10 and 6.8/11M40 ¹	High precision					
(.27 caliber short)	brown	2 [2]				
	white [brown]	2 [2]				
	green	3 [3]				
	yellow	4 [4]				
	red	6 [5]				
	black [purple]	7 [6]				
6.8/11M10 for DX6	titanium**	6 [5]	DX6			
(.27 caliber short)	black	7 [6]	DX6			
6.8/18M10	green	3	DX 76	/ DX 76	PTR	
(.27 caliber long)	yellow	4	DX 76 / DX 76 PTR			
	blue	5 [4.5]	DX 76 / DX 76 PTR			
	red	6 [5]	DX 76,	/ DX 76	PTR	
	black [purple]	7 [6]	DX 76 / DX 76 PTR			
6.8/18M40	blue	5 [4.5]	DX 860)-ENP, [DX 9-EN	IP
(.27 caliber long)	red	6 [5]	DX 860-ENP, DX 9-ENP			
	black [purple]	7 [6]	DX 860)-ENP, [DX 9-EN	IP
6.8/18	green	3	DX 600)N		
(.27 caliber long)	yellow	4	DX 600)N		
	red	5	DX 600)N		
	black [purple]	7 [6]	DX 600			

= compatible

* Color code and energy scale according to EN 16264, in brackets according to PATMI Training Manual.

** Hilti color code for DX6 cartridge stripe.

• All collated Hilti cartridges are available as Clean-Tec, environmentally-friendly heavy metal free cartridges except for 6.8/18 (.27 calibre long) for DX 600N tool.





Gas-actuated tools

GX 90 WF Gas-actuated tool for wood framing



Fastener:GX-WF_
smooth bright MX 34GX-WF_
profiled bright MX 34GX-WF_
smooth galvanized MX 34GX-WF_
profiled galvanized MX 34GX-WF_
smooth HDG MX 34GX-WF_
profiled HDG MX 34GX-WF_
profiled A2 stainless D-head

GX-WF_ profiled A2 stainless full round head GX-WF_ profiled A4 stainless D-head GX-WF_ profiled A4 stainless full round head

Energy: GC 32







GX 120 Gas-actuated tool for interior finishing applications



Fastener:
X-EGN 14 MX
X-GHP 16 MX
X-GHP 17 MX
X-GHP 20 MX
X-GHP 24 MX
X-GN 20 MX
X-GN 27 MX
X-GN 32 MX
X-GN 39 MX



GX 120-ME Gas-actuated tool for mechanical and electrical applications



Fastener:
X-EGN 14 MX
X-GHP 16 MX
X-GHP 17 MX
X-GHP 20 MX
X-GHP 24 MX
X-GN 20 MX
X-GN 27 MX
X-GN 32 MX
X-GN 39 MX
X-EHS MX
X-ECC MX
X-HS-W MX
X-EKB MX
X-FB MX
X-DFB MX
X-ECT MX
X-ET MX
X-EKS MX
X-EMTSC
X-G M6/W6
X-UCT MX
X-SW 30, X-SW 60

Energy:

GC20. GC 21 and GC 22







GX 3 Gas-actuated tool for interior finishing and building construction applications



Fastener:
X-S 14 G3 MX
X-P 17 G3 MX
X-P 20 G3 MX
X-P 24 G3 MX
X-C 20 G3 MX
X-C 27 G3 MX
X-C 32 G3 MX
X-C 39 G3 MX
X-M6-7-14 G3 P7
X-M6-7-24 G3 P7
X-W6-12-20 G3 P7
X-W6-12-14 G3 P7

Energy: GC42 for international



GC41 for use in North America GC40 for use in Japan

GX 3-ME Gas-actuated tool for mechanical and electrical applications



Fastener:
X-S 14 G3 MX
X-P 17 G3 MX
X-P 20 G3 MX
X-P 24 G3 MX
X-C 20 G3 MX
X-C 27 G3 MX
X-C 32 G3 MX
X-C 39 G3 MX
X-M6-7-14 G3 P7
X-M6-7-24 G3 P7
X-W6-12-20 G3 P7
X-W6-12-14 G3 P7

Energy:

GC42 for international



GC41 for use in North America GC40 for use in Japan



GX 2 Gas-actuated tool for interior finishing and building construction applications



Fastener:
X-P 14 G2 MX
X-P 17 G2 MX
X-P 20 G2 MX
X-C 20 G2 MX
X-C 27 G2 MX
X-C 32 G2 MX
X-C 39 G2 MX

Energy:	
GC52	
PHILIPPI	GC 52

Gas cans

The table below provides an overview of the main Hilti gas cans and their characteristics.

Model	Number of fastenings per can	Temperature range		Fuel gauge	Tool to be used with
GC 21	750	-5°C - +50°C		Yes	GX 120
GC 22	750	-10°C - +50°C		Yes	GX 120
GC 32	1000	-10°C - +50°C		No	GX 90 - WF
GC 42	1200	-10°C - +50°C	Destination of the second seco	Yes	GX 3
GC 52	1100	-10°C - +50°C		Yes	GX 2

Note: The models sold in North America and Japan have slightly different characteristics.





Battery-actuated tools

BX 3-BT Battery-actuated tool for multi-purpose and electrical connection applications



Fastener:
X-BT-MR M6/10 SN 8
X-BT-MR W6/10 SN 8
X-BT-MR M8/14 N 8
X-BT-MR M10/15 SN 8
X-BT-MR W10/15 SN 8
X-BT-ER M6/3 SN 8
X-BT-ER W6/3 SN 8
X-BT-ER M8/7 SN 8
X-BT-ER M10/7 SN 8
X-BT-ER W10/7 SN 8
X-BT M10-24-6 SN12-R
X-BT M10-24-6-R
X-BT W10-24-6 SN12-R
X-BT W10-24-6-R
X-BT-ER M10/3 SN4
X-BT-ER W10/3 SN4
X-BT-ER M8/7 SN4

Energy: Battery

Fastener Guide:X-FG B3-BT M (M6/M8/M10)X-FG B3-BT W (W6/W10)

BX 3-BTG Battery-actuated tool for fastening gratings



Fastener:
X-BT-GR M8/7 SN 8
X-BT M8-15-6 SN12-R

Energy:

Battery

Fastener Guide:

X-FG B3-BTG (M8 short)



BX 3-IF Battery-actuated tool for interior finishing and building construction applications



Fastener:
X-S 14 B3 MX
X-P 17 B3 MX
X-P 20 B3 MX
X-P 24 B3 MX
X-C 20 B3 MX
X-C 24 B3 MX
X-C 30 B3 P7
X-C 36 B3 P7
X-M6-7-14 B3 P7
X-M6-7-24 B3 P7
X-W6-12-20 B3 P7
X-W6-12-14 B3 P7

Energy:	
Battery	

BX 3-ME Battery-actuated tool for mechanical and electrical applications



Fastener:	
X-S 14 B3 MX	X-FB MX
X-P 17 B3 MX	X-DFB M
X-P 20 B3 MX	X-ECT M
X-P 24 B3 MX	X-ET MX
X-P 30 B3 P7	X-EKS M
X-P 36 B3 P7	X-EMTSC
X-C 20 B3 MX	X-ECH M
X-C 24 B3 MX	X-UCT M
X-M6-7-24 B3 P7	X-DHS M
X-M6-7-14 B3 P7	X-ECH FE
X-W6-12-20 B3 P7	X-EKB FE
X-W6-12-14 B3 P7	X-SW MX
X-EHS MX	
X-ECC MC	Energy:
X-HS-W MX	Battery
X-EKB MX	

X-FB MX
X-DFB MX
X-ECT MX
X-ET MX
X-EKS MX
X-EMTSC MC
X-ECH MX
X-UCT MX
X-DHS MX
X-ECH FE MX
X-EKB FE MX
X-SW MX
-





BX 3 (02) Battery-actuated tool for interior finishing applications



Fastener:
X-S 14 B3 MX
X-P 17 B3 MX
X-P 20 B3 MX
X-P 24 B3 MX
X-C 20 B3 MX
X-C 24 B3 MX
X-C 30 B3 MX

Energy:	
Battery	

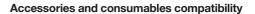
BX 3-L (02) Battery-actuated tool for interior finishing applications



Fastener:
X-S 14 B3 MX
X-P 17 B3 MX
X-P 20 B3 MX
X-P 24 B3 MX
X-C 20 B3 MX
X-C 24 B3 MX
X-C 30 B3 MX
X-C 36 B3 MX

Energy: Battery





BX 3-ME (02) Battery-actuated tool for mechanical and electrical applications



Fastener:
X-S 14 B3 MX
X-P 17 B3 MX
X-P 20 B3 MX
X-P 24 B3 MX
X-C 20 B3 MX
X-C 24 B3 MX
X-EHS MX
X-ECC MC
X-HS-W MX
X-EKB MX
X-FB MX
X-DFB MX

Dettern
Energy:
 X-SW MX
 X-EKB FE MX
 X-ECH FE MX
 X-DHS MX
 X-UCT MX
X-ECH MX
X-EMTSC MC
 X-EKS MX
X-ET MX
X-ECT MX

Battery

BX 3-L (03) Battery-actuated tool for interior finishing applications



Fastener:
X-S 14 B3 MX
X-P 17 B3 MX
X-P 20 B3 MX
X-P 24 B3 MX
X-C 20 B3 MX
X-C 24 B3 MX
X-C 30 B3 MX
X-C 36 B3 MX

Energy: Battery

BX 3 (03) Battery-actuated tool for interior finishing applications



Fastener:
X-S 14 B3 MX
X-P 17 B3 MX
X-P 20 B3 MX
X-P 24 B3 MX
X-C 20 B3 MX
X-C 24 B3 MX
X-C 30 B3 MX

Energy:

Battery





Energy: Battery

BX 3-ME (03) Battery-actuated tool for mechanical and electrical applications



Fastener:
X-S 14 B3 MX
X-P 17 B3 MX
X-P 20 B3 MX
X-P 24 B3 MX
X-C 20 B3 MX
X-C 24 B3 MX
X-EHS MX
X-ECC MC
X-HS-W MX
X-EKB MX
X-FB MX
X-DFB MX

X-ECT MX
X-ET MX
X-EKS MX
X-EMTSC MC
X-ECH MX
X-UCT MX
X-DHS MX
X-ECH FE MX
X-EKB FE MX
X-SW MX









Part 4:

Fasteners



/ Fasteners





X-ENP Decking nail

Product info

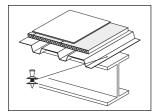
Product description



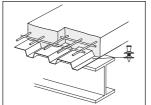
- Fully knurled tip provides high holding capacity
- High application limits with steel thickness $\geq 6 \text{ mm} (1/4'')$
- Proven system confirmed by global and local approvals
- Faster and safer fastening system compared to welding
- No pre-drilling required

Application conditions

Applications



Roof decking



Floor decking

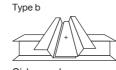
Siding

Connection types

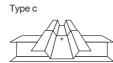
Type a



Single layer



Side overlap (two layer)



End overlap (two layer)

Type d



Side/end overlap (four layer)

Base materials



Steel



er) (

Load conditions



Static/ quasi static





Environmental condition

- Intended use only for fastenings not directly exposed to external weather or moist conditions.
- Fasteners can be used for exterior applications by using SDK2 stainless sealing caps.
- Exposure to exterior weather conditions during construction phase shall not exceed 180 days.
- For more details, please refer to following technical document(s): Hilti Corrosion Handbook.

Approvals and certificates

Authority	Approvals/certificates	Functional area	Application area	
DIBt	ETA-04/0101	Global	Deck fastening	
FM	3054498	USA	Deck fastening	
	3029102	USA	Form deck fastening	
IAPMO	ER 2018, Verco Co-listing	USA	Deck fastening	
	ER 161, ASC Co-listing	USA	Deck fastening	
ICC-ES	ESR-1663	USA	Deck fastening	
	ESR-2197	USA	Deck fastening	
	ESR-2776	USA	Deck fastening	
LR	97/00077(E4)	Global	Thin sheet fastening	

<u>LR</u>

 Not all information presented in this product data sheet might be subject to approval/certificate content. Please refer to approval/certificate for further information.





Product data

Dimensions

Technical drawing	Designation	Length	Shank	Head	Steel
			diameter	diameter	washer
					diameter
		L	ds	d _h	d _{washer}
d. G	X-ENP-19 L15				
	X-ENP-19 L15 MX	23.8 mm	4.5 mm	7.4 mm	15 mm
d d washer	X-ENP-19 L15 MXR				

Material properties for carbon steel parts

Designation	Element	Material	Coating	Coating	Hardness
				thickness	
X-ENP-19 L15		Steel C67	zinc	8 to 16 µm	58 HRC
X-ENP-19 L15 MX	Nail				
X-ENP-19 L15 MXR					





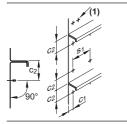
Application requirements

Fastened material properties

Fastened material	Tensile strength	Fastened material according to EN 10346
Steel sheet	≥ 360 N/mm ²	≥ S280GD

Fastener positioning in fastened material

	Fastened material	Trapezoidal profile	
	Fastened material thickness t _i	0.75 to 2.5 mm	
	Fastened material thickness t _{I,tot}	4 mm	
	Edge distance c _{min}	20 mm	
	Spacing s _{1,min}	45 mm	
$\overline{ \mathbf{x} \mathbf{x}}$	Asymmetric double fastening points	load reduction: 0.7 N_{Rk}	
	Spacing s _{2,min}	20 mm	
+ +			



Fastened material	Liner tray
Fastened material thickness t _l	0.75 to 1.5 mm
Edge distance c _{1,min}	20 mm
Edge distance c _{2,max}	75 mm
Spacing s _{min}	80 mm

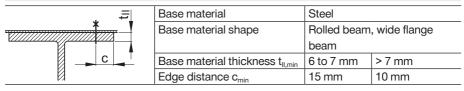
• When driving the fastener, the fastening tool needs to be positioned perpendicular to the surface. If $c_2 > 75$ mm, it is recommended to drive an additional fastener (1) at the other side of the tray.

H

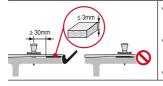




Base material properties and fastener positioning in base material

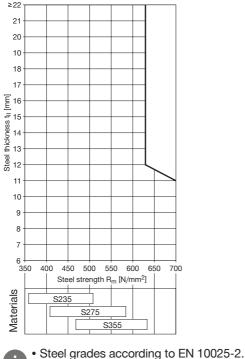


Fastener positioning in case of insulation/isolation tapes



Steel sheeting shall be in direct contact with the steel supporting structure in the connection area.
Fastener shall be installed minimum 30 mm away from the edge of the insulation/ isolation tape.
Insulation/ isolation tape thickness ≤ 3 mm

Application limitation







Performance data

Characteristic resistance under tension and shear load

Fastened	Trapezoidal	profile		Liner trays		
material	Tension	Shear	Reduction	Connection	Tension	Shear
thickness	load	load	factor	type	load	load
t _i	N _{Rk}	V _{Rk}	α _{cycl}		N _{Rk}	V _{Rk}
0.63 mm	4.1 kN	4.0 kN		a, b, c, d	-	-
0.75 mm	6.3 kN	4.7 kN		a, b, c, d	4.4 kN	3.3 kN
0.88 mm	7.2 kN	5.4 kN		a, b, c, d	5.0 kN	3.8 kN
1.00 mm	8.0 kN	6.0 kN]	a, b, c, d	5.6 kN	4.2 kN
1.13 mm	8.4 kN	7.0 kN	1.0	a, c	5.9 kN	4.9 kN
1.25 mm	8.8 kN	8.0 kN	1.0	a, c	6.2 kN	5.6 kN
1.50 mm	8.8 kN	8.6 kN]	а	6.2 kN	6.0 kN
1.75 mm	8.8 kN	8.6 kN]	а	-	-
2.00 mm	8.8 kN	8.6 kN	1	а	-	-
2.50 mm	8.8 kN	8.6 kN]	а	-	-



• For intermediate fastened material thicknesses linear intrepolation or the lower value can be used.

- For liner trays the load reduction according to EN 1993-1-1:2006, section B.3 (7) and fig. 8.2 has been taken into account.
- For trapezoidal profiles using specified connection types and steel grades up to S320 according to EN 10346 it is not necessary to take effects of constraints due to temperature into account.
- For trapezoidal profiles using specified connection types, steel grades S350 according to EN 10346 and base material thickness $t_{II} \ge 8$ mm forces of constraints can be neglected (verified by Hilti).
- Minimum fastened material thickness for DX 76 PTR according to ETA-04/0101: 0.75 mm.

Characteristic resistance under tension and shear load for other applications

Fastened material	Fastened material	Tension load	Shear load
	thickness		
	t _{l,max}	N _{Rk}	V _{Rk}
Clips, brackets, etc.	2.5 mm	4.5 kN	8.6 kN

- Redundancy of fastening points is required.
- Prying effect shall be considered.
- Valid for predominantly static loading.
- Failure of fastened material is not considered in loads.





Calculation equations

Calculation	Partial	Global
	factor for	safety factor
	material	
	properties	
$N_{Rd} = \alpha_{cycl} N_{Rk} / \gamma_{m}$	γ _m = 1.25	-
$V_{Rd} = V_{Rk} / \gamma_m$	γ _m = 1.25	-
$N_{\text{Rec}} = \alpha_{\text{cycl}} N_{\text{Rk}} / \gamma_{\text{global}}$	-	$\gamma_{global} = 1.875$
$V_{\text{Rec}} = V_{\text{Rk}} / \gamma_{\text{global}}$	-	$\gamma_{\text{global}} = 1.875$
	$\begin{split} N_{Rd} &= \alpha_{cycl} N_{Rk} / \gamma_m \\ V_{Rd} &= V_{Rk} / \gamma_m \\ N_{Rec} &= \alpha_{cycl} N_{Rk} / \gamma_{global} \end{split}$	$ \begin{array}{c} factor \ for \\ material \\ properties \end{array} \\ \hline N_{Rd} = \alpha_{cycl} \ N_{Rk} / \gamma_m \qquad \gamma_m = 1.25 \\ \hline V_{Rd} = V_{Rk} / \gamma_m \qquad \gamma_m = 1.25 \\ \hline N_{Rec} = \alpha_{cycl} \ N_{Rk} / \gamma_{global} \qquad - \end{array} $





System recommendation

Tool recommendation

DX 76, DX 76 MX, DX 860-ENP, DX 9-ENP:

Fastener	Tool	Fastener guide	Piston	Cartridge
X-ENP-19 L15	DX 76	X-76-F-15	X-76-P-ENP	6.8/18 M10
X-ENP-19 L15 MX	DX 76 MX	MX 76	X-70-F-LINF	0.0/10 1010
X-ENP-19 L15 MXR	DX 860-ENP	-	X-76-P-ENP	6.8/18 M40
A-ENF-19 L15 MAR	DX 9-ENP	-	X-9-ENP	6.8/18 M40

DX 76 PTR:

Fastener	Tool	Fastener guide	Piston	Cartridge
X-ENP-19 L15	DX 76 PTR	X-76-F-15-PTR	X-76-P-ENP-PTR	C 0/10 M10
X-ENP-19 L15 MX	DATOPIN	MX 76-PTR	X-70-P-ENP-PIR	0.0/10 1010

0

 For more details, please refer to the chapter Accessories and consumables compatibility in the Direct Fastening technology Manual (DFTM).

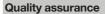
Cartridge recommendation

		Cartridge color (tool power level)			
Tool	Base material	Base material			
	thickness	S235	S275, S355		
DX 76,	t _{II} ≥ 15 mm	red 📕 (4), black 🔳 (2)	black 🔳 (4)		
DX 76 MX,	10 ≤ t _{II} < 15 mm	red 📕 (3), black 📕 (1)	black 🔳 (3)		
DX 860-ENP,	8 ≤ t _{II} < 10 mm	blue 🗖 (4), red 📕 (2)	red 📕 (4), black 🔳 (2)		
DX 9-ENP	6 ≤ t _{II} < 8 mm	blue 🗖 (3)	red 📕 (3)		
	t _{II} ≥ 15 mm	rad = (4) block $= (2)$	black ■ (4)		
	10 ≤ t _∥ < 15 mm	- red ■ (4), black ■ (2)			
DX 76 PTR	8 ≤ t _{ii} < 10 mm	blue 🗖 (4), red 📕 (2)	red 📕 (4), black 📕 (2)		
	6 ≤ t _{II} < 8 mm	blue 🗖 (3), red 📕 (1)	red 📕 (3), black 📕 (1)		

• Tool power level adjustment by setting tests on site (see chapter quality assurance).

- For S275: Start tool energy selection with recommendation for S355.
- For more details, please refer to the chapter Accessories and consumables compatibility in the Direct Fastening Technology Manual (DFTM).





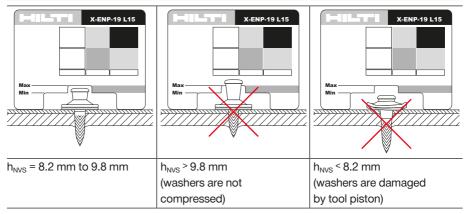
Fastening inspection

	Designation	Fastener stand-off	
		h _{NVS}	
	X-ENP-19 L15		
	X-ENP-19 L15 MX	8.2 to 9.8 mm	
	X-ENP-19 L15 MXR		
A Dever	The powder-actuate	d fastener is properly set if the metal	
	sheet tightened against the steel surface and the nail head		
	standoff h _{NVS} is in accordance with the requirements given		
	in ETA-04/0101, Annex C1 and Annex C2. A piston mark on		
and the second	the top washer is clearly visible.		

E

Always review/ follow the instruction for use (IFU) accompanying the product.

Fastening inspection with checking gauge for single layer fastenings



For multiple layer fastenings check piston mark on washer.
 If measurement is needed, us a slide caliper and measure nail head stand-off next to the perimeter of the washer.

X-ENP





Trouble shooting

Issue	Visual	Criteria	Trouble	Possible cause	Action
Nail stand-off too high	S.	No piston mark visible, nail head stays off, stand-off too high	Deck is not fastened properly to the beam	Power setting too low or cartridge not strong enough	Dial up power setting or increase strength of cartridg
Nail stand-off is OK		Washer compressed, piston mark clearly visible, deck flat – no deformation	_	-	-
Nail stand-off is too low		Washer over compressed, deck deformed, stand-off too low	Deck is not fastened properly to the beam	Power setting too high or cartridge is too strong	Dial down power setting or decrease strength of cartridge
Gap between deck profile and beam		Nail stand off OK or too low without piston clear mark	Deck profile does not lay solid on the beam	Gap caused by slope of the deck or local effects	Avoid gap between sheet and beam or fasten at the right side of the beam
Beam miss		Nail stand off OK or too low, sheet metal one sided deformed (edge of the beam visible)	Beam miss	Deck not marked	Mark the deck

Fastener program

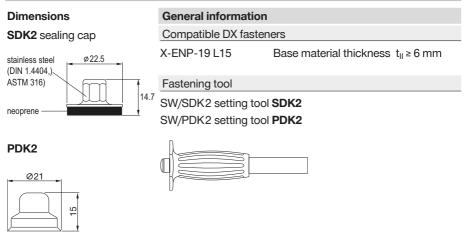
Item no. and description

•		
Designation	Item no.	Description
X-ENP-19 L15	283506	Single nail
X-ENP-19 L15 MX	283507	- Collated nail
X-ENP-19 L15 MXR	283508	



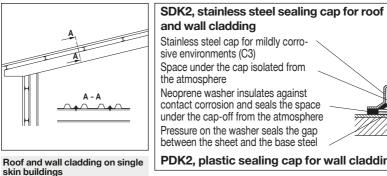
SDK2, PDK2 Sealing cap for cladding fastening

Product data



Applications

Examples





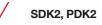
under the cap-off from the atmosphere Pressure on the washer seals the gap between the sheet and the base steel

 $\overline{\mathcal{X}}$

PDK2, plastic sealing cap for wall cladding

Corrosion protection



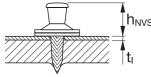


Fastening quality assurance

Fastening inspection

For detailed information on X-ENP-19 L15 please see the according product pages.

X-ENP-19 L15



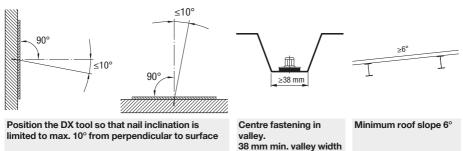
h_{NVS} Maximum thickness of single layer (type a): $t_{l, max} = 1.5 \text{ mm}$ t_{I} Total thickness of end overlap (type c): $\Sigma t_{l, tot} \le 2.5 \text{ mm}$

h_{NVS} = 8.2–9.8 mm

Note:

It has to be ensured, that the fastened sheet is properly compressed to the base material and no gap remains at fastening point location.

Installation



These are abbreviated instructions which may vary by application. **ALWAYS** review/follow the instructions accompanying the product.

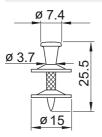




X-ENP 2K Siding and decking nail

Product data

Dimensions



Material specifications	
Carbon steel shank:	HRC 55.5
Zinc coating:	8–16 µm

Recommended fastening toolsTools:Single nail:DX 76 PTR withX-ENP 2K-20 L15X-76-F-15-PTR fastener guideV76 MX withX-76-F-15 fastener guideV76 MX with

Tools:	Collated nails:
DX 76 PTR	X-ENP 2K-20 L15 MX
DX 76 MX	(green magazine strip)

 For more details, please refer to the chapter
 Accessories and consumables compatibility in the Direct Fastening Technology Manual (DFTM).

Approvals and certificates

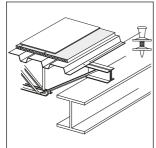
BUtgb (Belgium), ABS, ETA 13/0172 (Hilti-DX-DoP 003), LR 97/00077

н

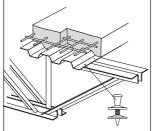
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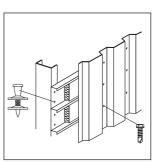
Applications

Examples



Roof and floor decking





Roof and floor decking





Performance data

Overlap	$3 \text{ mm} \le t_{II} \le 4 \text{ mm}$			4 mm ≤ t _{ll} ≤ 6 mm		
Sheeting thickness t _l [mm]	V _{Rk} [kN]	N _{Rk} [kN]	Types of conn.	V _{Rk} [kN]	N _{Rk} [kN]	Types of conn.
0.75	4.70	6.00	a, c	4.70	6.30	a, b, c, d
0.88	5.40	6.00	a, c	5.40	7.20	a, (b)*, c, d
1.00	6.00	6.00	a, c	6.00	8.00	a, (b)*, c, d
1.13	-	-	-	7.00	8.40	a, c
1.25	-	-	-	8.00	8.80	a, c
1.50	-	-	-	8.60	8.80	a

* Fastening type (b) covered for 5 mm ≤ t_{ll} < 6 mm, if N_{Bk} is reduced to 6.6 kN

Fastening type (b) fully covered for $t_{II} = 6$ mm

For a, b, c, d please refer to Application requirements, Sheet thicknesses and overlap types

Design

Design shear and tension resistance

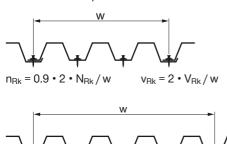
 $V_{Rd} = V_{Rk} / \gamma_{M} \qquad \qquad N_{Rd} = \alpha_{cycl} N_{Rk} / \gamma_{M \text{ with }} \alpha_{cycl} = 1.0 \text{ for all sheeting thickness } t_{I}$ $\alpha_{cycl} \text{ considers the effect of repeated wind loads}$

 $Y_M = 1.25$ in the absence of national regulations

Characteristic tension resistances n_{Rk} [kN/m] and shear resistances v_{Rk} [kN/m] per unit length, taking the effect of thermal constraints into account

 N_{Rk} and V_{Rk} characteristic shear and tension resistance

w ... width of the panel sheet

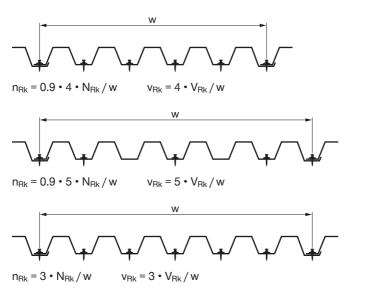


 $n_{Rk} = 0.9 \cdot 3 \cdot N_{Rk} / w$

 $v_{Bk} = 3 \cdot V_{Bk} / w$



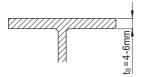




The same characteristic resistances can also be applied along supports at end-overlaps, if connection type "d" is not covered in the load table.

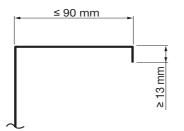
Application recommendation

Thickness of base material



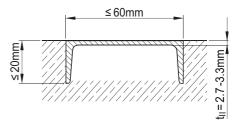
 $t_{II} = 4.0 - 6.0$ mm for general shapes

Fastening to cold-formed C- and Z-sections with a thickness from 2.9 to 4.0 mm



Grade: ≥ S320 GD according to EN 10346

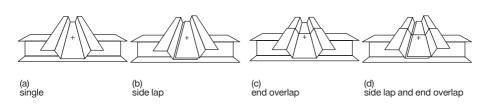
Fastening to U-shape concrete inlays with a nominal thickness t_{II} of 3 mm. t_{II} = 3.0 \pm 0.3 mm



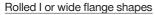


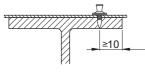


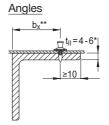
Sheet thicknesses and overlap types



Edge distances (mm)







* For t_{II} = 3 to 4 mm, restrictions on application. See approval or contact Hilti.

** Maximum recommended $b_x \le 8 \ge t_{II}$ however, jobsite verification advisable.

Trapezoidal profiles

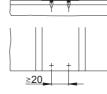


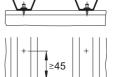


Centre fastenings in ribs

Clearance to end of

sheet



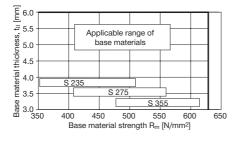


Double fastenings Note: Reduce tensile resistance per fastener to 0.7 N_{Bk}.





Application limits



Corrosion information

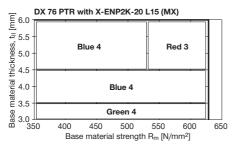


- The intended use only comprises fastenings which are not directly exposed to external weather conditions or moist atmospheres.
- For more details, please refer to following technical document: Hilti Corrosion Handbook

Fastener program and system recommendation					
Fasteners			Tools	Fastener guide	
	Designation	Item no.	Designation	Designation	
Single nail:	X-ENP 2K-20 L15	385133	DX 76 PTR	X-76-F-15-PTR	
			DX 76 MX	X-76-F-15	
Collated nails:	X-ENP 2K-20 L15 MX	385134	DX 76 PTR		
			DX 76 MX		
Piston:	X-76-P-ENP2K-PTR		DX 76 PTR		
	X-76-P-ENP2K		DX 76 MX		

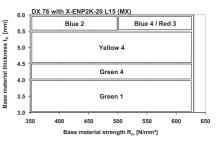
Cartridge selection and tool energy setting

DX 76 PTR



Fine adjustment by installation tests on site.

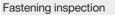


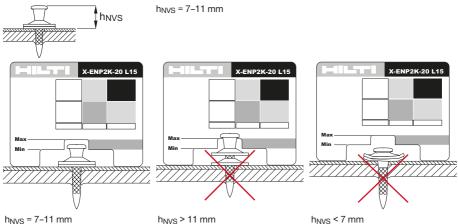






Quality assurance

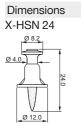






X-HSN 24 Diaphragm decking nail

Product data



X-EDNK22 THQ12 M



X-EDN19 THQ12 M



Material specifications	
Carbon steel shank:	HRC 55.5
Zinc coating:	5–13 µm

Recommended fastening tool Tools: DX 860-HSN, DX 9-HSN

Collated nails: X-HSN 24, red magazine strip X-EDNK22 THQ12 M, grey magazine strip X-EDN19 THQ12 M, white magazine strip

0

 For more details, please refer to the chapter
 Accessories and consumables compatibility in the Direct Fastening Technology Manual (DFTM).

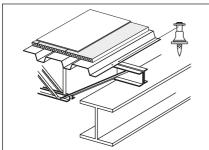
Approvals and certificates

FM, SDI, UL, ICC, ABS, LR

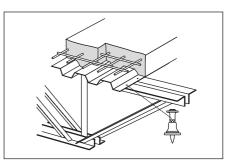
• Not all information presented in this product data sheet might be subject to approval/certificate content. Please refer to approval/certificate for further information.

Applications

Examples



Roof decking (diaphragm design)



Floor decking (diaphragm design)





Performance data

Design data for use in the USA – Diaphragm strength

Approvals provide load tables or calculation procedures for determination of the allowable strength (in lbs/ft or kN/m) of a steel deck diaphragm. The allowable diaphragm strength depends on the type, strength and thickness of the decking, the span of the decking, the type and pattern of the deck to frame fasteners (X-HSN24, X-EDNK22 or X-EDN19) and the type and spacing of the sidelap connectors (e.g. Hilti sidelap connectors S-SLC 01 and S-SLC 02).

For more details it is referred to the technical literature of Hilti North America ("Steel Deck Fastening Systems" Hilti North America Product Technical Guide) and the "Decking Design Center" offered on the website www.us.hilti.com as well as the respective approvals.

Recommended shear bearing loads V _{rec}					
Sheeting thic	Sheeting thickness t ₁ X-HSN24, X-EDNK22 and X-EDN19				
[Cauga]	[mm]	V _{rec} [lbs]	[kN]		
[Gauge]	[mm]	[ເມຣ]	[KN]		
22	0.76	500	2.20		
20	0.91	600	2.64		
18	1.21	785	3.45		
16	1.52	975	4.29		

 Valid for steel sheet with a minimum tensile strength of 45 ksi (310 N/mm²). Values refer to failure controlled by the single sheet metal attached.

• For intermediate sheet thicknesses, linear interpolation is allowed.

Recommended loads include safety factor 3.0 applied to mean shear resistance Q_f. An equation for Q_f is
published in the SDI (Steel Deck Institute) Diaphragm Design Manual, 3rd edition.

necommended tension load N _{rec}					
Sheeting thickness t ₁ X-HSN24, X-EDNK22		X-EDN19			
		N _{rec}		N _{rec}	
[Gauge]	[mm]	[lbs]	[kN]	[lbs]	[kN]
22	0.76	355	1.56	340	1.52
20	0.91	435	1.95	340	1.52
18	1.21	435	1.95	340	1.52
16	1.52	435	1.95	340	1.52

Recommended tension load N_{rec}

 Valid for steel sheet with minimum tensile strength of 45 ksi (310 N/mm²). Values are either controlled by pullover of sheet or by minimum value of fastener pullout of base metal.

• Values require fastener point penetration for X-EDNK22 and X-EDN19, of ½0 (12.7 mm). Higher recommended values be applicable for X-HSN24 (see Hilti North America "Steel Deck Fastening Systems")

 Recommended loads include a safety factor 3.0 applied to mean pullover resistance or a safety factor 5.0 applied to the mean value of pullout resistance.



Design data for use in Europe

Currently, the X-HSN24, X-EDNK22 and the X-EDN19 fasteners are only used in North America. Therefore, no design data is published evaluated in strict compliance with the provisions for European Technical Approvals.

For European markets, the fastener X-ENP2K-20 L15 in connection with the fastening tools DX 76 or DX 76 PTR are recommended for sheet metal fastenings to thin base materials (3 to 6 mm).

Application recommendation

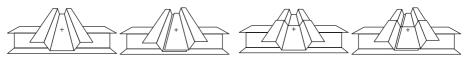
Fastening tool DX 860-HSN, DX 9-HSN

Fastener	Base material properties Thickness		Ultimate tensile strength	
	[inch]	[mm]	[ksi]	[N/mm ²]
X-EDNK22	1/8" to 1/4"	3.2 to 6.35	58 to 91	400-630
X-EDN19	³ /16" to ⁵ /16"	4.8 to 8.0	58 to 91	400-630
	⁵ /16" to ³ /8"	8.0 to 9.5	58 to 68	400–470

 Comment on fastening tool DX 460-SM and DX 5-SM: This fastening tool is recommended for base material thickness from ³/⁶" to ³/⁶" (4.8 to 8.0 mm). The same strength limits apply as with the DX 860-HSN and DX 9-HSN.

• X-HSN24 covers full range of the fasteners X-EDNK22 and X-EDN19.

Thickness of fastened material, fastener patterns, spacings and edge distance



(a) single (b) side lap (c) end overlap

(d) side lap and end overlap

As part of a steel deck diaphragm, all four fastening types (a), (b), (c) and (d) are executed with the X-HSN 24, X-EDNK22 and the X-EDN19. The sheet metal thickness typically varies between 22 Gauge (0.76 mm) and 16 Gauge (1.52 mm).

Dependent on the base material thickness and the frame fastener pattern, restrictions on the use of thicker decking might apply. For corresponding details of these provisions, it is referred to the quoted technical literature puplished by Hilti North America. This literature also contains details with respect to fastener patterns, spacings and edge distance adequately addressing the specifics of the diaphragm components used in the North American market.





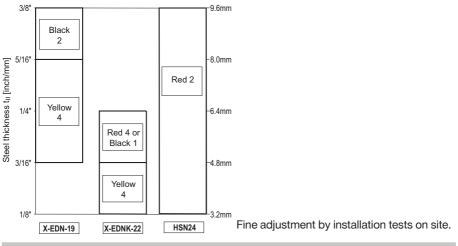
Corrosion information

- The intended use only comprises fastenings which are not directly exposed to external weather conditions or moist atmospheres.
- For more details, please refer to following technical document: Hilti Corrosion Handbook.

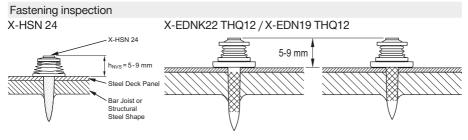
Fastener program and system recommendation

Fasteners	Designation	Item no.	Tool
Collated nails	X-HSN24	2042971	
	X-EDNK22 THQ12 M, grey magazine strip	34133	DX 860-HSN DX 9-HSN
	X-EDN19 THQ 12 M , white magazine strip	34134	

Cartridge selection and tool energy setting



Quality assurance







in

NPH Siding and decking nail

Dimensions	Material specifications				
Ø 7.4	Carbon steel shank: Zinc coating:	HRC 58 8–16 μm			
	Recommended fastening tools:				
Ø 4.5	Tools: DX 76 PTR with DX 76-F-Kwik-PTR fastener guide DX 76 with X-76-F-Kwik fastener guide	Cartridges: 6.8/18M blue			
ø 15		se refer to the chapter isumables compatibility ir echnology Manual (DFTM).			

Approvals and certificates

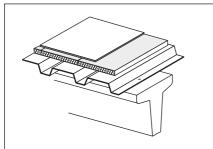
SOCOTEC (France), BUtgb (Belgium)



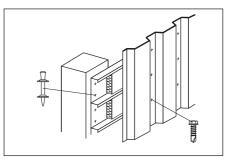
• Not all information presented in this product data sheet might be subject to approval/certificate content. Please refer to approval/certificate for further information.

Applications

Examples



Roof decking



Wall liners





Performance data

Recommended	loads
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Recommended loads				
Sheeting thickness t _l [mm] nominal	Trapezoidal profil (symmetric) N _{rec} [kN]	e V _{rec} [kN]	Liner trays (asymmetric) N _{rec} [kN]	V _{rec} [kN]
0.75	1.80	1.20	1.30	1.20
0.88	2.10	1.50	1.50	1.50
1.00	2.40	1.80	1.70	1.80
1.13	2.70	2.20	1.90	2.20
1.25	3.00	2.50	2.10	2.50
1.50	3.00	3.00	2.50	3.00
1.75	3.00	3.00	2.50	3.00
2.00	3.00	3.00	2.50	3.00

Recommended working loads valid for steel sheets with a minimum tensile strength of ≥ 360 N/mm².

For intermediate sheet thicknesses, use recommended load for next smaller thickness.

• Recommended loads are appropriate for EC1 (or similar) wind loading designs.

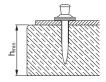
• The safety factor included is at least 2.0 applied to the static 5 % fractile value and 1.3 to the cyclic (5000 cycles) 5 % fractile value.

Application recommendation

Thickness of base material

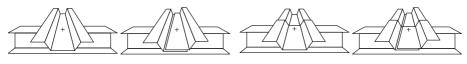
Minimum thickness of concrete member

h_{min} = 160 mm



Thickness of fastened material

Sheet thicknesses and overlap types



(a) single (b) side lap

(c) end overlap

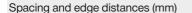
(d) side lap and end overlap

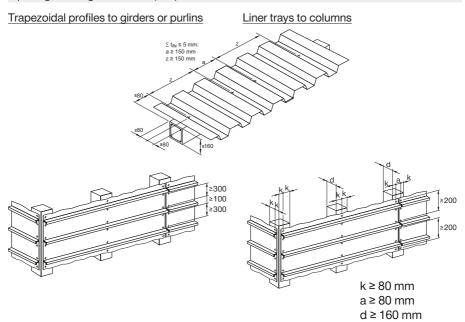
Nominal sheeting thickness t _l	Allowable overlap types
0.63–1.13 mm	a, b, c, d
> 1.13–2.50 mm	a

- With the above recommended sheet thickness and overlap types, the effects of temperature induced forces
 of constraint during construction can be neglected.
- These recommendations are valid for sheets up to S350GD.
- With other sheets or overlaps or when unusually large forces of constraint are expected, analyse the structural system to ensure that the shear force acting on the nail does not exceed V_{rec}.









Application limits

Types	of	concrete

Concrete design strength

Minimum strength/age at

time of fastening Minimum dimensions

of concrete member

- Precast and cast-in-place pre-stressed concrete
- · Precast and cast-in-place reinforced concrete
- Minimum C20/25 (f_c = 20 N/mm², f_{cc} = 25 N/mm²)
- Maximum C45/55 (f_c = 45 N/mm², f_{cc} = 55 N/mm²)
- The NPH/DX-Kwik system has been successfully used in concrete having an in-place cube strength of 70 N/mm²
- C20/25 concrete must be 28 days old
- C45/55 concrete must be 15 days old
- Minimum width = 180 mm
- Minimum thickness = 160 mm

Corrosion information

- The intended use only comprises fastenings which are not directly exposed to external weather conditions or moist atmospheres.
 - For more details, please refer to following technical document: Hilti Corrosion Handbook.





Fastener programm

Fasteners		Tool	Fastener guide	Piston
Designation	Item no.	Designation	Designation	Designation
NPH2-42 L15	40711	DX 76	X-76-F-Kwik	X-76-P-Kwik
		DX 76 PTR	X-76-F-Kwik-PTR	X-76-P-Kwik-PTR

Cartridge recommendation

Cartridges 6.8/18 M blue

- Tool power level adjustment by setting tests on site.
- Start tool energy selection with lowest recommended tool power level.

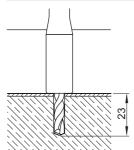
Place fastener with DX 76 PTR

or DX 76

• Correct according requirement from chapter quality assurance.

Quality assurance

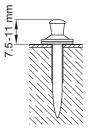




Pre-drill with TX-C-5/23 drill bit (Item no.: 00061787)

Fastening inspection





Check for conformity with recommendations (detailing spacing and edge distances for fastening)

Check the nailhead standoff of completed fastenings

These are abbreviated instructions which may vary by application. ALWAYS review/follow the instructions accompanying the product.

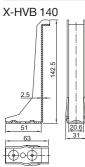


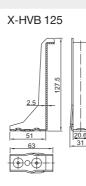


X-HVB Shear connector

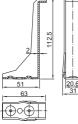
Product data

Dimensions





X-HVB 110

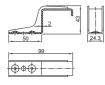


X-HVB 95

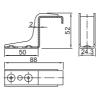




X-HVB 40



X-HVB 50



X-ENP-21 HVB



Material specifications

X-HVB	
Carbon steel:	R _m = 295–350 N/mm ²
Zinc coating:	≥ 3 µm
X-ENP-21 HVB	
Carbon steel shank:	HRC58
Zinc coating:	8–16 µm

Recommended fastening tools				
Tool	DX 76	DX 76 PTR		
Fastener guide	X-76-F-HVB	X-76-F-HVB-PTR		
Piston	X-76-P-HVB	X-76-P-HVB-PTR		
Cartridges	6.8/18Mb	lack, red		
	(for details	see application		
	limit X-ENF	P-21 HVB)		



 For more details, please refer to the chapter Accessories and consumables compatibility in the Direct Fastening Technology Manual (DFTM).

Approvals and design guidelines

ETA-15/0876, design according to Eurocode 4 (EN 1994-1-1, EN 1994-1-2) and Eurocode 8 (EN 1998-1)

MLIT / BCJ (Japan)

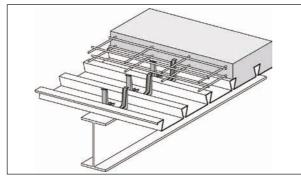
• With regard to composite design according to AISC (American Institute of Steel Construction), please refer to the technical literature of Hilti North America (Product Technical Guide).



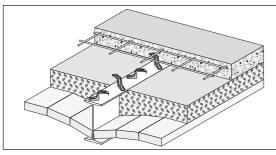


Applications

Examples



Typical application of X-HVB shear connector with steel deck, e.g. new construction.



Typical application of X-HVB shear connector with jack arch system (without steel deck), e.g. rehabilitation project. "Duckwalk"

Characteristic and design resistance (ETA-15/0876) in composite beams with solid slabs

Shear Connector	Characteristic Resistance P _{Rk} [kN]	Design Resistance P _{Rd} [kN]	Minimum base material thickness [mm]	X-HVB positioning	Ductility assessment
X-HVB 40	29	23	6	"duckwalk"	
X-HVB 50	29	23	6	duckwaik	
X-HVB 80	32.5	26			Ductile
X-HVB 95	35	28			according to
X-HVB 110	35	28	8*)	parallel with beam	EN 1994-1-1
X-HVB 125	37.5	30			
X-HVB 140	37.5	30			

*) Reduction to 6 mm possible, with regards to required reduction of design resistance see annex C3 of ETA-15/0876.

Conditions:

- Normal weight concrete C20/25 to C50/60
- Light weight concrete LC20/22 to LC50/55 with a minimum density ρ = 1750 kg/m³



Design resistance in composite beams with decking ribs transverse to beam axis

X-HVB positioning	Design Resistance P _{Rd,t} [kN]	Ductility assessment
X-HVB positioning longitudinal with the beam	$\begin{split} P_{Rd,t,l} &= k_{t,l} \cdot P_{Rd} \\ k_{t,l} &= \frac{0.66}{\sqrt{n_r}} \cdot \frac{b_0}{h_p} \cdot \left(\frac{h_{SC}}{h_p} - 1\right) \leq 1.0 \end{split}$	Ductile according to
X-HVB positioning transverse with the beam	$\begin{split} P_{Rd,t,t} &= 0.89 \cdot k_{t,t} \cdot P_{Rd} \\ k_{t,t} &= \frac{1.18}{\sqrt{n_r}} \cdot \frac{b_0}{h_p} \cdot \left(\frac{h_{SC}}{h_p} - 1\right) \leq 1.0 \end{split}$	EN 1994-1-1

Conditions:

• Applicable for X-HVB 80, X-HVB 95, X-HVB 110, X-HVB 125, X-HVB 140

• n_r corresponds to the number of X-HVBs per rib ($n_r \le 3$)

Design resistance in composite beams with decking ribs parallel to beam axis

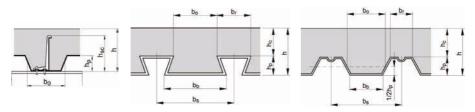
X-HVB positioning	Design Resistance P _{Rd,t} [kN]	Ductility assessment
≥20 mm ≥50 mm ≥50 mm	$P_{Rd,l} = k_l \cdot P_{Rd}$ $k_l = 0.6 \cdot \frac{b_0}{h_p} \cdot \left(\frac{h_{SC}}{h_p} - 1\right) \le 1.0$	Ductile according to EN 1994-1-1

Conditions:

• Applicable for X-HVB 80, X-HVB 95, X-HVB 110, X-HVB 125, X-HVB 140

• X-HVB are to be positioned parallel with beam

Decking geometric parameters



X-HVB





Design information

Connector placement along the beam

The X-HVB is a ductile shear connector according to EN 1994-1-1, section 6.6, and may be uniformly distributed between critical sections. These critical sections, where large changes in shear flow occur, may be at supporting points, points of application of point loads or areas with extreme bending moments.

Partial shear connection

Strength:

The minimum connection depends on the design code used:

In EN 1994-1-1 design, N/N $_{\rm f}\,$ must be at least 0.4. This increases depending on span length and decking geometry.

Deflection control only

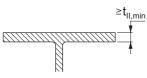
If the shear connection is needed for deflection control only, there is no minimum degree of connection. However, minimum allowable connector spacing applies and the steel beam must have enough strength to carry the self-weight and all imposed loads.

Further specific design topics covered in the ETA-15/0876

- Coverage of seismic loading according to Eurocode 8 (EN 1998-1-1)
- Design resistance in case of use of old steel with an ultimate strength greater than 300 N/mm² and less than 360 N/mm²
- Effect of reduced base material thickness less than 8 mm for X-HVB 80 to X-HVB 140
- · Design of end anchorage of composite slabs
- · Design in case of a fire

Application recommendation

Thickness of base material

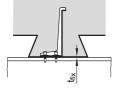


For beams with composite decking:

minimum thickness $t_{II} = 8$ mm.

For beams with solid concrete slabs: minimum thickness $t_{II} = 6$ mm, especially relevant in renovation projects in order to take the thin flange thickness of small I-sections (e.g. IAO 100, I 100, IPE 100) into account.

Thickness of fastened material



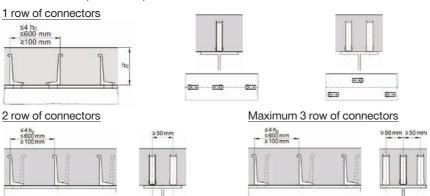
Maximum total thickness of fixed sheeting t_{fix}:

- 2.0 mm for X-HVB 80, X-HVB 95 and X-HVB 110
- 1.5 mm for X-HVB 125 and X-HVB 140



Positioning of X-HVB connectors in solid concrete slabs

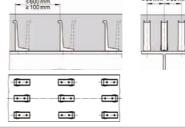
X-HVB are to be positioned parallel with beam



... •• ••

Spacing and positioning



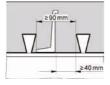


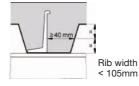
Positioning of X-HVB connectors with composite deck (deck positioned transverse to; and X-HVB positioned parallel with beam axis)

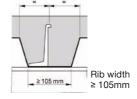


- $a_t \ge 50$ mm for compact profiled decking with $b_0/h_p \ge 1.8$
- $a_t \ge 100 \text{ mm}$ for other decking

1 row of connector - Minimum rib width and spacing to decking







Multiple rows of connector - Minimum rib width

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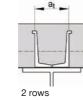


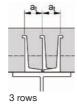


Positioning of X-HVB connectors with composite deck (deck and X-HVB positioned transverse to beam axis)









- 2 rows:
- a_t ≥ 100 mm for all types decking

3 rows:

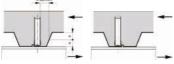
- $a_t \ge 50$ mm for compact profiled decking with $b_0/h_p \ge 1.8$
- a_t ≥ 100 mm for other decking

Positioning - 1 row of connectors

Without rib stiffener ≥40 mm

With rib stiffener (X-HVB in contact with rib stiffener) ≥40 mm





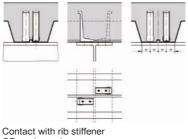
Preferred position in compression zone of concrete rib

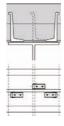
Positioning - 2 and 3 rows of connectors



Minimum width of deck rib





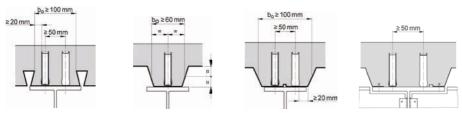


OR equi-spacing

Positioning of X-HVB connectors with composite deck (deck parallel with beam axis)

X-HVB are to be positioned parallel with beam

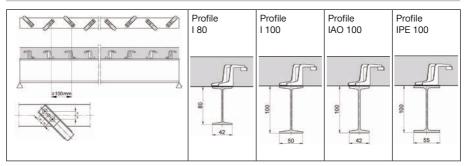
Spacing and positioning



• If a centric positioning within the concrete rib is not possible due to the shape of the composite decking, the decking needs to be split.



"Duckwalk" positioning of X-HVB 40 and 50 in combination with thin solid slabs for renovation construction

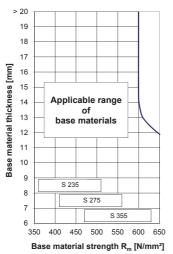


- Minimum section width = 40 mm (e.g. old section IAO 100)
- Minimum center distance of steel sections = 400 mm

Application limits

Application limits are valid only if correct cartridge and power setting are used!

Application limits X-ENP-21 HVB



> 20 19 18 17 Base material thickness [mm] 16 15 Black 4 Black 4 14 13 12 11 10 Black 3 9 Red 4 Black 2 8 7 Red 1 Red 1 6 S 235 S 355 Steel grade

In thermo-mechanically rolled construction steel, e.g. S 355M per EN 10025-4 the application limit is reduced by 50 N/mm² Fine adjustment by carrying out installation tests on site

Minimum section covered: IPE 100

05/2021

• Minimum base material thickness for beams with composite decking: 8 mm

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Cartridge preselection and power setting

X-HVB



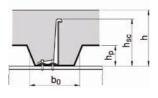
Fastener program

Minimum slab thickness

	Minimum slab thickness h [mm]			
X-HVB	Without effect of corrosion	With effect of corrosion		
40	50	60		
50	60	70		
80	80	100		
95	95	115		
110	110	130		
125	125	145		
140	140	160		

Maximum decking height hp, dependent on decking geometry

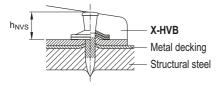
	ecking h _p [mm]		
X-HVB	$\frac{b_o}{h_p} \ge 1.8$	$1.0 < \frac{b_o}{h_p} < 1.8$	$\frac{b_o}{h_p} \le 1.0 \text{ x})$
80	45	45	30
95	60	57	45
110	75	66	60
125	80	75	73
140	80	80	80



 $^{x)} b_0 / h_p \ge 1.0$ for composite decking perpendicular to beam combined with X-HVB orientation parallel with beam

Quality assurance

Fastening inspection



 $8.2 \text{ mm} \le h_{\text{NVS}} \le 9.8 \text{ mm}$



Clearly visible piston mark on top washer



X-X Nail

Product data

X-X MX

Product description

X-X IVIX	
	•
X-X P8	

- Innovative Helix nail tip for better drivability when fastening to tough concrete and steel.
 High hardness (58 HRC) nails for better penetration in tough concrete or steel.
 Optimized for use with Hilti tools helps to secure
 - sufficient guidance and energy for driving straight and deep into the base material.

Dimensions for nails

Technical drawing	Designation	Shank	Head	Shank	Head
		length	length	diameter	diameter
		Ls	L _h	ds	d _h
de de	X-X 22	22 mm			
5	X-X 27	27 mm	2.4 mm 4		8.2 mm
	X-X 34	34 mm			
Lh Ls	X-X 40	40 mm			
	X-X 47	47 mm		4.4 mm	
	X-X 52	52 mm			
	X-X 57	57 mm			
	X-X 62	62 mm			
	X-X 72	72 mm			

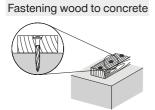
Material specification and material properties for carbon steel elements

Designation	Element	Material	Coating	Minimum	Hard-
				coating	ness
				thickness	
X-X	Nail	Carbon	Zinc	5 µm	58 HRC
		steel			

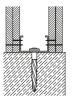




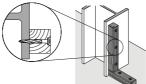
Applications



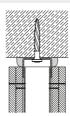
Drywall floor track connection



Fastening wood to steel

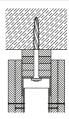


Drywall ceiling track connection



Fastening steel to concrete

Drywall sliding ceiling connection/deflection head



Base materials







Soft concrete

Standard concrete



Load conditions



Static/ quasi static

Fire

Environmental conditions and corrosion information



• The intended use comprises fastening in dry conditions.



Approvals and certificates

Authority	Approval/certificates	Functional	Application area
		area	
DIBt	ETA-22/0876	Europe	Fastening drywall track
			and deflection head
ITB	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel
ITB	ITB-KOT-2021/2019 wydanie 1	Poland	Fastening to concrete

 Not all information presented in this product data sheet might be subject to approval/certificate content. Please refer to approval/certificate for further information.

Fastener program

B

Item no. and description

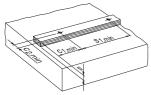
Designation	Item no.	Description
X-X 22 MX	2312327	
X-X 27 MX	2300016	
X-X 34 MX	2300018	
X-X 40 MX	2300019	
X-X 47 MX	2300020	Collated nail
X-X 52 MX	2300021	
X-X 57 MX	2300022	
X-X 62 MX	2300023	
X-X 72 MX	2300024	
X-X 22 P8	2312326	
X-X 27 P8	2300007	
X-X 34 P8	2300009	
X-X 40 P8	2300010	
X-X 47 P8	2300011	Single nail
X-X 52 P8	2300012	
X-X 57 P8	2300013	
X-X 62 P8	2300014	
X-X 72 P8	2300015	



X-X Nail for fastening wood to concrete

Application recommendation

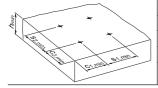
Fastened material properties and fastener positioning in fastened material



Fastened material	Wood
Fastened material thickness $t_{\scriptscriptstyle I}$	15–50 mm
Edge distance c _{1,min}	250 mm
Edge distance c _{2,min}	20 mm
Fastener spacing s _{1,min}	500 mm

• Edge distances and fastener spacing are recommendations to avoid splitting.

Base material properties and fastener positioning in base material



Base material	Concrete
Base material thickness h _{min}	80 mm
Edge distance c _{1,min} , c _{2,min}	70 mm
Fastener spacing s _{1,min} , s _{2,min}	100 mm

• For more details in relation to base material properties, please refer to the chapter **Fastener selection guide** in the Direct Fastening Technology Manual (DFTM).

Fastener shank length recommendation

	For standard fastening:	$L_s = h_{ef} + t_i$
here is a second s	For flush fastening:	$L_s = h_{ef} + t_i - 3 \text{ mm}$



Performance data

Recommended resistance under tension and shear load

Embedment depth h _{ef}	Tension load N _{rec}	↓ Nrec	Shear load V _{rec}	↓ Vrec
	Soft/medium	Tough	Soft/medium	Tough
	concrete	concrete	concrete	concrete
≥ 18 mm	0.25 kN	-	-	-
≥ 20 mm	0.35 kN	0.10 kN	0.35 kN	0.15 kN
≥ 25 mm	0.45 kN	0.15 kN	0.45 kN	0.25 kN

• Redundancy of fastening points is required.

• Minimum number of fastening points for safety relevant fastenings: ≥ 5

Stick rate estimation

	Designation	Soft/medium	Tough
		concrete	concrete
	X-X	84-92 %	80-90 %

- The stick rate indicates the percentage of nails that were driven correctly to carry a load.
- Stick rate can vary from the above values depending on job site conditions.



System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

System recommendation for fastening collated nails with powder-actuated tool

Designation	Powder-actuated tool			Base material				
	DX 6 MX	DX 5 MX	DX 460 MX		Soft concrete	Medium concrete	Tough concrete	
X-X 34 MX to X-X 72 MX								

 \blacksquare = recommended \square = feasible

System recommendation for fastening single nails with powder-actuated tools

Designation	Powde	Powder-actuated tool			Base material			
	DX 6 F8	DX 5 F8	DX 460 F8	DX 2	Soft concrete	Medium concrete	Tough concrete	
X-X 34 P8 to X-X 72 P8								
X-X 34 P8 to X-X 62 P8								

 \blacksquare = recommended \square = feasible



Cartridge recommendation

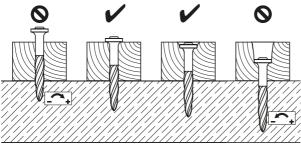
Base material	Cartridge color (tool power level)				
	Tool type:	Tool type:			
	DX 6 MX	DX 5 MX, DX 460 MX			
	DX 6 F8	DX 5 F8, DX 460 F8, DX 2 ¹⁾			
	Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M			
Soft/medium concrete	titanium 🔳 (2-8)	yellow 📕, red 📕			
Tough concrete	titanium 🔳 (4-8),	red 📕, black 🔳			
	black ■ (7–8)				

¹⁾ Black cartridges do not apply for this tool.

- Tool power level adjustment by setting tests on site.
- Start tool energy selection with lowest recommended tool power level.
- Correct according requirement from chapter quality assurance.

Quality assurance

Setting depth control and power tool adjustment



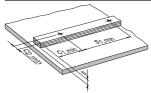
- Visible setting failures must be replaced with a new fastener, not in the same hole.
- These are abbreviated instructions which may vary by application.
- Always review/follow the instructions accompanying the product.



X-X Nail for fastening wood to steel

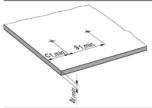
Application recommendation

Fastened material properties and fastener positioning in fastened material



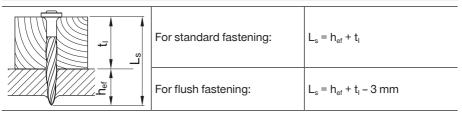
Fastened material	Wood
Fastened material thickness t _I	15–50 mm
Edge distance c _{1,min}	250 mm
Edge distance c _{2,min}	20 mm
Fastener spacing s _{1,min}	500 mm

Base material properties and fastener positioning in base material

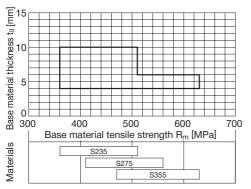


Base material	Steel
Base material thickness $t_{\mbox{\tiny II}}$	4–10 mm
Edge distance c _{1,min}	15 mm
Fastener spacing s _{1,min}	20 mm

Fastener shank length recommendation



Application limitation for fastening on steel



X-X



Performance data

Recommended resistance under tension and shear load

Embedment depth h _{ef}	Tension load N _{rec}	↓ Nrec	Shear load V _{rec}	↓ Vrec
≥ 7 mm	0.40 kN		0.60 kN	

- Redundancy of fastening points is required.
 - Minimum number of fastening points for safety relevant fastenings: ≥ 5 .

System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

System recommendation for fastening collated nails with powder-actuated tool

Designation	Powder-actuated tool			Base material				
	DX 6 MX	DX 5 MX	DX 460 MX		Steel S235	Steel S275	Steel S335	
X-X 22 MX to X-X 62 MX								

 \blacksquare = recommended \square = feasible

System recommendation for fastening single nails with powder-actuated tools

Designation	Powder-actuated tool			Base material				
	DX 6 F8	DX 5 F8	DX 460 F8	DX 2	Steel S235	Steel S275	Steel S335	
X-X 22 P8 to X-X 62 P8								
X-X 22 P8 to X-X 62 P8								

 \blacksquare = recommended \square = feasible

X-X



Cartridge recommendation

Base materia	ıl	Cartridge color (tool power level)			
		Tool type: DX 6 MX DX 6 F8	Tool type: DX 5 MX, DX 460 MX DX 5 F8, DX 460 F8, DX 2 ¹⁾		
		Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M		
0005 to	4 ≤ t _µ < 6 mm	titanium 🔳 (1-5)	green 🔳, yellow 📙, red 📕		
S235 to S355	6 ≤ t _µ ≤ 10mm	titanium III (4-8), black III (7-8)	yellow <mark>–</mark> , red ■ , black ■		

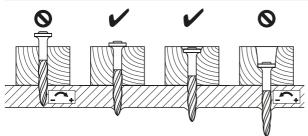
¹⁾ Black cartridges do not apply for this tool.

- Tool power level adjustment by setting tests on site.
- Start tool energy selection with lowest recommended tool power level.
- Correct according requirement from chapter quality assurance.

Quality assurance

F

Setting depth control



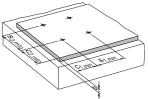
- Visible setting failures must be replaced with a new fastener, not in the same hole.
- These are abbreviated instructions which may vary by application.
- Always review/follow the instructions accompanying the product.



X-X Nail for fastening steel to concrete

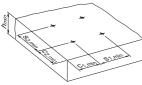
Application recommendation

Fastened material properties and fastener positioning in fastened material



Fastened material	Steel
Fastened material thickness t_{I}	0.5–2 mm
Edge distance c _{1,min}	20 mm
Fastener spacing s _{1,min}	100 mm

Base material properties and fastener positioning in base material

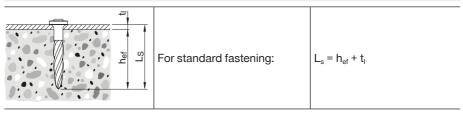


R

	Base material	Concrete
	Base material thickness h_{min}	80 mm
7	Edge distance $c_{1,min}$, $c_{2,min}$	70 mm
	Fastener spacing $s_{1,min}$, $s_{2,min}$	100 mm

• For more details in relation to base material properties, please refer to the chapter **Fastener selection guide** in the Direct Fastening Technology Manual (DFTM).

Fastener shank length recommendation





Performance data

Recommended resistance under tension and shear load

Embedment depth h _{ef}	Tension load N _{rec}		Shear load V _{rec}	
		▼ N _{rec}		↓ Vrec
	Soft/medium	Tough	Soft/medium	Tough
	concrete	concrete	concrete	concrete
≥ 18 mm	0.30 kN	0.15 kN	0.50 kN	0.25 kN
≥ 20 mm	0.40 kN	0.20 kN	0.75 kN	0.40 kN
≥ 25 mm	0.50 kN	0.25 kN	1.00 kN	0.50 kN

• Redundancy of fastening points is required.

• Minimum number of fastening points for safety relevant fastenings: \geq 5.

Stick rate estimation

111111	Designation	Soft/medium	Tough
		concrete	concrete
	X-X	95-99%	90-95%

- The stick rate indicates the percentage of nails that were driven correctly to carry a load.
 - Stick rate can vary from the above values depending on job site conditions.

System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

System recommendation for fastening collated nails with powder-actuated tool

Designation	Powder-actuated tool			Base material				
	DX 6 MX	DX 5 MX	DX 460 MX	DX 351 MX	Soft concrete	Medium concrete	Tough concrete	
X-X 22 MX to X-X 34 MX								

 \blacksquare = recommended \square = feasible

X-X



System recommendation for fastening single nails with powder-actuated tool

Designation	Powde	Powder-actuated tool				Base material		
	DX 6 F8	DX 5 F8	DX 460 MX F8	DX 351 F8	DX 2	Soft concrete	Medium concrete	Tough concrete
X-X 22 P8 to X-X 34 P8								
X-X 22 P8 to X-X 34 P8								

 \blacksquare = recommended \square = feasible

Cartridge recommendation

Base material	Cartridge color (tool power level)				
	Tool type:	Tool type:			
	DX 6 MX	DX 5 MX, DX 460 MX,			
		DX 351 MX ¹⁾			
	DX 6 F8	DX 5 F8, DX 460 F8, DX 2 ¹⁾ ,			
		DX 351 F8 ¹⁾			
	Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M			
Soft/medium concrete	titanium 🔳 (2-8)	yellow 📕, red 📕			
Tough concrete	titanium 🔳 (4-8),	red 📕, black 🔳			
	black 🔳 (7–8)				

¹⁾ Black cartridges do not apply for this tool.



• Tool power level adjustment by setting tests on site.

• Start tool energy selection with lowest recommended tool power level.

• Correct according requirement from chapter quality assurance.

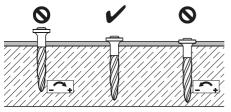
X-X





Quality assurance

Setting depth control and power tool adjustment



- Visible setting failures must be replaced with a new fastener, not in the same hole.
- These are abbreviated instructions which may vary by application.
- Always review/follow the instructions accompanying the product.



X-X Nail for fastening drywall track and deflection head

Application recommendation

Base material properties and fastener positioning in base material

14unia	*	
- Strand		Similar
	Pa Corne	

actorier poolaterining in bace material				
Base material	Concrete			
Concrete class	C20/25-C40/50			
Concrete turne	Cracked/uncracked			
Concrete type	concrete			
Base material thickness h _{min}	80 mm			
Edge distance $c_{1,min}, c_{2,min}$	150 mm			
Fastener spacing $s_{1,min}, s_{2,min}$	200 mm			
Fastener spacing $s_{1,max}, s_{2,max}$	600 mm			



• Tested concrete strength: \geq 60 N/mm².

Fastened material properties for drywall track

Fastened material	Fastened material	Fastened material
type	tensile strength	thickness
	R _m	t _{fix}
Drywall track	≥ 270 N/mm2	0.6 to 1.0 mm

Fastened material properties for gypsum board as part of deflection head configurations

Fastened material		Fastened material
type		bulk density
		ρ _b
Gypsum board	DF according to EN 520	> 900 kg/m3
	GKF according to DIN 18180	≥ 800 kg/m³



Performance data

Characteristic resistance under shear load and recommended shear loads

	Drywall floo	r and ceiling	Drywall sliding ceiling		
	track co	nnection	connection/deflection head		
		Fastened ma	terial thickness t _i	lix	
	0.6 mm	1.0 mm	38.1 mm	50.6 mm	
	(drywa	ll track)	3 × 12.5 mm	4 × 12.5 mm	
			(gypsun	n board)	
			0.6 mm (drywall track)		
Fastener	X-X 22 MX, X-X 22 P8		X-X 62 MX,	X-X 72 MX,	
Fasterier			X-X 62 P8	X-X 72 P8	
Characteristic resistance under shear load V _{Rk}	1.25 kN	1.49 kN	0.94 kN	0.85 kN	
Safety factor γ_{GLOB}			2.1		
Recommended shear load V_{rec}	0.60 kN 0.71 kN		0.45 kN	0.40 kN	

Characteristic resistance under shear load and fire exposure

		Drywall floo	r and ceiling	Drywall sliding ceiling		
		track connection		connection/deflection head		
			Fastened ma	terial thickness t	fix	
		0.6 mm	1.0 mm	38.1 mm	50.6 mm	
		(drywa	ll track)	3 × 12.5 mm	4 × 12.5 mm	
				(gypsun	n board)	
				+0.6 mm (di	rywall track)	
Fastener		X-X 22 MX, X-X 22 P8		X-X 62 MX,	X-X 72 MX,	
Fastener		A-A 22 IVIA, A-A 22 F0		X-X 62 P8	X-X 72 P8	
Characteristic	30 min	0.20 kN	0.23 kN	0.17 kN		
resistance under	60 min	0.16 kN	0.19 kN	0.17	′ kN	
shear load V_{Rk}	90 min	0.12 kN	0.15 kN	0.12	2 kN	
and fire exposure	120 min	0.05 kN	0.11 kN	-	_	
Safety factor γ_{GLOB}				1.0		
Recommended	30 min	0.20 kN	0.23 kN	0.17 kN		
shear load	60 min	0.16 kN	0.19 kN	0.17 kN		
V _{rec} under fire	90 min	0.12 kN	0.15 kN	0.12 kN		
exposure	120 min	0.05 kN	0.11 kN	-		





- Drywall loads resulting from dead weight, crowd pressure, eccentric vertical loads (cabinets) or similar.
- Linear interpolation to determine characteristic resistance under shear load between profile thicknesses is admissible.
- Valid partial factors unless otherwise regulated.
- Drywall floor/ceiling track connection can be equipped with Hilti CSF-TTS or PE-sealing.

Calculation equations

	H = Horizontal shear force on the track per meter
$V_{\text{Ed},\text{lim}} = H \cdot s \leq V_{\text{R},k} / (\gamma_{\text{M}} \cdot \gamma_{\text{F}})$	s = Spacing between fasteners
	$V_{R,k}$ = Characteristic resistance under shear load
	γ_{M} = Partial factor for material properties
	$\gamma_{\rm F}$ = Partial factor for working loads
$V_{Ed,lim} = H \cdot s \leq V_{rec}$	H = Horizontal shear force on the track per meter
	s = Spacing between fasteners
	V _{rec} = Recommended shear load

Design value of shear load acting on a fastening point: V_{Ed,lim} ≤ 2.0 kN

• Number of fasteners on a profiled drywall track: ≥ 5

Stick rate estimation

	Designation	Connection	Soft/standard	Tough
		type	concrete	concrete
	X-X	Drywall		
		floor track		
		connection	95-99%	90-95 %
		Drywall	95-99 %	90-95 %
		ceiling track		
		connection		
		Drywall		
		sliding ceiling		
		connection/	84-92 %	80-90 %
		deflection		
		head		

- A
- The stick rate indicates the percentage of nails that were driven correctly to carry a load.
 - Stick rate can vary from the above values depending on job site conditions.



System recommendation

System recommendation for fastening collated nails with powder-actuated tool

Designation	Powder-actuat	Powder-actuated tool				
	DX 6 MX	DX 5 MX	DX 460 MX	DX 351 MX		
X-X 22 MX						
X-X 62 MX, X-X 72 MX						

 \blacksquare = recommended \square = feasible

System recommendation for fastening single nails with powder-actuated tool

Designation	Powder-actuated tool				
	DX 6 F8	DX 5 F8	DX 460 F8	DX 351 F8	DX 351-CT F8
X-X 22 P8					
X-X 62 P8, X-X 72 P8					

 \blacksquare = recommended \square = feasible

Cartridge recommendation

Cartridge color (tool power lev	(el)	
Tool type:	Tool type:	
DX 6 MX	DX 5 MX, DX 460 MX,	
	DX 351 MX ¹⁾	
DX 6 F8	DX 351 F8 ¹⁾ , DX 351-CT F8 ¹⁾	
Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M	
titopium (2, 9)		
- titanium (2-0)	yellow –, red 📕	
titanium 🔳 (4-8),	red 📕, black 🔳	
black ■ (7–8)		
	DX 6 MX DX 6 F8 Cartridge type: 6.8/11 M titanium (2-8) titanium (4-8),	

¹⁾ Black cartridges do not apply for this tool.

- Tool power level adjustment by setting tests on site (see chapter quality assurance).
- For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

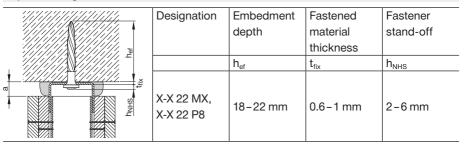


Quality assurance

Drywall floor connection

THE SHORE	Designation	Embedment	Fastened	Fastener
		depth	material	stand-off
			thickness	
		h _{ef}	t _{fix}	h _{NHS}
	X-X 22 MX, X-X 22 P8	18-22 mm	0.6–1 mm	2-6 mm

Drywall ceiling connection



Drywall sliding ceiling connection

	Designation	Embedment	Fastened	Fastener
		depth	material	stand-off
let			thickness	
		h _{ef}	t _{fix}	h _{NVS}
π	X-X 62 MX,		38.1 mm	
	X-X 62 MIX,	20-25 mm	(3 gypsum	1–6 mm
	X-X 02 F 0		layers)	
	X X 70 MX		50.6 mm	
Lives	X-X 72 MX,	18-23 mm	(4 gypsum	1–6 mm
	X-X 72 P8		layers)	

- Deflection head gap dimension: $a \le 20 \text{ mm}$
- Visible setting failures must be replaced with a new fastener, not in the same hole with a distance of 100 mm.
- These are abbreviated instructions which may vary by application.
- Always review/follow the instructions accompanying the product.

X-X



/ x-x

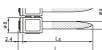


X-U Nail for fastening to concrete and steel

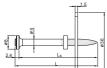
Product data

Dimensions

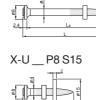
X-U__MX











X-U____P8



Material specifications Carbon steel shank: HRC 5

Zinc coating:

HRC 58 HRC 59 (X-U 15) 5–20 µm

X-U

Recommended fastening tools



See fastener program in the next pages.

Approvals

ICC ESR-2269 (USA) DIBt Z-14.4-517 (Germany), DNV-GL ABS, LR 97/00077, IBMB 4927/2020

A

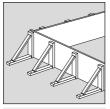
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Applications

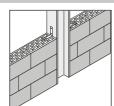
1+2



System formwork

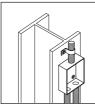


Conventional formwork

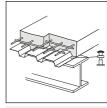


Wall-tie to steel and concrete





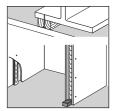
Mechanical and electrical fixtures



Tacking of metal decks



Drywall track to concrete and steel



Sill plates / 2x4 wood to concrete and steel

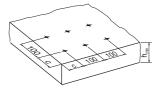
The intended use for safety relevant and permanent applications only comprises fastenings which are not directly exposed to external weather conditions or moist atmospheres.



X-U Nail for fastening to concrete

Application recommendation

Base material thickness and fastener positioning in base material



Base material thickness: Edge distance: Spacing: h_{min} = 80 mm c ≥ 70 mm s ≥ 100 mm

Fastener shank length recommendation

	Fastening type	Fastener shank length	Penetration depth
her	Wood to concrete	L _s = h _{ET} + t _l t _l = 15–57 mm	h _{ET} ≥ 14 mm
her t	Wood to concrete, head flush with surface	L _s = h _{ET} + t _l – 3 mm t _l = 15–57 mm	h _{ET} ≥ 14 mm
	Insulation to concrete	L _s = h _{ET} + t _i	h _{ET} ≥ 14 mm



	Fastening type	Fastener	Penetration depth
hET ti	Insulation to concrete	shank length L _s = h _{ET} + t _I – 5 mm	h _{ET} ≥ 14 mm
her ti	Steel to concrete	L _s = h _{ET} + t _l	h _{ET} ≥ 22 mm

Performance data

Recommended resistance under tension and shear load

Embedment depth ^h ET	Tension load N _{rec}	♦ Nrec	Shear load	↓ Vrec
	Soft/medium	Tough	Soft/medium	Tough
	concrete	concrete	concrete	concrete
≥ 14 mm	0.1 kN	-	0.1 kN	-
≥ 18 mm	0.2 kN	-	0.2 kN	-
≥ 22 mm	0.3 kN	-	0.3 kN	-
≥ 27 mm	0.4 kN	-	0.4 kN	-



• For safety relevant fastenings sufficient redundancy of the entire system is required: Minimum 5 fastenings per fastened unit.

- All visible failures must be replaced.
- Valid for concrete with strength of $f_{CC} \le 45 \text{ N/mm}^2$.
- Valid for predominantly static loading.
- Failure of the fastened material is not considered in recommended loads.
- To limit penetration of nail and to increase pull-over load, use nails with washers.
- For more details in relation to base material properties, please refer to the chapter **Fastener selection guide** in the Direct Fastening Manual (DFTM).

X-U





System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

Cartridge recommendation for fastening wood to concrete

Base material	Cartridge color (tool power level)			
	Tool type:	Tool type:		
	DX 6 MX	DX 5 MX, DX 460 MX		
	DX 6 F8	DX 5 F8, DX 460 F8, DX 2		
	Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M		
Soft concrete/medium	titanium 🔳 (1-5)	green 🔳, yellow 🗕		
Tough concrete	titanium 🔳 (4-8)	yellow 🦲, red 📕		

Cartridge recommendation for fastening steel to concrete

Base material	Cartridge color (tool power level)		
	Tool type:	Tool type:	
	DX 6 MX	DX 5 MX, DX 460 MX,	
		DX 351 MX	
	DX 6 F8	DX 5 F8, DX 460 F8, DX 2,	
		DX 351 F8	
	Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M	
Soft/medium concrete	titanium 🔳 (1-5)	green 📕, yellow 📙	
Tough concrete	titanium 🔳 (4-8)	yellow <mark>–</mark> , red –	

- Tool power level adjustment by setting tests on site.
- Start tool energy selection with lowest recommended tool power level.
- Correct according requirement from chapter quality assurance.



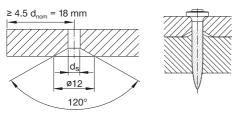
X-U Nail for fastening steel to steel

Application recommendation

Fastener shank length recommendation

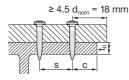
	Fastening type	Fastener shank length	Penetration depth
her ti ti ti ti ti ti ti ti ti ti	Steel to steel	$L_{s} = h_{ET} + t_{I}$ not pre-drilled: $t_{I} \le 3 \text{ mm}$ pre-drilled: $3 \text{ mm} < t_{I} \le 6 \text{ mm}$	h _{ET} = 12 ± 2 mm

Condition for fastened material thickness: 3 mm < tl ≤ 6 mm



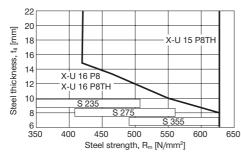
If a gap between the fastened part and the base material is unacceptable, the fastened part needs to be prepared with drilled holes.

Base material properties and fastener positioning in base material



Base material thickness: Edge distance: Spacing: Type: $t_{\parallel} \ge 6.0 \text{ mm}$ $c \ge 15 \text{ mm}$ $s \ge 20 \text{ mm}$ Rolled shapes

Application limitation



- Steel sheeting with 0.75 mm \leq t_l \leq 1.25 mm
- On higher steel grades, fastening with single nails (P8 or P8TH) may yield better results (e.g. less shear breaks) than fastening with collated nails (MX or MXSP) due to better nail guidance.







Performance data

Recommended resistance under tension and shear load

Fastening of steel sheets and other steel parts with X-U 16 and X-U 19

	X-U_P8/MX	X-U_S12	
t _i	N _{rec}	N _{rec}	V _{rec}
0.75 mm	1.0 kN	1.4 kN	1.2 kN
1.00 mm	1.2 kN	1.8 kN	1.8 kN
1.25 mm	1.5 kN	2.2 kN	2.6 kN
≥ 2.00 mm	2.0 kN	2.2 kN	2.6 kN

Tacking of steel sheets with X-U 15

according to ECCS-recommendation N73, "Good Construction Practice for Composite Slabs"

t _i	N _{rec}	V _{rec}
0.75–1.25 mm	0.6 kN	0.8kN

Conditions

- Valid for steel sheet with minimum tensile strength \ge 360 N/mm².
- For intermediate sheet thicknesses, use recommended load for next smaller thickness.
- In case of a design based on the characteristic resistance, recommended values have

to be multiplied by two: $N_{Rk} = N_{rec} \cdot 2.0$, $V_{Rk} = V_{rec} \cdot 2.0$

• For X-U 16 S12:

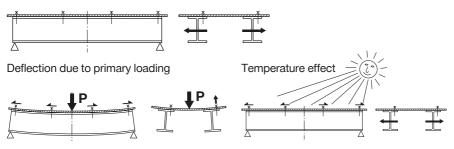
Base material thickness $t_{II,min}$ = 8 mm for t_I ≥ 1.50 mm

Base material thickness $t_{II,min}$ = 6 mm for $t_I \leq 1.25$ mm

- Other fastened parts: clips, brackets, etc.
- Redundancy (multiple fastening) must be provided.
- · Valid for predominantly static loading

Forces of constraint

When fastening large pieces of steel, the possibility of shear loadings from forces of constraint should be considered. Avoid exceeding V_{rec} for the fastener shank!







System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

Cartridge recommendation for X-U 16 P8, X-U 16 P8 TH, X-U 16 MX

Base materi	al	Cartridge color (tool power level)			
		Tool type:	Tool type:		
		DX 6 MX	DX 5 MX, DX 460 MX,		
			DX 351 MX ¹⁾		
		DX 6 F8	DX 5 F8, DX 460 F8, DX 351		
			F8 ¹), DX 2 ¹)		
		Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M		
S235 to	6 ≤ t _µ < 10 mm	titanium 🔳 (4-8)	red 📕		
10 ≤ t. ≤ 20 mm		titanium 🔳 (6-8),	red 📕, black 🔳		
S275		black 🔳 (7-8)			
S355	6 ≤ t _µ ≤ 8 mm	titanium 🔳 (6-8),	red 📕, black 📕		
		black 🔳 (7-8)			

¹⁾ Black cartridges do not apply for this tool.

Cartridge recommendation for X-U 15 P8TH

Base mater	ial	Cartridge color (tool power level)			
		Tool type: DX 6 F8	Tool type: DX 5 F8, DX 460 F8, DX 351 F8 ¹⁾		
Cartridge type: 6.8/11 I		Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M		
S235 to	6 ≤ t _µ < 12 mm	titanium 🔳 (2-5)	yellow		
S355	12 ≤ t _µ ≤ 20 mm	titanium 🔳 (4-8)	red 📕		



• Tool power level adjustment by setting tests on site.

• Start tool energy selection with lowest recommended tool power level.

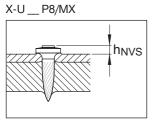
• Correct according requirement from chapter quality assurance.



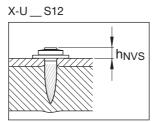


Quality assurance

Setting depth control

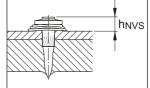


 $h_{NVS} = 2.5 - 4.5 \text{ mm}$



h_{NVS} = 4.0–5.5 mm

X-U_P8TH/MXSP



$h_{NVS} = 4.0-6.0 \text{ mm}$



X-U Nail for fastening wood to steel

Application recommendation

Base material properties

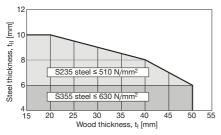
Base material thickness: $t_{\parallel} \ge 4.0 \text{ mm}$

Fastener shank length recommendation

	Fastening type	Fastener shank length	Penetration depth
HET I	Wood to steel	L _s = h _{ET} + t _l t _l = 15–57 mm	h _{ET} ≥8mm
PET I	Wood to steel, head flush with surface	L _s = h _{ET} + t _l – 3 mm t _l = 15–57 mm	h _{ET} ≥ 8 mm

Application limitation

For X-U 22 P8 to X-U 62 P8



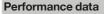


• On higher steel grades, fastening with single nails may yield better results (e.g. less shear breaks) than fastening with collated nails due to better nail guidance.



X-U





Recommended re Designation	sistance under ten Tension load N _{rec}	asion and shear loar	d Shear load V _{rec}	↓ Vrec
X-U	0.3 kN		0.60 kN	

Conditions:

- For safety-relevant fastenings sufficient redundancy of the entire system is required.
- In case soft material is fastened, its strength determines the loads.
- To limit penetration of nail and to increase pull-over load, use nails with washers.
- Observance of edge distance and fastener spacing in compliance with recognized standards EN 1995 (see approval).
- With respect to details of fastening wood, chipboard or OSB members to steel base material, it is refered to the German approval DIBt Z-14.4-517.

System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

Cartridge recommendation for X-U 22 P8 to X-U 62 P8

Base materi	al	Cartridge color (tool power level)			
		Tool type: DX 6 MX DX 6 F8	Tool type: DX 5 MX, DX 460 MX DX 5 F8, DX 460 F8, DX 2 ¹⁾		
		Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M		
S235 to	$4 \le t_{\parallel} < 6 \mathrm{mm}$	titanium 🔳 (1-5)	green 📕, yellow 📙		
S235 10 S355	6 ≤ t _µ ≤ 10 mm	titanium 🔳 (4-8),	yellow <mark>–</mark> , red – , black –		
3300		black 🔳 (7-8)			

¹⁾ Black cartridges do not apply for this tool.

- Tool power level adjustment by setting tests on site.
- Start tool energy selection with lowest recommended tool power level.
- Correct according requirement from chapter quality assurance.





Fastener program

			Pow	der-ac	tuate	d tool	S	
Fastener	Item no.	L _S	DX 6 MX, DX 5 MX, DX 460 MX	DX 6 F8, DX 5 F8 DX 460 F8	DX 2	DX 351 MX	DX 351 F8	Description
X-U 16 MX	237344	16 mm						Sheet metal on steel
X-U 19 MX	237345	19 mm						Sheet metal on steel
X-U 22 MX	237346	22 mm						Wood on concrete/steel
X-U 27 MX	237347	27 mm						Wood on concrete/steel
X-U 32 MX	237348	32 mm						Wood on concrete/steel
X-U 37 MX	237349	37 mm						Wood on concrete/steel
X-U 42 MX	237350	42 mm						Wood on concrete/steel
X-U 47 MX	237351	47 mm						Wood on concrete/steel
X-U 52 MX	237352	52 mm						Wood on concrete/steel
X-U 57 MX	237353	57 mm						Wood on concrete/steel
X-U 62 MX	237354	62 mm						Wood on concrete/steel
X-U 72 MX	237356	72 mm						Wood on concrete/steel
X-U 16 P8	237330	16 mm						Sheet metal on steel
X-U 19 P8	237331	19 mm						Sheet metal on steel
X-U 22 P8	237332	22 mm						Wood on concrete/steel
X-U 27 P8	237333	27 mm						Wood on concrete/steel
X-U 32 P8	237334	32 mm						Wood on concrete/steel
X-U 37 P8	237335	37 mm						Wood on concrete/steel
X-U 42 P8	237336	42 mm						Wood on concrete/steel
X-U 47 P8	237337	47 mm						Wood on concrete/steel
X-U 52 P8	237338	52 mm						Wood on concrete/steel
X-U 57 P8	237339	57 mm						Wood on concrete/steel
X-U 62 P8	237340	62 mm						Wood on concrete/steel
X-U 72 P8	237342	72 mm						Wood on concrete/steel
X-U 16 P8TH	237329	16 mm						Sheet metal on steel, *)
X-U 19 P8TH	385781	19 mm						Sheet metal on steel, *)
X-U 27 P8TH	385782	27 mm						Sheet metal on concrete, *)
X-U 15 MXSP	383466	16 mm						Sheet metal on steel
X-U 15 P8TH	237328	16 mm						Sheet metal on steel
X-U 27 P8S15	237371	27mm						High pull-over strength
X-U 32 P8S15	237372	32 mm						High pull-over strength



			Pow	Powder-actuated tools				
Fastener	Item no.	L _S	DX 6 MX, DX 5 MX, DX 460 MX	DX 6 F8, DX 5 F8 DX 460 F8	DX 2	DX 351 MX	DX 351 F8	Description
X-U 32 P8S36	237374	32 mm						Soft material on concr./steel
X-U 52 P8S36	237376	52 mm						Soft material on concr./steel
X-U 72 P8S36	237379	72 mm						Soft material on concr./steel

 \blacksquare = recommended, \square = feasible

*) firm hold down

			Powder-actuated tools					
Fastener	Item	L _S						Description
	no.		DX 460 F8S12	DX 5 F8S12	DX 462 F8S12			
X-U 16 S12	237357	16 mm						High pull-over strength
X-U 19 S12	237358	19 mm						High pull-over strength
X-U 22 S12	237359	22 mm						High pull-over strength
X-U 27 S12	237360	27 mm						High pull-over strength
X-U 32 S12	237361	32 mm						High pull-over strength

 \blacksquare = recommended, \square = feasible

*) firm hold down

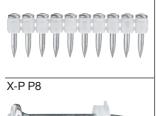


X-P Nail for fastening to concrete and steel

Product data

Product description

X-P MX



- Designed for fastening on tough concrete and steel.
- Long conical nail tip designed for best drivability in tough concrete.
- High hardness for best penetration in tough concrete.
- High load performance on tough concrete.

Dimensions for nails

Technical drawing	Designation	Shank	Head	Shank	Head			
		length	length	diameter	diameter			
		Ls	L _h	ds	d _h			
ds	X-P 22	22 mm						
5	X-P 27	27 mm						
	X-P 34	34 mm	34 mm					
	X-P 40	40 mm]		8.2 mm			
L _h L _s	X-P 47	47 mm	2.4 mm	4 mm				
	X-P 52	52 mm]					
	X-P 57	57 mm]					
	X-P 62	62 mm]					
	X-P 72	72 mm						

Material specification and material properties for nails

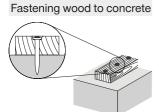
Designation	Element	Material	Coating	Minimum	Hardness
				coating	
				thickness	
X-P	Nail	Carbon	Zinc	5 µm	59 HRC
		steel			

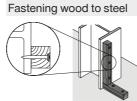
X-P

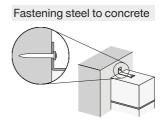




Applications







Base materials







Soft concrete

Medium Tough concrete

Steel te

Load conditions



Static/ quasi static

Environmental conditions



Dry indoor



• For more details, please refer to following technical document: Hilti Corrosion Handbook.





Approvals/certificates

Authority	Approval/certificate no.	Date of issue	Country of issue
IBMB	19210-2017	11/2017	Germany
IBMB	19211-2017	11/2017	Germany
IBMB	19212-2017	11/2017	Germany
IBMB	4927/2020	11/2019	Germany
ICC-ES ESR	2269	02/2019	USA
Rom. Ministry ICECCON	AT 016-01/420-2020	03/2020	Romania
VHT	PZ-809-15-Hilti-171027	10/2017	Germany



 Not all information presented in this product data sheet might be subject to approval/certificate content. Please refer to approval/certificate for further information.

Fastener program

Item no. and description

Designation	Item no.	Description
X-P 22 MX	2150380	
X-P 27 MX	2150381	
X-P 34 MX	2150382	
X-P 40 MX	2150383	
X-P 47 MX	2173900	Collated nail
X-P 52 MX	2173901	
X-P 57 MX	2173902	
X-P 62 MX	2173903	
X-P 72 MX	2173904	
X-P 22 P8	2150366	
X-P 27 P8	2150367	
X-P 34 P8	2150368	
X-P 40 P8	2150369	
X-P 47 P8	2173875	Single nail
X-P 52 P8	2173876	
X-P 57 P8	2173877	
X-P 62 P8	2173878	
X-P 72 P8	2173879	

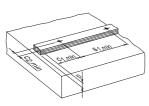


R

X-P Nail for fastening wood to concrete

Application recommendation

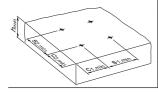
Fastened material properties and fastener positioning in fastened material



Fastened material	Wood
Fastened material	15–50 mm
thickness t _i	(soft/medium concrete)
Fastened material	15–40 mm
thickness t _i	(tough concrete)
Edge distance c _{1,min}	250 mm
Edge distance c _{2,min}	20 mm
Fastener spacing s _{1.min}	500 mm

• Edge distances and fastener spacing are recommendations to avoid splitting.

Base material properties and fastener positioning in base material



Base material	Concrete
Base material thickness h _{min}	80 mm
Edge distance c _{1,min} , c _{2,min}	70 mm
Fastener spacing s _{1,min} , s _{2,min}	100 mm

Fastener shank length recommendation

For standard fastening:	$L_s = h_{ET} + t_i$
For flush fastening:	$L_s = h_{ET} + t_i - 3 \text{ mm}$



Performance data

Recommended resistance under tension and shear load

Embedment depth h _{ET}	Tension load N _{rec}	▼ Nrec	Shear load V _{rec}	↓ V _{rec}
	Soft/medium	Tough	Soft/medium	Tough
	concrete	concrete	concrete	concrete
≥ 1 4 mm	0.10	-	0.10	-
≥ 18 mm	0.20	-	0.20	-
≥ 20 mm	0.30	-	0.30	-
≥ 25 mm	0.40	0.10 kN	0.40	0.10 kN



• Redundancy of fastening points is required.

- Minimum number of fastening points for safety relevant fastenings: ≥ 5.
- For more details in relation to base material properties, please refer to the chapter **Fastener selection guide** in the Direct Fastening Technology Manual (DFTM).

 Designation	Soft/medium	Tough		
	concrete	concrete		
X-P	84-92 %	80-90 %		

- The stick rate indicates the percentage of nails that were driven correctly to carry a load.
 - Stick rate can vary from the above values depending on job site conditions.



System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

System recommendation for fastening collated nails with powder-actuated tools

Designation	Pow	Powder-actuated tool							Base material			
	DX 6 MX	DX 5 MX	DX 460 MX						Soft concrete	Medium concrete	Tough concrete	
X-P 34 MX to X-P 72 MX												

 \blacksquare = recommended \square = feasible

System recommendation for fastening single nails with powder-actuated tools

Designation	Pow	Powder-actuated tool							Base material			
	DX 6 F8	DX 5 F8	DX 460 F8	DX 460 F8	DX351 F8	DX 2			Soft concrete	Medium concrete	Tough concrete	
X-P 34 P8 to X-P 72 P8												
X-P 34 P8 to X-P 47 P8												
X-P 34 P8 to X-P 62 P8												

 \blacksquare = recommended \square = feasible





Cartridge recommendation

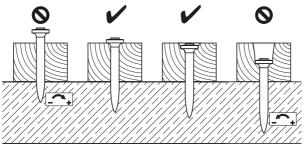
Base material	Cartridge color (tool power le	evel)
	Tool type:	Tool type:
	DX 6 MX	DX 5 MX, DX 460 MX
	DX 6 F8	DX 5 F8, DX 460 F8,
		DX 351 F8 ¹⁾ , DX 2 ¹⁾
	Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M
Soft/medium concrete	titanium 🔳 (1-8)	green 📕, yellow 📙, red 📕
Tough concrete	titanium 🔳 (4-8),	red 📕, black 🔳
	black 🔳 (6-8)	

¹⁾ Black cartridges do not apply for this tool.

- Tool power level adjustment by setting tests on site.
- Start tool energy selection with lowest recommended tool power level.
- Correct according requirement from chapter quality assurance.

Quality assurance

Setting depth control and power tool adjustment



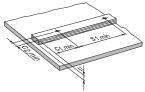
- Visible setting failures must be replaced with a new fastener, not in the same hole.
- These are abbreviated instructions which may vary by application.
- Always review/follow the instructions accompanying the product.



X-P Nail for fastening wood to steel

Application recommendation

Fastened material properties and fastener positioning in fastened material



Fastened material	Wood
Fastened material	15–50 mm
thickness t _i	
Edge distance c _{1,min}	250 mm
Edge distance c _{2,min}	20 mm
Fastener spacing s _{1,min}	500 mm

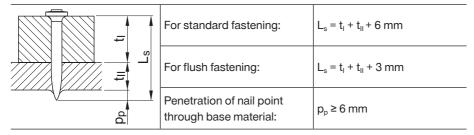
• Edge distances and fastener spacing are recommendations to avoid splitting.

Base material properties and fastener positioning in base material

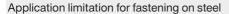


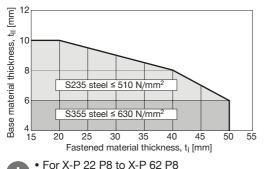
Base material	Steel
Base material thickness t_{II}	4–10 mm
Edge distance c _{1,min}	15 mm
Fastener spacing s _{1,min}	20 mm

Fastener shank length recommendation





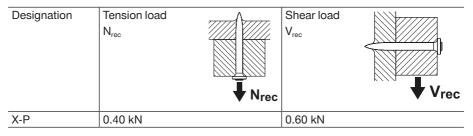




On higher steel grades, fastening with single nails (P8) may yield better results (e.g. less shear breaks) than fastening with collated nails (MX) due to better nail guidance.

Performance data

Recommended resistance under tension and shear load



System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

System recommendation for fastening collated nails with powder-actuated tools

Designation	Pow	Powder-actuated tool								Base material			
	DX 6 MX	DX 5 MX	DX 460 MX						S235	S275	S355		
X-P 34 MX to X-P 62 MX													

 \blacksquare = recommended \square = feasible

X-P



System recommendation for fastening single nails with powder-actuated tools

Designation	Pow	/der-a	ictuat	Base material							
	DX 6 F8	DX 5 F8	DX 460 F8	DX351 F8	DX 2			S235	S275	S355	
X-P 34 P8 to X-P 62 P8											
X-P 34 P8 to X-P 47 P8											
X-P 34 P8 to X-P 47 P8											

 \blacksquare = recommended \square = feasible

Cartridge recommendation

Base materia	ıl	Cartridge color (tool power lev	rel)			
		Tool type:	Tool type:			
		DX 6 MX	DX 5 MX, DX 460 MX			
		DX 6 F8	DX 5 F8, DX 460 F8,			
			DX 351 F81), DX 21)			
		Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M			
0005 +-	4 ≤ t _{II} < 6 mm	titanium 🔳 (1-5)	green 🔳, yellow 📒			
S235 to S355	6 ≤ t _{II} ≤ 10 mm	titanium 🔳 (4-8),	red 📕, black 🔳			
0000		black 🔳 (6–8)				

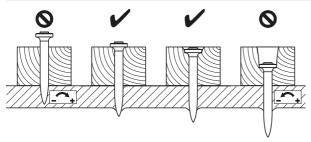
¹⁾ Black cartridges do not apply for this tool.

- Tool power level adjustment by setting tests on site.
- Start tool energy selection with lowest recommended tool power level.
- Correct according requirement from chapter quality assurance.



Quality assurance

Setting depth control



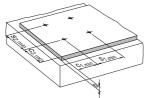
- Visible setting failures must be replaced with a new fastener, not in the same hole.
- These are abbreviated instructions which may vary by application.
- Always review/follow the instructions accompanying the product.



X-P Nail for fastening steel to concrete

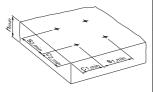
Application recommendation

Fastened material properties and fastener positioning in fastened material



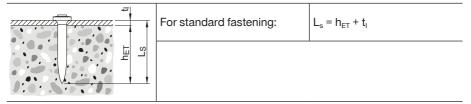
Fastened material	Steel
Fastened material	0.6–2 mm
thickness t _i	
Edge distance c _{1,min} , c _{2,min}	20 mm
Fastener spacing s _{1,min} , s _{2,min}	100 mm

Base material properties and fastener positioning in base material



Base material	Concrete
Base material thickness h _{min}	80 mm
Edge distance c _{1,min} , c _{2,min}	70 mm
Fastener spacing s _{1,min} , s _{2,min}	100 mm

Fastener shank length recommendation





Performance data

Recommended resistance under tension and shear load

Embedment depth h _{ET}	Tension load N _{rec}	↓ N _{rec}	Shear load V _{rec}	↓ Vrec
	Soft/medium	Tough	Soft/medium	Tough
	concrete	concrete	concrete	concrete
≥ 18 mm	0.20 kN	0.10 kN	0.40 kN	0.20 kN
≥ 20 mm	0.30 kN	0.15 kN	0.50 kN	0.30 kN
≥ 25 mm	0.40 kN	0.20 kN	0.80 kN	0.40 kN

• Redundancy of fastening points is required.

• Minimum number of fastening points for safety relevant fastenings: \geq 5.

• For more details in relation to base material properties, please refer to the chapter **Fastener selection guide** in the Direct Fastening Technology Manual (DFTM).

Stick rate estimation

 Designation	Soft/medium	Tough
	concrete	concrete
X-P	84-92 %	80-90 %



• The stick rate indicates the percentage of nails that were driven correctly to carry a load.

• Stick rate can vary from the above values depending on job site conditions.



F



System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

System recommendation for fastening collated nails with powder-actuated tools

Designation	Pow	der-a	ictuat	ed to	ol		Base material			
	DX 6 MX	DX 5 MX	DX 460 MX	DX 351 MX			Soft concrete	Medium concrete	Tough concrete	
X-P 22 MX to X-P 34 MX										

 \blacksquare = recommended \square = feasible

System recommendation for fastening single nails with powder-actuated tools

Designation	Pow	Powder-actuated tool								Base material			
	DX 6 F8	DX 5 F8	DX 460 F8	DX351 F8	DX 2				Soft concrete	Medium concrete	Tough concrete		
X-P 22 P8 to X-P 34 P8													
X-P 22 P8 to X-P 34 P8													

 \blacksquare = recommended \square = feasible



Cartridge recommendation

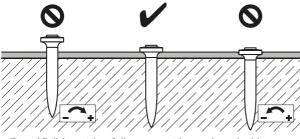
Base materia	al	Cartridge color (tool power lev	vel)			
		Tool type:	Tool type:			
		DX 6 MX	DX 5 MX, DX 460 MX			
			DX 351 MX ¹⁾			
		DX 6 F8	DX 5 F8,			
			DX 460 F8,			
			DX 351 F8 ¹⁾ , DX 2 ¹⁾			
		Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M			
S235 to S355	4 ≤ tll < 6 mm	titanium 🔳 (1-5)	green 📕, yellow 📕			
	6 ≤ tll ≤ 10 mm	titanium 🔳 (4-8),	red 📕, black 🔳			
		black ■ (6–8)				
Soft/medium concrete		titanium 🔳 (1-8)	green 📕, yellow 📕, red 📕			
Tough concrete		titanium 🔳 (4-8),	red 📕, black 📕			
		black				

¹⁾ Black cartridges do not apply for this tool.

- Tool power level adjustment by setting tests on site.
- Start tool energy selection with lowest recommended tool power level.
- Correct according requirement from chapter quality assurance.

Quality assurance

Setting depth control and power tool adjustment



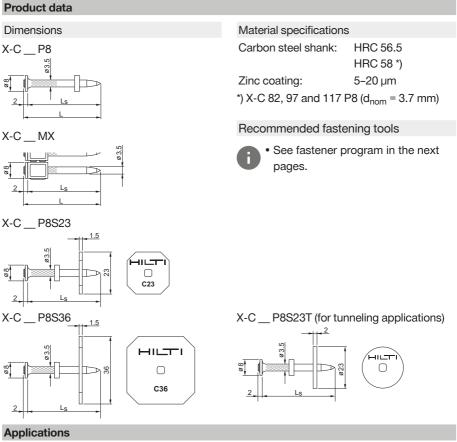
- Visible setting failures must be replaced with a new fastener, not in the same hole.
- These are abbreviated instructions which may vary by application.
- Always review/follow the instructions accompanying the product.



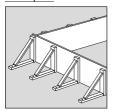
Х-Р



X-C Nail – Fastening to concrete and sand lime masonry



Examples



Conventional formwork



System formwork



Drywall track to concrete

X-C





Performance data

Recommended resistance under tension and shear load





Fastening v	vood to concre	te:
N _{rec}	V _{rec}	h _{ET}
0.4 kN	0.4 kN	≥27 mm
0.3 kN	0.3 kN	≥ 22 mm
0.2 kN	0.2 kN	≥ 18 mm
0.1 kN	0.1 kN	≥14 mm

Fastenings to sandlime masonry: $N_{rec} = V_{rec} = 0.4 \text{ kN for } h_{FT} \ge 27 \text{ mm}$

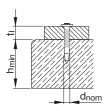
Conditions:

- For safety relevant fastenings sufficient redundancy of the entire system is required: minimum 5 fastenings per fastened unit.
- All visible failures must be replaced.
- Valid for concrete with strength of f_{cc} < 45 N/mm².
- Valid for predominantly static loading.
- Failure of the fastened material is not considered in recommended loads.
- To limit penetration of nail in soft material and to increase pullover load, use nails with washers.
- For more details in relation to base material properties, please refer to the chapter **Fastener selection guide** in the Direct Fastening Manual (DFTM).

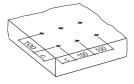
Application recommendation

Base material and fastened material thickness

Fastener positioning in base material



Concrete $h_{min} = 80 \text{ mm}$ $t_l \le 50.0 \text{ mm}$

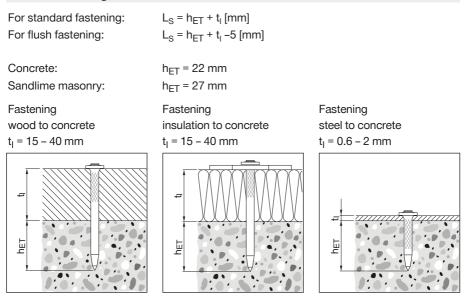


Edge distance: $c \ge 70 \text{ mm}$ Spacing: $s \ge 100 \text{ mm}$





Fastener shank length recommendation



Corrosion information



- The intended use for safety relevant and permanent applications only comprises fastenings which are not directly exposed to external weather conditions or moist atmospheres.
- For more details, please refer to following technical document: Hilti Corrosion Handbook.





System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

Cartridge recommendation for fastening wood to masonry and concrete

Base material	Cartridge color (tool power level)				
	Tool type:	Tool type:			
	DX 6 MX	DX 5 MX, DX 460 MX			
	DX 6 F8	DX 5 F8, DX 460 F8, DX 2			
	Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M			
Sand lime masonry	titanium 🔳 (1-3)	green 🔳			
Soft/medium concrete	titanium 🔳 (1-5)	green 📕, yellow 📙			
Tough concrete	titanium 🔳 (4-8)	yellow <mark>,</mark> red			

Cartridge recommendation for fastening steel to masonry and concrete

Base material	Cartridge color (tool power level)				
	Tool type:	Tool type:			
	DX 6 MX	DX 5 MX, DX 460 MX,			
		DX 351 MX			
	DX 6 F8	DX 5 F8, DX 460 F8,			
		DX 351 F8, DX 2			
	Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M			
Sand lime masonry	titanium 🔳 (1-3)	green 🔳			
Soft/medium concrete	titanium 🔳 (1-5)	green 🔳, yellow 📙			
Tough concrete	titanium 🔳 (4-8)	yellow <mark>–</mark> , red –			



• Start tool energy selection with lowest recommended tool power level.

н



Fastener program

Nails							-	Tool	s				
	lterr	1 no.		cifica-	DX 5 MX, DX 460 MX	DX 5 F8, DX 460 F8	36						
	Packs	Packs			6 MX, I	6 F8, D	ă	E72	351 MX	51 F8	10		
Designation	of 1000 pcs	of 100 pcs	L _s (mm)	d _{nom}	DX 6	DX 6	DX 2,	DX	DX 35	DX 351	DX 35	Description	
X-C 22 P8	2091378	2091377	22	3.5								Thin metal part to concrete	
X-C 27 P8	2091380	2091379	27	3.5								Thin metal part to concrete	
X-C 32 P8	2091382	2091381	32	3.5								Thin metal part to concrete	
X-C 37 P8	2091384	2091383	37	3.5								Thin metal part to concrete	
X-C 42 P8	2091386	2091385	42	3.5								Soft mat / Wood on concrete	
X-C 47 P8	2091388	2091387	47	3.5								Soft mat / Wood on concrete	
X-C 52 P8	2091390	2091389	52	3.5								Wood on concrete	
X-C 62 P8	2091392	2091391	62	3.5								Wood on concrete	
X-C 72 P8		2091393	72	3.5								Wood on concrete	
X-C 82 P8		360930	82	3.7								Wood on concrete (with pre-hammering)	
X-C 97 P8		360931	97	3.7								Wood on concrete (with pre-hammering)	
X-C 117 P8		360933	117	3.7								Wood on concrete (with pre-hammering)	
X-C 20 THP	2091373	2091372	20	3.5								Thin metal part to concrete	
X-C 22 P8 S15TH		2091410	22	3.5								Thin metal part to concrete	
X-C 22 P8TH	2091374	2091375	22	3.5								Thin metal part to concrete	
X-C 27 P8TH		2091376	27	3.5								Thin metal part to concrete	
X-C 27 P8S23	2091396	2091395	27	3.5								High pull-over strength on concrete	
X-C 32 P8S23	2091399	2091397	32	3.5								High pull-over strength on concrete	
X-C 37 P8S23	2091401	2091400	37	3.5								High pull-over strength on concrete	
X-C 42 P8S23	2091404	2091403	42	3.5								High pull-over strength on concrete	
X-C 47 P8S23	2091406	2091405	47	3.5								High pull-over strength on concrete	
X-C 37 P8S36	2091407		37	3.5								High pull-over strength on concrete	
X-C 52 P8S36	2091408		52	3.5								High pull-over strength on concrete	
X-C 62 P8S36	2091409		62	3.5								High pull-over strength on concrete	
X-C 32 P8S23T	2091398		32	3.5								Tunneling applications	
X-C 37 P8S23T	2091402		37	3.5								Tunneling applications	
X-C 20 MX	2091264	2091265	20	3.5								Thin metal part to concrete	
X-C 27 MX	2091266	2091267	27	3.5								Thin metal part to concrete	
X-C 32 MX	2091268	2091269	32	3.5								Thin metal part to concrete	
X-C 37 MX	2091360	2091361	37	3.5								Thin metal part to concrete	
X-C 42 MX	2091362	2091363	42	3.5								Soft material / Wood on concrete	
X-C 47 MX	2091364	2091365	47	3.5								Soft material / Wood on concrete	
X-C 52 MX	2091366	2091367	52	3.5								Wood on Concrete	
X-C 62 MX	2091368	2091369	62	3.5								Wood on Concrete	
X-C 72 MX	2091370	2091371	72	3.5								Wood on Concrete	

recommended, feasible





Х-С



X-S Nail for fastening drywall track to steel

Product data

Dimensions





X-S	16 P8TH	
Ø8	dnom Ls + 2.5	ø10

Material specifications					
Carbon steel shank:					
X-S 16 P8 TH	HRC 55.5				
X-S13 THP/MX	HRC 52.5				
Zinc coating:	5–13 µm				

Recommended fastening tools DX 6 MX, DX 460 MX, DX 5 MX, DX 36, DX 2, DX 351 MX, DX-E 72 DX 6 F8, DX 460 F8, DX 5 F8, DX 351 F8,



• See fastener program in the next pages.

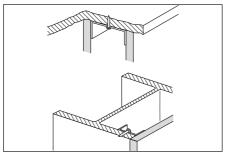
Approvals ICC (USA):

X-S (ESR-1752)

Not all information presented in this product data sheet might be subject to approval / certificate content. Please refer to approval/certificate for further information.

Applications

Examples



Drywall tracks to steel

X-S



Performance data

Recommended resistance under tension and shear load

Steel



- Conditions:
- Redundancy (multiple fastening) must be provided

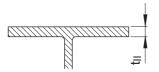
Steel:

• All visible failures must be replaced

0.4 kN

V_{rec} Application recommendation

Thickness of base material

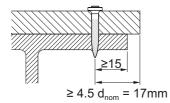


Thickness of fastened material

Wooden track:	t _i ≤ 24 mm
Metal track:	$t_i \le 2 \text{ mm}$

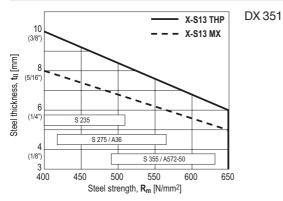
t_⊪ ≥ 4 mm

Fastener positioning



Edge distance: $c \ge 15 \text{ mm}$

Application limits



X-S



Corrosion information

- The intended use only comprises fastenings which are not directly exposed to external weather conditions or moist atmospheres.
- For more details, please refer to following technical document: Hilti Corrosion Handbook.

System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

Fastener selection

	Application	Base material	
X-S 16	Metal track	Steel	incre
X-S 13	Metal track	Steel	ngth

Cartridge recommendation

Base materia	ial Cartridge color (tool power level)				
		Tool type:	Tool type:		
		DX 6 MX	DX 5 MX, DX 460 MX,		
			DX 351 MX		
		DX 6 F8	DX 5 F8, DX 460 F8,		
			DX 351 F8, DX 2		
		Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M		
S235 to	3 ≤ t _∥ < 6 mm	titanium 🔳 (1-4)	green 📕, yellow 📕		
S355	$6 \le t_{II} \le 10 \text{mm}$	yellow <mark>,</mark> red E			

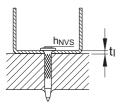
- Tool power level adjustment by setting tests on site.
- Start tool energy selection with lowest recommended tool power level.
- Correct according requirement from chapter quality assurance.



Quality assurance

Setting depth control

Fastening to steel



X-S: h_{NVS} = 2-4 mm

Fastener program

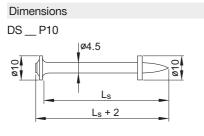
					Sta	anda	rd t	ools			
Fastener	Item no. Packs of 1000 nails	Item no. Packs of 100 nails	Ls	d _{nom}	DX 6 MX, DX 5 MX, DX 460 MX	DX 6 F8, DX 5 F8, DX 460 F8	DX 2, DX 36	DX E72	DX 351 MX	DX 351 F8	DX 35
X-S 13 THP	274061	274059	13 mm	3.7 mm							
X-S 16 P8 TH	388842		16 mm	3.7 mm							
X-S 13 MX	274062	274060	13 mm	3.7 mm							

X-S



DS Heavy-duty nail for fastening to concrete and steel

Product data



Material specifications	;
Carbon steel shank:	HRC 54 (DS)
	HRC 58 (DSH)
Zinc coating:	5–20 µm

Recommended fastening tools DX 6 F10, DX 5 F10, DX 460 F10, DX 76, DX 76 PTR



- See fastener program in the next pages.
- For more details, please refer to the chapter Accessories and consumables compatibility in the Direct Fastening Technology Manual (DFTM).

Approvals

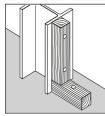
ICC (USA) LR 97/00077



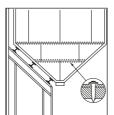
Not all information presented in this product data sheet might be subject to approval / certificate content. Please refer to approval/certificate for further information.

Applications

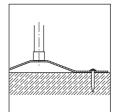
Examples



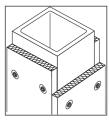
Wood to steel and concrete



Plastic and rubber to steel



Metal parts to concrete



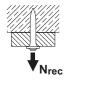
Soft material to steel and concrete



Performance data

Recommended resistance under tension and shear load

Fastening wood to concrete, sandlime masonry or steel





Fastening wood to concrete, sandlime masonry: $N_{rec} = V_{rec} = 0.4 \text{ kN}$

Fastening wood to steel: $N_{rec} = V_{rec} = 0.6 \text{ kN}$

Conditions

- For safety-relevant fastenings sufficient redundancy of the entire system is required: minimum 5 fastenings per fastened unit with normal weight concrete base material.
- All visible failures must be replaced.
- Valid for concrete and sandlime masonry with strength of f_{cc} < 40 N/mm².

 Fastened material: 	wood, minimum thickness	= 24 mm
	plywood, minimum thickness	= 16 mm

Soft material

- Working loads depend on strength and thickness of material fastened. Do not use working loads in excess of those for wood.
- Depth of penetration and other conditions same as for fastening wood.
- Use R23 or R36 (Ø 4.5 mm hole) washer to control penetration and to increase pull-over strength. Separately available from Hilti.

Metal profiles to concrete





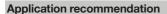
$$N_{rec} = V_{rec} = 0.4 \text{ kN}$$

Nrec

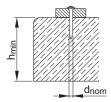
- Minimum 5 fastenings per fastened unit (normal weight concrete)
- Increase to 600 N possible if 8 or more fastenings in each fastened unit.
- All visible failures must be replaced
- t_l = 1–4 mm

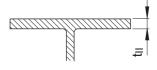
• For more details in relation to base material properties, please refer to the chapter **Fastener selection guide** in the Direct Fastening Manual (DFTM).





Base material thickness





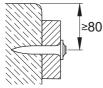
Concrete $h_{min} = 100 \text{ mm} (d_{nom} \ge 4.5 \text{ mm})$ Steel t_{II} ≥ 6 mm

Fastened material thickness

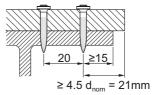
t_l ≤ 50.0 mm

Fastener positioning

Edge distance: concrete (mm)



Edge distance: steel (mm)



Spacing a = 20 mm

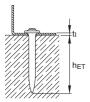




DS

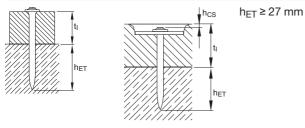


Fastener shanks length recommendation for fastening to concrete



Required nail shank length: Wood or metal profiles $L_S = h_{ET} + t_I$ [mm] Soft material $L_S = h_{ET} + t_I - 2 - h_{cs}$ [mm] $h_{CS} \cong 3$ mm if possible

Required depth of penetration hET



Fastener shanks length recommendation for fastening to steel



h_{ET} = 17–27 mm

Corrosion information

- The intended use for safety-relevant and permanent applications only comprises fastenings which are not directly exposed to external weather conditions or moist atmospheres.
 - For more details, please refer to following technical document: Hilti Corrosion Handbook.





System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

Cartridge recommendation for fastening to concrete

Base material	Cartridge color (tool power level)		
	Tool type:	Tool type:	Tool type:
	DX 6 F10	DX 5 F10,	DX 76,
		DX 460 F10	DX 76 PTR
	Cartridge type:	Cartridge type:	Cartridge type:
	6.8/11 M	6.8/11 M	6.8/18 M
Sand lime masonry	titanium 🔳 (1-5)	green 🔳, yellow 📕	
Soft/medium concrete	titanium 🔳 (2-8)	yellow 📙, red 📕	yellow <mark>–</mark> , red –
Tough concrete	titanium 🔳 (4-8),	red 📕,	red 📕
	black 🔳 (7-8)	black 🔳	

Cartridge recommendation for fastening to steel

Base material		Cartridge color (tool power level)		
		Tool type:	Tool type:	Tool type:
		DX 6 F10	DX 5 F10,	DX 76,
			DX 460 F10	DX 76 PTR
		Cartridge type:	Cartridge type:	Cartridge type:
		6.8/11 M	6.8/11 M	6.8/18 M
S235 to	6 ≤ t _{II} < 13 mm	titanium 🔳 (4-8),	red 📕,	red 📕,
S355		black 🔳 (7-8)	black 🔳	black 🔳



• Tool power level adjustment by setting tests on site.

• Start tool energy selection with lowest recommended tool power level.

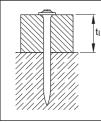
• Correct according requirement from chapter quality assurance.

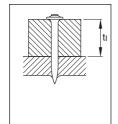


Quality assurance

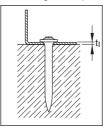
Setting depth control

Fastening wood or soft material





Fastening metal profiles



Flush setting of the nails

Fastener program

Designation	Item no.	LS [mm]	dnom [mm]
DS 27 P10	46157	27	4.5
DS 32 P10	46158	32	4.5
DS 37 P10	46159	37	4.5
DS 42 P10	46160	42	4.5
DS 47 P10	46161	47	4.5
DS 52 P10	46162	52	4.5
DSH 57 P10	40591	57	4.5
DS 62 P10	46164	62	4.5
DS 72 P10	46165	72	4.5

Nail length limits are for use without pre-driving into the wood. Hand-driving the nail into the wood and bringing the DX tool into position over the nail head extend the nail length range for the tools.

DS

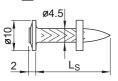


EDS Nail for fastening to steel

Product data



EDS P10



Material specifications	
Carbon steel shank:	
EDS 19/22	
Zinc coating:	

Recommended fastening tools

DX 76, DX 76 PTR

 For more details, please refer to EDS fastener program and to the chapter Accessories and consumables compatibility in the Direct Fastening Technology Manual (DFTM).

HRC 55.0

10-25 µm

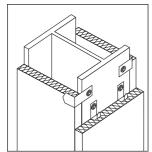
Approvals and certificates

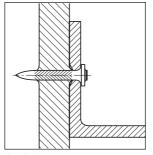
ICC (USA), ABS, LR, DNV-GL

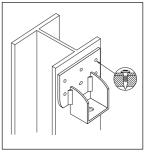
• Not all information presented in this product data sheet might be subject to approval/certificate content. Please refer to approval/certificate for further information.

Applications

Example







Metal clips

Angle bracket

Mounting bracket

EDS





Performance data

Recommended loads (predominantly static)

Steel sheet fastening	tening
-----------------------	--------

otoor on oor labtorning		
	EDS_P10	
t _l [mm]	N _{rec} [kN]	V _{rec} [kN]
0.75	1.1	1.5
1.00	1.3	2.3
1.25	1.7	3.2
≥ 2.00	2.4	4.0

• Recommended loads valid for steel sheet with minimum tensile strength $\geq 360 \text{ N/mm}^2.$

• For intermediate sheet thicknesses, use recommended load for next smaller thickness.

• N_{rec} and V_{rec} include an overall safety factor of 3.0 applied to the characteristic test data. Static test: N_{rec} = N_{test,k} / 3.0, V_{rec} = V_{test,k} / 3.0

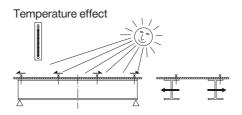
Forces of constraint

When fastening large pieces of steel, the possibility of shear loadings from forces of constraint should be considered. Avoid exceeding V_{rec} for the fastener shank!



Deflection due to primary loading









Application recommendation

Thickness of base material



Thickness of fastened material

 $t_l \le 3 \text{ mm}$

Steel fastened material ≤ 3 mm thick, usually deforms with the displaced base material to allow a tight fit between fastened steel and base material without predrilling.

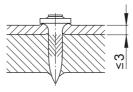
Because conditions may vary, trial fastenings are recommended

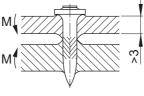
$t_l > 3 \text{ mm}$

Without pre-drilling: steel fastened material > 3 mm thick is too stiff to deform entirely with the displaced base material. The gap, which increases with increasing t_l , can result in bending moments being applied to the nail shank.

With pre-drilling:

If a gap between the fastened part and the base material is unacceptable, the fastened part can be prepared with drilled holes.

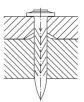




≥ 20mm

To prevent imposition of a moment on the shank of fastener, use three fasteners in a group.





ds

ø12

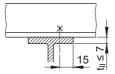
120°





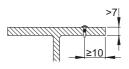
Spacing and edge distances (mm)

Base material



Application limits

Fastened material



① EDS with DX76 and DX 76 PTR

- Limit line valid for steel, $t_l \le 3 \text{ mm}$
- For steel $t_l > 3$ mm and without pre-drilling, either make trial fastenings or adjust t_{ll} to $t_{ll} + t_l$ before using the chart.

Corrosion information

- The intended use only comprises fastenings which are not directly exposed to external weather conditions or moist atmospheres.
- For more details, please refer to following technical document: Hilti Corrosion Handbook.





Fastener program

Base material thickness	Fix ≤1		nate 3	erial 5	thic 6	kne 7	ess t 8	i [m 9	m] 13	Fastener	Item no.		h _{ET} [mm]	DX tools
t _{II,min} ≥6mm										EDS 19 P10	46554	19	12-17	DX 76,
										EDS 22 P10	46556	22	12-17	DX76PTR
recommend	ded	thi	ckn	ess	6					$L_s = h_{ET} + t_I$				

Cartridge recommendation

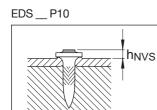
Cartridges 6.8/18 M red or black



- Tool power level adjustment by setting tests on site.
- Start tool energy selection with lowest recommended tool power level.
 - Correct according requirement from chapter quality assurance.

Quality assurance

Fastening inspection



h_{NVS} = 3.0–4.0 mm



EDS





X-R Stainless steel nail

Product data

Product description

X-R 14 P8	Stainless steel nail
	Corrosion-resistant
Statement of Statements	 Designed for fastening on steel
	 Engineered for high-quality, reliable fastening
w	Suitable for universal use

Dimensions for nails

Technical drawing	Product	Shank	Head	Shank	Head	Head
		length	height	diameter	diameter	diameter
		Ls	L _h	ds	d _h	d _{washer1}
ds	X-R 14 P8	14 mm	2.4 mm	3.7 mm	8.0 mm	8.0 mm
d d d masher d d d d d d d d d d d d d d d d d d d						

Material specification and material properties for stainless steel parts

Product type	Element	Material	Tensile	Hardness
			strength	
			R _m	
X-R P8	Nails	Stainless steel	2000 MPa	57 HRC

Material specification and material properties for plastic parts

Product type	Element	Material	
X-R P8	Plastic	Polyethylene	
	washer	(PE)	





Approvals and certificates

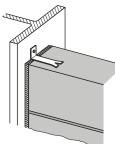
Authority	Approval/	Date	Expiry	Short description
	certificate	of issue	date	
American Bureau of Shipping (ABS)	21-2146145-PDA	08/21	08/26	 Fastening to steel for shipbuilding Fastening to steel for off-shore Fastening to steel for on-shore
Lloyd's register (LR)	LR 97/00078(E4)	01/19	01/24	 Fastening to steel for shipbuilding Fastening to steel for off-shore Fastening to steel for on-shore
ICC-ES	ESR-1663	03/21	03/23	- General purpose

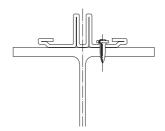
• Information presented in this product data sheet is based on Hilti Technical Data. For the specific application please refer to the corresponding approval/certificate.

Applications

Fastening wall ties

Fastening glas facade





Base materials



Steel





Load conditions



Static/ quasi static

Environmental conditions

Environmo	ntal condition	Product type
Environme		X-R P8
I	Dry indoor	•
	Indoor with temporary condensation	•
+	Outdoor with low pollution	•
1-10 km	Outdoor with moderate concentration of pollutants	•
0-1km	Coastal areas	
	Outdoor, areas with heavy industrial pollution	•
	Close proximity to roads	•
	Special application, e.g. swimming pool	
	Special application, e.g. tunneling	

= suitable

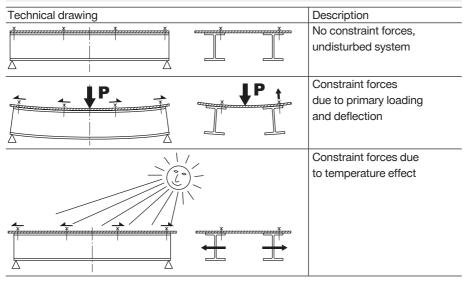
□ = requires expert evaluation



• For more details, please refer to following technical document(s): Hilti Corrosion Handbook.



Constraint forces



• When fastening large pieces of steel or aluminium, the possibility of shear loading due to forces of constraint must be taken into account in the fastening design. Allowance must be made for movement or, alternatively, forces of constraint must be taken into account in the design and maximum shear force limited by way of V_{rec} .

Fastener program

Product categorization

Designation		Technology	Product	Shank	Single nail	Item no.
			identifier	length	fastening	
Product family	Steel nail					
Product line	X-R	Х	R			
Product type	X-R P8	Х	R	P8		
Product	X-R 14 P8	X	R	14	P8	2122461

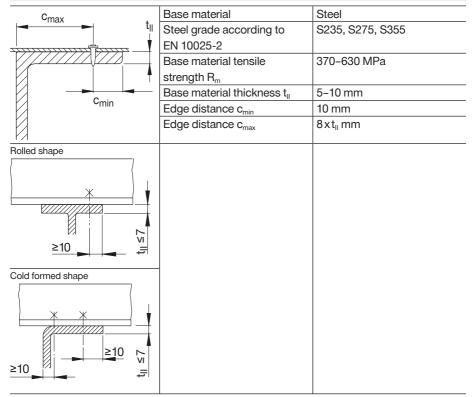


Application recommendation for fastening to steel

Fastened material properties and fastener positioning in fastened material

	Fastened material type	Steel sheet	Aluminum	
			sheet	
	Fastened material	Carbon steel,	Aluminum	
		stainless steel		
	Fastened material tensile	≥ 370 MPa	≥210 MPa	
	strength R _m			
≥12 N	Fastened material	0.75–3 mm	0.8–2.0 mm	
	thickness t _l			
	Edge distance c _{min}	12 mm (border	ed by formed	
		steel structure)		
	Edge distance c _{min}	20 mm		
	Fastener spacing s	≥ 20 mm		

Base material properties and fastener positioning in base material

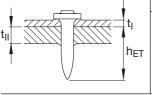


X-R



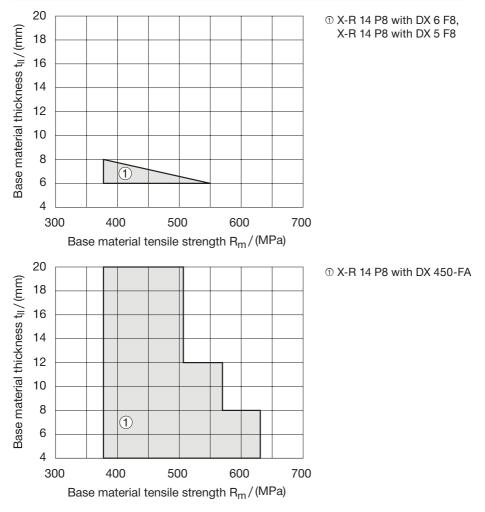


Fastener shank length recommendation



For standard fastening: $L_s = h_{ET} + t_1$ $h_{FT} \ge 9 \text{ mm}$

Application limitation for fastening on steel







Performance data

Recommended resistance under tension load, shear load and bending moment

Product	Fastened	Fastened	Tension	Shear	Bending	
	material	material	load	load	moment	
		thickness				
		tı	N _{rec}	V _{rec}	M _{rec}	
		0.75 mm	1.0 kN	1.1 kN		
		1.00 mm	1.2 kN	1.4 kN]	
	Stool shoot	1.25 mm	1.5 kN	1.7 kN]	
	Sleersneel	2.00 mm	2.2 kN	2.0 kN		
		2.50 mm	2.2 kN	2.0 kN		
X-R 14 P8		3.00 mm	2.2 kN	2.0 kN] –	
		0.80 mm	0.4 kN	0.4 kN		
	Aluminum	1.00 mm	0.6 kN	0.6 kN		
		1.20 mm	0.8 kN	0.9 kN]	
	sheet	1.50 mm	1.1 kN	1.4 kN		
		2.00 mm	1.6 kN	1.7 kN		

- Glas facade application: fastened material thickness t_{I, max} = 2.5 mm.
- Fastened material failure is not considered.
- Recommended loads $N_{\mbox{\tiny rec}}$ and $V_{\mbox{\tiny rec}}$ are suitable for use in working load design concept:

 $\begin{array}{l} \mbox{Characteristic acting load } N_{s} \leq N_{rec} = N_{Rk}/g_{global}, \mbox{ with } g_{global} = 3.0 \\ \mbox{Characteristic acting load } V_{s} \leq V_{rec} = V_{Rk}/g_{global}, \mbox{ with } g_{global} = 3.0 \\ \end{array}$

System recommendation

System recommendation for fastening single nails with powder-actuated tools

Product	Pow	Powder-actuated tool					Base material				
	DX 6 F8	DX 5 F8	DX 450-FA					Steel S235	Steel S275	Steel S355	
X-R 14 P8											

= recommended

= feasible



• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).



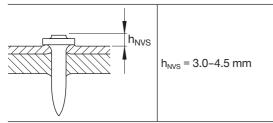
Cartridge recommendation

		Cartridge color (tool power level)							
Base material		Tool type:	Tool type:	Tool type:					
		DX 6 F8	DX 5 F8	DX 450-FA					
		Cartridge type:	Cartridge type:	Cartridge type:					
		6.8/11 M	6.8/11 M	6.8/11 M					
S025	$4 \le t_{\parallel} \le 6 \text{mm}$			yellow (1-3)					
S235-	6 ≤ t _{ii} ≤ 8 mm	titanium 🔳 (6–8)	red 📕 (3-4)	red 📕 (2–3)					
S355	$8 \le t_{\parallel} \le 20 \text{mm}$			red 📕 (2.5–3)					

- Tool power level adjustment by setting tests on site (see chapter quality assurance).
- Start tool energy selection with lowest recommended tool power level.
- Correct according requirement from chapter quality assurance.

Fastener stand-off

R



- Visible setting failures must be replaced with a new fastener, not in the same hole.
 - These are abbreviated instructions which may vary by application.
 - Always review/follow the instructions accompanying the product.





X-CR Stainless steel nail for fastening to steel

Product data

Product description

X-CR P8

- Stainless steel nail
- · Corrosion-resistant
- Designed for fastening on steel
- Engineered for high-quality, reliable fastening
- Suitable for universal use

Dimensions for nails without washer

Technical drawing	Product	Shank	Head	Shank	Head	Head
		length	height	diameter	diameter	diameter
		Ls	L _h	ds	d _h	d _{washer1}
d washer1	X-CR 16 P8	16 mm		3.7 mm	8.0 mm	8.0 mm
	X-CR 18 P8	16 mm	2.4 mm			
	X-CR 21 P8	16 mm				

Material specification and material properties for stainless steel parts

Product type	Element	Material	Tensile	Hardness
			strength	
			R _m	
X-CR P8	Nails	Stainless steel	1800 MPa	51 HRC

Material specification and material properties for plastic parts

Product type	Element	Material	
X-CR P8	Plastic	Polyethylene	
	washer	(PE)	





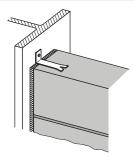
Approvals and certificates

Authority	Approval/	Date	Expiry	Short description
	certificate	of issue	date	
American Bureau of Shipping (ABS)	21-2146145-PDA	08/21	08/26	 Fastening to steel for shipbuilding Fastening to steel for off-shore Fastening to steel for on-shore
Lloyd's register (LR)	LR 97/00078(E4)	01/19	01/24	 Fastening to steel for shipbuilding Fastening to steel for off-shore Fastening to steel for on-shore
ICC-ES	ESR-1663	03/21	03/23	- General purpose

• Information presented in this product data sheet is based on Hilti Technical Data. For the specific application please refer to the corresponding approval/certificate.

Applications

Fastening wall ties



Base materials



Steel





Load conditions



Static/ quasi static

Environmental conditions

Environmental condition		Product type
Environme		X-CR P8
I	Dry indoor	
	Indoor with temporary condensation	
+	Outdoor with low pollution	
1-10 km	Outdoor with moderate concentration of pollutants	
0-1km	Coastal areas	
	Outdoor, areas with heavy industrial pollution	
	Close proximity to roads	•
	Special application, e.g. swimming pool	
	Special application, e.g. tunneling	

= suitable

□ = requires expert evaluation

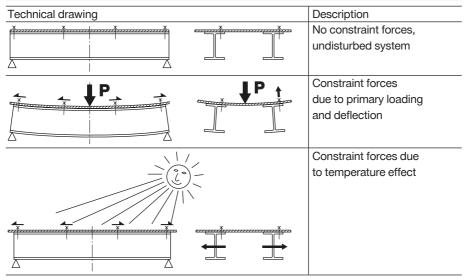


• For more details, please refer to following technical document(s): Hilti Corrosion Handbook.





Constraint forces



 When fastening large pieces of steel or aluminium, the possibility of shear loading due to forces of constraint must be taken into account in the fastening design.
 Allowance must be made for movement or, alternatively, forces of constraint must be taken into account in the design and maximum shear force limited by way of V_{rec}.

Fastener program

Product categorization

Designation		Technology	Product	Shank	Collation	Item no.
			identifier	length	type	
Product family	Steel nail					
Product line	X-CR	Х	CR			
Product type	X-CR P8	Х	CR		P8	
Product	X-CR 16 P8	Х	CR	16	P8	247356
	X-CR 18 P8	Х	CR	18	P8	247357
	X-CR 21 P8	Х	CR	21	P8	247358

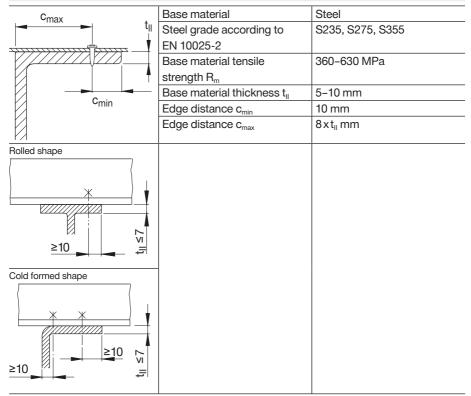


Application recommendation for fastening to steel

Fastened material properties and fastener positioning in fastened material

	Fastened material type	Steel sheet	Aluminum
			sheet
	Fastened material	Carbon steel,	Aluminum
		stainless steel	
	Fastened material tensile	≥ 370 MPa	≥210 MPa
	strength R _m		
	Fastened material	0.75–9 mm	0.8–2.0 mm
≥12 ⁰	thickness t _l		
	Edge distance c _{min}	12 mm (bordere	ed by formed
		steel structure)	
	Edge distance c _{min}	20 mm	
	Fastener spacing s	≥ 20 mm	

Base material properties and fastener positioning in base material

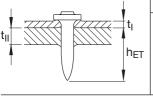


X-CR



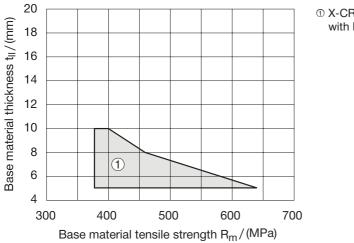


Fastener shank length recommendation



For standard fastening: $L_s = h_{ET} + t_1$ $h_{FT} \ge 9 \text{ mm}$

Application limitation for fastening on steel



① X-CR 16 P8 with DX 450-FA





Performance data

Recommended resistance under tension load, shear load and bending moment

Product	Fastened	Fastened	Tension	Shear	Bending
	material	material	load	load	moment
		thickness			
		t	N _{rec}	V _{rec}	M _{rec}
		0.75 mm	1.0 kN	1.1 kN	
X-CR 16 P8,	Steel sheet	1.00 mm	1.2 kN	1.4 kN	
	Steel Sheet	1.25 mm	1.5 kN	1.7 kN	
		2.00 mm	2.2 kN	2.0 kN	
X-CR 18 P8,		0.80 mm	0.4 kN	0.4 kN	-
X-CR 21 P8	Aluminum	1.00 mm	0.6 kN	0.6 kN	
	sheet	1.20 mm	0.8 kN	0.9 kN	
	Sheet	1.50 mm	1.1 kN	1.4 kN	
		2.00 mm	1.6 kN	1.7 kN	
X-CR 16 P8	Other steel	3 mm	1.6 kN	2.0 kN	3.8 kN
X-CR 18 P8	applications,	5–6 mm	1.6 kN	2.0 kN	3.8 kN
X-CR 21 P8	e.g. clips,	8–9 mm	1.6 kN	2.0 kN	3.8 kN
	brackets				

• For intermediate fastened material thicknesses, use load for next smaller thickness.

• Fastened material failure is not considered.

- Recommended loads $N_{\mbox{\tiny rec}}$ and $V_{\mbox{\tiny rec}}$ are suitable for use in working load design concept:

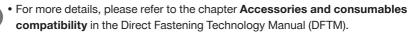
 $\begin{array}{l} \mbox{Characteristic acting load } N_{s} \leq N_{rec} = N_{Rk}/g_{global}, \mbox{ with } g_{global} = 3.0 \\ \mbox{Characteristic acting load } V_{s} \leq V_{rec} = N_{Rk}/g_{global}, \mbox{ with } g_{global} = 3.0 \\ \end{array}$

System recommendation

System recommendation for fastening single nails with powder-actuated tools

Product	Pow	Powder-actuated tool				Base material					
	DX 6 F8	DX 5 F8	DX 450-FA					Steel S235	Steel S275	Steel S355	
X-CR 16 P8											
X-CR 18 P8											
X-CR 21 P8											

 \blacksquare = recommended, \square = feasible





Cartridge recommendation

Base material steel grade		Cartridge color (tool power level)						
		Tool type:	Tool type:	Tool type:				
		DX 6 F8	DX 5 F8	DX 450-FA				
		Cartridge type:	Cartridge type:	Cartridge type:				
		6.8/11 M10 for DX6	6.8/11 M10	6.8/11 M10				
S235-	5 ≤ t _{II} ≤ 6 mm			yellow (1-3)				
	6 ≤ t _{II} ≤ 8 mm	titanium 🔳 (6–8)	red 📕 (3–4)	red 📕 (2–3)				
S355	8 ≤ t _{II} ≤ 10 mm			red 📕 (2.5–3)				

- Tool power level adjustment by setting tests on site (see chapter quality assurance).
- Start tool energy selection with lowest recommended tool power level.
- Correct according requirement from chapter quality assurance.

Fastener stand-off



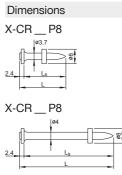
- Visible setting failures must be replaced with a new fastener, not in the same hole.
- These are abbreviated instructions which may vary by application.
- Always review/follow the instructions accompanying the product.

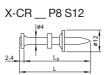




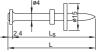
X-CR Stainless steel nail for fastening to concrete, sand lime masonry and steel

Product data









Material specificationsNail shank:CrNiMo Alloy
 $f_u \ge 1800 \text{ N/mm}^2$
(49 HRC)Zinc coating:X-CR 48/52 P8 S15 has
5–13 µm

Zinc coating to improve anchorage in concrete

Recommended fastening tools DX 6, DX 5, DX 460, DX 36, DX 2, DX-E72

Approvals

ABS. LR:

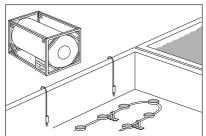
all types



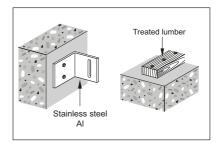
Not all information presented in this product data sheet might be subject to approval / certificate content. Please refer to approval/certificate for further information.

Applications

Examples



Exposure to weather or otherwise corrosive conditions



Noble or corrosive fastened material





Performance data

Recommended resistance under tension and shear load for DX Standard

Fastening wood to concrete, sandlime masonry or steel





Fastening wood to concrete, sandlime masonry: $N_{rec} = V_{rec} = 0.4 \text{ kN}$

Fastening wood to steel:

 $N_{rec} = V_{rec} = 0.6 \text{ kN}$

Conditions

- For safety relevant fastenings sufficient redundancy of the entire system is required: minimum 5 fastenings per fastened unit with normal weight concrete base material.
- All visible failures must be replaced.
- Valid for concrete and sandlime masonry with strength of fcc < 40 N/mm².
- Valid for predominantly static loading.

Soft material

- Working loads depend on strength and thickness of material fastened. Do not use working loads in excess of those for wood.
- Depth penetration and other conditions same as for fastening wood
- Use R23 or R36 (Ø 4.5 mm hole) washer to control penetration and to increase pull-over strength. Separately available from Hilti.

Recommended resistance under tension and shear load for DX-Kwik (with pre-drilling)

	N _{rec,1}	N _{rec,2}	Vrec	M _{rec}
X-CR 39/44	2.0 kN	0.6 kN	2.0 kN	5.5 kN
X-CR 48	3.0 kN	0.9 kN	3.0 kN	5.5 kN

Conditions

- N_{rec,1}: concrete in compressive zone.
- N_{rec,2}: concrete in tension zone.
- Static or cyclic (5000 load applications) loading.
- f_{cc} ≥ 25 N/mm². For higher concrete strengths, higher loadings may be possible if supported by testing.
- A sufficient redundancy has to be ensured, that the failure of a single fastening will not lead to collapse of the entire system.
- Recommended loads are based on failure of the fastener anchorage in the concrete. Thickness and quality of the fastened material may lower the loadings.
- Observance of all pre-drilling requirements, fastened thickness limits, and recommended details.
 - For more details in relation to base material properties, please refer to the chapter **Fastener selection guide** in the Direct Fastening Manual (DFTM).



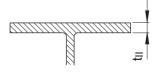


Application recommendation

Base material thickness



Concrete



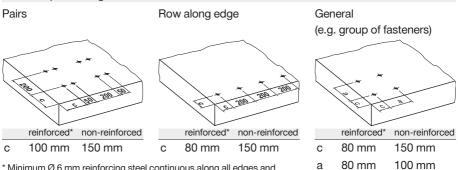
Steel $t_{\parallel} \ge 5$ mm for fastening of wood

 $h_{min} = 80 \text{ mm} (d_{nom} = 3.7 \text{ mm})$ $h_{min} = 90 \text{ mm} (d_{nom} \ge 4.0 \text{ mm})$

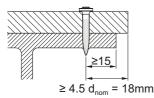
Fastened material thickness

 $t_l \le 25.0 \text{ mm}$ (detailed information see fastener selection)





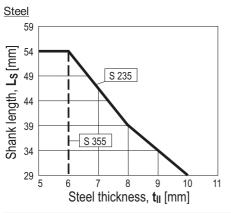
* Minimum Ø 6 mm reinforcing steel continuous along all edges and around all corners. Edge bar must be enclosed by stirrups.



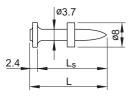


X-CR

Application limits



Fastener shanks length recommendation for DX Standard



 $\label{eq:loss} \begin{array}{ll} Wood: & L_S=h_{ET}+t_l \; [mm] \\ Soft material: \; L_S=h_{ET}+t_l-2.4-h_{cs} \; [mm] \\ h_{CS}\cong 3 \; mm \; if \; possible \end{array}$

Required depth of penetration h_{ET}

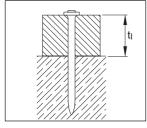
Normal weight con	crete NW	Sandlime masonry SLM			
f _{cc} [N/mm ²]	15	25	35	f _{cc} [N/mm ²] 15 25	5
h _{ET} [mm]	32	27	22	h _{ET} [mm] 32 27	7



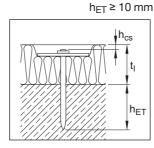
- h_{ET} according to concrete strength $f_{\text{cc}}.$





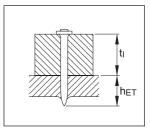


Normal weight concrete NWC



Steel

Sandlime masonry SLM



274

35

27





Corrosion information

- For fastenings exposed to weather or other corrosive conditions. Not for use in highly corrosive surroundings like swimming pools or highway tunnels.
- For more details, please refer to following technical document: Hilti Corrosion Handbook.

System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

Cartridge recommendation for fastening to masonry and concrete

Base material	Cartridge color (tool power level)					
	Tool type:	Tool type:				
	DX 6 F8	DX 5 F8, DX 460 F8, DX 2				
	Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M				
Sand lime masonry	titanium 🔳 (1-3)	green 🗖				
Soft/medium concrete	titanium 🔳 (2-8)	yellow 📕, red 📕				

Cartridge recommendation for fastening to concrete with Kwik method (incl. pre-drilling)

Base material	Cartridge color (tool power level)					
	Tool type:	Tool type:				
	DX 6 F8	DX 5 F8, DX 460 F8, DX 2				
	Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M				
Soft/medium concrete	titanium 🔳 (4-8)	red 📕				
Tough concrete	titanium 🔳 (4-8)	red 📕				

Cartridge recommendation for fastening to steel

Base mater	se material Cartridge color (tool power level)			
		Tool type:	Tool type:	
		DX 6 F8	DX 5 F8, DX 460 F8	
		Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M	
S235 to S355 $5 \le t_{ } < 10 \text{ mm}$		titanium 🔳 (2-8)	yellow 📕, red 📕	

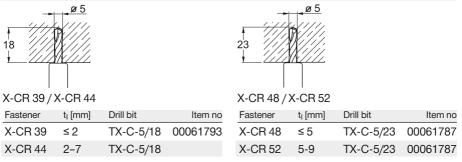


- Start tool energy selection with lowest recommended tool power level.
- Correct according requirement from chapter quality assurance.



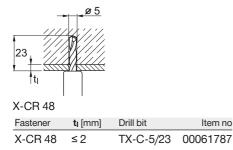
Quality assurance

Installation instruction for DX-Kwik: Pre-drilling details (not through fastened material)



Details valid for C20/25 – C45/55 (f_{cc} = 25–55 N/mm² / f_{c} = 20–45 N/mm²)

Installation instruction for DX-Kwik: Pre-drilling details (through fastened material)



Details valid for C20/25 - C50/60

• These are abbreviated instructions which may vary by application.

• Always review/follow the instructions accompanying the product.





Fastener program

Fasteners			Tool	
Designation	Item no	L _S	d _{nom}	Designation
X-CR 24 P8	247359	24 mm	3.7 mm	DX 6, DX 5, DX 460, DX 36, DX 2, DX-E 72 ¹)
X-CR 29 P8	247360	29 mm	3.7 mm	DX 6, DX 5, DX 460, DX 36, DX 2, DX-E 72 ¹)
X-CR 34 P8	247361	34 mm	3.7 mm	DX 6, DX 5, DX 460, DX 36, DX 2, DX-E 72 ¹)
X-CR 39 P8	247362	39 mm	4.0 mm	DX 6, DX 5, DX 460, DX 36, DX 2, DX-E 72 ')
X-CR 44 P8	247363	44 mm	4.0 mm	DX 6, DX 5, DX 460, DX 36, DX 2, DX-E 72 ')
X-CR 54 P8	247429	54 mm	4.0 mm	DX 6, DX 5, DX 460, DX 36, DX 2, DX-E 72 ¹)
X-CR 39 P8 S12	247354	39 mm	4.0 mm	DX 6, DX 5, DX 460, DX 36, DX 2 2)
X-CR 44 P8 S12	247355	44 mm	4.0 mm	DX 6, DX 5, DX 460, DX 36, DX 2 2)
X-CR 48 P8 S15	258121	48 mm	4.0 mm	DX 6, DX 5, DX 460, DX 36, DX 2 2)
X-CR 52 P8 S15	2052687	52 mm	4.0 mm	DX 6, DX 5, DX 460
X-CR-FOX 53 P8 S15 3)	2305190	53 mm	4.0 mm	DX 6, DX 5, DX 460

¹) DX Standard (without pre-drilling)

²) DX-Kwik (with pre-drilling)

³) Fastener for fixing Hilti brackets MFT-FOX V, MFT-FOX VI

(For more details, please refer to ETA-14/0426)



X-CR

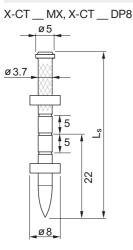




X-CT Nail for forming or other temporary use

Product data

Dimensions



Material specifications				
Carbon steel shank:	HRC 53			
Zinc coating:	5–20 µm			

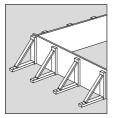
Recommended fastening tools DX 6 MX, DX 5 MX, DX 460 MX DX 6-F8, DX 5-F8, DX 460-F8, DX 36, DX 2, DX-E72



• See fastener program in the next pages.

Applications

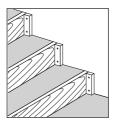
Examples



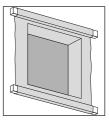
Conventional Formwork



System Formwork



To position and hold concrete formwork



Fasten plastic, netting, etc.





Performance data

Recommended resistance under shear load



Conditions

- Static loading only (placing and vibration of concrete does not affect design).
- Minimum 5 fastenings per fastened unit.

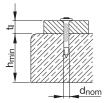
 $V_{rec} = 0.3 \text{ kN}$ for $h_{ET} \ge 22 \text{ mm}$

• For more details in relation to base material properties, please refer to the chapter **Fastener selection guide** in the Direct Fastening Manual (DFTM).

Application recommendation

Base material and fastened material thickness

Fastener positioning



 $h_{min} = 80 \text{ mm}$ $t_{l} = 20-50 \text{ mm}$

Fastener shank length recommendation

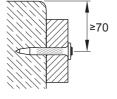
Required nail shank length

 $L_S = h_{ET} + t_I [mm]$

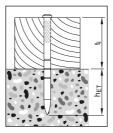
Recommendation

Concrete

h_{ET} = 22 mm



Edge distances $c \ge 70 \text{ mm}$







System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

Cartridge recommendation

Base material	Cartridge color (tool power le	Cartridge color (tool power level)					
	Tool type:	Tool type:					
	DX 6 MX	DX 5 MX, DX 460 MX					
	DX 6 F8	DX 5 F8, DX 460 F8, DX 2					
	Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M					
Sand lime masonry	titanium 🔳 (1-3)	green 🔳					
Soft/medium concrete	titanium 🔳 (1-5)	green 📕, yellow 📕					

• Tool power level adjustment by setting tests on site.

• Start tool energy selection with lowest recommended tool power level.

Fastener program

R

Fasteners				Tc	Tools				
Designation	Item no. Packs of 1000 nails	100 nails	L _S [mm]	d _{nom} [mm]	DX 6 MX, DX 5 MX, DX 460 MX	DX 6 F8, DX 5 F8, DX 460 F8	DX2, DX36	DX E72	Description
X-CT 47 MX	383588		47	3.7					Wood to concrete
X-CT 52 MX	383589	383576	52	3.7					Wood to concrete
X-CT 62 MX	383591	383579	62	3.7					Wood to concrete
X-CT 72 MX		383580	72	3.7					Wood to concrete
X-CT 47 DP8		383582	47	3.7					Wood to concrete
X-CT 52 DP8		383583	52	3.7					Wood to concrete
X-CT 62 DP8		383585	62	3.7					Wood to concrete
X-CT 72 DP8		383586	72	3.7					Wood on concrete (with pre-hammering)
X-CT 97 DP8		383587	97	3.7					Wood on concrete (with pre-hammering)
							omi sibl		ded

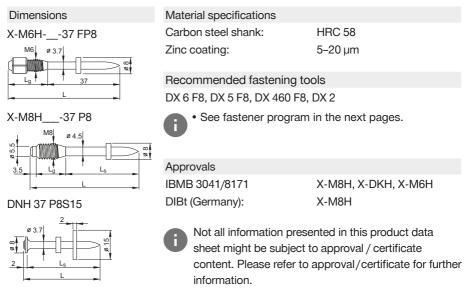




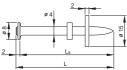


DX-Kwik – X-M6 H, X-M8 H and DNH, X-DKH Threaded studs and nails

Product data

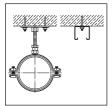


X-DKH 48 P8S15

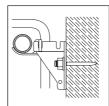


Applications

Examples



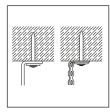
Base plates, rails for piping



Radiator brackets



Floor stands, metal fixtures to concrete



Suspended ceilings





Performance data

Recommended resistance under tension and shear load

	Nrec,1	Nrec,2	V _{rec,1}	M _{rec,1}
X-M6H, DNH 37	2.0 kN	0.6 kN	2.0 kN	5.5 kN
X-M8H, X-DKH 48	3.0 kN	0.9 kN	3.0 kN	10.0 kN

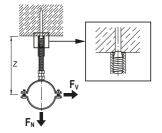
Conditions

- N_{rec.1}: concrete in compressive zone.
- N_{rec.2}: concrete in tension zone.
- Predominantly static loading.
- Concrete C20/25-C50/60.
- A sufficient redundancy has to be ensured, that the failure of a single fastening will not lead to collapse of the entire system.
- Recommended loads are based on failure of the fastener anchorage in the concrete.
 - Thickness and quality of the fastened material may lower the loadings.
 - Observance of all pre-drilling requirements, fastened thickness limits, and recommended details.
 - The recommended loads in the table refer to the resistance of the individual fastening and may not be the same as the loads F_N and F_V acting on the fastened part.
 Note: If relevant, prying forces need to be considered in design, see example.
 Moment acting on fastener shank only in case of a gap between base and fastened material.



• For more details in relation to base material properties, please refer to the chapter **Fastener selection guide** in the Direct Fastening Manual (DFTM).

Arrangements to prevent moment on shank Coupler tight against concrete







Non-symmetric arrangement



- · Moment on fastened part
- Prying effect must be considered in determining loads acting on fastener



Resultant forces on nail

Application recommendation

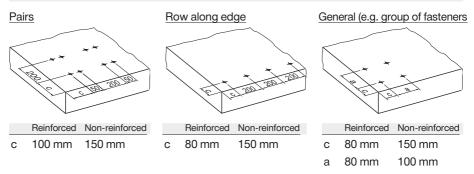
Base material thickness

X-M6H, DNH 37:	h _{min} = 100 mm
X-M8H, X-DKH 48:	h _{min} = 100 mm

Fastened material thickness

X-M6H:	tı ≤ Lg - t _{washer} - t _{nut} ≅ up to 13.5 mm
X-M8H:	tl ≤ Lg - t _{washer} - t _{nut} ≅ up to 14.0 mm
DNH 37:	t₁ ≤ 2.0 mm
X-DKH 48:	$t_l \le 5.0$ mm or $t_l \le 2.0$ by pre-drilling through fastened material

Fastener positioning in base material



Corrosion information

- The intended use only comprises fastenings which are not directly exposed to external weather conditions or moist atmospheres.
 - For more details, please refer to following technical document: Hilti Corrosion Handbook.





System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

Cartridge recommendation

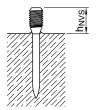
Base material	Cartridge color (tool power level)					
	Tool type:	Tool type:				
	DX 6 F8	DX 5 F8, DX 460 F8, DX 2				
	Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M				
Soft/medium concrete	titanium 🔳 (2-6)	yellow 📕, red 📕				
Tough concrete	titanium 🔳 (4-8)	yellow 📙, red 📕				

- Tool power level adjustment by setting tests on site.
- Start tool energy selection with lowest recommended tool power level.
- Correct according requirement from chapter quality assurance.

Quality assurance

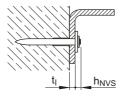
Fastening inspection

X-M6H, X-M8H



 $h_{NVS} = L - h_{ET}, h_{ET} = 37-41 \text{ mm}$

DNH 37, X-DKH 48



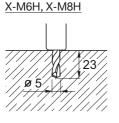
Place nails so that heads and washers bear tightly against each other and against the fastened material

 $h_{NVS} \cong 4 \text{ mm}$





Installation



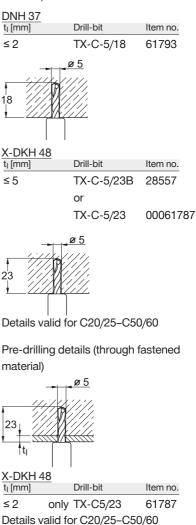
Pre-drill with drill bit Designation Item no TX-C-5/23B 28557 or TX-C-5/23 61787



Tightening torque
DesignationTrec [Nm]X-M6H6.5X-M8H10.0

DNH 37, X-DKH 48

Pre-drilling details (not through fastened material)



These are abbreviated instructions which may vary by application. <u>ALWAYS</u> review/follow the instructions accompanying the product.





Fastener program

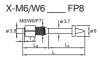
Fastened thickness	Fastener				
t _{l,max} [mm]	Designation	Item no.	Lg [mm]	L _s [mm]	L [mm]
-	X-M6H-10-37 FP8	40464	10	37	47
-	X-M8H-10-37 P8	20059	10	37	50.5
5.0	X-M8H/5-15-37 P8	26325	15	37	55.5
15.0	X-M8H/15-25-37 P8	20064	25	37	65.5
2.0	DNH 37 P8S15	44165	-	37	39
5.0*	X-DKH 48 P8S15	40514	-	48	50

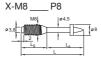
*) with pre-drilling through fastened material $t_{I,max} = 2.0 \text{ mm}$

X-M6, X-W6, X-M8, M10, W10 Threaded stud for fastening to concrete

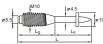
Product data

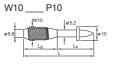
Dimensions





M10-24-32 P10





Material specifications	
Carbon steel shank:	HRC 53.5
Zinc coating:	5–20 µm

Recommended fastening tools DX 6, DX 5, DX 460, DX 351, DX 36, DX 2, DX E72, DX 76, DX 76 PTR, DX 600 N



• See fastener program in the next pages.

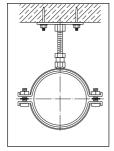
Approvals

ICC (USA): UL, FM: X-W6, W10 W10

• Not all information presented in this product data sheet might be subject to approval / certificate content. Please refer to approval/certificate for further information.

Applications

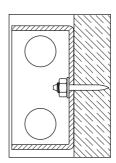
Examples



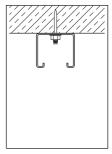
Plates for pipe rings



Hangings with threaded couplers



Electrical boxes



Miscellaneous attachments



Performance data

Recommended resistance

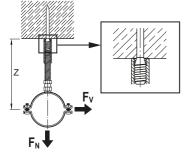
	Shank diameter	Bending moment
Designation	d _s	M _{rec}
X-M6/W6	3.7 mm	5.0 Nm
X-M8, M10	4.5 mm	9.0 Nm
W10	5.2 mm	14.0 Nm

Recommended resistance for X-M6/W6, X-M8, M10, W10

$N_{rec} = V_{rec} =$	0.4 kN for h _{ET} ≥ 27 mm
$N_{rec} = V_{rec} =$	0.3 kN for h _{ET} ≥ 22 mm
$N_{rec} = V_{rec} =$	0.2 kN for h _{ET} ≥ 18 mm

Arrangements to prevent moment on shank Coupler tight against concrete Non-symmetric arrangement

- Moment on fastened part
- Prying effect must be considered in determining loads acting on fastener



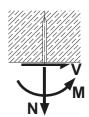
 z_2

Conditions

- Minimum 5 fastenings per fastened unit (normal weight concrete)
- All visible failures must be replaced.
- With lightweight concrete base material and greater loading may be possible, please contact Hilti.
- Predominantly static loading.
- Observance of all application limitations and recommendations.
- The recommended loads in the table refer to the resistance of the individual fastening and may not be the same as the loads $F_{\rm N}$ and $F_{\rm V}$ acting on the fastened part.

Note: If relevant, prying forces need to be considered in design, see example. Moment acting on fastener shank only in case of a gap between base and fastened material.

• For more details in relation to base material properties, please refer to the chapter **Fastener selection guide** in the Direct Fastening Manual (DFTM).





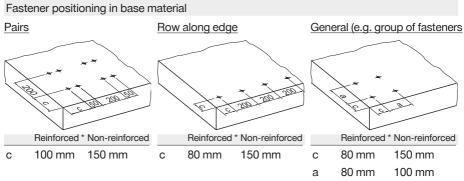
Application recommendation

Base material thickness

 $h_{min} = 80 \text{ mm} (d_{nom} = 3.7 \text{ mm})$ $h_{min} = 100 \text{ mm} (d_{nom} \ge 4.5 \text{ mm})$

Fastened material thickness

M6:	$t_l \le L_g - t_{washer} - t_{nut} \cong up \text{ to } 15 \text{ mm}$
W6:	$t_l \le L_g - t_{washer} - t_{nut} \cong up \text{ to } 33 \text{ mm}$
M8:	$t_l \le L_g - t_{washer} - t_{nut} \cong up \text{ to } 15 \text{ mm}$
M10:	$t_l \le L_g - t_{washer} - t_{nut} \cong up \text{ to } 19 \text{ mm}$
W10:	$t_l \le L_g - t_{washer} - t_{nut} \cong up \text{ to } 25 \text{ mm}$



* Minimum Ø 6 reinforcing steel continuous along all edges and around all corners. Edge bars must be enclosed by stirrups.

Fastener shank length recommendation

Required thread length

 $L_g \ge t_l + t_{washer} + t_{nut} [mm]$





Corrosion information

- . The intended use only comprises fastenings which are not directly exposed to external weather conditions or moist atmospheres.
- · For more details, please refer to following technical document: Hilti Corrosion Handbook.

System recommendation

· For more details, please refer to the chapter Accessories and consumables compatibility in the Direct Fastening Technology Manual (DFTM).

Cartridge recommendation

Base material	Cartridge color (tool power level)		
	Tool type:	Tool type:	
	DX 6 F8	DX 5 F8, DX 460 F8,	
		DX 351 F8, DX 2	
	Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M	
Soft/medium concrete	titanium 🔳 (2-6)	yellow <mark>,</mark> red	
Tough concrete	titanium 🔳 (4-8)	yellow <mark>,</mark> red 	

Cartridge recommendation

Base material	Cartridge color (tool power level)		
Tool type:		Tool type:	
	DX 76, DX 76 PTR	DX 600 N	
	Cartridge type: 6.8/18 M	Cartridge type: 6.8/11	
Soft/medium concrete	yellow 📕, red 📕	yellow 🗕, red 📕	
Tough concrete	yellow 🗕, red 📕	yellow <mark>–</mark> , red –	

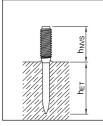
- Tool power level adjustment by setting tests on site.
- Start tool energy selection with lowest recommended tool power level.
- Correct according requirement from chapter quality assurance.



Quality assurance

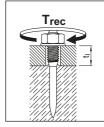
Fastening inspection

$\frac{X-M6 / W6}{Penetration depth}$



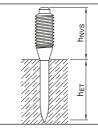
 h_{NVS} = $L_g \pm 2$

Tightening torque



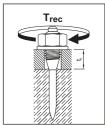
T_{rec} ≤ 4 Nm

X-M8, M10, W10 Penetration depth



 $h_{NVS} = L_g \pm 2$

Tightening torque





Fastener program

Fasteners Tool				Tool	
Group 1)	Designation	Item no.	Standard threading²) L _g [mm]	Standard shank lengths ²) L _S [mm]	Designation
M6	X-M6-20-27FP8	306079	20	27	DX 6, DX 5, DX 460, DX 351, DX 36, DX 2, DX E72
W6	X-W6-20-22FP8	306073	20	22	DX 6, DX 5, DX 460, DX 351, DX 36, DX 2, DX E72
	X-W6-20-27FP8	306074	20	27	DX 6, DX 5, DX 460, DX 351, DX 36, DX 2, DX E72
	X-W6-38-27FP8	306075	38	27	DX 6, DX 5, DX 460, DX 36, DX 2, DX E72
M8	X-M8-15-27P8	306092	18	27	DX 6, DX 5, DX 460, DX 36, DX 2, DX E72
	X-M8-15-42P8	306094	18	42	DX 6, DX 5, DX 460, DX 36, DX 2, DX E72
	X-M8-20-32P8	306096	23	32	DX 6, DX 5, DX 460, DX 36, DX 2, DX E72
M10	M10-24-32P10	26413	27	32	DX 76, DX 76 PTR
W10	W10-30-27P10	26472	30	27	DX 600 N
	W10-30-32P10	26473	30	32	DX 600 N
	W10-30-42P10	26476	30	42	DX 600 N

¹) Type threading: M = metric; W6, W10 = Whitworth 1/4"; 3/8"

²) Standard threading and shank lengths. Other lengths and combinations available on special order.



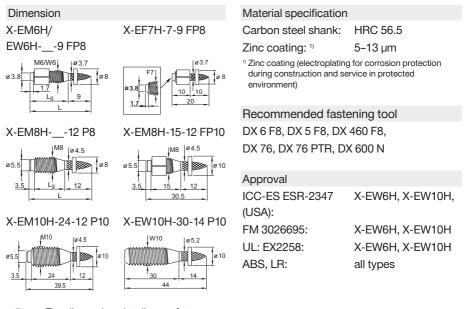
X-M6, X-W6, X-M8, M10, W10

/



X-EM6H, X-EW6H, X-EF7H, X-EM8H, X-EM10H, X-EW10H Threaded stud for fastening to steel

Product data



For dimension details see fastener program
Not all information presented in this product data sheet might be subject to approval/certificate content. Please refer to approval/certificate for further information.

Environmental condition			
		Fastener	
		X-EM6H, EW6H, X-EF7H	
Environmental condition		X-EM8H, X-EW8H, X-EM10H,	
		X-EW10H	
I	Dry indoor non-corrosive environment	•	



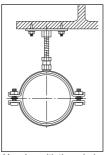
• For more details, please refer to following technical document: Hilti Corrosion Handbook.

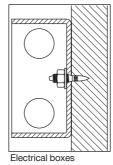


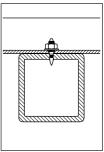
Application

Example:









Miscellaneous attachments

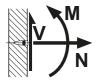
Base plates for pipe rings

Hanging with threaded couplers

Performance data

Recommended resistance under tension load, shear load and under bending moment

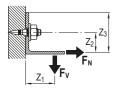
Designation	Shank	Tension load	Shear load	Bending
				moment
	d _s x L _s	N _{rec}	V _{rec}	M _{rec}
X-EM6H, X-EW6H, X-EF7H	3.7 x 8.5 mm	1.6 kN	1.6 kN	5.0 Nm
X-EM8H, X-EM10H	4.5 x 12.0 mm	2.4 kN	2.4 kN	9.0 Nm
X-EW10H-30-14	5.2 x 15.0 mm	3.0 kN	3.0 kN	14.0 Nm



Conditions:

- Redundancy (multiple fastening) must be provided.
- Global factor of safety for static pull-out >3 (based on 5% fractile value).
- Predominantly static loading.
- Strength of fastened material must be considered.
- Observance of all application limitations and recommendations.
- The recommended loads in the table refer to the resistance of the individual fastening and may not be the same as the loads $F_{\rm N}$ and $F_{\rm V}$ acting on the fastened part.

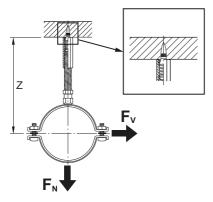
Note: If relevant, prying forces need to be considered in design, see example. Moment acting on fastener shank only in case of a gap between base and fastened material.





Arrangement to prevent moment on shank

Coupler tight against steel



Application recommendation

Base material thickness

	Designation	Base material thickness t _{II,min}
	X-EM6H-8-9 FP8	
	X-EM6H-11-9 FP8	
	X-EM6H-20-9 FP8	
	X-EW6H-11-9 FP8	4.0
	X-EW6H-20-9 FP8	4.0 mm
	X-EW6H-28-9 FP8	
	X-EW6H-38-9 FP8	
	X-EF7H-7-9 FS8	
	X-EM8H-11-12 P8	
	X-EM8H-15-12 P8	
	X-EM8H-15-12 FP10	6.0 mm
	X-EM10H-24-12 P10	
	X-EW10H-30-14 P10	



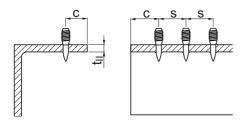
X-EM6H, X-EW6H, X-EF7H, X-EM8H, X-EM10H, X-EW10H

Fastened material thickness



Designation	Fastened material thickness
	t _{I,max}
X-EM6H-8-9 FP8	1.5 mm
X-EM6H-11-9 FP8	4.5 mm
X-EM6H-20-9 FP8	13.5 mm
X-EW6H-11-9 FP8	4.5 mm
X-EW6H-20-9 FP8	13.5 mm
X-EW6H-28-9 FP8	21.5 mm
X-EW6H-38-9 FP8	31.5 mm
X-EF7H-7-9 FS8	0.5 mm
X-EM8H-11-12 P8	2.0 mm
X-EM8H-15-12 P8	6.0 mm
X-EM8H-15-12 FP10	6.0 mm
X-EM10H-24-12 P10	14.0 mm
X-EW10H-30-14 P10	20.0 mm

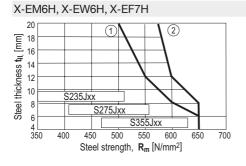
Fastener positioning and base material



Edge distance: $c \ge 15 \text{ mm}$ Spacing: $s \ge 15 \text{ mm}$



Application recommendation

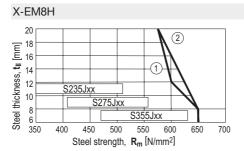


 Fastener: X-EF7H-7-9 FP8 Setting tool: DX 6 F8, DX 5 F8, DX 460 F8

② Fastener:

X-EM6H-8-9 FP8, X-EM6H-11-9 FP8, X-EM6H-20-9 FP8, X-EW6H-11-9 FP8, X-EW6H-20-9 FP8, X-EW6H-28-9 FP8, X-EW6H-38-9 FP8

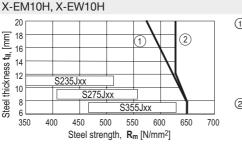
Setting tool: DX 6 F8, DX 5 F8, DX 460 F8



① Fastener:

X-EM8H-11-12 P8, X-EM8H-15-12 P8 Setting tool: DX 6 F8, DX 5 F8, DX 460 F8

 Pastener: X-EM8H-15-12 FP10 Setting tool: DX 76, DX 76 PTR



- Fastener: X-EM10H-24-12 P10 Setting tool: DX 76, DX 76 PTR
- Pastener:
 X-EW10H-30-14 P10
 Setting tool:
 DX 600 N



System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

Cartridge recommendation for X-EM6H, X-EW6H

Base mate	erial	Cartridge color (tool power level)	
Tool type: DX 6 F8		Tool type: DX 5 F8, DX 460 F8	
(Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M
S235	4 ≤ t _{II} ≤ 10 mm	titanium 🔳 (1-3)	green 🗖
	10 < t _{II} ≤ 20 mm	titanium 🔳 (2-5)	yellow 📕
S275	4≤t _{II} ≤6mm	titanium 🔳 (1-3)	green 🗖
5275	6 < t _{II} ≤ 20 mm	titanium 🔳 (2-5)	yellow 📕
S355	$4 \le t_{ } \le 20 \text{mm}$	titanium 🔳 (2–5)	yellow <mark>–</mark>

Cartridge recommendation for X-EF7H

Base material		Cartridge color (tool power level)		
		Tool type: DX 6 F8	Tool type: DX 5 F8, DX 460 F8	
		Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M	
S235	4≤t _{II} ≤8mm	titanium 🔳 (1-3)	green 🗖	
	8 < t _{II} ≤ 20 mm	titanium 🔳 (2-5)	yellow 📕	
S275	4≤t _{II} ≤6mm	titanium 🔳 (1-3)	green 🔳	
	6 < t _{II} ≤ 20 mm	titanium 🔳 (2-5)	yellow 📕	
S355 4 ≤ t _{II} ≤ 20 mm		titanium 🔳 (2–5)	yellow <mark>–</mark>	

Cartridge recommendation for X-EM8H

Base material		Cartridge color (tool power level)		
		Tool type:	Tool type:	
		DX 6 F8	DX 5 F8, DX 460 F8	
		Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M	
S235,	Cct comm	titanium 🔳 (5-8),	red 📕, black 🔳	
S275	6 ≤ t _{II} ≤ 8 mm	black 🔳 (6-8)		
S235,	9 < t < 20 mm	titanium 🔳 (7-8),	black	
S275 $8 \le t_{\parallel} \le 20 \text{ mm}$		black 🔳 (6-8)		
S355 $6 \le t_{ } \le 20 \text{ mm}$		titanium 🔳 (7-8),	black 🔳	
		black 🔳 (6-8)		



Cartridge recommendation for X-EM8H

Base material		Cartridge color (tool power level)	
		Tool type: DX 76 PTR	
		Cartridge type: 6.8/18 M	
S235	4 ≤ t _{II} ≤ 8mm	blue 🗖	
5230	8 < t _{II} ≤ 20 mm	red 📕	
	6≤t _{ll} ≤7mm	blue 🗖	
S275	7 < t _{II} ≤ 8 mm	red 📕	
	8 < t _{II} ≤ 20 mm	black 🔳	
S355	6≤t _{II} ≤8mm	red 📕	
	8 < t _{II} ≤ 20 mm	black	

Cartridge recommendation for X-EM10H

Base material		Cartridge color (tool power level)	
		Tool type: DX 76 PTR	
		Cartridge type: 6.8/18 M	
S235	6 ≤ t _{II} ≤ 20 mm	yellow <mark>–</mark>	
	6 ≤ t _{II} ≤ 7 mm	yellow <mark>–</mark>	
S275	7 < t ≤ 8 mm	blue 🗖	
	8 < t _{II} ≤ 20 mm	red 📕	
00EE	6≤t _{II} ≤8mm	red 📕	
S355	8 < t _{II} ≤ 20 mm	black	



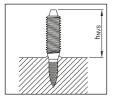
Base material		Cartridge color (tool power level)	
		Tool type: DX 600 N	
		Cartridge type: 6.8/18 M	
	6 ≤ t _{II} ≤ 20 mm	blue 🗖	
S235	8 ≤ t _{II} ≤ 15 mm	red 📕	
	15 < t _{II} ≤ 20 mm	black	
	6 ≤ t _{II} ≤ 8 mm	blue 🗖	
S275	8 < t _{II} ≤ 12mm	red 📕	
	12 < t _{ll} ≤ 20mm	black	
S355	6≤t _{II} ≤7mm	red 📕	
7 < t _{II} ≤ 20 mm		black 🔳	

Cartridge recommendation for X-EW10H

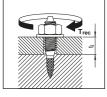
- Tool power level adjustment by setting tests on site.
 - Start tool energy selection with lowest recommended tool power level.
 - Correct according requirement from chapter quality assurance.

Quality assurance

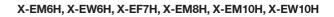
X-EM6H, X-EW6H, X-EF7H



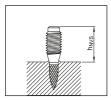
Designation	Nail standoff	Tightening torque
	h _{NVS}	T _{rec}
X-EM6H-8-9	8.0–11.0 mm	
X-EM6H-/X-EW6H-11-9	9.5–12.5 mm	
X-EM6H-/X-EW6H-20-9	18.5–21.5 mm	≤ 4 Nm
X-EW6H-28-9	26.5–29.5 mm	≥ 4 INIT
X-EW6H-38-9	36.5–39.5 mm	
X-EF7H-7-9	9.0–12.0 mm	



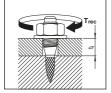




X-EM8H, X-EM10H, X-EW10H



Designation		Nail standoff	Tightening torque	
		h _{NVS}	T _{rec}	
	X-EM8H-11-12	11.5–15.5 mm		
	X-EM8H-15-12	15.5–19.5 mm	≤ 10.5 Nm	
	X-EM10H-24-12	26.5–29.5 mm		
	X-EW10H-30-14	28.0-31.0 mm	≤ 15.0 Nm	



Fastener program

Designation	Item no.	Threading length	Shank length
		Lg	Ls
X-EM6H-8-9 FP8	271965	8 mm	8.5 mm
X-EM6H-11-9 FP8	271963	11 mm	8.5 mm
X-EM6H-20-9 FP8	271961	20 mm	8.5 mm
X-EW6H-11-9 FP8	271973	11 mm	8.5 mm
X-EW6H-20-9 FP8	271971	20 mm	8.5 mm
X-EW6H-28-9 FP8	271969	28 mm	8.5 mm
X-EW6H-38-9 FP8	271967	38 mm	8.5 mm
X-EF7H-7-9 FS8	271975	7 mm	10 mm
X-EM8H-11-12 P8	271983	11 mm	12 mm
X-EM8H-15-12 P8	271981	15 mm	12 mm
X-EM8H-15-12 FP10	271982	15 mm	12 mm
X-EM10H-24-12 P10	271984	24 mm	12 mm
X-EW10H-30-14 P10	271985	30 mm	14 mm



• Fastener designation – Type of threading:

M = metric; W6, W10 = Whitworth ¹/₄"; ³/₈"; F7 = French 7 mm

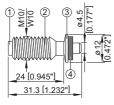


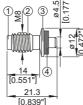
X-BT Stainless steel threaded stud

Product data

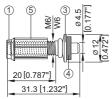
Dimensions

X-BT W10-24-6 SN12-R X-BT M10-24-6 SN12-R





X-BT W6-24-6 SN12-R X-BT M6-24-6 SN12-R



X-BT M8-15-6 SN12-R

Material specifications 1 Shank:

o onania.				
CR 500 (CrNiMo alloy) S31803 (1.4462)	equivalent to A4 / AISI grade 316 material			
. ,	0			
N 08926 (1.4529) 1	Available on request			
② Threaded sleeve:	S31609			
	(X5CrNiMo 17-12-2+2H, 1.4401)			
③ SN12-R washers:	S 31635			
	(X2CrNiMo 17-12-2, 1.4404)			
④ Sealing washers:	Chloroprene rubber CR			
	3.1107, black* Resistant to UV, salt water, water, ozone, oils, etc.			
¹) For High Corrosion Resistance HCR material inquire at Hilti				
Designation according to Unified Numbering System (UNS)				
Recommended fastening tools				
BX 3-BT / BTG DX 351-BT / BTG				
For more details, please refer to				

X-BT fastener program and to the chapter Accessories and consumables compatibility in the Direct Fastening Technology Manual (DFTM).

Approvals and certificates

ICC ESR-2347 (USA), ABS, LR, DNV-GL, BV 23498/B0, GL 12272-10HH, Russian Maritime Register



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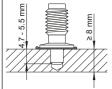
X-BT



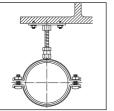
Applications

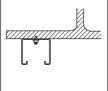
Examples

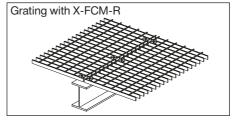


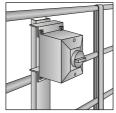


- High strength steel Coated steel
- structures Through penetration of base steel is not allowed







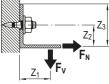


Base plates

- Installation rails
- Junction box, etc.

Performance data

Steel grade: Europe, US		S235, A36	S355, Grade 50 and stronger steel	N
Tension,	N _{rec} [kN/lb]	1.8/405	2.3/517	
Shear,	V _{rec} [kN/lb]	2.6/584	3.4 / 764	M 🔺 1883
Moment,	M _{rec} [Nm/lbft]	8.2/6	8.2/6	Example:
Torque,	T _{rec} [Nm/lbft]	8/5.9	8/5.9	
Recomme	ended loads - cast	iron *		
Tension,	N _{rec} [kN/lb]	0.5/115		
Shear,	V _{rec} [kN/lb]	0.75/170		



Conditions for recommended loads:

• Global factor of safety for static pull-out > 3 (based on 5% fractile value) • Minimum edge distance = 6 mm $[^{1}/4^{"}]$.

8.2/6

Moment, Mrec [Nm/lbft]

- Effect of base metal vibration and stress considered.
- · Redundancy (multiple fastening) must be provided.

[•] The recommended loads in the table refer to the resistance of the individual fastening and may not be the same as the loads FN and FV acting on the fastened part. Note: If relevant, prying forces need to be considered in design, see example. Moment acting on fastener shank only in case of a gap between base and fastened material.



Steel grade: Europe

Tension

Shear

N_{Rd} [kN]

V_{Rd} [kN]



Moment	M _{Rd} [Nm]	18.4	18.4		
Design re	sistance – cas	st iron *			
Tension	N _{RD} [kN]	0.8			
Shear	V _{RD} [kN]	1.2			
Moment	M _{RD} [Nm]	13.1			

*Requirements of spheroidal graphite cast iron base material

Subject	Requirements
Cast iron	Spheroidal graphite cast iron according to EN 1563
Strength class	EN-GJS-400 to EN-GJS-600 acording to EN 1563
Chemical analysis and amount of carbon	3.3-4.0 mass percentage
Microstructure	Form IV to VI (spherical) according to EN ISO 945-1:2010 Minimum size 7 according to Figure 4 of EN ISO 945-1:2010
Material thickness	t _{ll} ≥ 20 mm

Recommended interaction formula for combined loading

Combined loading situation	Interaction formula
V–N (shear and tension)	$\frac{V}{V_{rec}}$ + $\frac{N}{N_{rec}}$ ≤ 1.2 with $\frac{V}{V_{rec}}$ ≤ 1.0 and $\frac{N}{N_{rec}}$ ≤ 1.0
V–M (shear and bending)	$\frac{V}{V_{rec}}$ + $\frac{M}{M_{rec}}$ ≤ 1.2 with $\frac{V}{V_{rec}}$ ≤ 1.0 and $\frac{M}{M_{rec}}$ ≤ 1.0
N–M (tension and bending)	$\frac{N}{N_{rec}} + \frac{M}{M_{rec}} \le 1.0$
V-N-M (shear, tension and bending)	$\frac{V}{V_{rec}} + \frac{N}{N_{rec}} + \frac{M}{M_{rec}} \le 1.0$

Cyclic loading:

• Anchorage of X-BT-R threaded stud in steel base material is not affected by cyclic loading.

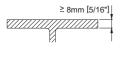
• Fatigue strength is governed by fracture of the shank. Inquire at Hilti for test data if high cycle loading has to be considered in the design.

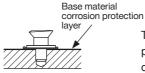
X-BT



Application recommendation

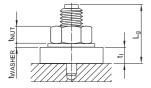
Thickness of base material





Thickness of base material corrosion protection layer ≤ 0.4mm. For thicker coatings, please contact Hilti.

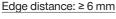
Thickness of fastened material

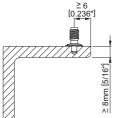


X-BT M8: $2.0 \le t_l \le 7.0 \text{ mm}$ X-BT M10 / X-BT W10: $2.0 \le t_l \le 15.0 \text{ mm}$ X-BT M6 / X-BT W6: $1.0 \le t_l \le 14.0 \text{ mm}$

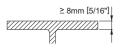
Note: For X-BT with SN 12R sealing washer $t_l \ge 2.0$ mm For X-BT M6 / W6 with SN 12R sealing washer $t_l \ge 1.0$ mm

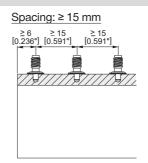
Spacing and edge distances





Application limit





- $t_{II} \ge 8 \text{ mm} [5/16^{11}] \rightarrow \text{No through penetration}$
- · No limits with regards to steel strength

Corrosion information

The corrosion resistance of Hilti CR500 and S31803 (1.4462) stainless steel material is equivalent to AISI 316 (A4) steel grade.

Studs made of N 08926 (HCR) material with higher corrosion resistance, e.g. for use in road tunnels or swimming pools, are available on special order.



Fastener program and system recommendation

Fastener program

Fastener designation	Item no.	Tool Designation		
X-BT M8-15-6 SN12-R	377074	BX 3-BTG, DX 351-BTG		
X-BT M10-24-6 SN12-R	377078	BX 3-BT, DX 351-BT		
X-BT W10-24-6 SN12-R	377076	BX 3-BT, DX 351-BT		
X-BT W10 without washer	377075	BX 3-BT, DX 351-BT		
X-BT M6-24-6 SN12-R	432266	BX 3-BT, DX 351-BT		
X-BT W6-24-6 SN12-R	432267	BX 3-BT, DX 351-BT		

Note: For High Corrosion Resistance HCR material inquire at Hilti

Cartridge recommendation

6.8/11 M high precision brown cartridge

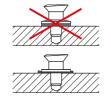
• Tool power level adjustment by setting tests on site.

• Correct according requirement from chapter quality assurance.

Quality assurance

Fastening inspection



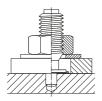


X-BT M8 h_{NVS} = 15.7–16.8 mm

X-BT M10 / X-BT W10 and X-BT M6 / X-BT W6 h_{NVS} = 25.7–26.8 mm

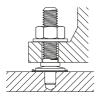
Installation

X-BT with washer



Fastened material hole \emptyset \geq 13 mm

X-BT M6 / X-BT W6



Fastened material with pre-drilled hole diameter < 7 mm



Fastened material with pre-drilled hole diameter ≥ 7 mm

х-вт



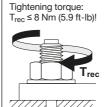
Pre-drill with TX-BT 4/7 step shank drill bit

Tighten using a screwdriver with torque clutch



Pre-drill until the shoulder grinds a shiny ring (to ensure proper drilling depth)





Hilti Torque tool X-BT 1/4"

Before fastener installation:	Hilti	Torque
the drilled hole must be clear of liquids and debris.	screwdriver:	setting:
The area around the drilled hole must be free from	SF 121-A	11
liquids and debris.	SF 150-A	9
	SF 180-A	8
	SF 144-A	9
	SF 22A	9
	SFC 22-A	5
	SBT 4-A22	5

These are abbreviated instructions which may vary by application.

ALWAYS review/follow the instructions accompanying the product.



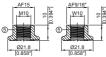
X-BT New Generation stainless steel threaded stud

Product data

Dimensions

X-BT-MR M10/15 SN 8 X-BT-MR W10/15 SN 8





X-BT-MR M6/10 SN 8

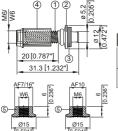
X-BT-MR W6/10 SN 8

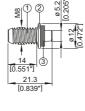
X-BT-MR M8/14 SN 8

€ 1 2 10.945"] 8W 24 [0.945"] 31.3 [1.232"]



X-BT-GR M8/7 SN 8





Features and benefits

The X-BT system is an approved Fastening on Steel system for grating and multi-purpose fastening applications. Benefits include no-rework to backside of base material, not having application limits and capability to work in C5 corrosive environment. The new generation X-BT system has increased load performance compared with the previous X-BT.

Material specifications

 Shank and thread: 	S31803 (1.4462)
	equivalent to A4 / AISI
	grade 316 material
② SN washer:	S 31635
	(X2CrNiMo 17-12-2, 1.4404)
③ Sealing washer:	Elastomer, black, resistant
	to UV, salt water, water,
	ozone,oils, etc.
④ Guiding sleeve:	Plastic
⑤ Flange nut:	A4 / AISI grade 316 material
Designation according to	Unified Numbering System (UNS)

Recommended fastening tools BX 3-BT / BTG DX 351-BT / BTG

6.

 For more details, please refer to X-BT-GR/-MR fastener program and to the chapter Accessories and consumables compatibility in the Direct Fastening Technology Manual (DFTM).

Approvals and certificates

ETA-20/1042, ABS 18-HS1755518, DNV-GL TAS00001SV, BV 54554, LR 19/0003, ICC-ES ESR-2347 (USA)

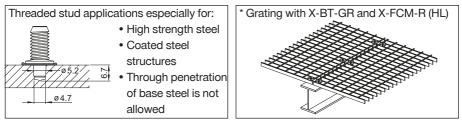
 Not all information presented in this product data sheet might be subject to approval/certificate content. Please refer to approval/certificate for further information.





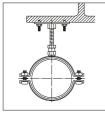
Applications

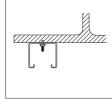
Examples

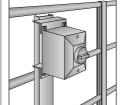


* Load data, application requirements, corrosion information, fastener selection, system recommendation, material specification and coating refer to section X-FCM-R, X-FCM-R HL or X-FCS-R Grating Fastening System in the Direct Fastening Technology Manual

Multi purpose fastening with X-BT-MR







Junction box, etc.

Performance data – Construction steel

Recommended loads - steel base material

Steel grade: Europe, USA	S235, S275 A36	S355 to S960 ≥ Grade 50	Example:
Tension, N _{rec} [kN/lb]	3.6/810	4.6 / 1030	
Shear -			
form lock V _{rec} [kN/lb]	4.3/970	5.3/1190	L F _N
friction lock V _{rec} [kN/lb]	0.20/45	0.20/45	
Moment, M _{rec} [Nm/lbft]	20.0 / 14.8	20.0/14.8	
Torque, T _{rec} [Nm/lbft]	20.0 / 14.8	20.0/14.8	
			M



Conditions for recommended loads:

- Application of working load design concept (e.g. ASD)
- For unalloyed construction, off-shore and Shipbuilding steel: e.g. European grades S235, S275, S355 according to EN 10025-2, S355M, S420M, S460M according to EN 10025-4 or EN 10225, S690Q and S960Q according to EN10025-6, US steel grade A36 and Grade 50.
- Minimum base material thickness $t_{II} = 8$ mm.
- \bullet Applicable for steel base materials up to a coating thickness of 500 $\mu m.$
- Edge distance $c \ge 10 \text{ mm} [3/8'']$.
- In case of edge distance 6 mm ≤ c < 10 mm, N_{rec}, V_{rec} and M_{rec} need to be reduced with the reduction factor α_c = 0.65.
- For group fastenings with up to 4 fasteners per group and shear force introduction via the sealing washer,

the resistance of all fasteners can be added up, provided the hole in the fastened material is equal or less than 14 mm (e.g. $V_{rec,group}$ = 17.2 kN for a group with 4 fasteners fixed to S235 base material). For more details see "New Generation Hilti X-BT-GR, X-BT-MR and X-BT-ER Threaded Fastener Specification".

• Redundancy (multiple fastening) must be provided.

Remarks:

- The recommended loads in the table refer to the resistance of the single fastener and need to be determined by static analysis from the loads F_N and F_V acting on the fastened part. Typical example is the need of consideration of prying forces, see example.
- Moments acting on the shank only need to be considered in case of a gap between the base and the fastened material.
- Global factor of safety for tension and shear load = 2.8 related to the characteristic resistance N_{Bk} and V_{Bk}
- Global factor of safety for bending moment = 1.75 related to the characteristic bending moment $M_{B,k}$ of the shank.
- Effects of base metal vibration and stresses are considered.
- For difference of form and friction lock for shear resistance, refer to explanations ate the end of this data sheet.





Characteristic resistance - steel base material

Steel grade: Europe, USA	S235, S275, A36	S355 to S960, ≥ Grade 50
Tension N _{Rk} [kN/lb]	10.0/2240	13.0/2920
Shear –		
form lock V _{Rk} [kN/lb]	12.0/2700	15.0/3360
friction lock V _{Rk} [kN/lb]	0.56 / 125	0.55 / 125
Moment M _{Rk} [Nm/lbft]	35.0/25.5	35.0 / 25.5

Design resistance - steel base material

Steel grade: Europe, USA	S235, S275, A36	S355 to S960, ≥ Grade 50
Tension N _{Rd} [kN/lb]	5.0/1120	6.5 / 1460
Shear -		
form lock V _{Rd} [kN/lb]	6.0 / 1350	7.5 / 1680
friction lock V _{Rd} [kN/lb]	0.28 / 62	0.28 / 62
Moment M _{Rd} [Nm/lbft]	28.0/20.5	28.0/20.5

Performance data - Cast iron

Recommended loads – cast iron *		
Tension, N _{rec} [kN/lb]	1.0/230	
Shear –		
form lock V _{rec} [kN/lb]	1.5/340	
friction lock V _{rec} [kN/lb]	0.20/45	
Moment, M _{rec} [Nm/lbft]	16.0/11.5	
Design resistance - cast iron *		

esign resistance – cast iror

Tension N _{Rd} [kN/lb]	1.6/360
Shear	
form lock V _{Rd} [kN/lb]	2.4 / 540
friction lock V _{Rd} [kN/lb]	0.28 / 62
Moment M _{Rd} [Nm/lbft]	26.0/19.0

*Requirements of spheroidal graphite cast iron base material

Subject	Requirements
Cast iron	Spheroidal graphite cast iron according to EN 1563
Strength class	EN-GJS-400 to EN-GJS-600 acording to EN 1563
Chemical analysis and amount of carbon	3.3 – 4.0 mass percentage
Microstructure	Form IV to VI (spherical) according to EN ISO 945-1:2010 Minimum size 7 according to Figure 4 of EN ISO 945-1:2010
Material thickness	t _{II} ≥ 20 mm



Recommended interaction formula for combined loading - steel and cast iron base material Load combination Interaction provison

V–N (shear and tension)	$\frac{V_{Sd}}{V_{Rd}} + \frac{N_{Sd}}{N_{Rd}} \le 1.2 \text{ with } \frac{V_{Sd}}{V_{Rd}} \le 1.0 \text{ and } \frac{N_{Sd}}{N_{Rd}} \le 1.0$
V-M (shear and bending)	$\frac{V_{Sd}}{V_{Rd}} + \frac{M_{Sd}}{M_{Rd}} \le 1.2 \text{ with } \frac{V_{Sd}}{V_{Rd}} \le 1.0 \text{ and } \frac{M_{Sd}}{M_{Rd}} \le 1.0$
N-M (tension and bending)	$\frac{N_{Sd}}{N_{Rd}} + \frac{M_{Sd}}{M_{Rd}} \le 1.0$
V–N–M (shear, tension and bending)	$\frac{V_{Sd.}}{V_{Rd}} + \frac{N_{Sd.}}{N_{Rd}} + \frac{M_{Sd.}}{M_{Rd}} \le 1.0$

Cyclic loading:

• Anchorage of X-BT threaded stud in steel base material is not affected by cyclic loading.

• Fatigue strength is governed by fracture of the shank. For more details see "New Generation Hilti X-BT-GR, X-BT-MR and X-BT-ER Threaded Fastener Specification".

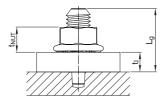
Application recommendation

Application limit and thickness of base material



 $t_{II} \ge 8 \text{ mm } [5/16"] \rightarrow \text{No through-penetration.}$ No limits with regard to steel strength.

Thickness of fastened material



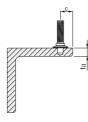
 $\begin{array}{ll} \text{X-BT-GR M8:} & 2.0 \leq t_l \leq 7.0 \text{ mm} \\ \text{X-BT-MR M10/W10:} & 2.0 \leq t_l \leq 15.0 \text{ mm} \\ \text{X-BT-MR M8:} & 2.0 \leq t_l \leq 14.0 \text{ mm} \\ \text{X-BT-MR M6/W6:} & 2.0 \leq t_l \leq 10.0 \text{ mm}^* \\ \end{array}$

* if base material sits on the collar of the stud $t_{Lmin} = 1.0 \text{ mm}$

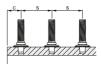
Spacing and edge distances

Edge distance:

c ≥ 10 mm (load reduction factor α_c = 1.00) 6 mm ≤ c < 10 mm (load reduction factor α_c = 0.65)



Spacing: s ≥ 15 mm







Corrosion information

The corrosion resistance of S31803 (1.4462) stainless steel material is equivalent to AISI 316 (A4) steel grade. For detailed information see "New Generation Hilti X-BT-GR, X-BT-MR and X-BT-ER Threaded Fastener Specification".

Fastener program and system recommendation

Fastener program

Designation	Item no.	Tool Designation
X-BT-GR M8/7 SN 8	2194344	BX 3-BTG, DX 351-BTG
X-BT-MR M6/10 SN 8	2252199	BX 3-BT, DX 351-BT
X-BT-MR M6/14 SN8	2194337	DX 351-BT
X-BT-MR W6/10 SN 8	2252470	BX 3-BT, DX 351-BT
X-BT-MR W6/14 SN 8	2194338	DX 351-BT
X-BT-MR M8/14 SN 8	2194339	BX 3-BT, DX 351-BT
X-BT-MR M10/15 SN 8	2194340	BX 3-BT, DX 351-BT
X-BT-MR W10/15 SN 8	2194341	BX 3-BT, DX 351-BT

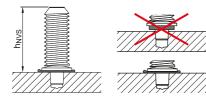
Cartridge selection and tool energy setting		
DX 351-BTG, DX 351-BT:	6.8/11 M high precision brown cartridge	
Battery selection and fastener guide adjustment		
BX 3-BT, BX 3-BTG:	22 V cordless tool battery platform	

Battery recommendation: B 22/2.6, also allowed B 22/3.0, B 22/4.0, B 22/5.2

The recommended fastener guide position is "1" (if required, adjust the fastener guide position based on job site tests and IFU).

Quality assurance

Fastening inspection



X-BT-GR M8 h_{NVS} = 15.7–16.8 mm

X-BT-MR M6/W6/M8/M10/W10 h_{NVS} = 25.7–26.8 mm



Installation recommendation

X-BT-MR M8

Fastened material:

- Hole diameter: 13 to 14 mm: Use of supplied flange nut (1)
- Hole diameter: beyond 14 to 18 mm: Use of supplied flange nut with supplement washer (maximum thickness of fixed component to be reduced with thickness of washer) ②

X-BT-MR M10/W10

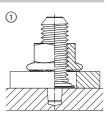
Fastened material:

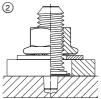
- Hole diameter: 13 to 18 mm: Use of supplied flange nut (1)
- Hole diameter: beyond 18 to 22 mm: Use of supplied flange nut with supplement washer (maximum thickness of fixed component to be reduced with thickness of washer) ②

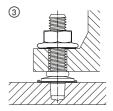
X-BT-MR M6/W6

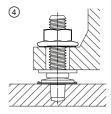
Fastened material:

- Hole diameter: 6.5 6.7: Fastener sits on collar of stud, use of supplied flange nut ③
- Hole diameter: 6.7 to 11 mm: Use of supplied flange nut with supplement washer sitting on collar ④
- Hole diameter: > 12 mm, fixed part sits on base material, use of flange nut with supplemental washer to cover hole clearance (maximum thickness of fixed component to be reduced with thickness of washer) ②









Remarks on group fastenings

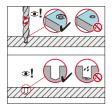
For group fastenings with up to 4 fasteners per group and shear force introduction via the sealing washer, the resistance of all fasteners can be added up, provided the hole in the fastened material is equal or less than 14 mm. For detailed information see "New Generation Hilti X-BT-GR, X-BT-MR and X-BT-ER Threaded Fastener Specification".





Pre-drill





- Pre-drill with TX-BT 4.7/7 step shank drill bit.
- Pre-drill until shoulder grinds a shiny ring.
- The drill hole and the area around drilled hole must be clean and free from liquids and debris.

These are abbreviated instructions which may vary by application.

<u>ALWAYS</u> review/follow the instructions accompanying the product.





Tightening torque

	Fastener: X-BT-GR, X-BT-MR
Element: nut	20 Nm

Tightening tool recommendation for tightening with cordless screwdriver

Cordless	Clutch type	Gear	Clutch
screwdriver	(stop detection)		
SF 6-A22	ESC (HJ)	1	5
SF 6H-A22	ESC (HJ)	1	5
SF 10W-A22	TRC	4	11
SF 8M-A22	TRC	4	11
SFC 14-A	TRC	2	11
SFC 22-A	TRC	2	11



Tool power level adjustment: Gear:

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t	



- The setting of the torque via the Hilti screwdriver with torque release coupling (TRC) can change as the clutch wears over time. The specified torque setting is only a rough guide value and applies to a new Hilti screwdriver.
 To ensure recommended torque is applied, Hilti recommends the use of a calibrated torque wrench or the Hilti torque tool.
- The specified torque setting for the Hilti screw drivers with electronic slip clutch (ESC) is only a rough guide value as the ESC has 2 stop detections; Soft Joint (SJ) detection and Hard Joint (HJ) detection. The hard joint detection is activated due to drop in speed (fast stop) and can lead to a torque spike. The installation torque may vary depending on the user and the application. To ensure recommended torque is applied, Hilti recommends the use of a calibrated torque wrench or the Hilti torque tool.

Tightening tool recommendation for tightening with Hilti torque tool

Hilti torque tool	
Torque tool X-BT 1/4" – 20 Nm	





Form and friction lock for shear connection

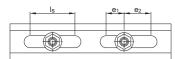
Shear load transfer via friction lock is relevant if non-slip connections are required in the service state

- Fixing the position of channel sections with slotted holes and forces in direction of the slots
- Connections with hole clearance beyond 14 mm

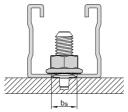
Slotted holes or bigger hole clearance allow easier assembly and geometric adjustment of the fixed component. Consequently form lock mechanism by means of direct contact of the fixed component with the washer of the X-BT-MR cannot be easily ensured with little slip in those cases. The New Generation X-BT-MR fasteners allow the use higher torque of 20 Nm resulting in a friction shear connection capacity. That friction lock can be utilized to fix the position of the attached component as well as for shear load transfer if the demand is comparably small. In case of high shear demand, the form lock mechanism has to be actived and can further be optimized for group fastenings (for more details on group fastenings relying on form lock, see "New Generation Hilti X-BT-GR, X-BT-MR and X-BT-ER Threaded Fastener Specification")

Examples of friction lock

MQ-41 channel with X-BT-MR M10/15 SN 8 and varying distances e1 and e2



ls ... length of the slot (50 mm) bs ... width of the slot (14 mm)



X-BT-MR connections with maximum hole diameter in fixed material

X-BT-MR M8/14 SN 8, max. hole \emptyset = 18 mm





X-BT-MR M10/15 SN 8, max. hole Ø = 22 mm



Conditions and remarks

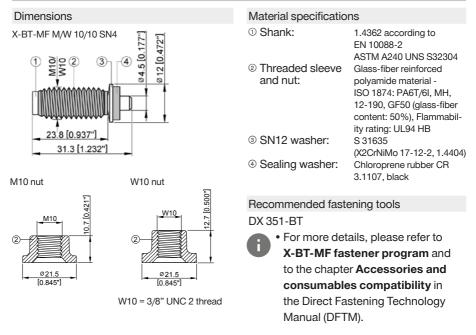
- The use of friction lock connection forces requires the application of an installation torque T = 20 Nm.
- Friction lock not suitable in case of base material vibrations.
- The friction lock values are suitable to fix the position of components and in case of lower shear load demand. Full shear load capacity are developed by means of form lock via contact of the fixed component with the sealing washer of the X-BT-MR.





X-BT-MF Composite threaded stud

Product data



Approvals and certificates

ICC ESR-2347



• Not all information presented in this product data sheet might be subject to approval/certificate content. Please refer to approval/certificate for further information.





Applications

Examples

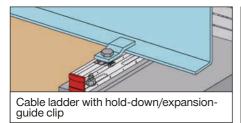
Threaded stud applications especially for:

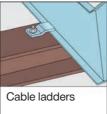
- 5.5 mm mm
- High strength steel Coated steel structures
- Through penetration of base steel is not allowed





Junction box, etc.







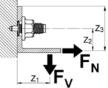
Performance data

Recommended loads

For structural steel (ultimate strength of base material R_m ≥ 350 MPa)

Service temperature		-40°C to +60°C /	+60°C to +100°C /
		–40°F to +140°F	+140°F to 212°F
Tension	N _{rec}	1.5 kN / 340 lb	1.0 kN / 225 lb
Shear	V _{rec}	2.2 kN / 500 lb	1.4 kN / 315 lb
Moment	M _{rec}	8.2 Nm / 6 lbft	8.2 Nm / 6 lbft
Torque	T _{rec}	≤ 8 Nm / ≤ 5.9 lbft	≤ 8 Nm / ≤ 5.9 lbft
During installation			
In service temp. range		-40°C to +100°C / -40°F to +212°F	
Installation temperature		-10°C to +60°C / 14°F to 140°F	









Conditions for recommended loads:

- Use with Hilti glass-fiber reinforced polyamide material nuts, M10 and W10 (2) according to General Information - Material specifications)
- Not to be used with any additional washer which provide an axial force when deformed, e.g. spring or lock washer, etc.
- Global factor of safety > 3 (based on 5% fractile value)
- Minimum edge distance = 6 mm [1/4"].
- Effect of base metal vibration and stress considered.
- Redundancy (multiple fastening) must be provided.
- The recommended loads in the table refer to the resistance of the individual fastening and may not be the same as the loads F_{N} and F_{V} acting on the fastened part. Note: If relevant, prying forces need to be considered in design, see example. Moment acting on fastener shank only in case of a gap between base and fastened material.
- Minimum temperature for installation and adjustments = -10°C

Design loads

For structural steel (ultimate strength of base material $R_m \ge 350$ MPa)

Service temperature		-40°C to +60°C /	+60°C to +100°C /
		–40°F to +140°F	+140°F to 212°F
Tension	N _{Rd}	2.0 kN / 450 lb	1.35 kN / 300 lb
Shear	V _{Rd}	3.0 kN / 675 lb	1.9 kN / 425 lb
Moment	M _{Rd}	18.4 Nm / 13.6 lbft	18.4 Nm / 13.6 lbft
During installation			
In service temp. range		-40°C to +100°C / -40°F to +212°F	
Installation temperature		-10°C to +60°C / 14°F to 140°F	

Recommended interaction formula for combined loading

Combined loading situation	Interaction formula
V–N (shear and tension)	$\frac{V}{V_{rec}} + \frac{N}{N_{rec}} \le 1.2$ with $\frac{V}{V_{rec}} \le 1.0$ and $\frac{N}{N_{rec}} \le 1.0$
V–M (shear and bending)	$\frac{V}{V_{rec}}$ + $\frac{M}{M_{rec}}$ ≤ 1.2 with $\frac{V}{V_{rec}}$ ≤ 1.0 and $\frac{M}{M_{rec}}$ ≤ 1.0
N–M (tension and bending)	$\frac{N}{N_{rec}} + \frac{M}{M_{rec}} \le 1.0$
V–N–M (shear, tension and bending)	$\frac{V}{V_{rec}} + \frac{N}{N_{rec}} + \frac{M}{M_{rec}} \le 1.0$

Cyclic loading

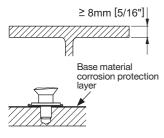
- Anchorage of X-BT-MF threaded stud in steel base material is not affected by cyclic loading.
- Fatigue strength is governed by fracture of the shank. Inquire at Hilti for test data if high cycle loading has to be considered in the design.





Application recommendation

Thickness of base material

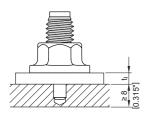


Where through penetration is not allowed* Thickness of base material corrosion protection layer \leq 0.4mm. For thicker coatings, please contact Hilti.

*Note: Corrosion protection may be compromised if base material thickness is less than 8mm.

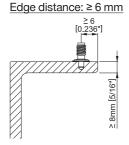
Please contact Hilti for load recommendations if base material thickness is less than 8mm and through penetration allowed.

Thickness of fastened material

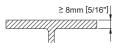


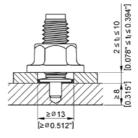
 $2.0 \le t_l \le 10.0 \text{ mm}$ $0.08'' \le t_l \le 0.39''$

Spacing and edge distances

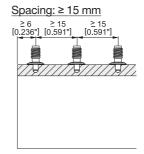


Application limit





Fastened material hole Ø ≥ 13mm (0.51")



- $t_{||} \ge 8 \text{ mm} [5/16] \rightarrow \text{No through penetration}$
- · No limits with regards to steel strength





Durability

From a durability point of view, it can be assumed that the Hilti X-BT-MF system will have a lifetime over 20 years even in mildly corrosive environment (C3 environment according to EN-ISO 12944-2).

Corrosion information

For fastenings exposed to outdoor environments in mildly corrosive conditions where HDG coated parts are commonly specified or used.

Not for use in atmospheres with chlorides (marine atmospheres) or in heavily polluted environments (e.g. sulphur dioxide).

Vibration (Transportation, handling and base material vibration)

When installed according to instruction for use and fastening quality assurance, the X-BT-MF system (stud and Hilti glass-fiber reinforced polyamide material nuts) is resistant to transportation, handling and base material vibration.

The use of additional lock washer is not required. Lock washer will affect the integrity and functionality of the Hilti glass-fiber reinforced polyamide material nuts. Therefore additional lock or spring washers must not be used in combination with the X-BT-MF system. For more information regarding vibration, please refer to "X-BT-MF Additional Technical Information".

Fastener program and system recommendation				
Fastener program				
Designation	Item no.	Tool designation		
X-BT-MF M10/10 SN4	2083549	DX 351-BT		
X-BT-MF W10/10 SN4	2083620	DX 351-BT		

Accessories

Designation	Item no.	For use with
Socket X-NSD 1/4" – 16mm	2097397	X-BT-MF M10/10 SN4 and
		T-handle or Torque tool
Socket X-NSD 1/4" - 9/16"	2107229	X-BT-MF W10/10 SN4 and
		T-handle or Torque tool
T-handle X-NSD 1/4"	2115130	X-NSD sockets
Torque tool X-BT 1/4"	2119272	X-NSD sockets

Cartridge selection and tool energy setting

6.8/11 M high precision brown cartridge

• Tool power level adjustment by setting tests on site.

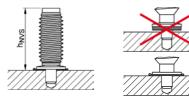
- Start tool energy selection with lowest recommended tool power level.
- Correct according requirement from chapter quality assurance.





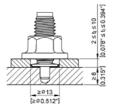
Quality assurance

Fastening inspection



X-BT-MF h_{NVS} = 25.7–26.8 mm = 1.012"–1.055"

Installation recommendation



Fastened material hole $\emptyset \ge 13 \text{ mm} (0.51'')$

Remark: for group fastenings subjected to shear loading the fastened material hole diameter should not exceed 14mm

Pre-drill





- Pre-drill with TX-BT 4/7 step shank drill bit.
 - Pre-drill until the shoulder grinds a shiny ring (to ensure proper drilling depth).
 - Before fastener installation: the drilled hole and the area around the drilled hole must be clear of liquids and debris.

These are abbreviated instructions which may vary by application. <u>ALWAYS</u> review/follow the instructions accompanying the product.





Tightening torque

	Fastener: X-BT-MF
Element: nut	8 Nm

Tightening tool recommendation for tightening with cordless screwdriver

Cordless	Clutch type	Gear	Clutch
		Cical	
screwdriver	(stop detection)		
SF 4-A22	TRC	1	8
SF 6-A22	ESC (HJ)	1	3
SF 6H-A22	ESC (HJ)	1	3
SFC 14-A	TRC	1	6
SFC 18-A	TRC	1	3
SFC 22-A	TRC	1	5
SBT 4-A22	TRC	1	7



Tool power level adjustment: Gear:

m
1
~



- The setting of the torque via the Hilti screwdriver with torque release coupling (TRC) can change as the clutch wears over time. The specified torque setting is only a rough guide value and applies to a new Hilti screwdriver. To ensure recommended torque is applied, Hilti recommends the use of a calibrated torque wrench or the Hilti torque tool.
- The specified torque setting for the Hilti screw drivers with electronic slip clutch (ESC) is only a rough guide value as the ESC has 2 stop detections; Soft Joint (SJ) detection and Hard Joint (HJ) detection. The hard joint detection is activated due to drop in speed (fast stop) and can lead to a torque spike. The installation torque may vary depending on the user and the application. To ensure recommended torque is applied, Hilti recommends the use of a calibrated torque wrench or the Hilti torque tool.

Tightening tool recommendation for tightening with Hilti torque tool

Hilti torque tool	
Torque tool X-BT 1/4" – 8 Nm	



X-BT-MF



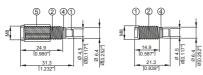
X-BT-MR-N Stainless steel threaded stud for narrow through hole

Product data

Dimensions

X-BT-MR-N M8/14 N 4

X-BT-MR-N M8/4 N 4



Note on drill-bit:

X-BT-MR-N requires the use of the specific drill bit TX-BT 4/5.5. The drill bit TX-BT 4/7, which is used for X-BT, X-BT-MF and X-BT-ER fasteners must not be used for X-BT-MR-N studs.

Material specifications

1 Shank:

CR 500 (CrNiMo alloy)	equivalent to A4 /
S31803 (1.4462)	AISI grade 316 material
N 08926 (1.4529) 1	Available on request
② Threaded sleeve:	S31609
	(X5CrNiMo 17-12-2+2H, 1.4401)
④ Sealing washers:	Chloroprene rubber CR
	3.1107, black*
⑤ Guide sleeve:	Plastic
* Resistant to UV, salt wa	ter. water. ozone. oils. etc.

1) For High Corrosion Resistance HCR material inquire at Hilti

Designation according to Unified Numbering System (UNS)

Recommended fastening tools

DX 351-BT / BTG

 For more details, please refer to X-BT-MR-N fastener program and to the chapter Accessories and consumables compatibility in the Direct Fastening Technology Manual (DFTM).

Approvals and certificates

ABS, LR, DNV-GL, BV



• Not all information presented in this product data sheet might be subject to approval/certificate content. Please refer to approval/certificate for further information.





Applications

Examples

Threaded stud applications especially for:
High strength steel Coated steel structures Through penetration of base steel is not allowed

Performance data

Recomme	ended loads – steel			
Steel grade: Europe, US/		S235, A36	S355, Grade 50 and stronger steel	N
Tension,	N _{rec} [kN/lb]	1.8/405	2.3/517	
Shear,	V _{rec} [kN/lb]	2.6/584	3.4/764	M A 1468
Moment,	M _{rec} [Nm/lbft]	8.2/6	8.2/6	Example:
Torque,	T _{rec} [Nm/lbft]	8/5.9	8/5.9	
Recomme	ended loads - cast	iron*		Z_2
Tension,	N _{rec} [kN/lb]	0.5/115		
Shear,	V _{rec} [kN/lb]	0.75/170		Z ₁ F v
Moment,	M _{rec} [Nm/lbft]	8.2/6		

Conditions for recommended loads

- Global factor of safety for static pull-out > 3 (based on 5% fractile value)
- Minimum edge distance = 6 mm [1/4"].
- Effect of base metal vibration and stress considered.
- Redundancy (multiple fastening) must be provided.
- The recommended loads in the table refer to the resistance of the individual fastening and may not be the same as the loads FN and FV acting on the fastened part. Note: If relevant, prying forces need to be considered in design, see example. Moment acting on fastener shank only in case of a gap between base and fastened material.



Doolan	ropistance	otool
Design	resistance	- Sleel

Steel grade:	:			
Europe		S235	S355	
Tension	N _{Rd} [kN]	2.9	3.7	
Shear	V _{Rd} [kN]	4.2	5.4	
Moment	M _{Rd} [Nm]	18.4	18.4	

Design resistance – cast iron*			
Tension	N _{Rd} [kN]	0.8	
Shear	V _{Rd} [kN]	1.2	
Moment	M _{Rd} [Nm]	13.1	

*Requirements of spheroidal graphite cast iron base material

Subject	Requirements
Cast iron	Spheroidal graphite cast iron according to EN 1563
Strength class	EN-GJS-400 to EN-GJS-600 acording to EN 1563
Chemical analysis and amount of carbon	3.3-4.0 mass percentage
Mictrostructure	Form IV to VI (spherical) according to EN ISO 945-1:2010 Minimum size 7 according to Figure 4 of EN ISO 945-1:2010
Material thickness	t _{II} ≥ 20 mm

Recommended interaction formula for combined loading - steel and cast iron base material

Combined loading situation	Interaction formula
V–N (shear and tension)	$\frac{V}{V_{rec}}$ + $\frac{N}{N_{rec}}$ ≤ 1.2 with $\frac{V}{V_{rec}}$ ≤ 1.0 and $\frac{N}{N_{rec}}$ ≤ 1.0
V–M (shear and bending)	$\frac{V}{V_{rec}}$ + $\frac{M}{M_{rec}}$ ≤ 1.2 with $\frac{V}{V_{rec}}$ ≤ 1.0 and $\frac{M}{M_{rec}}$ ≤ 1.0
N–M (tension and bending)	$\frac{N}{N_{rec}} + \frac{M}{M_{rec}} \le 1.0$
V–N–M (shear, tension and bending)	$\frac{V}{V_{rec}} + \frac{N}{N_{rec}} + \frac{M}{M_{rec}} \le 1.0$

Cyclic loading

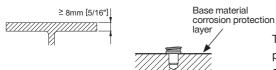
- Anchorage of X-BT-MR-N threaded stud in steel base material is not affected by cyclic loading.
- Fatigue strength is governed by fracture of the shank. Inquire at Hilti for test data if high cycle loading has to be considered in the design.





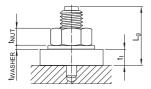
Application recommendation

Thickness of base material



Thickness of base material corrosion protection layer ≤ 0.4mm. For thicker coatings, please contact Hilti.

Thickness of fastened material

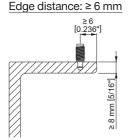


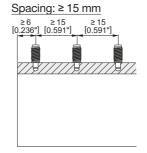
X-BT-MR-N M8/4 N 4: t X-BT-MR-N M8/14 N 4: 4

t_l≤4mm 4mm≤tl≤14mm

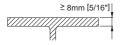
For thickness less than 4 mm, reduction of shear loading is required, please contact Hilti.

Spacing and edge distances





Application limit



- $t_{II} \ge 8 \text{ mm} [5/16] \rightarrow No \text{ through penetration}$
- No limits with regards to steel strength

Corrosion information

The corrosion resistance of Hilti CR500 and S31803 stainless steel material is equivalent to AISI 316 (A4) steel grade.



Fastener program and system recommendation

Fastener program

Designation	Item no.	Tool Designation
X-BT-MR-N M8/14 N 4	2112004	DX 351 BT
X-BT-MR-N M8/4 N 4	2112003	DX 351 BTG

Cartridge selection and tool energy setting

6.8/11 M high precision brown cartridge

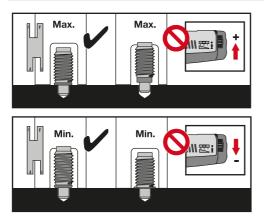


• Tool power level adjustment by setting tests on site.

- Start tool energy selection with lowest recommended tool power level.
- Correct according requirement from chapter quality assurance.

Quality assurance

Fastening inspection



X-BT-MR-N M8/4 N 4 h_{NVS} = 15.7–16.8 mm

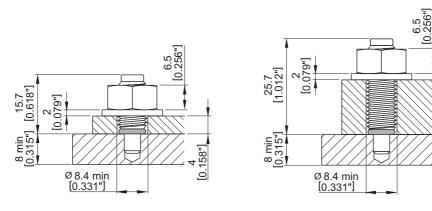
X-BT-MR-N M8/14 N 4 h_{NVS} = 25.7–26.8 mm





14 [0.551"[]]

Installation recommendation



X-BT-MR-N M8/4 N4

X-BT-MR-N M8/14 N4

Pre-drill





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- Pre-drill with TX-BT 4/5.5 step shank drill bit.
- Pre-drill until the shoulder grinds a shiny ring (to ensure proper drilling depth).
- Before fastener installation: the drilled hole must be clear of liquids and debris. The area around the drilled hole must be free from liquids and debris.

These are abbreviated instructions which may vary by application. <u>ALWAYS</u> review/follow the instructions accompanying the product.





Tightening torque

	Fastener: X-BT-MR N
Element: nut	8 Nm

Tightening tool recommendation for tightening with cordless screwdriver

		n	
Cordless	Clutch type	Gear	Clutch
screwdriver	(stop detection)		
SF 4-A22	TRC	1	8
SF 6-A22	ESC (HJ)	1	3
SF 6H-A22	ESC (HJ)	1	3
SFC 14-A	TRC	1	6
SFC 18-A	TRC	1	3
SFC 22-A	TRC	1	5
SBT 4-A22	TRC	1	7



Tool power level adjustment: Gear:

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- The setting of the torque via the Hilti screwdriver with torque release coupling (TRC) can change as the clutch wears over time. The specified torque setting is only a rough guide value and applies to a new Hilti screwdriver.
 To ensure recommended torque is applied, Hilti recommends the use of a calibrated torque wrench or the Hilti torque tool.
- The specified torque setting for the Hilti screw drivers with electronic slip clutch (ESC) is only a rough guide value as the ESC has 2 stop detections; Soft Joint (SJ) detection and Hard Joint (HJ) detection. The hard joint detection is activated due to drop in speed (fast stop) and can lead to a torque spike. The installation torque may vary depending on the user and the application. To ensure recommended torque is applied, Hilti recommends the use of a calibrated torque wrench or the Hilti torque tool.

Tightening tool recommendation for tightening with Hilti torque tool

Hilti torque tool	
Torque tool X-BT 1/4" – 8 Nm	



X-BT-MR-N



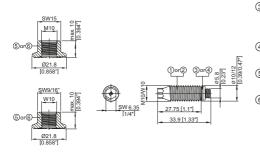
S-BT Screw-in stainless steel and carbon steel threaded stud

Material specification

Product data

Dimension

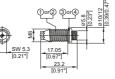
S-BT-MR M10/15 SN6 S-BT-MF M10/15 AN6 S-BT-MR MT M10/15 SN6*) S-BT-MF MT M10/15 AN6*) S-BT-MR M10/15 SN6 AL**) S-BT-MF W10/15 AN6 S-BT-MR W10/15 SN6 AL**)



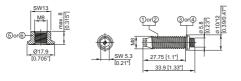
1	Threaded shank:	Stainless steel	(S-BTR)
		"S 31803 (1.446	62)"
		zinc-coated	
2	Threaded shank:	Carbon steel	(S-BTF)
		"1038/duplex-o	coated"
3	SN 12-R washers:	Ø 12 mm [0.47"]
		Stainless steel	(S-BTR)
		"S 31635 (1.440)4)"
4	AN10-F washers:	Ø 10 mm [0.39"]
		Aluminum	(S-BTF)
5	Serrated flange nut*):	Stainless steel	(S-BT-MR)
		grade A4 - 70/8	0
6	Serrated flange nut*):	Carbon steel	(S-BT-MF)
		HDG, grade 8	
	Sealing ring of		
	sealing washers:	Chloroprene rub	ober
		CR 3.1107, blac	k
		resistant to UV,	salt water,
		water, ozone, o	ils, etc.

S-BT-MRM8/7 SN6 S-BT-MRMTM8/7 SN6*) S-BT-GRM8/7 SN6 AL**) S-BT-GRM8/7 SN6*) S-BT-GRM8/7 SN6*) S-BT-GRM8/7 SN6AL*)**) S-BT-MF M8/7 AN 6 S-BT-MF MT M8/7 AN 6*) S-BT-GF M8/7 AN 6*) S-BT-GF NG M8/7 SN 6*)

(5) or (6)



S-BT-MRM8/15SN6 S-BT-MRM8/15SN6AL**) S-BT-MFM8/15AN6



Assessments, Reports and Type Approvals

ETA-20/0530 ICC-ES ESR-4185 ABS: 16-HS1550085-PDA DNV-GL: TAS00000N6 LR: 16/00063 BV: 45116/A BV Russian Maritime Register of Shipping: 18.40040.250 RINA: FPE278318CS China Classification Society CCS: NJ17P2016

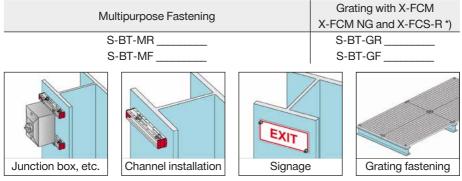


- *) package does not include serrated flange nuts
- **) for use in aluminum base material



Applications

Examples



*) Load data, application requirements, corrosion information, fastener selection, system recommendation, material specification and coating refer to section X-FCM Grating Fastening System, X-FCM NG Grating Fastening System or X-FCS-R Grating Fastening System in the Hilti Direct Fastening Technology Manual.

Load data

Recommended loads

	S-BT-MR and S-BT-GR made of stainless steel				
Base material thickness 1)	t _" ≥ 5 mm [0.20"]			3 mm [0.12"] ≤ t _µ < 5 mm [0.20"]	
Base material type	Steel S235 A36	Steel S355, S420 Grade 50	Aluminum f _u ≥ 270 MPa	Steel S235 A36	Steel S355, S420 Grade 50
Tension, N _{rec} [kN/lb]	1.9/425	2.3/515	1.9/425	1.8/405	2.1/470
Shear, V_{rec} [kN/lb] For edge distance 6 mm [0.24"] \leq c < 15 mm [0.59"]	2.5/560	2.8/625	2.9/650	2.4/540	2.5/560
Shear, V_{rec} [kN/lb] For edge distance c ≥ 15 mm [0.59"]	4.0/895	4.0/895	3.5/785	3.8/850	3.8/850
Moment, M _{rec} [Nm/lbft]			11.1/8.0		
	S_BT_N	AF and S-BT-G	= made of duple	ex coated ca	arbon steel

	S-BI-MF and S-BI-GF made of duplex coated carbon steel				arbon steel
Base material thickness 1)	t _" ≥ 5 mm [0.20"]			3 mm [0.12"] ≤ t _µ < 5 mm [0.20"]	
Base material type	Steel S235 A36	Steel S355, S420 Grade 50	Aluminum f _u ≥ 270 MPa	Steel S235 A36	Steel S355, S420 Grade 50
Tension, N _{rec} [kN/lb]	2.0/450	2.4/540	n.a.	1.9/425	2.3/515
Shear, V_{rec} [kN/lb] For edge distance 6 mm [0.24"] \leq c < 15 mm [0.59"]	2.5/560	2.8/625	n.a.	2.4/540	2.5/560
Shear, V_{rec} [kN/lb] For edge distance c ≥ 15 mm [0.59"]	2.7/605	2.9/650	n.a.	2.7/605	2.9/650
Moment, M _{rec} [Nm/lbft]	6.	.7/5.0	n.a.	6.	7/5.0

 $^{1)}$ For base material thickness 3 mm [0.12"] < t₁ < 6 mm [0.24"] rework of the coating on the back side of the plate/profile may be needed.



Design loads

	S-BT-MR and S-BT-GR made of stainless steel				
Base material thickness ¹⁾	t _∥ ≥ 5 mm [0.20"]			3 mm [0.12"] ≤ t _µ < 5 mm [0.20"]	
Base material type	Steel S235 A36	Steel S355, S420 Grade 50	Aluminum f _u ≥ 270 MPa	Steel S235 A36	Steel S355, S420 Grade 50
Tension, N _{Rd} [kN/lb]	2.7/605	3.2/715	2.7/605	2.5/560	3.0/670
Shear, V_{Rd} [kN/lb] For edge distance 6 mm [0.24"] \leq c < 15 mm [0.59"]	3.5/785	3.9/875	4.0/895	3.4/760	3.5/785
Shear, V _{Rd} [kN/lb] For edge distance c ≥ 15 mm [0.59"]	5.6/1255	5.6/1255	5.0/1120	5.3/1190	5.3/1190
Moment, M _{Rd} [Nm/lbft]	15.6/12.0				
	S-BT-MF and S-BT-GF made of duplex coated carbon steel			rbon steel	
Base material thickness 1)		t > 5 mm [0 20"] 3			n [0.12"] mm [0.20"]
Base material type	Steel S235 A36	Steel S355, S420 Grade 50	Aluminum f _u ≥ 270 MPa	Steel S235 A36	Steel S355, S420 Grade 50
Tension, N _{Rd} [kN/lb]	2.8/625	3.3/740	n.a.	2.7/605	3.2/715
Shear, $V_{_{Rd}}$ [kN/lb] For edge distance 6 mm [0.24"] \leq c < 15 mm [0.59"]	3.5/785	3.9/875	n.a.	3.4/760	3.5/785
Shear, V _{Rd} [kN/lb] For edge distance c ≥ 15 mm [0.59"]	3.8/850	4.0/895	n.a.	3.8/850	4.0/895
Moment, M _{Rd} [Nm/lbft]	9.4/7.0 n.a. 9.4/7.0			4/7.0	

¹⁾ For base material thickness 3 mm [0.12"] ≤ t_{ii} < 6 mm [0.24"] rework of the coating on the back side of the plate/profile may be needed.

Conditions for recommended loads and design loads:

 Use S-BT-MR and S-BT-MF (multipurpose fastening) only with the supplied Hilti serrated flange nuts M8, M10, W10 (⑤ or ⑥ as per according to General Information – Material specifications)



 Global factor of safety Ω resp. partial factor of safety γ_m (based on 5 % fractile ultimate test value)
 Becommended loads
 Design load

	Recommended loads	Design loads
static pull-out	2.80	2.00
static shear	2.80	2.00
Bending	1.75	1.25



- Minimum edge distance = 6 mm [0.24"], minimum spacing ≥ 18 mm [0.709"]
- Effect of base metal vibration and stress (e.g. areas with tensile stress) considered.
- Redundancy (multiple fastening) must be provided.
- If eccentric loading exists (e.g. use of an angle clip), moments caused by off-center loading must be considered.

S-BT



Cyclic loading

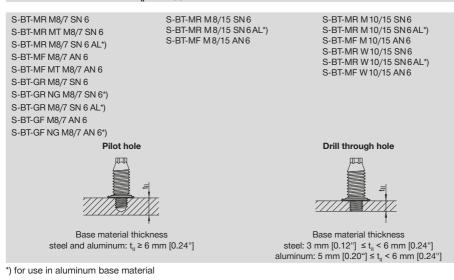
S-BT threaded studs are only to be used for fastenings subject to static or quasi-static loading. Inquire at Hilti for test data if cyclic loading has to be considered in the design.

Recommended interaction formula for combined loading

V–N (shear and tension)	$\frac{V}{V_{rec}}$ + $\frac{N}{N_{rec}}$ ≤ 1.0 with $\frac{V}{V_{rec}}$ ≤ 1.0 and $\frac{N}{N_{rec}}$ ≤ 1.0
V-M (shear and bending)	$\frac{V}{V_{rec}} + \frac{M}{M_{rec}} \le 1.0 \text{ with } \frac{V}{V_{rec}} \le 1.0 \text{ and } \frac{M}{M_{rec}} \le 1.0$
N–M (tension and bending)	$\frac{N}{N_{rec}} + \frac{M}{M_{rec}} \le 1.0$
V–N–M (shear, tension and bending)	$\frac{V}{V_{rec}} + \frac{N}{N_{rec}} + \frac{M}{M_{rec}} \le 1.0$
х с,	$\frac{N}{N_{rec}} + \frac{M}{M_{rec}} \le 1.0$

Application Requirements

Base material thickness t_n and type of bore hole



Thickness of base material corrosion protection layer ≤ 0.8 mm [0.0315"]. For thicker coatings, please contact Hilti. Base material corrosion protection layer





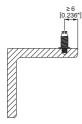


Thickness of fastened material tl

S-BT/7	1.6 mm [0.063"] ≤ t _I ≤ 7.0 mm [0.28"]
S-BT/15	1.6 mm [0.063"] ≤ t _l ≤ 15.0 mm [0.59"]

Spacing & edge distances

Edge distance: ≥ 6 mm [0.24"]



Spacing: ≥ 18 mm [0.709"] for all S-BT M8 ≥ 22 mm [0.866"] for all S-BT M10				
	and S-BT W10			
≥6 ≥18 ≥18 [0.236"] [0.709"] [0.709"]	≥6 ≥22 ≥22 [0.236"] [0.866"] [0.866"]			

Corrosion information

The S-BT stainless steel fasteners are made from the duplex stainless steel type 1.4462, which is equivalent to AISI 316 (A4) steel grade. This grade of stainless steel is classified in the corrosion resistance class IV according to DIN EN 1993-1-4:2015, which makes the material suitable for aggressive environments like in coastal and offshore applications.

The microstructures of duplex stainless steels consist of a mixture of austenite and ferrite phases. Compared to the austenitic stainless steel grades, duplex stainless steels are magnetic. The surface of the S-BT stainless steel fasteners is zinc-coated (anti-friction coating) in order to reduce the thread forming torque when the stud is screwed in into the base material.

The coating of the carbon steel S-BT fasteners consists of an electroplated Zn-alloy for cathodic protection and a top coat for chemical resistance (Duplex-coating). The thickness of the coating is 35 μ m. The use of this coating is limited to the corrosion category C1, C2 and C3 according the standard EN ISO 9223. For higher corrosion categories stainless steel fasteners should be used.

In case of a drill through hole or a pilot hole in thin base material, rework of the coating on the back side of the plate/profile may be needed.

Note: ETA-20/0530 allows the use of carbon steel threaded studs with duplex coating only in dry indoor environment (C1 acc. to EN ISO 9223).



	S-BT-MF, S-BT-GF		S-BT-MR, S-BT-GR	
Corrosivity category C	C3 medium corrosive		C5 very high corrosive	
Drill hole type and base material thickness $t_{\mu}^{1)}$	Topside protection	Backside protection	Topside protection	Backside protection
Drill through hole 3 mm [0.12''] ≤ t _µ < 6 mm [0.24'']	1	X ²⁾	1	X ²⁾
Pilot hole 6 mm [0.24''] ≤ t _µ < 7 mm [0.28'']	1	1	1	√ ³⁾
Pilot hole t _µ ≥ 7 mm [0.28'']	1	1	1	1

¹⁾ Real base material thickness, not nominal material thickness or material thickness with coating.

²⁾ Damage of the coating on the back side of the plate/profile require a rework of the coating.

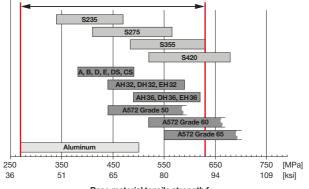
³⁾ Damage of the coating on the back side of the plate/profile require a rework of the coating, if the drilling tools SF BT22-A or SF BT18-A were used for drilling the bore hole. If the drilling tool SBT4-A22 was used for drilling the bore hole, no damage of the coating on the back side of the plate/profile will occur.

Application limit

The base material is limited to steel grade with a maximum tensile strength $f_u = 630 \text{ MPa} [91 \text{ ksi}]$. The minimum tensile strength of steel is $f_u \ge 340 \text{ MPa} [49 \text{ ksi}]$.

The minimum tensile strength of aluminum is $f_{II} \ge 270 \text{ MPa}$ [39 ksi].

Minimum thickness of base material t_{\parallel} : refer to section "Application Requirements" Maximum thickness of base material t_{\parallel} : no limits



Base material tensile strength f_u





Fastener selection and system recommendation

	Fastener	Drilling tool	Drill bit	Setting tool	Depth gauge	
	S-BT-MR M8/7 SN6		TS-BT 5.5-74 S			
	S-BT-MR MT 8/7 SN 6]	15-81 5.5-74 5		S-DG BT M8/7 Short 6	
	S-BT-MR M8/7 SN6AL		TS-BT 5.5-74 AL			
	S-BT-MR M8/15 SN6	-		TS-BT 5.5-74 S		C DC DT M8/15 Long 6
-	S-BT-MR M8/15 SN6AL		TS-BT 5.5-74 AL		S-DG BT M8/15 Long 6	
steel	S-BT-GR M8/7 SN6		TS-BT 5.5-74 S			
ess	S-BT-GR M8/7 SN6AL		TS-BT 5.5-74 AL		S-DG BT M8/7 Short 6	
Stainless	S-BT-GR NG M8/7 SN6		TS-BT 5.5-110 S			
ŝ	S-BT-MR M 10/15 SN 6			SBT 4-A22 or SF 4-A22 or SFC 18-A or	S-DG BT M10-W10/15 Long 6	
	S-BT-MR MT M 10/15 SN 6	SBT 4-A22 or	TS-BT 5.5-74 S			
	S-BT-MR M10/15 SN6AL	SF BT 18-A or SF BT 22-A	TS-BT 5.5-74 AL			
	S-BT-MR W 10/15 SN 6		TS-BT 5.5-74 S			
	S-BT-MR W 10/15 SN 6 AL		TS-BT 5.5-74 AL	SFC 22-A		
	S-BT-GF NG M8/7 AN6		TS-BT 5.5-110 S			
	S-BT-GF M8/7 AN6				C DC DT MR/7 Short 6	
<u>e</u>	S-BT-MF M8/7 AN6				S-DG BT M8/7 Short 6	
ו ste	S-BT-MF MT M8/7 AN6]				
Carbon steel	S-BT-MF M8/15 AN 6]	TS-BT 5.5-74 S		S-DG BT M8/15 Long 6	
Ca	S-BT-MF M10/15 AN6					
	S-BT-MF MT M 10/15 AN 6				S-DG BT M10-W10/15 Long 6	
	S-BT-MF W 10/15 AN 6]				

Fastener quality assurance

In order to ensure the exact screw-in depth and a proper compressed sealing washer, the S-BT studs have to be installed with the appropriate depth gauge. With this tool the screw-in depth can be adjusted in a range of 0-1.5 mm (3 steps, 0.5mm per step).

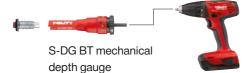
The S-CC BT calibration card is needed to check the initial stand-off of the S-BT stud and to adjust/calibrate the S-DG BT depth gauge. After finding the right adjustment level for the S-DG BT depth gauge, the gauge can be adjusted and the studs can be installed without additional check of the S-DG BT depth gauge.

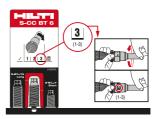
The depth gauge has to be re-adjusted (calibrated) at following times:

- · Start of the installation process
- Change of the working position (upwards, downwards, horizontal) and base material (thickness, strength, type)
- Installer change
- · After each packaging respectively after the installation of 100 S-BT studs



The lifetime of the S-DG BT depth gauge is \geq 1000 settings.





Design and functionality of the mechanical calibration card S-CC BT

Fastening inspection

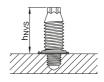
The installer is responsible for the correct setting of the S-BT studs. For the periodical verification of the correct stud stand-off the S-CG BT check gauge can be used.

Verify stud stand-off h_{NVS} with check gauge S-CG BT S-BT-____7___6 h_{NVS} = 18.6 mm to 19.1 mm

S-BT-____/15____6 h_{NVS} = 29.3 mm to 29.8 mm



Design and functionality of the check gauge S-CG BT

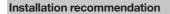


Designation	Product name	Comment
S-DG BT M8/7 Short 6	Depth gauge	for exact setting of S-BT M8/7
S-DG BT M8/15 Long 6	Depth gauge	for exact setting of S-BT M8/15
S-DG BT M10-W10/15 Long 6	Depth gauge	for exact setting of S-BT M 10/W 10
S-CC BT 6	Calibration card	for calibration of the depth gauge
		(short/long studs)
S-CG BT/7 Short 6	Check gauge	for verification of the stand-off
		for short studs (7 mm)
S-CG BT/15 Long 6	Check gauge	for verification of the stand-off
		for long studs (15 mm)

[0.732" to 0.752"]

[1.153" to 1.173"]



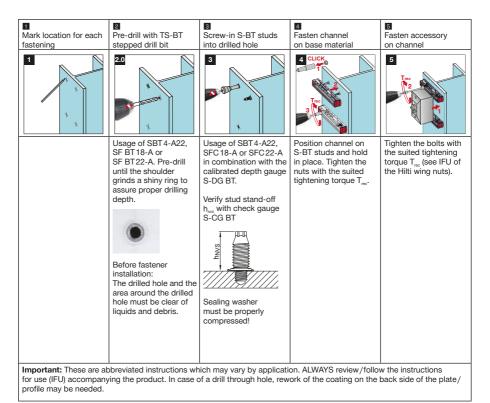


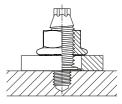
S-BT fasteners made of stainless steel with washer- \emptyset 12 mm (S-BT-_R) Fastened material hole $\emptyset \ge$ 13 mm [0.51"]

S-BT fasteners made of carbon steel with washer- \emptyset 10 mm (S-BT-_F) Fastened material hole $\emptyset \ge 11$ mm [0.43"]

Important:

For group fastenings subjected to shear loading the fastened material hole diameter should not exceed 14 mm [0.55"] (S-BT-_R) and 12 mm [0.47"] (S-BT-_F) respectively.





/ S-вт



Tightening torque for fastening to steel base material $t_{\parallel} \ge 6$ mm

	Fastener: S-BT-MF, S-BT-MR
Element: nut	8 Nm

Tightening tool recommendation for tightening with cordless screwdriver

Cordless	Clutch type	Gear	Clutch
screwdriver	(stop detection)		
SF 4-A22	TRC	1	8
SF 6-A22	ESC (HJ)	1	3
SF 6H-A22	ESC (HJ)	1	3
SBT 4-A22	TRC	1	7
SFC 18-A	TRC	1	5
SFC 22-A	TRC	1	5

Gear:



Tool power level adjustment:

_		(
1		(
1		



- The setting of the torque via the Hilti screwdriver with torque release coupling (TRC) can change as the clutch wears over time. The specified torque setting is only a rough guide value and applies to a new Hilti screwdriver.
 To ensure recommended torque is applied, Hilti recommends the use of a calibrated torque wrench or the Hilti torque tool.
- The specified torque setting for the Hilti screw drivers with electronic slip clutch (ESC) is only a rough guide value as the ESC has 2 stop detections; Soft Joint (SJ) detection and Hard Joint (HJ) detection. The hard joint detection is activated due to drop in speed (fast stop) and can lead to a torque spike. The installation torque may vary depending on the user and the application. To ensure recommended torque is applied, Hilti recommends the use of a calibrated torque wrench or the Hilti torque tool.

Tightening tool recommendation for tightening with Hilti torque tool

Hilti torque tool	
Torque tool X-BT 1/4" – 8 Nm	



Tightening torque for fastening to aluminum base material and in steel base material $3 \text{ mm} \le t_u \le 5 \text{ mm}$ (drill through hole)

	Fastener: S-BT-MF, S-BT-MR, S-BT-MR AL
Element: nut	5 Nm

Tightening tool recommendation for tightening with cordless screwdriver

Cordless	Clutch type	Gear	Clutch
screwdriver	(stop detection)		
SF 2-A12	TRC	1	15
SF 2H-A12	TRC	1	15
SF 4-A22	TRC	1	4
SF 6-A22	ESC (HJ)	1	2
SF 6H-A22	ESC (HJ)	1	2
SBT 4-A22	TRC	1	5
SFC 18-A	TRC	1	4
SFC 22-A	TRC	1	4



Tool power level adjustment: Gear:

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1	$\overline{\Delta}$	



 The setting of the torque via the Hilti screwdriver with torque release coupling (TRC) can change as the clutch wears over time. The specified torque setting is only a rough guide value and applies to a new Hilti screwdriver.
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• The specified torque setting for the Hilti screw drivers with electronic slip clutch (ESC) is only a rough guide value as the ESC has 2 stop detections; Soft Joint (SJ) detection and Hard Joint (HJ) detection. The hard joint detection is activated due to drop in speed (fast stop) and can lead to a torque spike. The installation torque may vary depending on the user and the application. To ensure recommended torque is applied, Hilti recommends the use of a calibrated torque wrench or the Hilti torque tool.

Tightening tool recommendation for tightening with Hilti torque tool

Hilti torque tool	
Torque tool S-BT 1/4" – 5 Nm	



	S-BT-MR, S-BT-MF, S-BT-GR, S-BT-GF				
Base material thickness	t _∥ ≥ 5 mm [0.20"]			3 mm [0.12"] ≤ t _µ < 5 mm [0.20"]	
Base material type	Steel S235 A36	Steel S355 Grade 50	Aluminum f _u ≥ 270 MPa	Steel S235 A36	Steel S355 Grade 50
Tightening torque serrated flange nut T_{rec} [Nm/lbft]	8/5.9	8/5.9	5/3.6	5/3.6	5/3.6

Important: The tightening torque (T_{rec}) for the serrated flange nut is dependent on the stud type, the base material type and thickness, and the drill hole type. Exceeding the tightening torque (T_{rec}) leads to damage of the S-BT stud's anchorage with negative impact on the load values and the sealing function.

System program

Designation	Item no.	Product name	Comment	Application
S-BT-GF M8/7 AN6	2140527	Threaded stud	use with X-FCM grating disc	Grating
S-BT-GF NG M8/7 AN6	2302143	Threaded stud	use with X-FCM-M NG grating disc	Grating
S-BT-MF M8/7 AN6	2139174	Threaded stud	package includes serrated flange nut	Multipurpose
S-BT-MF MT M8/7 AN6	2298450	Threaded stud	package does not include serrated flange nut	Multipurpose
S-BT-MF M8/15 AN 6	2148618	Threaded stud	package includes serrated flange nut	Multipurpose
S-BT-MF M10/15 AN 6	2140528	Threaded stud	package includes serrated flange nut	Multipurpose
S-BT-MF MT M10/15 AN6	2309240	Threaded stud	package does not include serrated flange nut	Multipurpose
S-BT-MF W10/15 AN6	2139173	Threaded stud	package includes serrated flange nut	Multipurpose
				.
S-BT-GR M8/7 SN6	2140529	Threaded stud	use with X-FCM grating disc	Grating
S-BT-GR M8/7 SN6AL	2140742	Threaded stud	use with X-FCM grating disc	Grating
S-BT-GR NG M8/7 SN6	2302142	Threaded stud	use with X-FCM-R NG grating disc	Grating
S-BT-MR M8/7 SN6	2139172	Threaded stud	package includes serrated flange nut	Multipurpose
S-BT-MR MT M8/7 SN6	2298451	Threaded stud	package does not include serrated flange nut	Multipurpose
S-BT-MR M8/7 SN6AL	2140743	Threaded stud	package includes serrated flange nut	Multipurpose
S-BT-MR M8/15 SN6	2148612	Threaded stud	package includes serrated flange nut	Multipurpose
S-BT-MR M8/15 SN6AL	2148614	Threaded stud	package includes serrated flange nut	Multipurpose
S-BT-MR M10/15 SN6	2140740	Threaded stud	package includes serrated flange nut	Multipurpose
S-BT-MR MT M 10/15 SN 6	2205156	Threaded stud	package does not include serrated flange nut	Multipurpose
S-BT-MR M10/15 SN6AL	2140744	Threaded stud	package includes serrated flange nut	Multipurpose
S-BT-MR W10/15 SN6	2140741	Threaded stud	package includes serrated flange nut	Multipurpose
S-BT-MR W10/15 SN6AL	2140745	Threaded stud	package includes serrated flange nut	Multipurpose



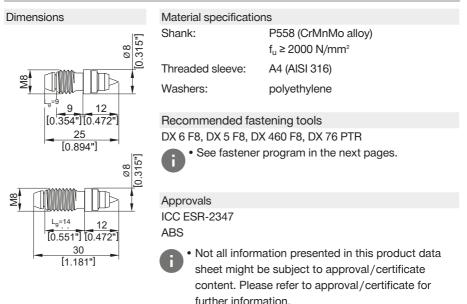
Designation	Item no.	Product name	Comment	Application
TS-BT 5.5-74 S	2143137	Stepped drill bit	for base material steel	
TS-BT 5.5-110 S	2201685	Stepped drill bit	For use in combination with the S-CS NG centering Spacer	Grating
TS-BT 5.5-74 AL	2143138	Stepped drill bit	for base material aluminum	
S-CS NG	2310191	Centering Spacer	For perpendicular pilot hole drilling and precise location of studs	Grating
S-DG BT M8/7 Short 6	2279735	Depth gauge	for exact setting of the S-BT	
S-DG BT M10-W10/15 Long 6	2143261	Depth gauge	for exact setting of the S-BT	
S-DG BT M8/15 Long 6	2148575	Depth gauge	for exact setting of the S-BT	
S-CG BT/7 Short 6	2143262	Check gauge	for verification of the stud stand-off	
S-CG BT/15 long 6	2143263	Check gauge	for verification of the stud stand-off	
S-CC BT 6	2143270	Calibration card	for calibration of the depth gauge	
S-BT 1/4" – 5 Nm	2143271	Torque tool	manual torque tool (5 Nm)	
X-BT 1/4" – 8 Nm	2119272	Torque tool	manual torque tool (8 Nm)	
S-NS 13 C 95/3 ³ / ₄ "	2149244	Nut setter	for serrated flange nut M8	
S-NS 15 C 95/3 ³ / ₄ "	2149245	Nut setter	for serrated flange nut M10	
S-NS ⁹ / ₁₆ " C 95/3 ³ / ₄ "	2149246	Nut setter	for serrated flange nut W10	





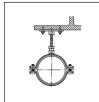
X-ST-GR Stainless steel threaded stud for fastening to steel

Product data



Applications

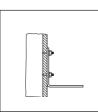
Examples



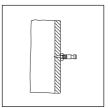
Base plates for pipe rings



Installation rails



Facade brackets



X-ST-GR

Special purpose connections



Grating

Checker plate





Performance data

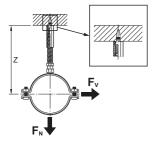
Recommended resistance under tension load, shear load and bending moment

N _{rec}	V _{rec}	M _{rec}
1.8 kN	1.8 kN	5.5 Nm

Condition:

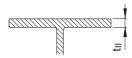
• For safety-relevant fastenings sufficient redundancy of the entire system is required.

Arrangements to reduce or prevent moment on shank



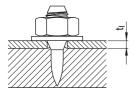
Application recommendation

Base material thickness



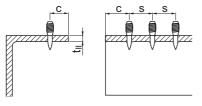
t_{II} ≥ 6 mm

Fastened material thickness



$$\begin{split} t_l &\leq Lg \text{ - } t_washer \text{ - } t_nut \\ t_l &\leq 10mm \text{ for X-ST-GR M8/10 P8} \\ t_l &\leq 5mm \text{ for X-ST-GR M8/5 P8} \end{split}$$

Fastener positioning in base material

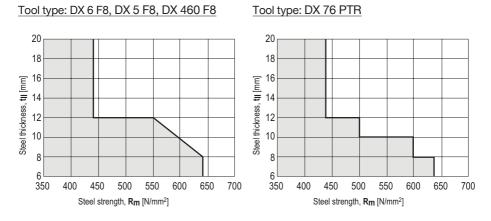


Edge distance: $c \ge 15 \text{ mm}$ Spacing: $s \ge 15 \text{ mm}$





Application limit



Corrosion information

- For fastenings exposed to outdoor environments in mildly corrosive conditions where HDG coated parts are commonly specified or used.
 - Not for use in atmospheres with chlorides (marine atmospheres) or in heavily polluted environments (e.g. sulphur dioxide).
 - For more details, please refer to following technical document: Hilti Corrosion Handbook.

System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

Cartridge recommendation

Base material		Cartridge color (tool power level)		
		Tool type:	Tool type:	
		DX 6 F8	DX 5 F8, DX 460 F8	
		Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M	
	6 ≤ t _{II} ≤ 8mm	titanium 🔳 (4-6)	red 📕 (1-3)	
S235	8 < t _{II} ≤ 20 mm	titanium 🔳 (5-8),	black ■ (1-3)	
		black ■ (6–7)		
S275	6 ≤ t _{II} ≤ 12 mm	titanium 🔳 (5-8),	black ■ (1-3)	
		black ■ (6–7)		
S355	6 ≤ t _{II} ≤ 8 mm	titanium 🔳 (5-8),	black 🔳 (1-3)	
		black 🔳 (6–7)		





Cartridge recommendation

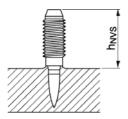
Base materia	al	Cartridge color (tool power level)	
		Tool type:	
		DX 76 PTR	
		Cartridge type: 6.8/18 M	
S235	6≤t _{II} ≤8mm	yellow <mark>–</mark> (1-4)	
3233	8 < t _{II} ≤ 20 mm	yellow <mark>–</mark> (1-4)	
S275	6 ≤ t _{II} ≤ 12 mm	yellow 📒 (1-4), red 📕 (1-2)	
S355	6≤t _{II} ≤8mm	red 📕 (1)	
	8 < t _{II} ≤ 10mm	red 📕 (1-2)	

- Tool power level adjustment by setting tests on site.
- Start tool energy selection with lowest recommended tool power level.
- Correct according requirement from chapter quality assurance.

Quality assurance

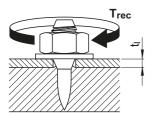
R

Setting depth control



Designation	h _{NVS}
X-ST-GR M8/5 P8	12.0–15.0 mm
X-ST-GR M8/10 P8	17.0-20.0 mm

Installation information



Tightening torque:

T_{rec} = 8.5 Nm

Fastener program

Item no. and description

Designation	Item no.	Lg
X-ST-GR M8/5 P8	2122209	9 mm
X-ST-GR M8/10 P8	2122460	14 mm



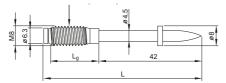


X-CRM Stainless steel threaded stud for fastening to concrete and steel

Product data

Dimensions

X-CR M8-__-42 P8 (DX-Kwik)



Material specifications	
Shank:	CrNiMo alloy, $f_u \ge 1800 \text{ N/mm}^2$ (49 HRC)
Threaded sleeve:	A4 (AISI 316)
Zinc coating:	5–13 µm
Washers/guidance sleeve:	polyethylene

Approvals

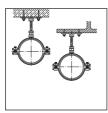
DIBt (Germany):

X-CR M8-__-42 P8 (DX-Kwik)

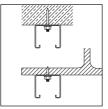


 Not all information presented in this product data sheet might be subject to approval/certificate content. Please refer to approval/certificate for further information.

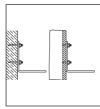
Applications



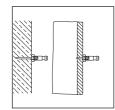
Base plates for pipe rings



Installation rails



Facade brackets



Special purpose connections





Performance data

Recommended resistance under tension load, shear load and bending moment

Designation	Tension load		Shear load	Bending
				moment
	N _{rec,1}	N _{rec,2}	V _{rec}	M _{rec}
	Compressive	Tension		
	zone	zone		
X-CR M842 P8	3.0 kN	0.9 kN	3.0 kN	5.5 Nm



• DX-Kwik method (pre-drilling) for fastening to concrete: $fcc \ge 20 \text{ N/mm}^2$.

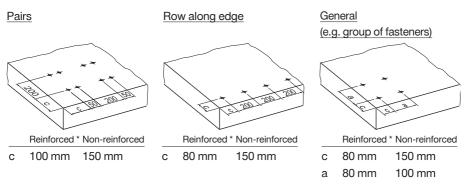
- A sufficient redundancy has to be ensured, that the failure of a single fastening will not lead to collapse of the entire system.
- Observance of all pre-drilling requirements.
- For more details in relation to base material properties, please refer to the chapter Fastener selection guide in the Direct Fastening Manual (DFTM).

Application recommendation

Base material thickness

X-CR M8-__-42 P8: h_{min} = 100 mm

Fastener positioning in base material for fastening to concrete



* Minimum ${\it \emptyset}$ 6 reinforcing steel continuous along all edges and around all corners. Edge bars must be enclosed by stirrups

Application limits for fastening to concrete

No general restrictions existent. Limitations are dependent on application and user requirements.





Corrosion information

- For fastenings exposed to weather or other corrosive conditions.
- Not for use in highly corrosive surroundings like swimming pools or highway tunnels.
- For more details, please refer to following technical document: Hilti Corrosion Handbook.

System recommendation

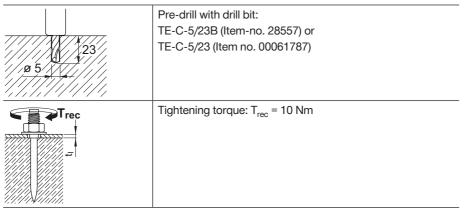
• For more details, please refer to the chapter Accessories and consumables compatibility in the Direct Fastening Technology Manual (DFTM).

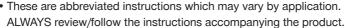
Cartridge recommendation

Base material	Cartridge color (tool power level)		
	Tool type: DX 6 F8	Tool type: DX 5 F8, DX 460 F8, DX 36, DX 2	
	Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M	
Soft/medium concrete	titanium 🔳 (2-6)	yellow <mark>,</mark> red 	
Tough concrete	titanium 🔳 (4-8)	yellow <mark>,</mark> red =	

- Tool power level adjustment by setting tests on site.
- Start tool energy selection with lowest recommended tool power level.
- Correct according requirement from chapter quality assurance.

Installation recommendation









Quality assurance

Fastening inspection

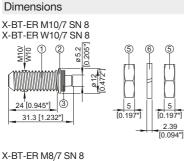
	Designation	Fastener stand-off
		h _{NVS}
	X-CR M8-14-42 P8	12.0–16.0 mm
	X-CR M8-22-42 P8	20.0–24.0 mm
<u> </u>		

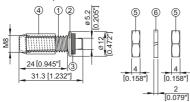
Fastener program

Designation	Item no.	Fastened	L _g	Ls	Tools
		material			
		thickness			
		t _{I,max}			
X-CR M8-14-42 P8	255911	5.0 mm	14 mm	42 mm	DX 6 F8, DX 5 F8, DX 460 F8, DX 36, DX 2
X-CR M8-22-42 P8	255910	13.0 mm	22 mm	42 mm	

X-BT-ER Stainless steel threaded stud for electrical connection

Product data





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Material specifications

(1) Shank and thread:	S31803 (1.4462) at least equivalent to A4 / AISI grade 316 material
② SN washer:	S 31635 (X2CrNiMo 17-12-2, 1.4404)
③ Sealing washer:	Elastomer, black, resistant to UV, salt water, water, ozone, oils, etc.
④ Guided sleeve:	Plastic
⑤ Nut:	A4 / AISI grade 316 material
6 Lock washer:	A4 / AISI grade 316 material

Recommended fastening tools

BX 3-BT, DX 351-BT

- For more details, please refer to
 - X-BT-ER fastener program and to the chapter Accessories and consumables compatibility in the Direct Fastening Technology Manual (DFTM).

Approvals for X-BT-ER stainless steel threaded studs for electrical connections ABS 18-HS1755518, DNV-GL TAS00001 SV, BV 54554, LR 19/0003, UL-file E257067

• Not all information presented in this product data sheet might be subject to approval/certificate content. Please refer to approval/certificate for further information.

Applications

X-BT-ER M6/3 SN 8 X-BT-ER W6/3 SN 8

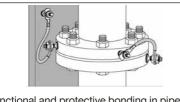
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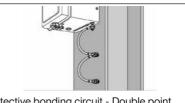
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Examples



Functional and protective bonding in pipe (Outer diameter of installed surface ≥150 mm)



Protective bonding circuit - Double point connection



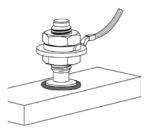


Performance data

Functional bonding and terminal connection in a circuit

For low permanent current due to static charge built up in pipes or for low permanent current when closing an electrical circuit

Single point connection



Recommended electrical Maximum allowable connectors: permanent current = 40 A X-BT-ER M10/7 SN 8 X-BT-ER M10/7 SN 8 X-BT-ER M8/7 SN 8 X-BT-ER M6/3 SN 8, X-BT-ER M6/7 SN 8 X-BT-ER W6/3 SN 8, X-BT-ER W6/7 SN 8 Note:

 Recommended connected cable size (tested to 40 A) according to IEC/ EN 60204-1: ≤ 10 mm² copper (≤ 8 AWG). <u>Fastening of thicker cable</u> is acceptable provided the maximum permanent current of 40 A is not exceeded and the provisions on cable lug thickness are observed.

Protective bonding circuit

For discharging short circuit current while protecting electrical equipment or earth / ground or bonded cable trays and ladders

Single point connection

Recommended electrical
connectors:Max. short circuit current for
period of 1 s = 1250 AX-BT-ER M10/7 SN 8X-BT-ER W10/7 SN 8X-BT-ER M8/7 SN 8X-BT-ER M6/3 SN 8, X-BT-ER M6/7 SN 8X-BT-ER W6/3 SN 8, X-BT-ER W6/7 SN 8Note:

- Recommended connected cable size (tested to 1250 A for 1 s) following IEC/EN 60947-7-2: 510 mm² copper (≤ 8 AWG).
 Fastening of thicker cable is acceptable provided the maximum current of 1250 A for a period of 1 second is not exceeded and the provisions on cable lug thickness are observed.
- Recommended connected cable size (tested to 750 A for 4 s) according to UL 467: \leq 10 AWG





Max, short circuit current for

period of 1 s = 1800 A

Double point connection



Recommended electrical connectors: X-BT-ER M10/7 SN 8 X-BT-ER W10/7 SN 8 X-BT-ER M8/7 SN 8 X-BT-ER M6/7 SN 8 X-BT-ER W6/7 SN 8

Note:

 Recommended connected cable size (tested to 1800 A for 1 s) following IEC/EN 60947-7-2: ≤ 16 mm² copper (≤ 6 AWG).
 Fastening of thicker cable is acceptable provided the maximum current of 1800 A for a period of 1 second is not exceeded and the provisions on cable lug thickness are observed.

Lightning protection

For high temporary current due to lightning.

Single point connection



 Recommended electrical
 Maximum te

 connectors:
 (according te

 X-BT-ER M10/7 SN 8
 ≤ 50 kA for 2

 X-BT-ER W10/7 SN 8
 ×

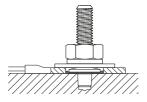
 X-BT-ER M8/7 SN 8
 ×

 X-BT-ER M6/3 SN 8, X-BT-ER M6/7 SN 8
 ×

 X-BT-ER W6/3 SN 8, X-BT-ER W6/7 SN 8
 ×

Maximum test current (according to EN 62561-1): \leq 50 kA for 2 ms

- When one nut is utilized and cable lug is in contact with base material.
- Cable lug must be in direct contact with non-coated base material.
- Extra M10/W10 stainless steel washer to be used and installed between lock washer and cable lug.
- Base material must not contact the X-BT-ER SN washer, lock washer and nut.
- Cable lug thickness = 2 mm to 12 mm. Cable lug hole diameter ≥ 14 mm.
- Max. tightening torque = 20 Nm.



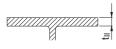
Recommended electrical Maximum test current: connectors: ≤ 100 kA for 2 ms X-BT-ER M10/7 SN 8 X-BT-ER M10/7 SN 8 X-BT-ER M8/7 SN 8 X-BT-ER M6/3 SN 8, X-BT-ER M6/7 SN 8 X-BT-ER W6/3 SN 8, X-BT-ER W6/7 SN 8





Application recommendation

Thickness of base material

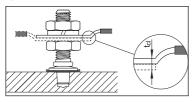




Thickness of cable lug

X-BT-ER M8/M10/W10 X-BT-ER M6/W6 /7 SN 8

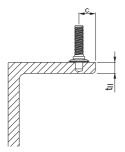
t_{cl} ≤ 7 mm (0.28")



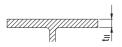
Spacing and edge distances

Edge distance:

c≥6mm



Application limit

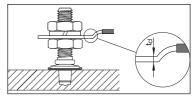


Base material corrosion protection

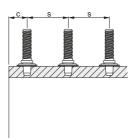
Thickness of base material corrosion protection layer ≤ 0.4 mm. For thicker coatings, please contact Hilti.

X-BT-ER M6/W6 /3 SN 8





<u>Spacing:</u> s ≥ 15 mm



- $t_{||} \ge 8 \text{ mm} [5/16"]$ no through penetration
- $t_{II} \ge 6 \text{ mm}$ for through penetration
- No limits with regards to steel strength

Corrosion information

The corrosion resistance of Hilti CR500 and S31803 stainless steel material is equivalent to AISI 316 (A4) steel grade.



/

X-BT-ER

Fastener program and system recommendation BX 3-BT

Fastener program

		Tool	Fastener Guide
Designation	ltem no.	designation	designation
X-BT-ER M10/7 SN 8	2194352	BX 3-BT	X-FG B3-BT M
X-BT-ER M8/7 SN 8	2194351	BX 3-BT	X-FG B3-BT M
X-BT-ER M6/3 SN 8	2252195	BX 3-BT	X-FG B3-BT M
X-BT-ER W10/7 SN 8	2194353	BX 3-BT	X-FG B3-BT W
X-BT-ER W6/3 SN 8	2252198	BX 3-BT	X-FG B3-BT W

Fastener program and system recommendation DX 351-BT

Fastener program

		Tool	Fastener Guide
Designation	ltem no.	designation	designation
X-BT-ER M10/7 SN 8	2194352	DX 351-BT	BT FG M1024
X-BT-ER M8/7 SN 8	2194351	DX 351-BT	BT FG M1024
X-BT-ER M6/3 SN 8	2252195	DX 351-BT	BT FG M1024
X-BT-ER M6/7 SN 8	2194349	DX 351-BT	BT FG M1024
X-BT-ER W10/7 SN 8	2194353	DX 351-BT	BT FG W1024
X-BT-ER W6/3 SN 8	2252198	DX 351-BT	BT FG W1024
X-BT-ER W6/7 SN 8	2194350	DX 351-BT	BT FG W1024

Cartridge selection and tool energy setting

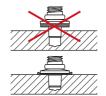
6.8/11 M high precision brown cartridge

- Tool power level adjustment by setting tests on site.
- Start tool energy selection with lowest recommended tool power level.
- Correct according requirement from chapter quality assurance.

Quality assurance

Fastening inspection





X-BT-ER M/W10, X-BT-ER M8 and X-BT-ER M/W6 h_{NVS} = 25.7–26.8 mm = 1.01"–1.055"





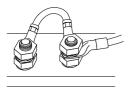
Installation for electrical connections

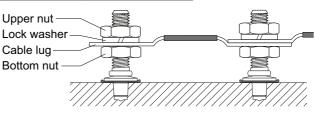
Single point connection for all X-BT-ER



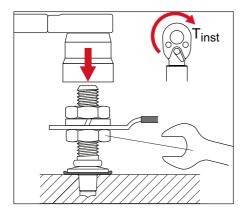
Upper nut Lock washer Cable lug Bottom nut

Double point connection only for X-BT-ER M6/W6 and X-BT-ER M8





Torque recommendation for X-BT-ER



Hold the bottom nut with a spanner while tightening the upper nut.

Tightening torque: T_{inst} = 8 – 20 Nm

These are abbreviated instructions which may vary by application. **<u>ALWAYS</u>** review/follow the instructions accompanying the product.

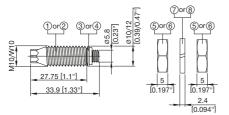


S-BT-ER (HC) and S-BT-EF (HC) screw-in stainless steel and carbon steel threaded studs for electrical connections

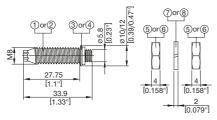
Product data

Dimensions

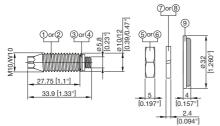
S-BT-ER M10/15 SN6 S-BT-ER W10/15 SN6 S-BT-EF M10/15 AN6 S-BT-EF W10/15 AN6



S-BT-ER M8/15 SN6 S-BT-EF M8/15 SN6



S-BT-ER M 10 HC 120 S-BT-ER W 10 HC AWG4/0 S-BT-EF M 10 HC 120 S-BT-EF W 10 HC AWG4/0



Material specifications

IVI	atenai specificatio	ns	
1	Threaded shank:	Stainless steel "S 31803 (1.4462)	(S-BT-ER) "
2	Threaded shank:	zinc-coated Carbon steel "1038/duplex-co	(S-BT-EF) ated"
3	SN12-R washers:	Ø 12 mm [0.47"] Stainless steel "S 31603 (1.4404)	(S-BT-ER)
4	AN10-F washers:	Ø 10 mm [0.39"] Aluminum	(S-BT-EF)
5	Nut:	Stainless steel grade A4/AISI 31	(S-BT-ER)
6	Nut:	Carbon steel HDG	
7	Lock washer:	Stainless steel grade A4/AISI 31	
8	Lock washer:	Carbon steel HDG	(S-BT-EF)
9	Conductivity disc:	Ø 32 mm [1.260"] Copper alloy CuSi (tin-coated) with s	
	aling ring:		
Se	aling washers:	Chloroprene rubb CR3.1107, black, to UV, salt water, ozone, oils etc.	resistant
Co	onductivity discs:	FKM, Resistant to salt water, water, oils, etc.	

Recommended fastening tool

Refer to section "Fastener selection and system recommendation" for more details.

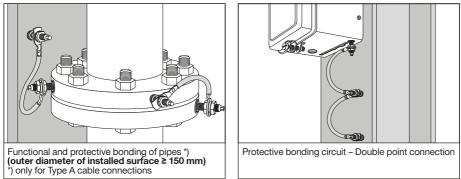
Listings and type approvals





Applications

Examples



Functional bonding and terminal connection in a circuit

For permanent current (leakage current) due to static charge built up in pipes or when closing an electrical circuit.

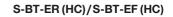
Single point connection

	Recommended electrical connectors:	Maximum allowable permanent current
Type A	S-BT-ER M10/15 SN 6 S-BT-ER W10/15 SN 6 S-BT-EF M10/15 AN 6 S-BT-EF W10/15 AN 6 S-BT-ER M8/15 SN 6 S-BT-EF M8/15 AN 6	I _{th} = 57 A
Type B	S-BT-ER M10 HC 120 S-BT-ER W10 HC AWG4/0 S-BT-EF M10 HC 120 S-BT-EF W10 HC AWG4/0	I _{th} = 269 A

Note:

- Recommended maximal cross section of connected cable according IEC 60947-7-2 and IEC 60947-7-1:
 10 mm² (8 AWG) copper (tested permanent current I_{th} = 57 A)
 120 mm² (4/0 AWG) copper (tested permanent current I_{th} = 269 A)
- Fastening of thicker cable is acceptable, if the maximum allowable permanent current I_{th} is not exceeded and the provisions on cable lug thickness t_{cl} are observed.





Protective bonding circuit

For discharging short circuit current while protecting electrical equipment or earth/ground cable trays and ladders.

Single point connection

Туре	A
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 S-BT-ER M10 HC 120
 $I_{cw} = 14.40 \text{ kA (IEC)}$

 S-BT-ER W10 HC 120
 $I_{cw} = 10.10 \text{ kA (UL)}$

 S-BT-EF W10 HC AWG4/0
 $I_{cw} = 10.10 \text{ kA (UL)}$

Note:

• Recommended maximal cross section of connected cable according IEC 60947-7-2 and IEC 60947-7-1:

10 mm² (8 AWG) copper (tested short circuit current I_{cw} = 1.20 kA for 1 s) 120 mm² (4/0 AWG) copper (tested short circuit current I_{cw} = 14.40 kA for 1 s) according UL 467:

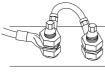
10 AWG copper (tested short circuit current I_{cw} = 0.75 kA for 4 s)

4/0 AWG copper (tested short circuit current I_{cw} = 10.10 kA for 9 s)

 Fastening of thicker cable is acceptable, if the maximum short circuit current I_{cw} and the exposure time is not exceeded and the provisions on cable lug thickness t_{cl} are observed.

Double point connection





Recommended electrical connectors: S-BT-ER M10/15 SN 6 S-BT-ER W10/15 SN 6 S-BT-EF M10/15 AN 6 S-BT-EF W10/15 AN 6 S-BT-ER M8/15 SN 6 S-BT-EF M8/15 AN 6 Max. short circuit current according to IEC

I_{cw} = 1.92 kA (IEC)



Note:

- Recommended maximal cross section of connected cable according IEC 60947-7-2 and IEC 60947-7-1:
 16 mm² (6 AWG) copper (tested short circuit current I_{cw} = 1.92 kA for 1 s)
- Fastening of thicker cable is acceptable, if the maximum short circuit current I_{cw} and the exposure time is not exceeded and the provisions on cable lug thickness t_{cl} are observed.

Lightning protection

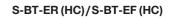
For high temporary current due to lightning.

Single point connection		
Classification N (acc. IEC 62561-1)	Recommended electrical connectors:	Maximum lightning current
Type A	S-BT-ER M10/15 SN 6 S-BT-ER W10/15 SN 6 S-BT-EF M10/15 AN 6 S-BT-EF W10/15 AN 6 S-BT-ER M8/15 SN 6 S-BT-EF M8/15 AN 6	I _{imp} = 50 kA for ≤ 5 ms (according to IEC 62561-1)
Туре В	S-BT-ER M10 HC 120 S-BT-ER W10 HC AWG4/0 S-BT-EF M10 HC 120 S-BT-EF W10 HC AWG4/0	
Classification H (acc. IEC 62561-1) Type B	Recommended electrical connectors: S-BT-ER M10 HC 120 S-BT-ER W10 HC AWG4/0 S-BT-EF M10 HC 120 S-BT-EF W10 HC AWG4/0	I _{imp} = 100 kA for ≤ 5 ms (according to IEC 62561-1)

Note:

- When S-BT-ER/-EF is used in class H applications only type B cable connection is allowed.
- Tightening torque of 8 Nm must be observed accurately for type B cable connection.



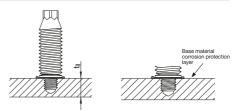


Application Requirements

Base material thickness $t_{\mu} \ge 6 \text{ mm}^*$)

Thickness of base material corrosion protection layer ≤ 0.8 mm [0.0315"].

For single point connection type B conductivity disc must be in direct contact with non-coated base material.



*) for the applications "Functional bonding and terminal connection in a circuit" and "Protective bonding circuit" the minimum base material thicknees can be reduced to t_{μ} = 3 mm. Applicable only for Type A, single point connections.

In case of a drill through hole or a pilot hole in thin base material, rework of the coating on the back side of the plate/profile may be needed.

Cable lug characteristics and connector types

Cable lug thickness t_{cl} and inner hole diameter d₂

		Single conn	e point Double p ector connect			•
Fastener	Тур	e A	Тур	e B	Тур	e A
	t _{ci} [mm]	d ₂ [mm]	t _{cl} [mm]	d ₂ [mm]	t _{cl} [mm]	d ₂ [mm]
S-BT-ER M10/15 SN 6	≤7	10.5			≤7	10.5
S-BT-ER W10/15 SN 6	≤7	10.5			≤7	10.5
S-BT-EF M10/15 AN 6	≤7	10.5			≤7	10.5
S-BT-EF W10/15 AN 6	≤7	10.5			≤7	10.5
S-BT-ER M8/15 SN 6	≤7	8.5			≤7	8.5
S-BT-EF M8/15 AN 6	≤7	8.5			≤7	8.5
S-BT-ER M10 HC 120			≤ 12	10.5		
S-BT-ER W10 HC AWG4/0			≤ 12	10.5		
S-BT-EF M10 HC 120			≤ 12	10.5		
S-BT-EF W10 HC AWG4/0			≤ 12	10.5		

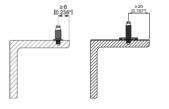


Single conn	Double point connector	
Туре А	Туре В	Туре А

Spacing & edge distances

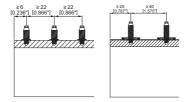
Edge distance:

Type A connector: $\geq 6 \text{ mm} [0.236"]$ Type B connector: $\geq 20 \text{ mm} [0.787"]$



Spacing:

Type A connector: ≥ 22 mm [0.866"] Type B connector: ≥ 40 mm [1.575"]



Installation temperature and service temperature

The installation temperature is the temperature at which the S-BT-ER/-EF studs are installed. A distinction is made between the temperature of the base material and the temperature of the S-BT-ER/-EF studs, drilling and installation tools and accessories. The installation temperature range can be found in the table below.

The service temperature is the temperature at which the S-BT-ER/-EF studs operate. The S-BT studs will operate effectively and without any loss in performance (loads, sealing function, etc.) within the specified service temperature range. Outside this temperature range the S-BT-ER/-EF studs may fail.





Designation	Installation	temperature	Service temperature		
Designation	min	max	min	max	
Base material	–40 °C	+60 °C	–40 °C	+100 °C	
S-BT-ER/-EF studs	–10 °C	+60 °C	–40 °C	+100 °C	
Drilling & Installation tools and accessories	–10 °C	+60 °C	n.a.	n.a.	

Note:

The service temperature range of the connected cable lugs and cables has to be observed. For details please contact the supplier of the cable lugs and cables.

Corrosion information

The S-BT-ER stainless steel fasteners are made from the duplex stainless steel type 1.4462, which is equivalent to AISI 316 (A4) steel grade. This grade of stainless steel is classified in the corrosion resistance class IV according to DIN EN 1993-1-4:2015, which makes the material suitable for aggressive environments like in coastal and offshore applications. The microstructures of duplex stainless steels consist of a mixture of austenite and ferrite phases. Compared to the austenitic stainless steel grades, duplex stainless steels are magnetic. The surface of the S-BT-ER stainless steel fasteners is zinc-coated (anti-friction coating) in order to reduce the thread forming torque when the stud is screwed in into the base material.

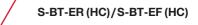
The coating of the carbon steel S-BT-EF fasteners consists of an electroplated Zn-alloy for cathodic protection and a top coat for chemical resistance (Duplex-coating). The thickness of the coating is $35 \,\mu$ m. This product is designed for use in corrosive categories C1, C2 and C3 according the standard EN ISO 9223.

The conductivity disc of the S-BT-ER/-EF HC is made from copper alloy CuSn8 with a tin-coating on the surface and a sealing ring on the bottom side. The copper alloy is classified as largely insensitive to stress corrosion cracking and pitting corrosion.

The conductivity disc is designed for use in corrosion categories C1 - C5 according to EN ISO 9223. It is therefore suitable for use in aggressive environments like coastal and offshore applications.

To prevent corrosion of the base material due to the drilling process the following base material thickness tll has to be given.





	Fast	ener
	Carbon steel S-BT-EF	Stainless steel S-BT-ER
Corrosivity category C Corrosion resistance class (CRC)	C1, C2, C3	CRC III, IV
Base material thickness $t_{\parallel}^{(1)}$		
3 mm $[0.12"] \le t_{\parallel} \le 6$ mm $[0.24"]$ Pilot drill may cause damage to backside coating	* ²⁾	* ²⁾
6 mm [0.24"] \leq t _{II} < 7 mm [0.28"] Pilot drill may cause damage to backside coating	✓	√ ³⁾
$t_{\parallel} \ge 7 \text{ mm} [0.28"]$ Pilot drill will not affect backside of base material	✓	✓

¹⁾ Real base material thickness, not nominal material thickness or material thickness with coating.

²⁾ Damage of the coating on the back side of the plate/profile require a rework of the coating.

³⁾ Damage of the coating on the back side of the plate/profile require a rework of the coating, if the drilling tools SFBT22-A or SFBT18-A were used for drilling the bore hole. If the tool SBT4-A22 was used for drilling the bore hole, no damage of the coating on the back side of the plate/profile will occur.

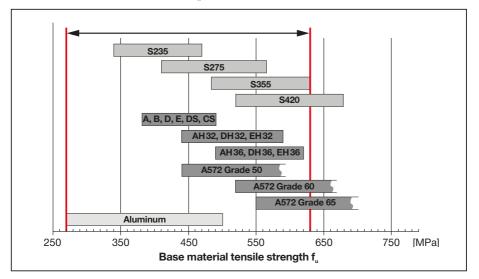
Application limit

The base material is limited to steel grade with a maximum tensile strength $f_u = 630$ MPa

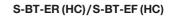
[91 ksi]. The minimum tensile strength of steel is $f_u \ge 340 \text{ MPa}$ [49 ksi].

Minimum thickness of base material t_u: refer to section "Application Requirements".

Maximum thickness of base material t₁₁: no limits.







Fasteners	Drilling tool	Stepped drill bit	Setting tool	Depth gauge
S-BT-ER M8/15 SN 6				S-DG BT M8/15 Long 6
S-BT-EF M8/15 AN 6	SBT 4-A22		SBT 4-A22	S-DG BT Wo/ 15 Long 6
S-BT-ER M10/15 SN 6	or SF BT 18-A	TS-BT 5.5-74 S	or SFC 18-A	
S-BT-ER W10/15 SN 6	or	13-01 3.3-74 5	or	S-DG BT M10-W10/15
S-BT-EF M10/15 AN 6	SF BT 22-A		SFC 22-A	Long 6
S-BT-EF W10/15 AN 6				
Fasteners	Drilling tool	Stepped drill bit + coating removal drill bit	Setting tool	Depth gauge
S-BT-ER M10 HC 120	SBT 4-A22		SBT 4-A22	
S-BT-ER W10 HC AWG4/0	or SF BT 18-A	TS-BT 5.5-74 S TS-BT HC 120/	or SFC 18-A	S-DG BT M10-W10 HC 6
S-BT-EF M10 HC 120	or	AWG4/0	or	S-DG DI WIU-WIUHC 6
S-BT-EF W10 HC AWG4/0	SF BT 22-A		SFC 22-A	

Fastener selection and system recommendation

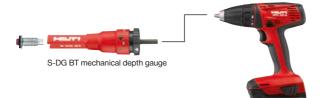
Fastener quality assurance

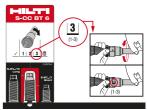
In order to ensure the exact screw-in depth and a proper compressed sealing washer, the S-BT-ER/-EF studs have to be installed with the appropriate depth gauge. With this tool the screw-in depth can be adjusted in a range of 0-1.5 mm (3 steps, 0.5mm per step). The S-CC BT calibration card is needed to check the initial stand-off of the S-BT-ER/-EF stud and to adjust/calibrate the S-DG BT depth gauge. After finding the right adjustment level for the S-DG BT depth gauge, the gauge can be adjusted and the studs can be installed without additional check of the S-DG BT depth gauge.

The depth gauge has to be re-adjusted (calibrated) at following times:

- · Start of the installation process
- Change of the working position (upwards, downwards, horizontal) and base material (thickness, strength, type)
- Installer change
- After each packaging respectively after the installation of 100 S-BT-ER / -EF studs

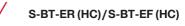
The lifetime of the S-DG BT depth gauge is \geq 1000 settings.





Design and functionality of the mechanical calibration card S-CC BT





Fastening inspection

The installer is responsible for the correct setting of the S-BT-ER / -EF studs. For the periodical verification of the correct stud stand-off the S-CG BT check gauge can be used.

Verify stud stand-off h_{NVS} with check gauge S-CG BT

 h_{NVS} = 29.3 mm to 29.8 mm [1.153" to 1.173"]

S-BT-ER M10/15 SN 6 S-BT-ER W10/15 SN 6 S-BT-EF M10/15 AN 6 S-BT-EF W10/15 AN 6 S-BT-ER M8/15 SN 6 S-BT-EF M8/15 AN 6

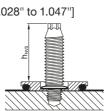


S-BT-ER M10 HC ____

S-BT-ER W10 HC ____

S-BT-EF M10 HC ____

S-BT-EF W10 HC ____





Design and functionality of the check gauge S-CG BT

Designation	Product name	Comment
S-DG BT M8/15 Long 6	Dopth gauge	for exact setting of
	Depth gauge	S-BT-ER M8/15 SN 6, S-BT-EF M8/15 AN 6
S-DG BT M10-W10/15		for exact setting of
Long 6	Depth gauge	S-BT-ER M10/15 SN 6, S-BT-ER W10/15 SN 6,
		S-BT-EF M10/15 AN 6, S-BT-EF W10/15 AN 6
		for exact setting of
S-DG BT M10-W10 HC 6	Depth gauge	S-BT-ER M10 HC, S-BT-ER W10 HC
		S-BT-EF M10 HC, S-BT-EF W10 HC
S-CC BT 6	Calibration card	for calibration of the depth gauge
3-00 DT 0	Calibration Calu	for S-BT-ER and S-BT-EF
		for calibration of the depth gauge for
S-CC BT HC 6	Calibration card	S-BT-ER M10 HC, S-BT-ER W10 HC
		S-BT-EF M10 HC, S-BT-EF W10 HC
S-CG BT/15 Long 6	Check gauge	for verification of the stand-off for
3-00 BT/15 LONG 0	Check gauge	S-BT-ER and S-BT-EF
S-CG BT HC		for verification of the stand-off for
	Check gauge	S-BT-ER M10 HC, S-BT-ER W10 HC
		S-BT-EF M10 HC, S-BT-EF W10 HC

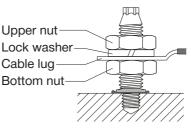


Installation

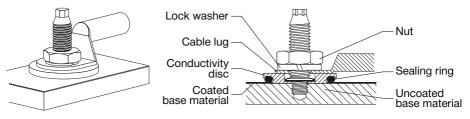
Single point connection

Single point connection type A:





Single point connection type B:

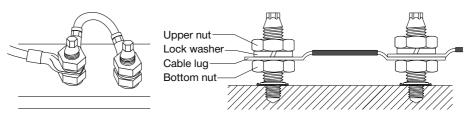


For Type B cable connection the following requirements have to be observed:

- The conductivity disc must be in direct contact with the non-coated base material. Coating has to be removed with the coating removal drill bit.
- Tightening torque of 8 Nm must be observed accurately.

Double point connection

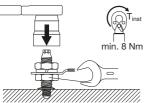
Double point connection type A:





Torque recommendation for all S-BT-ER and S-BT-EF

Single point connection type A and double point connection type A:

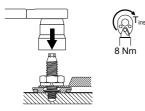


Hold the bottom nut with a spanner while tightening the upper nut.

Tightening Torque:

Min. 8 Nm Max. 20 Nm

Single point connection type B:



The tightening torque is 8 Nm. Exceeding or falling below this tightening torque value is not allowed. Tighten the nut using torque tool X-BT ¹/₄" (8 Nm), torque wrench or Hilti screw driver SBT 4-A22, SFC 18-A, SFC 22-A (torque setting 5) with socket S-NS.

Important:

These are abbreviated instructions which may vary by application.

ALWAYS review/follow the instructions for use (IFU) accompanying the product.





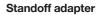
Fastener program

Designation	Item no.	Product name	Comment	Application
S-BT-EF M8/15 AN 6	2186208	Threaded stud		Fleetsieel
S-BT-EF M10/15 AN 6	2186204	Threaded stud	package includes nuts and lock washers	Electrical connection
S-BT-EF W10/15 AN 6	2186206	Threaded stud		connection
S-BT-ER M8/15 SN 6	2186207	Threaded stud		Electrical
S-BT-ER M10/15 SN 6	2186203	Threaded stud	package includes nuts and lock washers	connection
S-BT-ER W10/15 SN 6	2186205	Threaded stud		connection
S-BT-ER M10 HC 120	2204739	Threaded stud	package includes nuts, lock washers	
S-BT-ER W10 HC AWG4/0	2206611	Threaded stud	and conductor discs	Electrical
S-BT-EF M10 HC 120	2204932	Threaded stud	package includes nuts, lock washers	connection
S-BT-EF W10 HC AWG4/0	2206612	Threaded stud	and conductor discs	
TS-BT 5.5-74 S	2143137	Stepped drill bit	for base material steel	
TS-BT HC 120/AWG4/0	2204736	Coating removal drill bit	for removal of the coating from the base material	
S-DG BT M10-W10/15 Long 6	2143261	Depth gauge	for exact setting of the S-BT	
S-DG BT M8/15 Long 6	2148575	Depth gauge	for exact setting of the S-BT	
S-DG BT M10-W10/15 HC 6	2204933	Depth gauge	for exact setting of the S-BT HC	
S-CC BT 6	2143270	Calibration card	for calibration of the depth gauge	
S-CC BT HC 6	2204934	Calibration card	for calibration of the depth gauge	
X-BT 1/4" – 8 Nm	2119272	Torque tool	manual torque tool (8 Nm)	



/





Standoff adapters

Product data

Product description

Adapter M8-MR 25 Adapter M8-MR 50 Adapter M8-MR 75 Adapter M8-MR 100 Adapter M8-MF 25 Adapter M8-MF 50 Adapter M8-MF 75 Adapter M8-MF 100



Adapter M10-MR 50 Adapter M10-MF 50 Adapter W10-MR 50 Adapter W10-MF 50



Fastening system

		Fastener	
Adapter	S-BT-GR M8/7 SN 6 S-BT-MR M8/7 SN 6	S-BT-GF M8/7 AN 6 S-BT-MF M8/7 AN 6	X-BT-GR M8/7 SN 8
Adapter M8-MR 25			
Adapter M8-MR 50			
Adapter M8-MR 75			
Adapter M8-MR 100			
Adapter M8-MF 25			
Adapter M8-MF 50			
Adapter M8-MF 75			
Adapter M8-MF 100			

- For fastenings on steel with passive fire protection (PFP) coating, bare steel members or insulated steel members
- Faster and more efficient no welding/bracketing needed
- Helps to prevent contact between fixtures and steel beams or plates – both uncoated or PFP coated beams
- Versatile threaded standoff adapters can be used as a spacer for a wide range of fastenings on PFP coated beams
- Wide M8 flange nut available for use with Hilti MQ strut channel





	Fastener			
Adapter	S-BT-MR M10/15 SN 6	S-BT-MF M10/15 AN 6	S-BT-MR W10/15 SN 6	S-BT-MF W10/15 AN 6
Adapter M10-MR 50				
Adapter W10-MR 50				
Adapter M10-MF 50				
Adapter W10-MF 50				

	Fastener			
Adapter	X-BT-MR M10/15 SN 8	X-BT-MR W10/15 SN 8		
Adapter M10-MR 50				
Adapter W10-MR 50				
Adapter M10-MF 50				
Adapter W10-MF 50				

Material specification and material properties

Material specification and material properties for stainless steel parts

Designation	Material	Coating	Steel grade	Standard	Corrosion resistance acc. to EN 1993-1-4
Adapter M8-MR	Otalialaaa		1 4 4 0 1	EN 10000	
Adapter M10-MR	Stainless steel	none	1.4401 316	EN 10088 ASTM, AISI, SAE	CRC III
Adapter W10-MR					
Serrated flange nut M8	Stainless		A4-70	EN ISO 3506-2	CRC III
Serrated flange nut M10	steel	none	A4-70	EN 130 3300-2	

Material specification and material properties for carbon steel parts

Designation	Material	Coating	Steel grade	Standard	Corrosivity category acc. to EN ISO 9223
Adapter M8-MF Adapter M10-MF	Carbon steel	electroplated Zn-alloy +	1.0737	EN 10277-3	C1 – C3
Adapter W10-MF		top coat (Duplex coat.)	12L14	ASTM, AISI, SAE	
Serrated flange nut M8	Carbon steel	HDG	Grade 8	EN ISO 898-2	C1 - C3
Serrated flange nut M10	Carbon Steer	TIDG	Grade o	LN 130 898-2	01-03





Product re	Product recommendation under various environmental conditions				
		Fastene	r system		
Environment	al condition	Adapter M8-MR Adapter M10-MR combined with S-BT-GR M8/7 SN 6 S-BT-MR M8/7 SN 8 X-BT-GR M8/7 SN 8 S-BT-MR M10/15 SN 8 S-BT-MR M10/15 SN 8 S-BT-MR W10/15 SN 8 X-BT-MR W10/15 SN 8	Adapter M8-MF Adapter M10-MF combined with S-BT-GF M8/7 AN 6 S-BT-MF M8/7 AN 6 S-BT-MF M10/15 AN 6 S-BT-MF W10/15 AN 6		
-	Dry indoor	•	•		
	Indoor with temporary condensation	•	•		
+	Outdoor with low pollution	•			
1-10 km	Outdoor with moderate concentration of pollutants	•			
0-1km	Coastal areas	•	-		
	Outdoor, areas with heavy industrial pollution	•	-		
*	Close proximity to roads	•	-		
	Special application	Please contact our E	xpert Hilti Engineers		
	Special application		ommendation		

Suitable for corrosion prevention

□ = Suitable, requires expert evaluation

Further information can be found in following Hilti brochures:

- X-BT Threaded Fastener Specification
- New Generation X-BT-GR, X-BT-MR and X-BT-ER Threaded Fastener Specification
- S-BT Threaded Fastener Specification





Load condition

Static/quasi static

Base materials



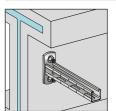
Steel

Approvals and certificates

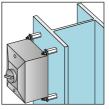
- Information presented in this product data sheet is based on Hilti Technical Data.
- Approvals / certificates available for following fastening systems: S-BT threaded studs, X-BT threaded studs

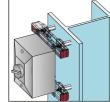
Applications

Fastening on steel with passive fire protection (PFP) coating



Fastening on bare steel members or insulated steel members





Dimensions

	Designation	L	L	d ₁	d ₂	d₃	AF
	Adapter M8-MR 25	10	25 mm	acc. to	acc. to	14	10
	Adapter M8-MF 25	46 mm	25 mm	M8	М8	14 mm	19 mm
	Adapter M8-MR 50	71 mm	50 mm	acc. to	acc. to	14	19 mm
AF	Adapter M8-MF 50		50 mm	M8	M8	14 mm	19 1111
	Adapter M8-MR 75	06	75 mm	acc. to	acc. to	14	19 mm
ย ยยย	Adapter M8-MF 75	96 mm	75 mm	M8	M8	14 mm	19 1111
L ₁	Adapter M8-MR 100	121 mm	100 mm	acc. to	acc. to	14 mm	19 mm
L	Adapter M8-MF 100	121 mm	100 mm	M8	M8	14 mm	19 mm
	Adapter M10-MR 50	71 mm	50 mm	acc. to	acc. to	14	19 mm
	Adapter M10-MF 50	/ 1 11111	50 mm	M10	M10	14 mm	19 1111
	Adapter W10-MR 50	71 mm	50 mm	acc. to	acc. to	14 mm	19 mm
	Adapter W10-MF 50	/	50 1111	W10	W10	141/111	13 1111





AF	Designation	t _{NUT}	d ₁	d ₂	AF
	Serrated flange nut M8	7.9 mm	acc. to M8	21.8 mm	13 mm
	Serrated flange nut M10	9.9 mm	acc. to M10	21.8 mm	15 mm
d2	Serrated flange nut W10	9.9 mm	acc. to W10	21.8 mm	9/16"

Performance data

Recommended interaction formula for combined loading

S-BT threaded studs with standoff adapter

V-N (shear and tension)
$$\frac{V}{V_{rec}} + \frac{N}{N_{rec}} \le 1.0$$
 with $\frac{V}{V_{rec}} \le 1.0$ and $\frac{N}{N_{rec}} \le 1.0$

X-BT threaded studs with standoff adapter

V-N (shear and tension)
$$\frac{V}{V_{rec}} + \frac{N}{N_{rec}} \le 1.2$$
 with $\frac{V}{V_{rec}} \le 1.0$ and $\frac{N}{N_{rec}} \le 1.0$

N_{rec} = Recommended resistance under tension

V_{rec} = Recommended resistance under shear load

N_{Rd} = Design resistance under tension load

V_{Rd} = Design resistance under shear load

Recommended loads

	S-	S-BT-MR / S-BT-GR with standoff adapter made of stainless steel			
Base material thickness	t _∥ ≥ 5 mr	m [0.20"]	t _{II} = 4 mm [0.16"]	t _{II} = 3 mm [0.12"]	
Base material type	Steel S235 A36	Steel S355, S420 Grade 50	Steel*) S235 A36	Steel*) S235 A36	
Tension, N _{rec} Standoff Adapter 25, 50, 75, 100 mm	1.89 kN / 425 lb	2.27 kN / 510 lb	1.79 kN / 400 lb	1.79 kN / 400 lb	
Shear, V _{rec} Standoff Adapter 25 mm	0.84 kN / 190 lb	1.00 kN / 225 lb	0.69 kN / 155 lb	0.55 kN / 125 lb	
Shear, V _{rec} Standoff Adapter 50 mm	0.45 kN / 100 lb	0.54 / kN 120 lb	0.38 kN / 85 lb	0.31 kN / 70 lb	
Shear, V _{rec} Standoff Adapter 75 mm	0.33 kN / 75 lb	0.40 kN / 90 lb	0.28 kN / 60 lb	0.24 kN / 55 lb	
Shear, V _{rec} Standoff Adapter 100 mm	0.23 kN / 50 lb	0.28 kN / 60 lb	0.19 kN / 40 lb	0.18 kN / 40 lb	

*) For steel base material of grade S355, S420, S390GD, S420GD, AH36, DH36, EH36 the values are allowed to be increased up to 20%



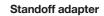


	S-	BT-MF / S-BT-GF made of duplex co	with standoff adap bated carbon steel	ter
Base material thickness	t _{ii} ≥5 mr	m [0.20"]	t _{ii} = 4 mm [0.16"]	t _{II} = 3 mm [0.12"]
Base material type	Steel S235 A36	Steel S355, S420 Grade 50	Steel*) S235 A36	Steel*) S235 A36
Tension, N _{rec} Standoff Adapter 25, 50, 75, 100 mm	1.96 kN / 440 lb	2.36 kN / 530 lb	1.89 kN / 425 lb	1.89 kN / 425 lb
Shear, V _{rec} Standoff Adapter 25 mm	0.84 kN / 190 lb	1.00 kN / 225 lb	0.69 kN / 155 lb	0.55 kN / 125 lb
Shear, V _{rec} Standoff Adapter 50 mm	0.45 kN / 100 lb	0.54 / kN 120 lb	0.38 kN / 85 lb	0.31 kN / 70 lb
Shear, V _{rec} Standoff Adapter 75 mm	0.33 kN / 75 lb	0.40 kN / 90 lb	0.28 kN / 60 lb	0.24 kN / 55 lb
Shear, V _{rec} Standoff Adapter 100 mm	0.23 kN / 50 lb	0.28 kN / 60 lb	0.19 kN / 40 lb	0.18 kN / 40 lb

 $^{*})$ For steel base material of grade S355, S420, S390GD, S420GD, AH36, DH36, EH36 the values are allowed to be increased up to 20%

	X-BT MR / X-BT GR with standoff adapter made of stainless steel or duplex coated carbon steel		
Base material thickness	t _{II} ≥ 8 r	nm [0.31"]	
Base material type	Steel S235, A36	Steel S355, S420, Grade 50	
Tension, N _{rec} Standoff Adapter 25, 50, 75, 100 mm	3.60 kN / 810 lb	4.60 kN / 1035 lb	
Shear, V _{rec} Standoff Adapter 25 mm	1.14 kN / 255 lb	1.43 kN / 320 lb	
Shear, V _{rec} Standoff Adapter 50 mm	0.62 kN / 140 lb	0.78 kN / 175 lb	
Shear, V _{rec} Standoff Adapter 75 mm	0.52 kN / 115 lb	0.65 kN / 145 lb	
Shear, V _{rec} Standoff Adapter 100 mm	0.35 kN / 80 lb	0.44 kN / 100 lb	





Design loads

	S-BT-MR / S-BT-GR with standoff adapter made of stainless steel			
Base material thickness	t _{II} ≥ 5 mm [0.20"]		t _{II} = 4 mm [0.16"]	t _{II} = 3 mm [0.12"]
Base material type	Steel S235 A36	Steel S355, S420 Grade 50	Steel*) S235 A36	Steel*) S235 A36
Tension, N _{Rd} Standoff Adapter 25, 50, 75, 100 mm	2.65 kN / 595 lb	3.18 kN / 715 lb	2.50 kN / 560 lb	2.50 kN / 560 lb
Shear, V _{Rd} Standoff Adapter 25 mm	1.17 kN / 260 lb	1.41 kN / 315 lb	0.96 kN / 215 lb	0.77 kN / 170 lb
Shear, V _{Rd} Standoff Adapter 50 mm	0.64 kN / 140 lb	0.76 kN / 170 lb	0.53 kN / 120 lb	0.43 kN / 95 lb
Shear, V _{Rd} Standoff Adapter 75 mm	0.47 kN / 105 lb	0.55 kN / 125 lb	0.39 kN / 90 lb	0.34 kN / 75 lb
Shear, V _{Rd} Standoff Adapter 100 mm	0.32 kN / 70 lb	0.39 kN / 90 lb	0.27 kN / 60 lb	0.25 kN / 55 lb

	S-BT-MF / S-BT-GF with standoff adapter made of duplex coated carbon steel			
Base material thickness	t _{II} ≥ 5 mm [0.20"]		t _{II} = 4 mm [0.16"]	t _{II} = 3 mm [0.12"]
Base material type	Steel S235 A36	Steel S355, S420 Grade 50	Steel*) S235 A36	Steel*) S235 A36
Tension, N _{Rd} Standoff Adapter 25, 50, 75, 100 mm	2.75 kN / 615 lb	3.30 kN / 740 lb	2.65 kN / 595 lb	2.65 kN / 595 lb
Shear, V _{Rd} Standoff Adapter 25 mm	1.17 kN / 260 lb	1.41 kN / 315 lb	0.96 kN / 215 lb	0.77 kN / 170 lb
Shear, V _{Rd} Standoff Adapter 50 mm	0.64 kN / 140 lb	0.76 kN / 170 lb	0.53 kN / 120 lb	0.43 kN / 95 lb
Shear, V _{Rd} Standoff Adapter 75 mm	0.47 kN / 105 lb	0.55 kN / 125 lb	0.39 kN / 90 lb	0.34 kN / 75 lb
Shear, V _{Rd} Standoff Adapter 100 mm	0.32 kN / 70 lb	0.39 kN / 90 lb	0.27 kN / 60 lb	0.25 kN / 55 lb

*) For steel base material of grade S355, S420, S390GD, S420GD, AH36, DH36, EH36 the values are allowed to be increased up to 20%





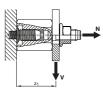
	X-BT MR / X-BT GR with standoff adapter made of stainless steel or duplex coated carbon steel		
Base material thickness	t _{ii} ≥8 mm [0.31"]		
Base material type	Steel S235, A36	Steel S355, S420, Grade 50	
Tension, N _{Rd} Standoff Adapter 25, 50, 75, 100 mm	5.00 kN / 1120 lb	6.50 kN / 1460 lb	
Shear, V _{Rd} Standoff Adapter 25 mm	1.60 kN / 360 lb	2.00 kN / 450 lb	
Shear, V _{Rd} Standoff Adapter 50 mm	0.87 kN / 195 lb	1.09 kN / 245 lb	
Shear, V _{Rd} Standoff Adapter 75 mm	0.73 kN / 165 lb	0.91 kN / 205 lb	
Shear, V _{Rd} Standoff Adapter 100 mm	0.49 kN / 110 lb	0.61 kN / 135 lb	

Conditions for recommended loads and design loads:

- The design resistance can be used for the design according the partial safety concept, e.g. EN 1993-1-1 (Eurocode 3).
- Global factor of safety Ω resp. partial factor of safety γ m (based on 5% fractile ultimate test value) Recommended loads Design loads

static pull-out	2.80	2.00
static shear	2.80	2.00

- For the shear resistance values a stand-off distance Z1 = 30 mm [1.18"], 55 mm [2.16"], 80 mm [3.15"], 105 mm [4.13"] is considered.
- Minimum edge distance = 15 mm [0.59"], spacing ≥ 18 mm [0.709"]
- Effect of base metal vibration and stress (e.g. areas with tensile stress) considered.
- Redundancy (multiple fastening) must be provided.
- Maximum displacement in direction of the shear force ≤ 2.0 mm [0.08"]





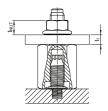
Standoff adapter

Application recommendation

Base material

All requirements for the base material (type, strength, thickness, spacing and edge distances, application limits, etc.) are given in the Product Data Sheet (PDS) of the S-BT fastener and X-BT fastener.

Thickness of fastened material t_i Adapter M8-MR and M8-MF: \leq 9 mm [0.35"] Adapter M10-MR and M10-MF: \leq 7 mm [0.27"] Adapter W10-MR and W10-MF: \leq 7 mm [0.27"]



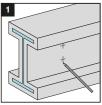
Fastener	Standoff adapter		Standoff length
		Adapter M8-MR 25	25 mm [1"]
S-BT-GR M8/7 SN 6 S-BT-MR M8/7 SN 6	Stainless steel	Adapter M8-MR 50	50 mm [2"]
X-BT GR M8/7 SN 8	Stainless steel	Adapter M8-MR 75	75 mm [3"]
,		Adapter M8-MR 100	100 mm [4"]
		Adapter M8-MF 25	25 mm [1"]
S-BT-GF M8/7 AN 6 S-BT-MF M8/7 AN 6	Carbon steel	Adapter M8-MF 50	50 mm [2"]
X-BT GR M8/7 SN 8		Adapter M8-MF 75	75 mm [3"]
		Adapter M8-MF 100	100 mm [4"]
S-BT-MR M10/15 SN 6 X-BT-MR M10/15 SN 8	Stainless steel	Adapter M10-MR 50	50 mm [2"]
S-BT-MF M10/15 AN 6 X-BT-MR M10/15 SN 8	Carbon steel	Adapter M10-MF 50	50 mm [2"]
S-BT-MR W10/15 SN 6 X-BT-MR W10/15 SN 8	Stainless steel	Adapter W10-MR 50	50 mm [2"]
S-BT-MF W10/15 AN 6 X-BT-MR W10/15 SN 8	Carbon steel	Adapter W10-MF 50	50 mm [2"]



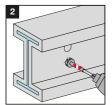


Installation recommendation

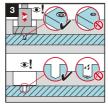
Fastening standoff adapter with S-BT or X-BT on PFP-coated steel



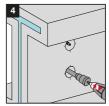
Mark location of each fastening.



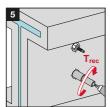
Remove PFP and pre-drill with stepped drill bit ...



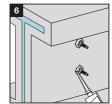
... until shoulder grinds a shiny ring. The drilled hole and the area around drilled hole must be clean and free from liquids and debris.



Set studs into drilled hole.



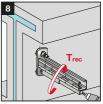
Screw-on the Hilti standoff adapter on the stud and tighten it with the recommended installation torque T_{rec} of 8 Nm.



Close the opening within 4 hours of the opening is being made in accordance to the patching instructions by the PFP-manufacturer.

_	
7	/

Position accessory on standoff adapter and hold in place. Use of MQZ bore plate as needed for strut applications.



Fasten the accessory on the standoff adapter with the recommended installation torque T_{rec} of 20 Nm.

Important notes:

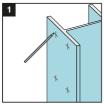
These are abbreviated instructions which may vary by application. ALWAYS review / follow the instructions for use (IFU) accompanying the product.



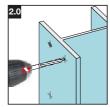


Fastening standoff adapter with S-BT or X-BT on bare steel members

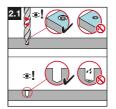
Installation instructions



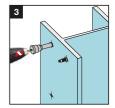
Mark location of each fastening.



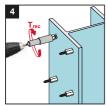
Pre-drill with stepped drill bit ...



... until shoulder grinds a shiny ring. The drilled hole and the area around drilled hole must be clean and free from liquids and debris.



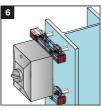
Set studs into drilled hole.



Screw-on the Hilti standoff adapter on the stud and tighten it with the recommended installation torque $T_{\rm rec}$ of 8 Nm.



Position channel on standoff adapter and hold in place. Tighten the nuts with a tightening torque T_{rec} of 20 Nm.



Fasten the accessory on the channel with the suited installation torque.

Important notes:

These are abbreviated instructions which may vary by application. ALWAYS review / follow the instructions for use (IFU) accompanying the product. In case of a drill through hole, rework of the coating on the back side of the plate / profile may be needed





Tightening torque for standoff adapter

	Fastener: X-BT-MR, S-BT-MR, S-BT-MF
Element: standoff adapter	8 Nm

Tightening tool recommendation for tightening with cordless screwdriver

Cordless	Clutch type	Gear	Clutch
screwdriver	(stop detection)		
SF 4-A22	TRC	1	8
SF 6-A22	ESC (HJ)	1	7
SF 6H-A22	ESC (HJ)	1	7
SBT 4-A22	TRC	1	7



Tool power level adjustment:





- The setting of the torque via the Hilti screwdriver with torque release coupling (TRC) can change as the clutch wears over time. The specified torque setting is only a rough guide value and applies to a new Hilti screwdriver.
 To ensure recommended torque is applied, Hilti recommends the use of a calibrated torque wrench or the Hilti torque tool.
- The specified torque setting for the Hilti screw drivers with electronic slip clutch (ESC) is only a rough guide value as the ESC has 2 stop detections; Soft Joint (SJ) detection and Hard Joint (HJ) detection. The hard joint detection is activated due to drop in speed (fast stop) and can lead to a torque spike. The installation torque may vary depending on the user and the application. To ensure recommended torque is applied, Hilti recommends the use of a calibrated torque wrench or the Hilti torque tool.

Tightening tool recommendation for tightening with Hilti torque tool

Hilti torque tool	
Torque tool X-BT 1/4" – 8 Nm	





Tightening torque for upper flange nut

	Fastener: standoff adapter
Element: Upper flange nut	20 Nm

Tightening tool recommendation for tightening with cordless screwdriver

Cordless	Clutch type	Gear	Clutch
screwdriver	(stop detection)		
SF 6-A22	ESC (HJ)	1	5
SF 6H-A22	ESC (HJ)	1	5



Tool power level adjustment: Gear:

<u> </u>	



- The setting of the torque via the Hilti screwdriver with torque release coupling (TRC) can change as the clutch wears over time. The specified torque setting is only a rough guide value and applies to a new Hilti screwdriver.
 To ensure recommended torque is applied, Hilti recommends the use of a calibrated torque wrench or the Hilti torque tool.
- The specified torque setting for the Hilti screw drivers with electronic slip clutch (ESC) is only a rough guide value as the ESC has 2 stop detections; Soft Joint (SJ) detection and Hard Joint (HJ) detection. The hard joint detection is activated due to drop in speed (fast stop) and can lead to a torque spike. The installation torque may vary depending on the user and the application. To ensure recommended torque is applied, Hilti recommends the use of a calibrated torque wrench or the Hilti torque tool.

Tightening tool recommendation for tightening with Hilti torque tool

Hilti torque tool	
Torque tool X-BT 1/4" – 20 Nm	





Fastener selection

Component	Designation	Item no.	Comment			
Standoff adapter	Adapter M8-MF 25	2268526				
Standoff adapter	Adapter M8-MF 50	2268527]			
Standoff adapter	Adapter M8-MF 75	2268528				
Standoff adapter	Adapter M8-MF 100	2268529	M8: package includes			
Standoff adapter	Adapter M8-MR 25	2268522	serrated wide flange nut			
Standoff adapter	Adapter M8-MR 50	2268523]			
Standoff adapter	Adapter M8-MR 75	2268524				
Standoff adapter	Adapter M8-MR 100	2268525	7			
Standoff adapter	Adapter M10-MF 50	2281194				
Standoff adapter	Adapter M10-MR 50	2281193	M10/W10: package			
Standoff adapter	Adapter W10-MF 50	2281192	includes adapters only			
Standoff adapter	Adapter W10-MR 50	2281191				
Threaded stud	S-BT-GF M8/7 AN 6	2140527	use with Adapter M8-MF			
Threaded stud	S-BT-GR M8/7 SN 6	2140529	use with Adapter M8-MR			
Threaded stud	S-BT-MF M10/15 AN 6	2140528	use with Adapter M10-MF			
Threaded stud	S-BT-MF W10/15 AN 6	2139173	use with Adapter W10-MF			
Threaded stud	S-BT-MR M10/15 SN 6	2140740	use with Adapter M10-MR			
Threaded stud	S-BT-MR W10/15 SN 6	2140741	use with Adapter W10-MR			
Threaded stud	X-BT-GR M8/7 SN 8	2194344	use with Adapter M8-MR or M8-MF			
Threaded stud	X-BT-MR M10/15 SN 8	2194340	use with Adapter M10-MR or M10-MF			
Threaded stud	X-BT-MR W10/15 SN 8	2194341	use with Adapter W10-MR or W10-MF			
Stepped drill bit	TS-BT 31-74 PFP	2270470	for removal of the PFP-coating from the base material			
Stepped drill bit	TX-BT 31-74 PFP	2310192	for removal of the PFP-coating from the base material			
Stepped drill bit	TS-BT 5.5-74 S	2143137	for base material steel			
Stepped drill bit	TX-BT 4.7/7-80	2197930	for base material steel			
Depth gauge	S-DG BT M8/7 Short 6	2279735	for exact setting of the S-BT M8			
Depth gauge	S-DG BT M10-W10/15 Long 6	2143261	for exact setting of the S-BT M10/W10			
Calibration card	S-CC BT 6	2143270	for calibration of the depth gauge			
Torque tool	X-BT 1/4" – 8 Nm	2119272	manual torque tool (8 Nm)			
Torque tool	X-BT 1/4" – 20 Nm	2212510	manual torque tool (20 Nm)			
Nut setter	S-NS 19 95/3 1/4"	2268521	for standoff adapter			
Nut setter	S-NS 13 C 95/3 3/4"	2149244	for serrated flange nut M8			
Nut setter	S-NS 15 C 95/3 1/4""	2149245	for serrated flange nut M10			
Nut setter	S-NS 9/16" C 95/3 3/4"	2149246	for serrated flange nut W10			





X-FCM Grating fastening system

Product data

Product description

Grating element for s	ecuring grating		Special features				
X-FCM	X-FCM-F	X-FCM-R	 standard disc protrusion above the walkway ≤ 4 mm 				
	X-FCM-F L	X-FCM-R L	 large disc protrusion above the walkway ≤ 8 mm 				
	X-FCM-F HL	X-FCM-R HL	 high load resistance high tension resistance for use in wave zones vibration resistance protrusion above the walkway ≤ 4 mm 				
	X-FCM-F NG	X-FCM-R NG	 narrow gratings protrusion above the walkway ≤ 4 mm 				
low corrosion resistance zinc plated	medium corrosion resistance duplex coated	 high corrosion resistance stainless steel 	Special material characteristics				

• Discs with locking tabs to ensure durable hold and to prevent loosening or spinning.

- Non-slip disc surface to reduce trip hazard.
- Labour-saving due to fewer installation steps compared to grating clamps or welding.
- Grating elements will be assembled on pre-installed fasteners.
- Fastener installation is described in the corresponding Product Data Sheet(s) for fasteners.

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Designation for grating element

Designation			I I				
		Technology	Product identifier	Corrosion resistance	Feature/characteristic	Minimum grating height	Maximum grating height
Product family	Grating element						
Product type	X-FCM	Х	FCM				
Product subtype	X-FCM	Х	FCM				
Product	X-FCM 28/33	Х	FCM			28	33
Product family	Grating element						
Product type	X-FCM	Х	FCM				
Product subtype	X-FCM-F	Х	FCM	F			
Product	X-FCM-F 28/33	Х	FCM	F		28	33
Product family	Grating element						
Product type	X-FCM	Х	FCM				
Product subtype	X-FCM-F L	Х	FCM	F	L		
Product	X-FCM-F L 28/33	Х	FCM	F	L	28	33
Product family	Grating element						
Product type	X-FCM	Х	FCM				
Product subtype	X-FCM-R HL	Х	FCM	R	HL		
Product	X-FCM-R HL 28/33	Х	FCM	R	HL	28	33
Product family	Grating element						
Product type	X-FCM	Х	FCM				
Product subtype	X-FCM-R NG	Х	FCM	R	NG		
Product	X-FCM-R NG 28/33	Х	FCM	R	NG	28	33





Designation for stud extension adapter

Designation							
		Technology	Product identifier	Corrosion resistance	Length	Thread holder size	
Product family	Stud Extension Adapter						
Product type	X-SEA	Х	SEA				
Product subtype	X-SEA-R	Х	SEA	R			
Product	X-SEA-R 30 M8	Х	SEA	R	30	M8	

• Information presented in this product data sheet at product family level are valid for all other levels, i.e. product type, product subtype and product. This statement applies also to lower levels.





Grating fastening system for fastening to steel and aluminum

					1					
Fa	stener	X-BT-GR M8/7 SN 8	S-BT-GR M8/7 SN 6 HL	S-BT-GF M8/7 AN 6 HL	S-BT-MF M8/15 AN 6 HL	X-ST-GR M8/10 P8	X-EM8H-15-12 P8	X-EM8H-15-12 FP10	S-BT-GR M8/7 SN 6 HL AL	
stu	tional: d extension apter			X-SEA-F 30 M8			X-SEA-R 30 M8			
Bas	se material		Steel					Aluminum		
	X-FCM									
	X-FCM-F						-	-		
÷	X-FCM-F L						-	-		
Grating element	X-FCM-F HL						-	-		
ig ele	X-FCM-F NG						-	-		
ratin	X-FCM-R			-	-	-	-	-		
G	X-FCM-R L			-	-	-	-	-		
	X-FCM-R HL			-	-	-	-	-	-	
	X-FCM-R NG			-	-	-	-	-		

recommended for combination

 \Box = suitable for combination

- = not applicable



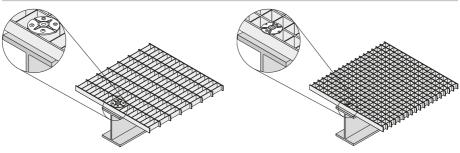


Approvals and certificates

Authority	Approval/certificate no.	Date	Designation	Application area
-		of issue		
American Bureau	22-2285526-PDA	09/2022	all X-FCM	Marine industry,
of Shipping ABS			grating	offshore industry
			elements	
Bureau Veritas	71291/A0 BV	04/2022	all X-FCM	Marine industry,
BV			grating	offshore industry
			elements	
Det Norske Veritas	TAS00001UJ Rev-3	08/2022	all X-FCM	Marine industry,
DNV			grating	offshore industry
			elements	
Lloyd's Register	LR21394055TA	10/2021	all X-FCM	Marine industry,
LR			grating	offshore industry
	LR 19-00003-02	07/2020	elements,	
			except	
			X-FCM-F L	
			and	
			X-FCM-R L	
RINA	FPE247421CS/001	07/2021	X-FCM-R,	Marine industry,
			X-FCM-R HL	offshore industry

• Information presented in this product data sheet is based on Hilti Technical Data. For the specific application please refer to the corresponding approval/certificate.

Application



Securing rectangular grating

Securing square grating





Base materials



Steel

Aluminum

Base material properties and fastener positioning in base material

Fastener	X-EM8H-15-12 P8, X-EM8H-15-12 FP10, X-ST-GR M8/10 P8
Base material	Steel
Base material tensile	360 - 630 MPa
strength R _m	
Base material thickness $t_{\!\scriptscriptstyle \parallel}$	≥ 6 mm

Fastener	X-BT-GR M8/7 SN 8
Base material	Steel
Base material tensile	≥ 360 MPa
strength R _m	
Base material thickness t_{\parallel}	≥ 8 mm
Base material coating	≤ 500 µm
thickness t _c	

Fastener	S-BT-GR M8/7 SN 6 HL, S-BT-GF M8/7 AN 6 HL,
	S-BT-MF M8/7 AN 6 HL
Base material	Steel
Base material tensile	360 – 760 MPa
strength R _m	
Base material thickness t _{II}	≥3 mm
Base material coating	≤ 800 µm
thickness t_c	
Base material steel grade	S235 Jxx – S500 Jxx acc. to EN 10025-2
	S275N - S460 N S275NL - S460 NL acc. to EN 10025-3
	S280 GD - S550 GD acc. to EN 10346
	S315MC - S550MC acc. to EN 10149-2



Fastener	S-BT-GR M8/7 SN 6 HL AL
Base material	Aluminum
Base material tensile	≥ 270 MPa
strength R _m	
Base material thickness t_{\parallel}	≥5 mm
Base material steel grade	acc. to EN 1999-1-1



- Maximum base material tensile strength R_m depending on fastener application limitation, see corresponding Product Data Sheet(s).
- Fastener positioning in base material is described in the corresponding Product Data Sheet(s) for fasteners.

Base material back side coating rework

Base material	Base material thickness	Back side coating rework	
Steel	3 ≤ t _{II} < 6 mm	Rework process based on end use requirements	
	t _∥ ≥ 6 mm	no rework	

Load conditions



Static/ quasi static

Environmental conditions



- In general, grating fastening system not to be used in wave zones due to high load impact. For applications in wave zones see X-FCM-R HL.
- For more details, please refer to following technical document(s): Hilti Corrosion Handbook.

X-FCM

 - -				
Environmental condition	rastened part	X-FCM combined with S-BT-GF M8/7 AN 6 HL,	X-FCM-F HL combined with	X-FCINI-K, X-FCINI-K L, combined with
		S-BT-MF M8/15 AN 6 HL, X-FM8H-15-12 P8	S-BT-GF M8/7 AN 6 HL, S-BT-MF M8/15 AN 6 HI	X-BT-GR M8/7 SN 8, S-RT-GR M8/7 SN 6 HI
		X-EM8H-15-12 FP10	X-ST-GR M8 10P8	S-BT-GR M8/7 SN 6 HL AL
				X-FCM-R HL combined with X-BT-GR M8/7 SN 8, S-BT-GR M8/7 SN 6 HL
			X-FCM-F NG combined with S-BT-GF M8/7 AN 6 HL S-BT-MF M8/15 AN 6 HL	X-FCM-R NG combined with S-BT-GR M8/7 SN 6 HL, S-BT-GR M8/7 SN 6 HL AL
Dry indoor	Steel (zinc-coated, painted), aluminum, stainless steel	•		-
Indoor with temporary	Steel (zinc-coated, painted), aluminum			
Condensation	Stainless steel	I	I	•
Outdoor with Iow pollution	Steel (zinc-coated, painted), aluminum		D	
	Stainless steel		I	I
	Steel (zinc-coated, painted), aluminum		1	
1-10km of pollutants	Stainless steel	I	I	•
Coastal areas	Steel (zinc-coated, painted), aluminum, stainless steel	I	1	
Outdoor, areas with heavy industrial pollution	Steel (zinc-coated, painted), aluminum, stainless steel	I	I	
Close proximity to	o Steel (zinc-coated, painted), aluminum, stainless steel	I	I	•

400

Х-ЕСМ





Notes for next page:

- = expected lifetime of fasteners 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 European Technical Assessments is 50 years for concrete anchors, 25 years for power-driven fasteners, steel and sandwich panel screws, and 10 years for flat roof insulation screws.
- □ = 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.
- ¹⁾ From a technical point of view, HDG/duplex coatings and A2/304 material are suitable for outdoor environments with certain application restrictions. This is based on long-term 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 guidelines for stainless steel grades provided in Eurocode 3 EN 1993 (final draft 2014) or in the national technical approval issued by the DIBt Z.30.3-6 (April 2014) and the ICC-ES evaluation reports for our products 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 Assessments (ETA) of fasteners, where it is stated that fasteners 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.



Х-ЕСМ

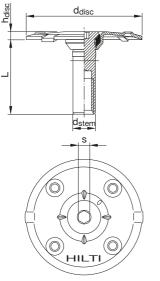


X-FCM, X-FCM-F, X-FCM-R Securing grating with standard disc

Dimensions

Technical drawings for grating element with standard disc with medium and high corrosion resistance

Technical drawing



Designation X-FCM, X-FCM-F, X-FCM-R

• Threaded stem, Disc, Absorber O-Ring.



Dimensions for grating elements with standard discs

Designation	Grating	Grating	Grating	Grating	Grating
	element	element	element	element	element
	length	stem	disc	disc	hex
		diameter	diameter	height	width
	L	d _{stem}	d _{disc}	h _{disc}	s
X-FCM 23/28	18 mm				
X-FCM 28/33	23 mm				
X-FCM 32/37	27 mm	10.3 mm	50 mm	4 mm	5 mm
X-FCM 38/43	33 mm				
X-FCM 48/53	43 mm]			

Designation		Grating	Grating	Grating	Grating	Grating
		element	element	element	element	element
		length	stem	disc	disc	hex
			diameter	diameter	height	width
		L	d _{stem}	d _{disc}	h _{disc}	s
X-FCM-F 23/28	X-FCM-R 23/28	18 mm				
X-FCM-F 28/33	X-FCM-R 28/33	23 mm				
X-FCM-F 32/37	X-FCM-R 32/37	27 mm	10.3 mm	50 mm	4 mm	5 mm
X-FCM-F 38/43	X-FCM-R 38/43	33 mm				
X-FCM-F 48/53	X-FCM-R 48/53	43 mm				

Material specification and material properties

Material specification and material properties for carbon steel parts

Designation	Element	Material	Coating	Coating thickness	Category of corrosivity of the atmosphere according to EN ISO 9223
X-FCM	Disc, threaded stem	Carbon steel	Zinc	≥ 20 µm	C1
X-FCM-F	Disc, threaded stem	Carbon steel	Duplex coated	≥ 30 µm	С3

- Duplex coated steel is comparable to HDG steel.
- Duplex coated steel is tested according to EN ISO 9227: NSS, 480 h on salt spray exposure.





Material specification and material properties for stainless steel parts

Designation	Element	Material	Coating	Steel grade	Corrosion
				according	resistance
				to	class
				EN 10088	according to
					EN 1993-1-4
	Disc,	Stainless			
X-FCM-R	threaded	steel	-	1.4404	CRC III
	stem	5000			

Material specification and material properties for plastic parts

Designation	Element	Material	Color	Other properties
X-FCM	Absorber	Poly-		Resistant to UV,
X-FCM-F		urethane	Black	water, saltwater, ozone,
X-FCM-R	O-Ring	(PUR)		oil, grease

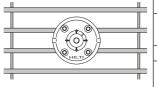
Application recommendation

Grating material and grating material properties for square grating

0 0 0		5
	Grating type	Square
	Grating material	Carbon steel, stainless
		steel, reinforced fiberglass
	Clear bar spacing wbearing bar	18 – 30 mm
	Clear cross bar spacing	18 – 30 mm
	W _{cross bar}	
	Grating height h _G	23 – 53 mm
	Grating height h _G with X-SEA	53 – 83 mm



Grating material and grating material properties for rectangular grating



Grating type	Rectangular	
Grating material	Carbon steel, stainless	
	steel, reinforced fiberglass	
Clear bar spacing w _{bearing bar}	18 – 30 mm	
Clear cross bar spacing	≥ 18 mm	
W _{cross bar}	= 10 mm	
Grating height h _G	23 – 53 mm	
Grating height h _G with X-SEA	53 – 83 mm	

Grating element recommendation

Technical drawing	Designation	Grating	Grating type	Grating
		material		height h _G
	X-FCM 23/28	Carbon		23 – 28 mm
	X-FCM 28/33		Sauara	28 – 33 mm
ے ا	X-FCM 32/37	steel, reinforced	Square,	32 – 37 mm
ے ا	X-FCM 38/43		rectangular	38 – 43 mm
	X-FCM 48/53	fiberglass		48 – 53 mm
	X-FCM-F 23/28	Carbon steel,	on , Square, prced rectangular	23 –28 mm
'/////////TFT//////////////////////////	X-FCM-F 28/33			28 – 33 mm
	X-FCM-F 32/37			32 – 37 mm
	X-FCM-F 38/43	reinforced		38 – 43 mm
	X-FCM-F 48/53	fiberglass		48 – 53 mm
	X-FCM-R 23/28	Stainless		23 – 28 mm
	X-FCM-R 28/33		Sauara	28 – 33 mm
	X-FCM-R 32/37	steel,	Square,	32 – 37 mm
	X-FCM-R 38/43	reinforced	ass 38 - 4	38 – 43 mm
	X-FCM-R 48/53	fiberglass		48 – 53 mm



Grating element recommendation for use with stud extension adapter X-SEA

Technical drawing	Designation	Grating	Grating type	Grating
		material		height h _G
	X-FCM 23/28	Carban		53 – 58 mm
	X-FCM 28/33	Carbon	Sauara	58 – 53 mm
	X-FCM 32/37	steel, reinforced	Square, rectangular	62 – 67 mm
	X-FCM 38/43	fiberglass	rectangular	68 – 73 mm
	X-FCM 48/53	libergiass		78 – 83 mm
<u>'////////////////////////////////////</u>				



• Please contact Hilti for grating element recommendation when the requirements deviate from the standard.

Performance data

Recommended tension load for grating elements

Designation	Grating type	Clear bar spacing	Tension load
		Wbearing bar	N _{rec}
		18 mm	2.4 kN
X-FCM	Square grating	30 mm	0.8 kN
X-FCIVI	Destancy dev eveting	18 mm	0.8 kN
	Rectangular grating	30 mm	0.8 kN
		18 mm	1.8 kN
X-FCM-F	Square grating	30 mm	0.8 kN
X-FCIVI-F	De staa sudau sustia s	18 mm	0.8 kN
	Rectangular grating	30 mm	0.8 kN
	O an a section of	18 mm	1.8 kN
Y FOM D	Square grating	30 mm	1.0 kN
X-FCM-R	De stan su las sustin s	18 mm	1.4 kN
	Rectangular grating	30 mm	1.0 kN



Recommended tension load for grating fastening system

	0 0	•••			
Designation	Grating	Clear bar	Base material	Base	Tension
	type	spacing	tensile	material	load
			strength	thickness	
		Wbearing bar	R _m	t _{II}	N _{rec}
X-FCM combined with	Square	18 mm		t _u ≥3 mm	2.4 kN
S-BT-GF M8/7 AN 6 HL	Square	30 mm	Steel:	ι = 3 mm	0.8 kN
S-BT-MF M8/15 AN 6 HL	Rectangular	18 mm	360 – 760 MPa	t _u ≥3 mm	0.8 kN
	Tiectarigular	30 mm			0.8 kN
X-FCM combined with	Square	18 mm	Steel: ≥ 360 MPa	t _{II} ≥ 6 mm	1.8 kN
X-EM8H-15-12 P8		30 mm			0.8 kN
	Rectangular	18 mm			0.8 kN
X-EM8H-15-12 FP10		30 mm			0.8 kN
X-FCM-F combined with	Square	18 mm		t > 3 mm	1.8 kN
S-BT-GF M8/7 AN 6 HL	Square	30 mm	Steel:	t _∥ ≥3mm	0.8 kN
S-BT-MF M8/15 AN 6 HL	Pootongular	18 mm	360 – 760 MPa	t _u ≥3 mm	0.8 kN
S-BI-IVIF IVIO/ 15 AIN 6 HL	Rectangular	30 mm		ι _∥ ≤ 3 mm	0.8 kN
X-FCM-F combined	Squara	18 mm			1.8 kN
with	Square	30 mm	Steel:	+ >6 mm	0.8 kN
	Destancy day	18 mm	≥ 360 MPa	t _∥ ≥6mm	0.8 kN
X-ST-GR M8/10 P8	Rectangular	30 mm			0.8 kN



• Maximum base material tensile strength R_m depending on fastener application limitation, see corresponding Product Data Sheet(s).



Designation	Grating	Clear bar	Base material	Base	Tension
	type	spacing	tensile	material	load
			strength	thickness	
		Wbearing bar	R _m	t _{II}	N _{rec}
X-FCM-R combined	Square	18 mm		t _u ≥3mm	1.8 kN
with	Square	30 mm	Steel:		1.0 kN
	Destangular	18 mm	360 – 760 MPa	+ > 2 mm	1.4 kN
S-BT-GR M8/7 SN 6 HL	Rectangular	30 mm		t _∥ ≥3mm	1.0 kN
X-FCM-R combined	Sauara	18 mm	Steel:		1.8 kN
with	Square	30 mm		+ > 9 mm	1.0 kN
	Destangular	18 mm	≥ 360 MPa,	t _∥ ≥ 8 mm	1.4 kN
X-BT-GR M8/7 SN 8	Rectangular	30 mm	no upper limit		1.0 kN
X-FCM-R combined	Causara	18 mm			1.8 kN
with	Square	30 mm	Aluminum:	+ > 5 mm	1.0 kN
	Destancy der	18 mm	≥ 270 MPa	t _{II} ≥ 5 mm	1.4 kN
S-BT-GR M8/7 SN 6 HL AL	Rectangular	30 mm			1.0 kN



• Data valid for use with stud extension adapter X-SEA.

Recommended shear load for grating fastening system

- Not suitable for explicit shear load design, e.g. diaphragms.
- Shear resistance by friction is depending on surface characteristics.
- Shear loads up to 0.3 kN will not result in permanent deformation.
- Small unexpected shear loads can be accommodated without damage.

Design resistance under tension and shear load for grating fastening system

Load type	Partial factor for actions	Characteristic resistance
	γ _f	
Tension load	1.4	$N_{Rd} = N_{rec} \cdot \gamma_f$
Shear load	1.4	$V_{Rd} = V_{rec} \cdot \gamma_{f}$



• Design resistance can be calculated.

Characteristic resistance under tension and shear load for grating fastening system



• For characteristic resistance under shear and tension load contact Hilti.





8 Nm

≥ 6 mm

Installation recommendation

IIISta	installation recommendation				
Reco	ommended	tightening torque for tighten	ning grating elem	ent	
Desi	gnation		Base material	Base material	Tightening
Grating element combined with fastener			thickness	torque	
				t _{II}	T _{rec}
		S-BT-GF M8/7 AN 6 HL	Steel	≥3 mm	8 Nm
X-FC	CM	S-BT-MF M8/15 AN 6 HL	Steel	2.011111	ONIT
X-EM8H-15-12 FP10		Steel	≥ 6 mm	8 Nm	
		S-BT-GF M8/7 AN 6 HL	Steel	≥ 3 mm	8 Nm
X-FC	CM-F	S-BT-MF M8/15 AN 6 HL	Steel	2.5 11111	OINIII

Designation		Base material	Base material	Tightening
Grating element combined with fastener			thickness	torque
			t _{II}	T _{rec}
	S-BT-GR M8/7 SN 6 HL	Steel	≥ 3 mm	8 Nm
X-FCM-R	X-BT-GR M8/7 SN 8	Steel	≥ 8 mm	8 Nm
	S-BT-GR M8/7 SN 6 HL AL	Aluminum	≥ 5 mm	8 Nm

Steel

• Data valid for use with stud extension adapter X-SEA.

X-ST-GR M8/10 P8

R



Tightening tool recommendation for tightening with screwdriver

Designation	Clutch type	Tightening torque	
	(stop detection)	T _{rec} = 8 Nm	
		Tool power level adj	ustment
		Gear	Clutch
SF 2-A12	TRC	1	15
SF 2H-A12	TRC	1	15
SF 4-(A)22	TRC	1	8
SF 6-(A)22	ESC (SJ)	1	7
SF 6H-(A)22	ESC (SJ)	1	7
SF 18-A	TRC	1	5
SFC 18-A	TRC	1	5
SF 22-A	TRC	1	5
SFC 22-A	TRC	1	5
SBT 4-A22	TRC	1	7
SBT 6-22	ESC (SJ)	1	7



• Data valid for use with stud extension adapter X-SEA.

• Hilti recommends using a calibrated torque wrench or the Hilti Torque tool to apply the recommended tightening torque.

- Tool power level adjustment is a guiding value which applies to new Hilti screwdriver.
- Tightening torque may vary depending on the user and the application.
- Torque release coupling (TRC): Achievable torque can change over time due to clutch wear.
- Electronic slip clutch (ESC): ESC has 2 stop detections, Soft Joint (SJ) and Hard Joint (HJ). Hard joint detection is activated due to drop in speed (fast stop) and can lead to a torque spike.

Tightening tool recommendation for tightening with Hilti torque tool

Designation	Tightening torque
	T _{rec}
X-BT 1/4" – 8 Nm	8 Nm



• Data valid for use with stud extension adapter X-SEA.



Fastener	program
autorior	program

Item no. and description for grating elements

	for graang elernente	
Designation	Item no.	Description
X-FCM 23/28	2349077, 2349147	
X-FCM 28/33	2349078, 2349148	Zinc plated grating element
X-FCM 32/37	2349149	for securing grating
X-FCM 38/43	2349120, 2349150	with standard disc
X-FCM 48/53	2349151	
X-FCM-F 23/28	2349122, 2349152	
X-FCM-F 28/33	2349123, 2349153	Duplex coated grating element
X-FCM-F 32/37	2349154	for securing grating
X-FCM-F 38/43	2349125, 2349155	with standard disc
X-FCM-F 48/53	2349126, 2349156	
X-FCM-R 23/28	2349157	
X-FCM-R 28/33	2349133, 2349158	Stainless steel grating element
X-FCM-R 32/37	2349134, 2349159	for securing grating
X-FCM-R 38/43	2349135, 2349160	with standard disc
X-FCM-R 48/53	2349136, 2349161	
X-FCM-R 38/43	2349135, 2349160	



• Item no. depending on region.

Item no. and description for fastener

		_
Designation	Item no.	Description
S-BT-GF M8/7 AN 6 HL	2345766	Screw-in carbon steel threaded stud
S-BT-MF M8/15 AN 6 HL	2345769	Screw-in carbon steel threaded stud
X-EM8H-15-12 P8	271981	Sharp-tip zinc plated carbon steel threaded stud
X-EM8H-15-12 FP10	271982	Sharp-tip zinc plated carbon steel threaded stud
X-ST-GR M8/10 P8	2122460	Sharp-tip stainless steel threaded stud
X-BT-GR M8/7 SN 8	2194344	Blunt-tip stainless steel threaded stud
S-BT-GR M8/7 SN 6 HL	2345767	Screw-in stainless steel threaded stud
S-BT-GR M8/7 SN 6 HL AL	2350548	Screw-in stainless steel threaded stud



Item no. and description for tools

Designation	Item no.	Description		
BX 3-BTG		Battery-actuated fastening tool		
DX 351-BTG		Powder-actuated fastening tool		
SF 2-A12		Screwdriver		
SF 2H-A12		Screwdriver		
SF 4-A22		Screwdriver		
SF 6-(A)22	refer to	Screwdriver		
SF 6H-(A)22	Hilti online	Screwdriver		
SF 18-A		Screwdriver		
SFC 18-A		Screwdriver		
SF 22-A		Screwdriver		
SFC 22-A		Screwdriver		
SBT 4-A22		Screwdriver		
SBT 6-22		Screwdriver		
X-BT 1/4" – 8 Nm	2119272	Hilti torque tool (8 Nm)		

Item no. and description for accessories

Designation	Item no.	Description
X-SEA-R 30 M8	432274	Stainless steel stud extension adapter
TX-BT 4.7/7-80	2197930	Stepped drill bit
TX-BT 4.7/7-110	2197931	Stepped drill bit
TS-BT 5.3-95 S	2346084	Stepped drill bit
TS-BT 5.5-74 AL	2143138	Stepped drill bit
Allen key – Size 5 mm	refer to	Adapter
	Hilti online	Adapter





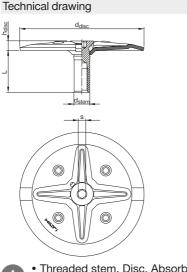




X-FCM-F L, X-FCM-R L Securing grating with large disc with medium and high corrosion resistance

Dimensions

Technical drawings for grating element



Designation

X-FCM-F L, X-FCM-R L



• Threaded stem, Disc, Absorber O-Ring.





Dimensions for grating elements with large discs

Designation		Grating	Grating	Grating	Grating	Grating
		element	element	element	element	element
		length	stem	disc	disc	hex
			diameter	diameter	height	width
		L	d _{stud}	d _{disc}	h _{disc}	s
X-FCM-F L 28/33	X-FCM-R L 28/33	23 mm				
X-FCM-F L 32/37	X-FCM-R L 32/37	27 mm	10.3 mm	00 mm	8 mm	5.0 mm
X-FCM-F L 38/43	X-FCM-R L 38/43	33 mm	10.311111	02 11111	011111	5.0 mm
X-FCM-F L 48/53	X-FCM-R L 48/53	43 mm				

Material specification

Material specification and material properties for carbon steel parts

Designation	Element	Material	Coating	Coating thickness	Category of corrosivity of the atmosphere according to EN ISO 9223
X-FCM-F L	Disc, threaded stem	Carbon steel	Duplex coated	≥ 30 µm	C3

• Duplex coated steel is comparable to HDG steel.

• Duplex coated steel is tested according to EN ISO 9227: NSS/AASS/CASS, 480 h on salt spray exposure.

Material specification and material properties for stainless steel parts

Designation	Element	Material	Coating	Steel grade	Corrosion
				according	resistance
				to	class according
				EN 10088	to EN 1993-1-4
X-FCM-R L	Disc, threaded stem	Stainless steel	-	1.4404	CRC III

Material specification and material properties for plastic parts

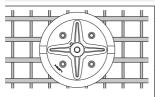
Designation	Element	Material	Color	Other properties
X-FCM-F L	Absorber	Polyure-	Black	Resistant to UV, saltwater,
X-FCM-R L	O-Ring	thane (PUR)	DIACK	ozone, oil, grease





Application recommendation for securing grating

Grating material and grating material properties for square grating



Grating type	Square grating
Grating material	Carbon steel bar grating
	Stainless steel bar grating
	Reinforced fiberglass grating
Clear bar spacing wbearing bar	30 – 60 mm
Clear cross bar spacing	30 – 60 mm
W _{cross bar}	
Grating height h _G	28 – 53 mm
Grating height h _g with X-SEA	58 – 83 mm

Grating material and grating material properties for rectangular grating

	Grating type	Rectangular grating
	Grating material	Carbon steel bar grating
		Stainless steel bar grating
		Reinforced fiberglass grating
	Clear bar spacing wbearing bar	30 – 57 mm
"	Clear cross bar spacing	≥ 30 mm
	W _{cross bar}	
	Grating height h _G	28 – 53 mm
	Grating height h_{G} with X-SEA	58 – 83 mm





Grating element recommendation

Technical drawing	Designation	Grating	Grating type	Grating
5	<u>.</u>	material	3 7 1	height h _G
	X-FCM-F L 28/33	Carbon	Causara and	28 – 33 mm
	X-FCM-F L 32/37	steel and	Square and	32 – 37 mm
e ع	X-FCM-F L 38/43	reinforced	rectangular	38 – 43 mm
	X-FCM-F L 48/53	fiberglass	grating	48 – 53 mm
	X-FCM-R L 28/33	Stainless	Causara and	28 – 33 mm
	X-FCM-R L 32/37	steel and	Square and	32 – 37 mm
·/////////////////////////////////////	X-FCM-R L 38/43	reinforced	rectangular	38 – 43 mm
	X-FCM-R L 48/53	fiberglass	grating	48 – 53 mm

Grating element recommendation for use with stud extension adapter X-SEA

Technical drawing	Designation	Grating	Grating type	Grating
		material		height h _G
	X-FCM-R L 28/33	Stainless	0	58 – 53 mm
	X-FCM-R L 32/37	steel and	Square and	62 – 67 mm
	X-FCM-R L 38/43	reinforced	rectangular	68 – 73 mm
	X-FCM-R L 48/53	fiberglass	grating	78 – 83 mm
<u>/////////////////////////////////////</u>				





Performance data						
Recommended tension load for grating elements						
Designation	Grating type	Clear bar spacing	Tension load			
		Wbearing bar	N _{rec}			
	Square grating	30 mm	1.8 kN			
X-FCM-F L	Square granny	60 mm	0.8 kN			
	Rectangular grating	30 mm	0.8 kN			
		57 mm	0.8 kN			
	Square grating	30 mm	1.8 kN			
X-FCM-R L	Square grating	60 mm	0.8 kN			
	De staar wijse westinge	30 mm	0.8 kN			
	Rectangular grating	57 mm	0.8 kN			

Recommended tension load for grating fastening system

Designation	Grating	Clear bar	Base	Base	Tension
	type	spacing	material	material	load
			tensile	thickness	
			strength		
		Wbearing bar	R _m	t _{II}	N _{rec}
X-FCM-F L	Square	30 mm		+ > 2 mm	1.8 kN
combined with	grating	60 mm	Steel:	t _∥ ≥ 3 mm	0.8 kN
S-BT-GF M8/7 AN 6 HL,	Rectangular	30 mm	360 – 760 MPa	+ > 2 mm	0.8 kN
S-BT-MF M8/15 AN 6 HL	grating	57 mm		$t_{\parallel} \ge 3 \text{ mm}$ 0.	0.8 kN
X-FCM-F L	Square	30 mm			1.8 kN
combined with	grating	60 mm	Steel:	+ >6 mm	0.8 kN
X-ST-GR M8/10 P8	Rectangular	30 mm	≥ 360 MPa	t _∥ ≥ 6 mm	0.8 kN
	grating	57 mm			0.8 kN

• Maximum base material tensile strength R_m depending on fastener application limitation, see corresponding Product Data Sheet(s).





Designation	Grating	Clear bar	Base	Base	Tension
	type	spacing	material	material	load
			tensile	thickness	
			strength		
		Wbearing bar	R _m	t _{II}	N _{rec}
X-FCM-R L	Square	30 mm		+ > 2 mm	1.8 kN
combined with	grating	60 mm	Steel:	t _∥ ≥3mm	0.8 kN
	Rectangular	30 mm	360 – 760 MPa	t ≥ 3 mm	0.8 kN
S-BT-GR M8/7 SN 6 HL	grating	57 mm		ι 2 3 ΠΠΠ	0.8 kN
X-FCM-R L	Square	30 mm	Steel:	t _u ≥ 8 mm	1.8 kN
combined with	grating	60 mm			0.8 kN
X-BT-GR M8/7 SN 8	Rectangular	30 mm	≥ 360 MPa, no upper limit		0.8 kN
	grating	57 mm	no upper innit		0.8 kN
X-FCM-R L	Square	30 mm		+ > 5 mm	1.8 kN
combined with S-BT-GR M8/7 SN 6 HL AL	grating	60 mm	Aluminum:	t _{II} ≥ 5 mm	0.8 kN
	Rectangular	30 mm	≥ 270 MPa	t _u ≥5 mm	0.8 kN
	grating	57 mm		ц <u>-</u> 5 ппп	0.8 kN

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• Data valid for use with stud extension adapter X-SEA.

Design resistance under tension and shear load for grating fastening system

Load type	Partial factor for actions Characteristic re	
	Υ _f	
Tension load	1.4	$N_{Rd} = N_{rec} \cdot \gamma_f$
Shear load	1.4	$V_{Rd} = V_{rec} \cdot \gamma_f$



F

• Design resistance can be calculated.

Characteristic resistance under tension and shear load for grating fastening system

• For characteristic resistance under shear and tension load contact Hilti.





Installation recommendation

Recommended tightening torque for tightening grating element

Designation		Base material	Base material	Tightening
Grating element combined with fastener			thickness	torque
			t _{II}	T _{rec}
S-BT-GF M8/7 AN 6 HL, X-FCM-F L S-BT-MF M8/15 AN 6 HL Stee		> 2 mm	≥ 3 mm	8 Nm
		Steel	2.5 11111	0 1111
	X-ST-GR M8/10 P8		≥ 6 mm	8 Nm

Designation		Base material	Base material	Tightening
Grating element combined with fastener			thickness	torque
			t _{II}	T _{rec}
	S-BT-GR M8/7 SN 6 HL	Steel	≥ 3 mm	8 Nm
X-FCM-R L	X-BT-GR M8/7 SN 8	Steel	≥ 8 mm	8 Nm
	S-BT-GR M8/7 SN 6 HL AL	Aluminum	≥ 5 mm	8 Nm

• Data valid for use with stud extension adapter X-SEA.

A



rightening too recommendation for tightening with sciewanver				
Designation	Clutch type	Tightening torque		
	(stop detection)	T _{rec} = 8 Nm		
		Tool power level adjus	tment	
		Gear	Clutch	
SF 2-A12	TRC	1	15	
SF 2H-A12	TRC	1	15	
SF 4-A22	TRC	1	8	
SF 6-(A)22	ESC (SJ)	1	7	
SF 6H-(A)22	ESC (SJ)	1	7	
SF 18-A	TRC	1	5	
SFC 18-A	TRC	1	5	
SF 22-A	TRC	1	5	
SFC 22-A	TRC	1	5	
SBT 4-A22	TRC	1	7	
SBT 6-22	ESC (SJ)	1	7	

Tightening tool recommendation for tightening with screwdriver



• Hilti recommends using a calibrated torque wrench or the Hilti Torque tool to apply the recommended tightening torque.

- Tool power level adjustment is a guiding value which applies to new Hilti screwdriver.
- Tightening torque may vary depending on the user and the application.
- Torque release coupling (TRC): Achievable torque can change over time due to clutch wear.
- Electronic slip clutch (ESC): ESC has 2 stop detections, Soft Joint (SJ) and Hard Joint (HJ). Hard joint detection is activated due to drop in speed (fast stop) and can lead to a torque spike.

Tightening tool recommendation for tightening with Hilti torque tool

Designation	Tightening torque
	T _{rec}
X-BT 1/4" – 8 Nm	8 Nm

• Data valid for use with stud extension adapter X-SEA.





Fastener program

Item no. and description for grating elements

1 8	0	
Designation	Item no.	Description
X-FCM-F L 28/33	2354532	
X-FCM-F L 32/37	2354533	Duplex coated grating element
X-FCM-F L 38/43	2354534	for securing grating with large disc
X-FCM-F L 48/53	2354535	
X-FCM-R L 28/33	2354514	
X-FCM-R L 32/37	2354515	Stainless steel grating element
X-FCM-R L 38/43	2354516	for securing grating with large disc
X-FCM-R L 48/53	2354517	
X-FCM-R L 38/43	2354516	

Item no. and description for fastener

Designation	Item no.	Description
S-BT-GF M8/7 AN 6 HL	2345766	Screw-in carbon steel threaded stud
S-BT-MF M8/15 AN 6 HL	2345769	Screw-in carbon steel threaded stud
X-ST-GR M8/10 P8	2122460	Sharp-tip stainless steel threaded stud
X-BT-GR M8/7 SN 8	2194344	Blunt-tip stainless steel threaded stud
S-BT-GR M8/7 SN 6 HL	2345767	Screw-in stainless steel threaded stud
S-BT-GR M8/7 SN 6 HL AL	2350548	Screw-in stainless steel threaded stud

Item no. and description for tools

Designation	Item no.	Description
BX 3-BTG		Battery-actuated fastening tool
DX 351-BTG		Powder-actuated fastening tool
SF 2-A12		Screwdriver
SF 2H-A12		Screwdriver
SF 4-A22		Screwdriver
SF 6-(A)22	refer to	Screwdriver
SF 6H-(A)22	Hilti online	Screwdriver
SF 18-A		Screwdriver
SFC 18-A		Screwdriver
SF 22-A		Screwdriver
SFC 22-A		Screwdriver
SBT 4-A22		Screwdriver
SBT 6-22		Screwdriver
X-BT 1/4" – 8 Nm	2119272	Hilti torque tool (8 Nm)



R



Item no. and description for accessories

	r	
Designation	Item no.	Description
X-SEA-R 30 M8	432274	Stainless steel stud extension adapter
TX-BT 4.7/7-80	2197930	Stepped drill bit
TX-BT 4.7/7-110	2197931	Stepped drill bit
TS-BT 5.3-95 S	2346084	Stepped drill bit
TS-BT 5.5-74 AL	2143138	Stepped drill bit
Allen key – Size 5 mm	refer to	Adaptar
	Hilti online	Adapter

• Please check delivery times for special item(s) with Hilti Customer Service.

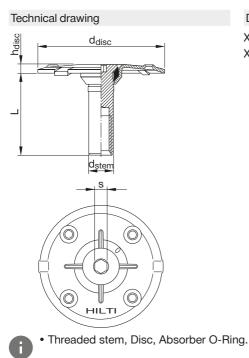




X-FCM-F HL, X-FCM-R HL Securing grating under high load with medium and high corrosion resistance

Dimensions

Technical drawings for grating element



Designation

X-FCM-F HL, X-FCM-R HL



Dimensions for grating elements for gratings under high loads

			1			
Designation		Grating	Grating	Grating	Grating	Grating
		element	element	element	element	element
		length	stem	disc	disc	hex
			diameter	diameter	height	width
		L	d _{stud}	d _{disc}	h _{disc}	s
X-FCM-F HL 23/28	X-FCM-R HL 23/28	18 mm				
X-FCM-F HL 28/33	X-FCM-R HL 28/33	23 mm				
X-FCM-F HL 32/37	X-FCM-R HL 32/37	27 mm	10.3 mm	50 mm	4 mm	5 mm
X-FCM-F HL 38/43	X-FCM-R HL 38/43	33 mm				
X-FCM-F HL 48/53	X-FCM-R HL 48/53	43 mm				

Material specification

Material specification and material properties for carbon steel parts

Designation	Element	Material	Coating	Coating	Corrosion	
				thickness	category	
					according to	
					EN ISO 9223	
X-FCM-F HL	Disc, threaded	Carbon steel	Duplex	≥ 45 um	C3	
	stem	Carbon steer	coated	≥ 45 µm	03	

• Duplex coated steel is comparable to HDG steel.

• Duplex coated steel is tested according to EN ISO 9227: NSS/AASS/CASS, 480 h on salt spray exposure

Material specification and material properties for stainless steel parts

Designation	Element	Material	Coating	Steel grade	Corrosion	
				according	resistance	
				to	class	
				EN 10088	according to	
					EN 1993-1-4	
X-FCM-R HL	Disc, threaded	Stainless		1.4404	CRC III	
	stem	steel	-	1.4404		

Material specification and material properties for plastic parts

Designation	Element	Material	Color	Other
				properties
X-FCM-F HL,	Absorber	Thermoplastic	Red	
X-FCM-R HL	O-Ring	Polyurethane (TPU)	neu	

H



R

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Application recommendation

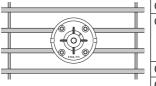
Grating material and grating material properties for square grating

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T	T	Т	1	- 11	-	- 11	—

Grating type	Square grating
Grating material	Carbon steel bar grating
	Stainless steel bar grating
	Reinforced fiberglass grating
Clear bar spacing w _{bearing bar}	18 – 44 mm
Clear cross bar spacing	18 – 44 mm
W _{cross bar}	18 - 44 11111
Grating height h _G	23 – 53 mm
Grating height h _G with	53 – 83 mm
stud extension adapter X-SEA	

• Clear bar spacing/clear cross bar spacing for X-FCM-F HL: 18 – 40 mm

Grating material and grating material properties for rectangular grating



	Grating type	Rectangular grating
_	Grating material	Carbon steel bar grating
		Stainless steel bar grating
		Reinforced fiberglass grating
	Clear bar spacing wbearing bar	18 – 44 mm
	Clear cross bar spacing	≥ 20 mm
	W _{cross bar}	- 20 mm
	Grating height h _G	23 – 53 mm
	Grating height h _G with	53 – 83 mm
	stud extension adapter X-SEA	00 - 00 11111

• Clear bar spacing for X-FCM-F HL: 18 - 40 mm



Grating element recommendation

Technical drawing	Designation	Grating	Grating type	Grating
		material		height h _G
	X-FCM-F HL 23/28	Carbon		23 – 28 mm
	X-FCM-F HL 28/33	steel and		28 – 33 mm
	X-FCM-F HL 32/37	reinforced	Square and rectangular	32 – 37 mm
P P	X-FCM-F HL 38/43	fiberglass Stainless steel and reinforced		38 – 43 mm
	X-FCM-F HL 48/53			48 – 53 mm
	X-FCM-R HL 23/28			23 – 28 mm
' <u> </u>	X-FCM-R HL 28/33		grating	28 – 33 mm
	X-FCM-R HL 32/37			32 – 37 mm
	X-FCM-R HL 38/43			38 – 43 mm
	X-FCM-R HL 48/53	fiberglass		48 – 53 mm

Grating element recommendation for use with stud extension adapter X-SEA

Technical drawing	Designation	Grating	Grating type	Grating
		material		height h _G
	X-FCM-F HL 23/28	Carbon		53 – 58 mm
	X-FCM-F HL 28/33	steel and		58 – 63 mm
	X-FCM-F HL 32/37	reinforced	Square and - rectangular grating	62 – 67 mm
	X-FCM-F HL 38/43	fiberglass		68 – 73 mm
	X-FCM-F HL 48/53			78 – 83 mm
	X-FCM-R HL 23/28	Stainless		53 – 58 mm
	X-FCM-R HL 28/33	steel and		58 – 63 mm
	X-FCM-R HL 32/37			62 – 67 mm
	X-FCM-R HL 38/43	reinforced		68 – 73 mm
<u>'////////////////////////////////////</u>	X-FCM-R HL 48/53	fiberglass		78 – 83 mm

Application areas

- X-FCM-R HL together with X-BT-GR M8/7 SN 8 or S-BT-GR M8/7 SN6 HL threaded fasteners forms a high resistance and robust fastening system to fix grating in marine C5 corrosive environment.
- High tension resistance for use in wave zones.

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Performance data

Recommended tension and shear load for grating elements

Designation	Grating type	Clear bar spacing	Tension load	Shear
				load
		Wbearing bar	N _{rec}	V _{rec}
	Square	18 ≤ w _{bearing bar} ≤ 38 mm	3.6 kN	0.6 kN
	grating	$38 < w_{bearing bar} \le 40 \text{ mm}$	1.2 kN	0.0 KN
		18 ≤ w _{bearing bar} ≤ 24 mm	2.8 kN	
X-FCM-F HL	Rectangular	24 < w _{bearing bar} ≤ 30 mm	2.1 kN	0.4 kN
	grating	30 < w _{bearing bar} ≤ 35 mm	1.4 kN	0.4 KN
		35 < w _{bearing bar} ≤ 40 mm	0.7 kN	
	Square	18 ≤ w _{bearing bar} ≤ 38 mm	3.6 kN	0.6 kN
	grating	38 < w _{bearing bar} ≤ 44 mm	1.2 kN	0.0 KN
X-FCM-R HL		18 ≤ w _{bearing bar} ≤ 24 mm	2.8 kN	
	Rectangular	24 < w _{bearing bar} ≤ 30 mm	2.1 kN	0.4 kN
	grating	30 < w _{bearing bar} ≤ 35 mm	1.4 kN	0.4 KIN
		35 < w _{bearing bar} ≤ 44 mm	0.7 kN	

Recommended tension load for grating fastening system

Designation	Grating type	Clear bar spacing	Tension load
		Wbearing bar	N _{rec}
	Square	$18 \le W_{\text{bearing bar}} \le 38 \text{ mm}$	3.6 kN
X-FCM-F-HL combined with	grating	38 < w _{bearing bar} ≤ 40 mm	1.2 kN
S-BT-GF M8/7 AN 6 HL,		18 ≤ w _{bearing bar} ≤ 24 mm	2.8 kN
, , ,	Rectangular	24 < w _{bearing bar} ≤ 30 mm	2.1 kN
S-BT-MF M8/15 AN 6 HL,	grating	30 < w _{bearing bar} ≤ 35 mm	1.4 kN
X-ST-GR M8/10 P8		35 < w _{bearing bar} ≤ 40 mm	0.7 kN
	Square	18 ≤ w _{bearing bar} ≤ 38 mm	3.6 kN
X-FCM-R-HL	grating	38 < w _{bearing bar} ≤ 44 mm	1.2 kN
combined with X-BT-GR M8/7 SN 8 or		18 ≤ w _{bearing bar} ≤ 24 mm	2.8 kN
	Rectangular	24 < w _{bearing bar} ≤ 30 mm	2.1 kN
S-BT-GR M8/7 SN 6 HL	grating	30 < w _{bearing bar} ≤ 35 mm	1.4 kN
		35 < w _{bearing bar} ≤ 44 mm	0.7 kN



• Data valid for use with stud extension adapter X-SEA.



Recommended shear load for grating fastening system				
Designation	Grating type	Clear bar spacing	Grating	Tension
			system	load
		Wbearing bar	extension	N _{rec}
X-FCM-F HL	Square	19 c w c 40 mm	-	0.6 kN
combined with	grating	18 ≤ w _{bearing bar} ≤ 40 mm	X-SEA-F	0.4 kN
S-BT-GF M8/7 AN 6 HL,	Rectangular		-	0.4 kN
S-BT-MF M8/15 AN 6 HL,	U	18 ≤ w _{bearing bar} ≤ 40 mm	X-SEA-F	0.4 kN
X-ST-GR M8/10 P8	grating			0.4 KIN
X-FCM-R HL	Square	10 <	-	0.6 kN
combined with	grating	18 ≤ w _{bearing bar} ≤ 44 mm	X-SEA-R	0.4 kN
X-BT-GR M8/7 SN 8 or	Rectangular	19 < 14 mm	-	0.4 kN
S-BT-GR M8/7 SN 6 HL	grating	18 ≤ w _{bearing bar} ≤ 44 mm	X-SEA-R	0.4 kN

Design resistance under tension and shear load for grating fastening system

Load type	Partial factor for actions	Characteristic resistance	
	γ _f		
Tension load	1.4	$N_{Rd} = N_{rec} \cdot \gamma_{f}$	
Shear load	1.4	$V_{Rd} = V_{rec} \cdot \gamma_f$	



• Design resistance can be calculated.

Characteristic resistance under tension and shear load for grating fastening system



• Characteristic tensile loads $N_{_{Rk}}$ can be conservatively calculated by multiplying the recommended load values $N_{\rm \tiny rec}$ with the factor 2.8, $N_{\rm \tiny Rk}$ = 2.8 * $N_{\rm \tiny rec}$





Installation recommendation

Recommended tightening torque for tightening grating element

Designation		Base material	Base material	Tightening
Grating element combined with fastener			thickness	torque
			t _{II}	T _{rec}
	S-BT-GF M8/7 AN 6 HL			
X-FCM-F HL	S-BT-MF M8/15 AN 6 HL	Steel	≥ 5 mm	16 Nm
	X-ST-GR M8/10 P8			
X-FCM-R HL	X-BT-GR M8/7 SN 8	Steel	≥ 8 mm	20 Nm
	S-BT-GR M8/7 SN 6 HL	SIEEI	≥ 5 mm	16 Nm



• Data valid for use with stud extension adapter X-SEA.

Tightening tool recommendation for tightening with screwdriver

Designation	Clutch type	Tightening torque			
	(stop detection)	T _{rec} = 16 Nm		T _{rec} = 20 Nm	
		Tool power le	evel adjustmer	nt	
		Gear	Clutch	Gear	Clutch
SF 6-(A)22	ESC (SJ)	1	13	1	15
SF 6H-(A)22	ESC (SJ)	1	13	1	15
SBT 6-22	ESC (SJ)	1	13	1	15



- Data valid for use with stud extension adapter X-SEA.
- Hilti recommends using a calibrated torque wrench or the Hilti Torque tool to apply the recommended tightening torque.
- Tool power level adjustment is a guiding value which applies to new Hilti screwdriver.
- Tightening torque may vary depending on the user and the application.
- Electronic slip clutch (ESC): ESC has 2 stop detections, Soft Joint (SJ) and Hard Joint (HJ). Hard joint detection is activated due to drop in speed (fast stop) and can lead to a torque spike.

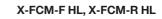
Tightening tool recommendation for tightening with Hilti torque tool

Designation	Tightening torque
	T _{rec}
X-BT 1/4" – 20 Nm	20 Nm
S-BT 1/4" – 16 Nm	16 Nm



Data valid for use with stud extension adapter X-SEA.





Fastener program

Item no. and description

Designation	Item no.	Description
X-FCM-F HL 23/28	2343288	
X-FCM-F HL 28/33	2343289	Duplay agated grating element
X-FCM-F HL 32/37	2343690	Duplex coated grating element
X-FCM-F HL 38/43	2343691	for securing grating under high load
X-FCM-F HL 48/53	2343692	
X-FCM-R HL 23/28	2349142	
X-FCM-R HL 28/33	2349143	Stainlass steel grating element
X-FCM-R HL 32/37	2349144	Stainless steel grating element
X-FCM-R HL 38/43	2349145	for securing grating under high load
X-FCM-R HL 48/53	2349146	

Item no. and description for fastener and stud extension adapter

Designation	Item no.	Description
S-BT-GF M8/7 AN 6 HL	2345766	Screw-in carbon steel threaded stud
S-BT-MF M8/15 AN 6 HL	2345769	Screw-in carbon steel threaded stud
X-ST-GR M8/10 P8	2122460	Threaded stud
X-BT-GR M8/7 SN 8	2194344	Threaded stud for highly corrosive environment
S-BT-GR M8/7 SN 6 HL	2350548	Screw-in stainless steel threaded stud

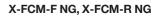
Item no. and description for tools

Designation	Item no.	Description
BX 3-BTG	refer to Hilti online	Battery-actuated fastening tool
DX 351-BTG		Powder-actuated fastening tool
SF 6-(A)22		Screwdriver
SF 6H-(A)22		Screwdriver
SBT 6-22		Screwdriver
X-BT 1/4" – 20 Nm	2212510	Hilti torque tool (20 Nm)
S-BT 1/4" – 16 Nm	2346085	Hilti torque tool (16 Nm)

Item no. and description for accessories

Designation	Item no.	Description
X-SEA-R 30 M8	432274	Stainless steel stud extension adapter
TX-BT 4.7/7-80	2197930	Stepped drill bit
TX-BT 4.7/7-110	2197931	Stepped drill bit
TS-BT 5.3-95 S	2346084	Stepped drill bit
Allen key – Size 5mm	refer to	Adaptor
	Hilti online	Adapter

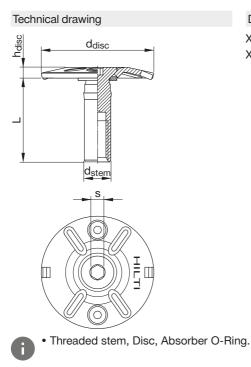




X-FCM-F NG, X-FCM-R NG Securing narrow grating with medium and high corrosion resistance

Dimensions

Technical drawings for grating element



Designation

X-FCM-F NG, X-FCM-R NG



Dimensions for grating elements for narrow gratings

Designation		Grating	Grating	Grating	Grating	Grating
		element	element	element	element	element
		length	stem	disc	disc	hex
			diameter	diameter	height	width
		L	d _{stud}	d _{disc}	h _{disc}	s
X-FCM-F NG 23/28	X-FCM-R NG 23/28	18 mm				
X-FCM-F NG 28/33	X-FCM-R NG 28/33	23 mm				
X-FCM-F NG 32/37	X-FCM-R NG 32/37	27 mm	10.3 mm	44 mm	4 mm	5 mm
X-FCM-F NG 38/43	X-FCM-R NG 38/43	33 mm				
X-FCM-F NG 48/53	X-FCM-R NG 48/53	43 mm				

Material specification

Material specification and material properties for carbon steel parts

Designation	Element	Material	Coating	Coating	Category of	
				thickness	corrosivity of	
					the atmosphere	
					according to	
					EN ISO 9223	
	Disc, threaded	Carbon steel	Duplex	≥ 45 um	C3	
X-FCM-F NG	stem	Carbon Sleer	coated	- 45 μm	03	

• Duplex coated steel is comparable to HDG steel.

• Duplex coated steel is tested according to EN ISO 9227: NSS/AASS/CASS, 480 h on salt spray exposure.

Material specification and material properties for stainless steel parts

Designation	Element	Material	Coating	Steel grade	Corrosion	
				according	resistance	
				to	class according	
				EN 10088	to EN 1993-1-4	
	Disc,	Stainless		1.4404	CRC III	
X-FCM-R NG	threaded stem	steel	-	1.4404		

Material specification and material properties for plastic parts

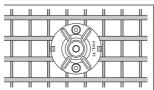
Designation	Element	Material	Color	Other properties
X-FCM-F NG	Absorber	Polyure-	Block	
X-FCM-R NG	O-Ring	thane (PUR)	Black	

434



Application recommendation

Grating material and grating material properties for square grating



Grating type	Square grating
Grating material	Carbon steel bar grating
	Stainless steel bar grating
	Reinforced fiberglass grating
Clear bar spacing wbearing bar	13 – 22 mm
Clear cross bar spacing W _{cross bar}	13 – 22 mm
Grating height h _G	23 – 53 mm
Grating height h _G with	53 – 83 mm
stud extension adapter X-SEA	

Grating material and grating material properties for rectangular grating

	Grating type	Rectangular grating
	Grating material	Carbon steel bar grating
		Stainless steel bar grating
		Reinforced fiberglass grating
	Clear bar spacing wbearing bar	13 – 22 mm
"	Clear cross bar spacing	≥ 13 mm
	W _{cross bar}	
	Grating height h _G	23 – 53 mm
	Grating height h _G with	53 – 83 mm
	stud extension adapter X-SEA	



Grating element recommendation

Technical drawing	Designation	Grating	Grating type	Grating
		material		height h _G
	X-FCM-F NG 23/28	Carbon		23 – 28 mm
	X-FCM-F NG 28/33	steel and	Square and	28 – 33 mm
<u> </u>	X-FCM-F NG 32/37	reinforced	rectangular	32 – 37 mm
ے ا	X-FCM-F NG 38/43	fiberglass	grating	38 – 43 mm
	X-FCM-F NG 48/53			48 – 53 mm
	X-FCM-R NG 23/28	Stainless		23 – 28 mm
·/////////////////////////////////////	X-FCM-R NG 28/33	steel and	Square and	28 – 33 mm
	X-FCM-R NG 32/37		rectangular	32 – 37 mm
	X-FCM-R NG 38/43	reinforced	grating	38 – 43 mm
	X-FCM-R NG 48/53	fiberglass		48 – 53 mm

Grating element recommendation for use with stud extension adapter X-SEA

Technical drawing	Designation	Grating	Grating type	Grating
		material		height h _G
	X-FCM-F NG 23/28	Carbon		53 – 58 mm
	X-FCM-F NG 28/33	steel and	Square and	58 – 63 mm
	X-FCM-F NG 32/37	reinforced	rectangular	62 – 67 mm
(5	X-FCM-F NG 38/43		grating	68 – 73 mm
<u>م</u>	X-FCM-F NG 48/53	fiberglass		78 – 83 mm
	X-FCM-R NG 23/28	Stainless		53 – 58 mm
	X-FCM-R NG 28/33	steel and	Square and	58 – 63 mm
	X-FCM-R NG 32/37	reinforced	rectangular	62 – 67 mm
	X-FCM-R NG 38/43		grating	68 – 73 mm
	X-FCM-R NG 48/53	fiberglass		78 – 83 mm

• Please contact Hilti for grating element recommendation when the requirements deviate from the standard.

F





Performance data

Recommended tension load for grating fastening system

		1			
Designation	Grating type	Clear bar	Base material	Base material	Tension
		spacing	steel grade	thickness	load
		Wbearing bar		t _{II}	N _{rec}
		13 mm			2.3 kN
X-FCM-F NG		18 mm		3 ≤ t _{II} < 5 mm	2.3 kN
combined with	Square	22 mm	Steel:		1.7 kN
S-BT-GF M8/7 AN 6 HL,	grating	13 mm			4.0 kN
S-BT-MF M8/15 AN 6 HL		18 mm	360 – 760 MPa	t _{II} ≥5mm	2.5 kN
		22 mm			1.7 kN
		13 mm			2.3 kN
X-FCM-F NG		18 mm		3 ≤ t _{II} < 5 mm	2.1 kN
combined with	Rectangular	22 mm	Steel:		1.2 kN
S-BT-GF M8/7 AN 6 HL,	grating	13 mm	360 - 760 MPa		4.0 kN
S-BT-MF M8/15 AN 6 HL		18 mm		t _{II} ≥5mm	2.1 kN
		22 mm			1.2 kN





Designation	Grating type	Clear bar	Base	Base	Tension
		spacing	material	material	load
		Wbearing bar	steel grade	thickness t _{II}	N _{rec}
		13 mm			2.3 kN
		18 mm		3 ≤ t _{II} ≤ 5 mm	2.3 kN
		22 mm	Steel:		2.3 kN
X-FCM-R NG	Square	13 mm	360-760 MPa		3.6 kN
combined with		18 mm		t _{II} ≥5mm	3.6 kN
S-BT-GR M8/7 SN 6 HL	grating	22 mm			2.7 kN
		13 mm	Aluminium: ≥270 MPa	t _{II} ≥5mm	2.1 kN
		18 mm			2.1 kN
		22 mm	2270 MFa		2.1 kN
		13 mm		$3 \le t_{ } \le 5 \text{ mm}$	2.3 kN
		18 mm			2.3 kN
		22 mm	Steel:		2.1 kN
X-FCM-R NG	Rectangular	13 mm	360-760 MPa		3.6 kN
combined with	-	18 mm		t _{II} ≥5mm	3.6 kN
S-BT-GR M8/7 SN 6 HL	grating	22 mm			2.1 kN
		13 mm	Aluminium:		2.1 kN
		18 mm	≥ 270 MPa	t _µ ≥5 mm	2.1 kN
		22 mm	= 210 MPa		2.1 kN

Data valid for use with stud extension adapter X-SEA.

Recommended shear load for grating fastening system

- Not suitable for explicit shear load design, e.g. diaphragms.
- Shear resistance by friction is depending on surface characteristics.
- Shear loads up to 0.3 kN will not result in permanent deformation.
- Small unexpected shear loads can be accommodated without damage.

Design resistance under tension and shear load for grating fastening system

Load type	Partial factor for actions	Characteristic resistance
	Υ _f	
Tension load	1.4	$N_{Rd} = N_{rec} \cdot \gamma_{f}$
Shear load	1.4	$V_{Rd} = V_{rec} \cdot \gamma_f$

Design resistance can be calculated.

Characteristic resistance under tension and shear load for grating fastening system

• For characteristic resistance under shear and tension load contact Hilti.





Installation recommendation

Recommended tightening torque for tightening grating element

Designation		Base material	Base material	Tightening
Grating elemen	t combined with fastener		thickness	torque
			t _{II}	T _{rec}
X-FCM-F NG	S-BT-GF M8/7 AN 6 HL,	Steel	t _u ≥3 mm	5 Nm
X-FGM-FING	S-BT-MF M8/15 AN 6 HL	Sleer	ι _{ll} = 3 mm	5 1111

Designation		Base material	Base material	Tightening
Grating elemen	t combined with fastener		thickness	torque
			t _{II}	T _{rec}
X-FCM-R NG	S-BT-GR M8/7 SN 6 HL	Steel	t _{II} ≥3mm	8 Nm
	S-BT-GR M8/7 SN 6 HL AL	Aluminium	t _{II} ≥5mm	8 Nm

• Data valid for use with stud extension adapter X-SEA.

Tightening tool recommendation for tightening with screwdriver

Designation	Clutch type	Tightening torque				
	(stop detection)	T _{rec} = 5 Nm		T _{rec} = 8 N	T _{rec} = 8 Nm	
		Tool power level adjustment				
		Gear	Clutch	Gear	Clutch	
SF 2-A12	TRC	1	15	n.a.	n.a.	
SF 2H-A12	TRC	1	15	n.a.	n.a.	
SF 4-A22	TRC	1	4	1	8	
SF 6-(A)22	ESC (SJ)	1	5	1	7	
SF 6H-(A)22	ESC (SJ)	1	5	1	7	
SFC 22-A	TRC	1	4	1	5	
SBT 4-A22	TRC	1	5	1	7	
SBT 6-22	ESC (SJ)	1	5	1	7	



• Hilti recommends using a calibrated torque wrench or the Hilti Torque tool to apply the recommended tightening torque.

- Tool power level adjustment is a guiding value which applies to new Hilti screwdriver.
- Tightening torque may vary depending on the user and the application.
- Torque release coupling (TRC): Achievable torque can change over time due to clutch wear.
- Electronic slip clutch (ESC): ESC has 2 stop detections, Soft Joint (SJ) and Hard Joint (HJ). Hard joint detection is activated due to drop in speed (fast stop) and can lead to a torque spike.



Tightening tool recommendation for tightening with Hilti torque tool

Designation	Tightening torque
	T _{rec}
S-BT 1/4" – 5 Nm	5 Nm
X-BT 1/4" – 8 Nm	8 Nm



• Data valid for use with stud extension adapter X-SEA.

Fastener program

Item no. and description

Designation	Item no.	Description
X-FCM-F NG 23/28	2351686	
X-FCM-F NG 28/33	2279753	Duploy apotod grating element
X-FCM-F NG 32/37	2279754	Duplex coated grating element
X-FCM-F NG 38/43	2279755	for securing grating with standard disc
X-FCM-F NG 48/53	2279756	
X-FCM-R NG 23/28	2351685	
X-FCM-R NG 28/33	2279757	Stainless steel grating element
X-FCM-R NG 32/37	2279758	
X-FCM-R NG 38/43	2279759	for securing grating with standard disc
X-FCM-R NG 48/53	2279752	

Item no. and description for fastener and stud extension adapter

Designation	Item no.	Description
S-BT-GF M8/7 AN 6 HL	2345766	Screw-in carbon steel threaded stud
S-BT-GR M8/7 SN 6 HL	2345767	Screw-in stainless steel threaded stud
S-BT-MF M8/15 AN 6 HL	2345769	Screw-in carbon steel threaded stud
S-BT-GR M8/7 SN 6 HL AL	2350548	Screw-in stainless steel threaded stud



Item no. and description for tools

Designation	Item no.	Description
SF 2-A12		Screwdriver
SF 2H-A12		Screwdriver
SF 4-A22		Screwdriver
SF 6-(A)22	refer to	Screwdriver
SF 6H-(A)22	Hilti online	Screwdriver
SFC 22-A		Screwdriver
SBT 4-A22		Screwdriver
SBT 6-22		Screwdriver
S-BT 1/4" – 5 Nm	2143271	Hilti torque tool (5 Nm)
X-BT 1/4" – 8 Nm	2119272	Hilti torque tool (8 Nm)

Item no. and description for accessories

Designation	Item no.	Description
X-SEA-R 30 M8	432274	Stainless steel stud extension adapter
TS-BT 5.3-95 S	2346084	Stepped drill bit
Allen key – Size 5 mm	refer to	Adapter
	Hilti online	Adapter



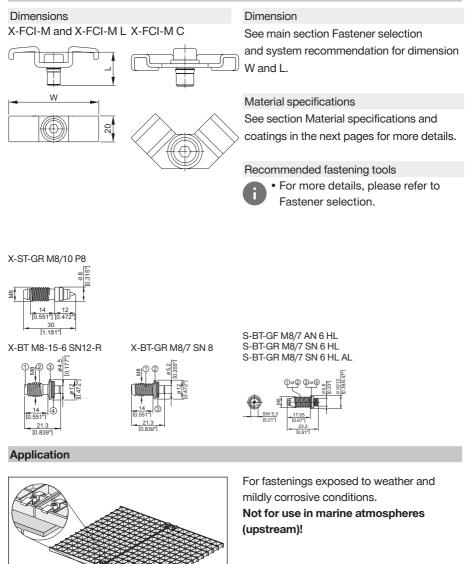
• Please check delivery times for special item(s) with Hilti Customer Service.





X-FCI-M Grating fastening system

Product data





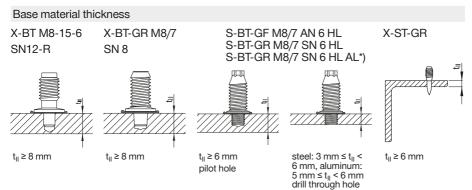


Performance data

Recommended resistance under tension load $N_{rec} = 0.8 \text{ kN} (180 \text{ lb})$

- Tensile loading is limited by plastic deformation of the saddle clip
 - X-FCI-M resists shear by friction and is not suitable for explicit shear load design

Application recommendation



*) for use in aluminum base material

Fastened material thickness

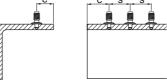
Grating height: X-FCI-M:

HG = 28-52 mm (1.10"-2.05"), other dimensions for X-FCI-M are available on demand.

See Fastener selection for detailed dimensions

Fastener positioning in base material

<u>X-ST-GR</u>			<u>X</u> -	X-BT, X-BT-GR, S-BT HL		
Edge distances:	c ≥ 15 mm		Ed	dge distance:	c≥ 6mm	
Spacing:	s ≥ 15 mm		S	pacing:	s ≥ 15 mm	
		<u>C</u>	C S	S		



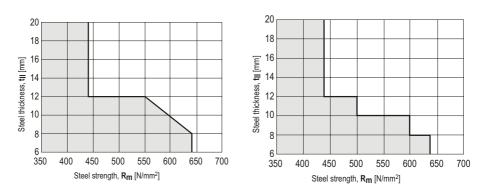




Application limits

Fastener: X-ST-GR

Tool type: DX 460, DX 5, DX 6



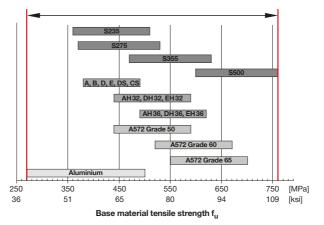
Tool type: DX 76 PTR

Fastener: X-BT and X-BT-GR

No application limits	\rightarrow using in high strength steel (f _u up to 1000 MPa)
No through penetration	→ t _{II} ≥ 8 mm [⁵ / ¹⁶ "]

Fastener: S-BT HL

The base material is limited to steel grade with a maximum tensile strength $f_u = 760$ MPa (110 ksi). The minimum tensile strength of steel is $f_u \ge 360$ MPa (52 ksi). The minimum tensile strength of aluminum is $f_u \ge 270$ MPa (39 ksi). Minimum thickness of base material t_{II} : refer to section "Thickness of base material" Maximum thickness of base material t_{II} : no limits



03/2023





Corrosion information

• For more details, please refer to following technical document: Hilti Corrosion Handbook.

X-FCI-M is used to weather and mildly corrosive conditions, not suitable for coastal and offshore applications.

X-BT, X-BT-GR and S-BT-GR HL stainless steel fasteners is suitable for coastal and offshore environment. However, they can only be used for weather and mildly corrosive conditions once combining with X-FCI-M.

The coating of the carbon steel S-BT HL fasteners consists of an electroplated Zn-alloy for cathodic proctection and a top coat for chemical resistance (Duplex-coating). The use of this coating is limited to the corrosion category C1, C2 and C3 accoring the standard EN ISO 9223. For higher corrosion categories stainless steel fasteners should be used. In case of a drill through hole, rework of the coating on the back side of the plate/profile may be needed.

The intended use of the X-ST-GR fasteners comprises fastenings exposed to outdoor environments in mildly corrosive conditions where HDG coated parts are commonly specified or used. Not for use in atmospheres with chlorides (marine atmospheres) or in heavily polluted environments (e.g. sulphur dioxide).





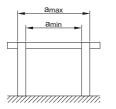
System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

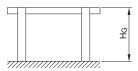
Fastener selection

Fastener	Item no.			Grating width	Grating height
		W	L	а	Н _G
		mm (inch)	mm (inch)	mm (inch)	mm (inch)
X-FCI-M 28/32	2223485	40 (1.58")	22.5 (0.89")	23-38 (0.91"-1.50")	28-32 (1.10"-1.26")
X-FCI-M 33/37	2223486	40 (1.58")	27.5 (1.08")	23-38 (0.91"-1.50")	33-37 (1.30"-1.46")
X-FCI-M 38/42	2223487	40 (1.58")	32.5 (1.30")	23-38 (0.91"-1.50")	38-42 (1.50"-1.65")
X-FCI-M 43/47	2223488	40 (1.58")	37.5 (1.48")	23-38 (0.91"-1.50")	43-47 (1.69"-1.85")
X-FCI-M 48/52	2223489	40 (1.58")	42.5 (1.67")	23-38 (0.91"-1.50")	48-52 (1.89"-2.05")
X-FCI-M 28/32 L	2223661	67 (2.64")	21 (0.83")	35-65 (1.38"-2.56")	28-32 (1.10"-1.26")
X-FCI-M 33/37 L	2223662	67 (2.64")	26 (1.02")	35-65 (1.38"-2.56")	33-37 (1.30"-1.46")
X-FCI-M 38/42 L	2223663	67 (2.64")	31 (1.22")	35-65 (1.38"-2.56")	38-42 (1.50"-1.65")
X-FCI-M 43/47 L	2223664	67 (2.64")	36 (1.42")	35-65 (1.38"-2.56")	43-47 (1.69"-1.85")
X-FCI-M 48/52 L	2223665	67 (2.64")	41 (1.61")	35-65 (1.38"-2.56")	48-52 (1.89"-2.05")
X-FCI-M 28/32 C	2223667	32 (1.26")	21 (0.83")	30 + (1.18" +)	28-32 (1.10"-1.26")
X-FCI-M 33/37 C	2223668	32 (1.26")	26 (1.02")	30 + (1.18" +)	33-37 (1.30"-1.46")
X-FCI-M 38/42 C	2223669	32 (1.26")	31 (1.22")	30 + (1.18" +)	38-42 (1.50"-1.65")
X-FCI-M 43/47 C	2223670	32 (1.26")	36 (1.42")	30 + (1.18" +)	43-47 (1.69"-1.85")
X-FCI-M 48/52 C	2223671	32 (1.26")	41 (1.61")	30 + (1.18" +)	48-52 (1.89"-2.05")

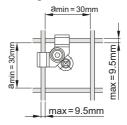
Grating width of X-FCI-M _/_ (L)



Grating height



Grating width of X-FCI-M _/_ C







Threaded studs

Designation	Item no.
X-ST-GR M8/10 P8	2122460
X-BT M8-15-6 SN12-R	377074
X-BT-GR M8/7 SN 8	2194344
S-BT-GF M8/7 AN 6 HL	2345766
S-BT-GR M8/7 SN 6 HL	2345767
S-BT-GR M8/7 SN 6 HL AL	2350548

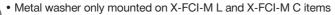
Cartridge selection and tool energy setting



• Fastener setting information (e.g. cartridge recommendation, tool power level adjustment, base material properties and fastend material properties) and installation information (e.g. quality assurance) are part of the corresponding product data sheet for fastener.

Material specifications and coatings

Fastener X-FCI-M	Saddle	Threaded stem	Washer
Material designation	DC0136	11SMNPB30+C	Stainless Steel 316
Coating	Duplex	Duplex	-



• Duplex: comparable to 45 µm HDG steel (480 h Salt spray test per DIN 50021)

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Threaded studs

	X-BT M8-15-6 SN12-R			X-ST-GR	
	Shank ①		Sealing ring of sealing washer 1)④	Shank	Threaded sleeve
Material	Stainless steel	X2CrNiMo17132	Elastomer,	P558	(A4 / AISI316)
designation	1.4462, CR 500	X5CrNiMo17122+2H	black	(CrMnMo	
	(A4 / AISI316)	(A4 / AISI316)		alloy)	
Coating	none	none		none	none

1) resistant to: UV, saltwater ozone, oil, grease

²) Zinc applied by electroplating. Intended for corrosion protection during shipment, storage, construction and service in protected environment. It is not adequate for protection against corrosion in outside or otherwise corrosive applications

Threaded studs

	S-BTR HL, Threaded Shank ①	K-BT-GR SN 12-R washer ®	Sealing ring of sealing washer1)③		AN 10-F washer ④	Sealing ring of sealing washer 1)@
Material	Stainless steel	Stainless steel	Elastomer,	Carbon steel	Aluminum	Elastomer,
designation	1.4462	1.4404	black	1038		black
	(A4 / AISI316)	(A4 / AISI316)				
Coating	Zinc ³)	none	none	Duplex-coating	none	HDG

¹) resistant to: UV, salt water, ozone, oil, grease

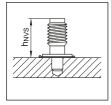
³) The surface of the S-BT HL stainless steel fasteners is zinc plated (anti-friction coating) in order to reduce the thread forming torque when the stud is screwed in into the base material.

3) only S-BT HL is coated, X-BT-GR is uncoated

Quality assurance

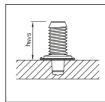
Fastening inspection

X-BT M8-15-6 SN12-R



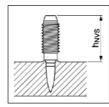
h_{NVS} = 15.7 – 16.8 mm

X-BT-GR M8/7 SN 8

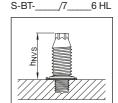


 $h_{NVS} = 15.7 - 16.8 \text{ mm}$

X-ST-GR M8/10 P8



h_{NVS} = 17.0-20.0 mm



h_{NVS} = 18.6-19.1mm





Installation recommendation

Tightening torque for X-FCI-M, X-FCI-M-L

	Fastener: X-ST-GR, X-BT-GR, S-BT-GF HL,
	S-BT-GR HL
Element: X-FCI-M, X-FCI-M-L	4–5 Nm

Tightening tool recommendation for tightening with cordless screwdriver

Cordless	Clutch type	Gear	Clutch
screwdriver	(stop detection)		
SF 2-A12	TRC	1	15
SF 2H-A12	TRC	1	15
SF 4-A22	TRC	1	4
SF 6-A22	ESC (SJ)	1	5
SF 6H-A22	ESC (SJ)	1	5
SF 8M-A22	TRC	3	5
SF 10W-A22	TRC	4	4-5
SBT 6-22	ESC (SJ)	1	5



Tool power level adjustment: Gear:





- The setting of the torque via the Hilti screwdriver with torque release coupling (TRC) can change as the clutch wears over time. The specified torque setting is only a rough guide value and applies to a new Hilti screwdriver. To ensure recommended torque is applied, Hilti recommends the use of a calibrated torque wrench or the Hilti torque tool.
- The specified torque setting for the Hilti screw drivers with electronic slip clutch (ESC) is only a rough guide value as the ESC has 2 stop detections; Soft Joint (SJ) detection and Hard Joint (HJ) detection. The hard joint detection is activated due to drop in speed (fast stop) and can lead to a torque spike. The installation torque may vary depending on the user and the application. To ensure recommended torque is applied, Hilti recommends the use of a calibrated torque wrench or the Hilti torque tool.

Tightening tool recommendation for tightening with Hilti torque tool

Hilti torque tool	
Torque tool S-BT 1/4" – 5 Nm	





Tightening torque for X-FCI-M C

	Fastener: X-ST-GR, X-BT-GR, S-BT-GF HL,
	S-BT-GR HL
Element: X-FCI-M C	6–8 Nm

Tightening tool recommendation for tightening with cordless screwdriver

Cordless	Clutch type	Gear	Clutch
screwdriver	(stop detection)		
SF 4-A22	TRC	1	8
SF 6-A22	ESC (SJ)	1	7
SF 6H-A22	ESC (SJ)	1	7
SF 8M-A22	TRC	3	7
SF 10W-A22	TRC	4	6
SBT 6-22	ESC (SJ)	1	7



Tool power level adjustment: Gear:

	ħ
L	
-	



- The setting of the torque via the Hilti screwdriver with torque release coupling (TRC) can change as the clutch wears over time. The specified torque setting is only a rough guide value and applies to a new Hilti screwdriver.
 To ensure recommended torque is applied, Hilti recommends the use of a calibrated torque wrench or the Hilti torque tool.
- The specified torque setting for the Hilti screw drivers with electronic slip clutch (ESC) is only a rough guide value as the ESC has 2 stop detections; Soft Joint (SJ) detection and Hard Joint (HJ) detection. The hard joint detection is activated due to drop in speed (fast stop) and can lead to a torque spike. The installation torque may vary depending on the user and the application. To ensure recommended torque is applied, Hilti recommends the use of a calibrated torque wrench or the Hilti torque tool.

Tightening tool recommendation for tightening with Hilti torque tool

Hilti torque tool	
Torque tool X-BT 1/4" – 8 Nm	







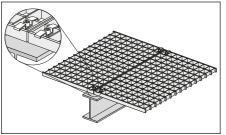


X-GR Grating fastening system

Product data

Dimensions Material specifications X-GR an X-GR-L X-R 20-4.0 Zn P8 Screw: Carbon steel 2 8 Zinc coating: Duplex* coated Nail: Stainless steel: CrMnMo Alloy and zinc Ø8 315" 20 [0.787"] coated 22.2 [0.874"] Upper part: Carbon steel: DD11 or DC01 Zinc coating: Duplex* coated Bottom part: Carbon steel: S315MC or DC04 Zinc coating: Duplex* coated *) 480 h salt spray test per DIN 50021 and 10 cycles Kesternich test per DIN 50018/2.0 (comparable to X-GR C 45 µm HDG steel) Recommended fastening tools DX 6 GR, DX 5 GR and DX 460 GR · See system recommendation in the next pages. See Fastener selection for detailed dimensions

Application



Fastening of grating

- · For fastenings exposed to weather and mildly corrosive conditions.
- Not for use in marine atmospheres (upstream)!





Performance data

Recommended resistance under tension load $N_{rec} = 0.8 \text{ kN} (180 \text{ lb})$

- Tensile loading is limited by plastic deformation of the saddle clip.
- X-GR resists shear by friction and is not suitable for explicit shear load designs.
- For X-GR C: In case of dynamic load N_{rec} = 0.6 kN (135 lb).

Application recommendation

Base material thickness

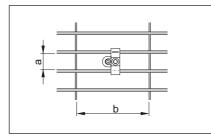
 $t_{||} \ge 4 \text{ mm} (0.157^{\circ})$

Fastened material thickness

Grating $H_G = 23-52 \text{ mm} (0.91''-2.05'')$

height: Standard X-GR (X-GR 25/30, X-GR 1 ¹/₄", X-GR 35/40):
See Fastener selection for detailed dimensions
Specials X-GR (X-GR 33/37, X-GR 43/47, X-GR 48/52, X-GR _/_ L and X-GR _/_ C):
Other dimensions special X-GR are available on demand

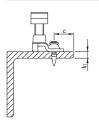
Grating opening types



a : see Fastener selection b \geq 30 mm (1.18")

Fastener positioning in base material

Edge distance: $c \ge 15 \text{ mm} (0.59'')$

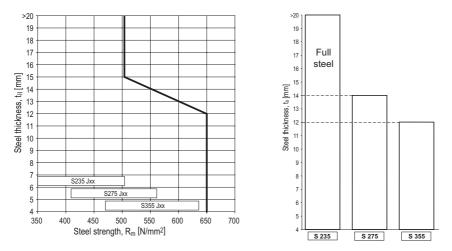






Application limits

Fastener: X-GR Tool type: DX 460, DX 5, DX 6



- S235: No application limit
- S275: Full coverage of grade up to 14mm base material thickness
- S355: Full coverage of grade up to 12mm base material thickness

Corrosion information

- For fastenings exposed to weather and mildly corrosive conditions.
- Not for use in marine atmospheres (upstream) or in heavily polluted environments.
- For more details, please refer to following technical document: Hilti Corrosion Handbook.



F



System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

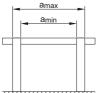
Fastener selection

Fastener	Item no.			Grating width	Grating height
		w	L	a	H _G
		mm (inch)	mm (inch)	mm (inch)	mm (inch)
X-GR 25/30	2106415 or	40 (1.58")	32 (1.26")	23-38 (0.91"-1.50")	25-30 (0.98"-1.18")
	2154241				
X-GR 1 ¹ / ₄ "	2106416 or	40 (1.58")	34 (1.34")	23-38 (0.91"-1.50")	27-32 (1.06"-1.26")
	2154243				
X-GR 35/40	2106417 or	40 (1.58")	42 (1.65")	23-38 (0.91"-1.50")	35-40 (1.38"-1.57")
	2154242				
X-GR 33/37	2222597	40 (1.58")	32 (1.26")	23-38 (0.91"-1.50")	33-37 (1.30"-1.46")
X-GR 43/47	2222598	40 (1.58")	42 (1.65")	23-38 (0.91"-1.50")	43-47 (1.69"-1.85")
X-GR 48/52	2222599	40 (1.58")	47 (1.85")	23-38 (0.91"-1.50")	48-52 (1.89"-2.05")
X-GR 23/27 L	2222640	65 (2.56")	32 (1.26")	35-65 (1.38"-2.56")	23-27 (0.91"-1.06")
X-GR 28/32 L	2222641	65 (2.56")	37 (1.46")	35-65 (1.38"-2.56")	28-32 (1.10"-1.26")
X-GR 33/37 L	2222642	65 (2.56")	42 (1.65")	35-65 (1.38"-2.56")	33-37 (1.30"-1.46")
X-GR 38/42 L	2222643	65 (2.56")	47 (1.85")	35-65 (1.38"-2.56")	38-42 (1.50"-1.65")
X-GR 43/47 L	2222644	65 (2.56")	52 (2.05")	35-65 (1.38"-2.56")	43-47 (1.69"-1.85")
X-GR 48/52 L	2222645	65 (2.56")	57 (2.24")	35-65 (1.38"-2.56")	48-52 (1.89"-2.05")
X-GR 23/27 C	2222646	32 (1.26")	32 (1.26")	30 + (1.18" +)	23-27 (0.91"-1.06")
X-GR 28/32 C	2222647	32 (1.26")	37 (1.46")	30 + (1.18" +)	28-32 (1.10"-1.26")
X-GR 33/37 C	2222648	32 (1.26")	42 (1.65")	30 + (1.18" +)	33-37 (1.30"-1.46")
X-GR 38/42 C	2222649	32 (1.26")	47 (1.85")	30 + (1.18" +)	38-42 (1.50"-1.65")
X-GR 43/47 C	2222650	32 (1.26")	52 (2.05")	30 + (1.18" +)	43-47 (1.69"-1.85")
X-GR 48/52 C	2222651	32 (1.26")	57 (2.24")	30 + (1.18" +)	48-52 (1.89"-2.05")

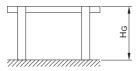




Grating width of X-GR _/_ and X-GR _/_ L

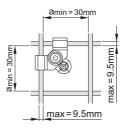


Grating height



Cartridge recommendation

Grating width of X-GR _/_ C



Base material		Cartridge color (tool power level)			
		Tool type:	Tool type:		
		DX 6 GR	DX 5 GR, DX 460 GR		
		Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M		
	$4 \le t_{ } \le 6 \text{mm}$	titanium 🔳 (4)	red 📕 (1)		
S235	6 < t _{II} ≤ 12 mm	titanium 🔳 (5-8),	black ■ (1–3)		
3235		black 🔳 (6–7)			
	12 < t _{ll} ≤ 20 mm	black ■ (6–8)	black ■ (3–4)		
	4 ≤ t _{II} ≤ 6 mm	titanium 🔳 (4-6)	red 📕 (1-2)		
S275	6 < t _{II} ≤ 12 mm	titanium 🔳 (6-8),	black ■ (2–3)		
5215		black 🔳 (6–7)			
	12 < t _{ll} ≤ 20 mm	black 🔳 (8)	black 🔳 (4)		
	$4 \le t_{ } \le 6 \text{mm}$	titanium 🔳 (4-7)	red 📕 (1-3)		
S335	6 < t _{II} ≤ 10 mm	titanium 🔳 (6-8),	black 🔳 (2–4)		
3333		black ■ (6–8)			
	10 < t _µ ≤ 14 mm	black 🔳 (8)	black 🔳 (4)		

• Tool power level adjustment by setting tests on site.

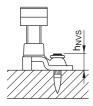
- Start tool energy selection with lowest recommended tool power level.
- Correct according requirement from chapter quality assurance.





Quality assurance

Fastening inspection

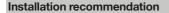


H

h_{NVS} = 7–10.5 mm (0.28"–0.41")

• Observing the cartridge selection and tool energy setting typically leads to a stand-off between 9 and 10 mm.





Tightening torque for X-GR 25/30, X-GR 1 1/4", X-GR 35/40

	Fastener: Pre-mounted X-R 20
Element: X-GR 25/30, X-GR 1 1/4",	3–5 Nm
X-GR 35/40	

Tightening tool recommendation for tightening with cordless screwdriver

Cordless	Clutch type	Gear	Clutch
screwdriver	(stop detection)		
SF 2-A12	TRC	1	15
SF 2H-A12	TRC	1	15
SF 4-A22	TRC	1	4
SF 6-A22	ESC (SJ)	1	5
SF 6H-A22	ESC (SJ)	1	5
SFC 14-A	TRC	2	6-7
SF 8M-A22	TRC	4	3-5
SF 10W-A22	TRC	4	3-5



Tool power level adjustment: Gear:

	F III	
L		
+		



- The setting of the torque via the Hilti screwdriver with torque release coupling (TRC) can change as the clutch wears over time. The specified torque setting is only a rough guide value and applies to a new Hilti screwdriver.
 To ensure recommended torque is applied, Hilti recommends the use of a calibrated torque wrench or the Hilti torque tool.
- The specified torque setting for the Hilti screw drivers with electronic slip clutch (ESC) is only a rough guide value as the ESC has 2 stop detections; Soft Joint (SJ) detection and Hard Joint (HJ) detection. The hard joint detection is activated due to drop in speed (fast stop) and can lead to a torque spike. The installation torque may vary depending on the user and the application. To ensure recommended torque is applied, Hilti recommends the use of a calibrated torque wrench or the Hilti torque tool.

Tightening tool recommendation for tightening with Hilti torque tool

Hilti torque tool	
Torque tool S-BT 1/4" – 5 Nm	

X-GR



Tightening torque for Installation recommendation for X-GR 33/37, X-GR 43/47, X-GR 48/52, X-GR _/_ L

	Fastener: Pre-mounted X-R 20
Element: X-GR 33/37, X-GR 43/47, X-GR	5–8 Nm
48/52, X-GR _/_ L	

Tightening tool recommendation for tightening with cordless screwdriver

Cordless	Clutch type	Gear	Clutch
screwdriver	(stop detection)		
SF 2-A12	TRC	1	15
SF 2H-A12	TRC	1	15
SF 4-A22	TRC	1	9
SF 6-A22	ESC (SJ)	1	8
SF 6H-A22	ESC (SJ)	1	8
SF 8M-A22	TRC	4	3-5
SF 10W-A22	TRC	4	3-5



Tool power level adjustment:





- The setting of the torque via the Hilti screwdriver with torque release coupling (TRC) can change as the clutch wears over time. The specified torque setting is only a rough guide value and applies to a new Hilti screwdriver.
 To ensure recommended torque is applied, Hilti recommends the use of a calibrated torque wrench or the Hilti torque tool.
- The specified torque setting for the Hilti screw drivers with electronic slip clutch (ESC) is only a rough guide value as the ESC has 2 stop detections; Soft Joint (SJ) detection and Hard Joint (HJ) detection. The hard joint detection is activated due to drop in speed (fast stop) and can lead to a torque spike. The installation torque may vary depending on the user and the application. To ensure recommended torque is applied, Hilti recommends the use of a calibrated torque wrench or the Hilti torque tool.

Tightening tool recommendation for tightening with Hilti torque tool

Hilti torque tool	
Torque tool S-BT 1/4" – 5 Nm	
Torque tool X-BT 1/4" – 8 Nm	





Tightening torque for Installation recommendation for X-GR_/_C

	Fastener: Pre-mounted X-R 20
Element: X-GR _/_ C	5–8 Nm

Cordless	Clutch type	Gear	Clutch
screwdriver	(stop detection)		
SF 2-A12	TRC	1	15
SF 2H-A12	TRC	1	15
SF 4-A22	TRC	1	9
SF 6-A22	ESC (SJ)	1	8
SF 6H-A22	ESC (SJ)	1	8
SF 8M-A22	TRC	4	3-5
SF 10W-A22	TRC	4	3-5

Tightening tool recommendation for tightening with cordless screwdriver



Tool power level adjustment:

Gear:	



- The setting of the torque via the Hilti screwdriver with torque release coupling (TRC) can change as the clutch wears over time. The specified torque setting is only a rough guide value and applies to a new Hilti screwdriver.
 To ensure recommended torque is applied, Hilti recommends the use of a calibrated torque wrench or the Hilti torque tool.
- The specified torque setting for the Hilti screw drivers with electronic slip clutch (ESC) is only a rough guide value as the ESC has 2 stop detections; Soft Joint (SJ) detection and Hard Joint (HJ) detection. The hard joint detection is activated due to drop in speed (fast stop) and can lead to a torque spike. The installation torque may vary depending on the user and the application. To ensure recommended torque is applied, Hilti recommends the use of a calibrated torque wrench or the Hilti torque tool.

Tightening tool recommendation for tightening with Hilti torque tool

Hilti torque tool	
Torque tool S-BT 1/4" – 5 Nm	
Torque tool X-BT 1/4" – 8 Nm	







X-FCS-R Grating element

X-FCS-R G	X-FCS-R Grating element designation					
Х	-	FCS	- R	3	25	
Technology	y Ap	plication	Material	Number of saddles	Bar spacing	
Technology X	<i>י</i> :		DX soluti	on		
Application FCS	1:	Grating element				
Material: R			Stainless	steel		
Number of s 3 4	saddle	95:		stening saddles ening saddles		
Bar spacing 25	g:		Bar spac	ing		





Product data

X-FCS-R-3-25	Product description
	 Grating fastening system is an approved system for securing gratings under tension and shear load Grating element is available with three saddles for rectangular gratings and four saddles for square gratings Grating element X-FCS-R can be combined with various
X-FCS-R-4-25	fasteners

Grating fastening system

	Fastener				
Grating element	X-BT M8-15-6 SN 12 R	X-BT-GR M8/7 SN 8	S-BT-GR M8/7 SN 6		
X-FCS-R-3-25	•	•	•		
X-FCS-R-4-25	•	•	•		

Material specification and material properties

Material specification and material properties for stainless steel parts

Grating fastening system		Material	Coating	Steel grade		Corrosion
				acc. to		resistance
				EN 10088	ASTM AISI SAE	acc. to EN 1993-1-4
X-FCS-R-3-25	Saddle	Stainless steel	none	1.4404	316 L	CRC III
X-FCS-R-3-25	Threaded nut	Stainless steel	none	1.4401	316	CRC III
X-FCS-R-4-25	Saddle	Stainless steel	none	1.4404	316 L	CRC III
X-FCS-R-4-25	Threaded nut	Stainless steel	none	1.4401	316	CRC III



Grating fastening system recommendation under various environmental conditions					
		Grating fastening system			
Environmental condition		X-FCS-R combined with X-BT M8-15-6 SN 12 R	X-FCS-R combined with X-BT-GR M8/7 SN8	X-FCS-R combined with S-BT-GR M8/7 SN6	
+	Dry indoor				
	Indoor with temporary condensation	-	•	•	
+	Outdoor with low pollution	•	•	•	
+	Outdoor with moderate concentration of pollutants	-		-	
0-1km	Coastal areas			•	
	Outdoor, areas with heavy industrial pollution	-			
	Close proximity to roads				
	Special application	Please conta	act our Expert Hi	Iti Engineers	
	Special application	to support recommendation			

- = Suitable for corrosion prevention
- Feasible for corrosion prevention

Further information can be found in following Hilti brochures:

- X-BT Threaded Fastener Specification
- New Generation X-BT-GR, X-BT-MR and X-BT-ER Threaded Fastener Specification
- S-BT Threaded Fastener Specification
- Corrosion handbook





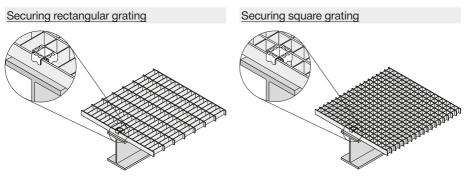
Base material	Load condition
Steel	Static/quasi static

Approval/certificate

Authority	American Bureau	Bureau Veritas	Det Norske Veritas Germanischer	Lloyd's Register	RINA
	of Shipping	BUREAU VERITAS		Hoyds Register	RI

- Information presented in this product data sheet is based on Hilti Technical Data. For the specific application please refer to the corresponding approval/certificate.
- Approvals/certificates available for following grating fastening systems: X-FCS-R-3-25 (Saddles connected to bearing bar: 3) X-FCS-R-4-25 (Saddles connected to bearing bar: 4)

Application



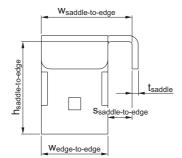


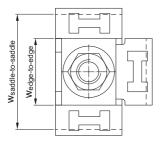


Grating element

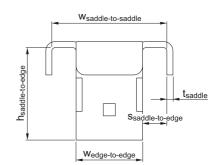
Grating element definition

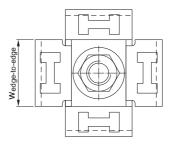
X-FCS-R-3-25





X-FCS-R-4-25





- $w_{saddle-to-edge}$ = Width between saddle and edge
- w_{saddle-to-saddle} = Width between saddles
- w_{edge-to-edge} = Grating element width
- s_{saddle-to-edge} = Spacing between saddle and grating edge
- t_{saddle} = Saddle thickness
- h_{saddle-to-edge} = Grating element height

Grating element definition

Grating element	Saddle width	Grating element width	Spacing between saddle and grating element	Saddle thickness	Grating element height
	W _{saddle-to-edge} W _{saddle-to-saddle}	W _{edge-to-edge}	S _{saddle-to-saddle}	t _{saddle}	h _{saddle-to-edge}
X-FCS-R-3-25 31/35	30 mm	22 mm	8 mm	2 mm	30.5 mm
X-FCS-R-3-25 37/41	30 mm	22 mm	8 mm	2 mm	36.5 mm
X-FCS-R-4-25 31/35	38 mm	22 mm	8 mm	2 mm	30.5 mm
X-FCS-R-4-25 37/41	38 mm	22 mm	8 mm	2 mm	36.5 mm



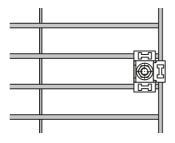


Grating fastening

Grating element for rectangular grating fastening

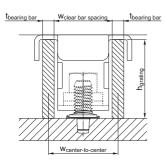
X-FCS-R-3-25 31/35 X-FCS-R-3-25 37/41

3 saddles connected to bearing bar



Grating definition

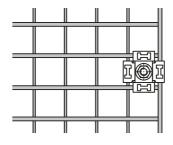
Example: Fastening with X-BT



Grating element for square grating fastening

X-FCS-R-4-25 31/35 X-FCS-R-4-25 37/41

4 saddles connected to bearing bar



t _{bearing bar}	Bearing bar thickness
W _{clear bar spacing}	Clear bar spacing
W _{center-to-center}	Center-to-center bar spacing
h _{grating}	Grating height

Grating dimension

Grating element	Bearing bar thickness	Clear bar spacing	Center-to-center bar spacing	Minimum grating height	Maximum grating height
	t _{bearing bar}	W _{bearing bar}	W _{center-to-center}	h _{grating, min}	h _{grating, max}
X-FCS-R-3-25 31/35	5 mm	25 mm	30 mm	31 mm	35 mm
X-FCS-R-3-25 37/41	5 mm	25 mm	30 mm	37 mm	41 mm
X-FCS-R-4-25 31/35	5 mm	25 mm	30 mm	31 mm	35 mm
X-FCS-R-4-25 37/41	5 mm	25 mm	30 mm	37 mm	41 mm





Load data

Design concept for single fastening points under tension and shear load					
Recommended resistance under tension Design resistance under tension load					
N_{rec} = min { $N_{rec, grating element}$; $N_{rec, fastener}$ }	$N_{Rd} = min \{N_{Rd, grating element}; N_{Rd, fastener}\}$				
Recommended resistance under shear load	Design resistance under shear load				
$V_{rec} = min \{V_{rec, grating element}; V_{rec, fastener}\}$	$V_{Rd} = min \{V_{Rd, grating element}; V_{Rd, fastener}\}$				

Design concept for load interaction						
Recommended resistance under combined	Design resistance under combined load					
load						
$\frac{N}{N_{rec}} + \frac{V}{V_{rec}} \le 1.2$	$\frac{N_{Sd}}{N_{Rd}} + \frac{V_{Sd}}{V_{Rd}} \le 1.2$					

N _{rec} N _{rec, grating element} N _{rec, fastener}	 Recommended resistance under tension load for grating fastening system Recommended resistance under tension load for grating element Recommended resistance under tension load for fastener
V _{rec} V _{rec, grating elemen} V _{rec, fastener}	 Recommended resistance under shear load for grating fastening system Recommended resistance under shear load for grating element Recommended resistance under shear load for fastener
N _{Sd} N _{Rd} N _{Rd, grating element} N _{Rd, fastener}	 = Design tension load = Design resistance under tension load for grating fastening system t = Design resistance under tension load for grating element = Design resistance under tension load for fastener
V _{Sd} V _{Rd} V _{Rd, grating element} V _{Rd, fastener}	 Design shear load Design resistance under shear load for grating fastening system Design resistance under shear load for grating element Design resistance under shear load for fastener





Shear load direct	Shear load direction definition for single fastening points						
Grating element	Saddles		Shear load directior				
	connected to	Load direction a	Load direction b	Load direction c			
X 500 D 0 05	bearing bar						
X-FCS-R-3-25	3						
X-FCS-R-3-25	2		Not admissible				
			Not admissible	C T			
_				Contact connection of 2 saddles to the bearing bar is required			
X-FCS-R-4-25	4						



X-FCS-R

Recommended resistance under tension and shear load for single fastening points

Grating	Saddles		Base material	Resistance	Base	material thic	kness
element	connected	(EN 10025-2)	(ASTM AISI under	t _∥ ≥8mm	t _∥ ≥8mm	t _∥ ≥6mm	
	to bearing bars	SAE)		tension and shear load	X-BT M8-15-6 SN 12-R	X-BT-GR M8/7 SN 8	S-BT-GR M8/7 SN 6
				N _{rec}	1.8 kN	2.6 kN	1.8 kN
		S235	A36	V _{rec, direction a}	2.6 kN	4.3 kN	2.6 kN
		5235	A30	V _{rec, direction b}	0.8 kN	0.8 kN	0.8 kN
X-FCS-R-3-25	2			V _{rec, direction c}	2.6 kN	4.3 kN	2.6 kN
X-FC3-R-3-23	3			N _{rec}	2.3 kN	2.6 kN	2.3 kN
		S355	Grade 50	V _{rec, direction a}	3.2 kN	4.3 kN	3.2 kN
		3333	Grade 50	V _{rec, direction b}	0.8 kN	0.8 kN	0.8 kN
				V _{rec, direction c}	3.2 kN	4.3 kN	3.2 kN
		S235	A36	N _{rec}	-	1.7 kN	-
	2			V _{rec, direction a}	-	4.3 kN	-
				V _{rec, direction b}	-	-	-
X-FCS-R-3-25				V _{rec, direction c}	-	4.3 kN	-
X-1 00-H-0-20		S355	Grade 50	N _{rec}	-	1.7 kN	-
				V _{rec, direction a}	-	4.3 kN	-
				V _{rec, direction b}	-	-	-
				V _{rec, direction c}	-	4.3 kN	-
				N _{rec}	1.8 kN	2.6 kN	1.8 kN
		S235	A36	V _{rec, direction a}	2.6 kN	4.3 kN	2.6 kN
		3235	ASO	V _{rec, direction b}	2.6 kN	4.3 kN	2.6 kN
X-FCS-R-4-25	4			Vrec, direction c	2.6 kN	4.3 kN	2.6 kN
л-ruð-n-4-25	4			N _{rec}	2.3 kN	2.6 kN	2.3 kN
		8255	Crada 50	Vrec, direction a	3.2 kN	4.3 kN	3.2 kN
		S355	Grade 50	V _{rec, direction b}	3.2 kN	4.3 kN	3.2 kN
				Vrec, direction c	3.2 kN	4.3 kN	3.2 kN





Design resistance under tension and shear load for single fastening points

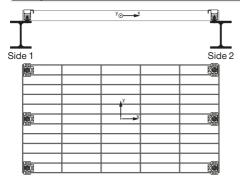
Grating	Saddles		Base material	Resistance	Base	material thic	kness
element	connected	(EN 10025-2)	(ASTM AISI	SAE) tension and shear load	t _∥ ≥8mm	t _∥ ≥8mm	t _∥ ≥6mm
	to bearing bars		SAE)		X-BT M8-15-6 SN 12-R	X-BT-GR M8/7 SN 8	S-BT-GR M8/7 SN 6
				N _{Rd}	2.5 kN	3.6 kN	2.5 kN
		S235	A36	V _{Rd, direction a}	3.6 kN	6.0 kN	3.6 kN
		3235	A30	V _{Rd, direction b}	1.1 kN	1.1 kN	1.1 kN
X-FCS-R-3-25	3			V _{Rd, direction c}	3.6 kN	6.0 kN	3.6 kN
X-FU3-N-3-23	3			N _{Rd}	3.2 kN	3.6 kN	3.2 kN
		S355	Grade 50	V _{Rd, direction a}	4.5 kN	6.0 kN	4.5 kN
		3355	Grade 50	V _{Rd, direction b}	1.1 kN	1.1 kN	1.1 kN
				V _{Rd, direction c}	4.5 kN	6.0 kN	4.5 kN
		S235	A36	N _{Rd}	-	2.2 kN	-
	2			V _{Rd, direction a}	-	6.0 kN	-
				V _{Rd, direction b}	-	-	-
X-FCS-R-3-25				V _{Rd, direction c}	-	6.0 kN	-
X-1 00-H-0-20		S355	Grade 50	N _{Rd}	-	2.2 kN	-
				V _{Rd, direction a}	-	6.0 kN	-
				V _{Rd, direction b}	-	-	-
				V _{Rd, direction c}	-	6.0 kN	-
				N _{Rd}	2.5 kN	3.6 kN	2.5 kN
		S235	A36	V _{Rd, direction a}	3.6 kN	6.0 kN	3.6 kN
		3235	A30	V _{Rd, direction b}	3.6 kN	6.0 kN	3.6 kN
X-FCS-R-4-25	4			V _{Rd, direction c}	3.6 kN	6.0 kN	3.6 kN
л-гоз-R-4-25	4			N _{Rd}	3.2 kN	3.6 kN	3.2 kN
		S355	Crada 50	V _{Rd, direction a}	4.5 kN	6.0 kN	4.5 kN
		3333	Grade 50	V _{Rd, direction b}	4.5 kN	6.0 kN	4.5 kN
				V _{Rd, direction c}	4.5 kN	6.0 kN	4.5 kN



X-FCS-R

Design concept for multiple fastening points under tension and shear load

Example: Recommended resistance for rectangular grating under symmetrical load in x-axis

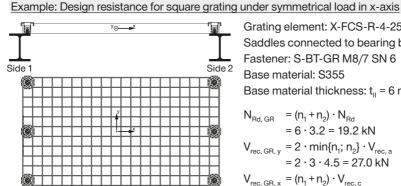


Grating element: X-FCS-R-3-25 Saddles connected to bearing bar: 2 Fastener: X-BT M8-15-6 SN 12 R Base material: S235 Base material thickness: t_{ii} = 8 mm

$$\begin{split} N_{\text{rec, GR}} &= (n_1 + n_2) \cdot N_{\text{rec}} \\ &= 6 \cdot 1.8 = 10.8 \text{ kN} \\ V_{\text{rec, GR, y}} &= 2 \cdot \min\{n_1; n_2\} \cdot V_{\text{rec, a}} \\ &= 2 \cdot 3 \cdot 2.6 = 15.6 \text{ kN} \\ V_{\text{rec, GR, x}} &= n_1 \cdot V_{\text{rec, c}} \\ &= 3 \cdot 2.6 = 7.8 \text{ kN} \end{split}$$

X-FCS-R-3-25 per side of rectangular grating: Number of X-FCS-R side 1: $n_1 = 3$ Number of X-FCS-R side 2: $n_2 = 3$

Note: Load resistance in direction b is neglected due to lower stiffness in direction b compared to direction c.



X-FCS-R-4-25 per side of rectangular grating: Number of X-FCS-R side 1: $n_1 = 3$ Number of X-FCS-R side 2: $n_2 = 3$

Grating element: X-FCS-R-4-25 Saddles connected to bearing bar: 4 Fastener: S-BT-GR M8/7 SN 6 Base material: S355 Base material thickness: t_u = 6 mm

$$\begin{split} N_{\text{Rd, GR}} &= (n_1 + n_2) \cdot N_{\text{Rd}} \\ &= 6 \cdot 3.2 = 19.2 \text{ kN} \\ V_{\text{rec, GR, y}} &= 2 \cdot \min\{n_1; n_2\} \cdot V_{\text{rec, a}} \\ &= 2 \cdot 3 \cdot 4.5 = 27.0 \text{ kN} \\ V_{\text{rec, GR, x}} &= (n_1 + n_2) \cdot V_{\text{rec, c}} \\ &= 6 \cdot 4.5 = 27.0 \text{ kN} \end{split}$$

Note: Load resistance in direction b is neglected due to lower stiffness in direction b compared to direction c.





System recommendation

System recommendation for tightening grating element						
Grating	Fastener	Torque	Tightening tool	Nut setter		
element		moment				
X-FCS-R-3-25	X-BT M8-15-6 SN 12-R	8 Nm	SBT 4-A22 ¹⁾	S-NS 12		
X-FCS-R-4-25	X-BT-GR M8/7 SN 8	20 Nm	SFC 22-A ¹⁾			
X-FCS-R-4-20	S-BT-GR M8/7 SN 6	8 Nm	SFC 22-A"	C 95/3 3/4"		

¹ Other tightening tools with torque moment control function can be used.

Fastener setting and installation information

Fastener setting information (e.g. base material properties, fastened material properties and setting energy) and installation information (e.g. quality assurance) are part of the corresponding Product Data Sheet for fasteners.

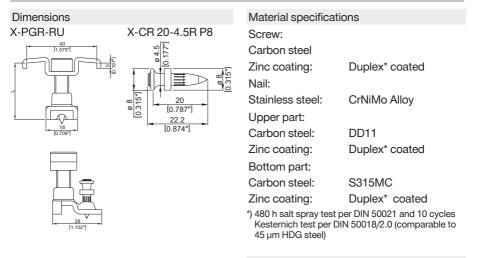
Grating fastening system component

Component	Designation	Item no.
Grating element	X-FCS-R-3-25 31/35	2198296
Grating element	X-FCS-R-3-25 37/41	2198297
Grating element	X-FCS-R-4-25 31/35	2198298
Grating element	X-FCS-R-4-25 37/41	2198299
Fastener	X-BT M8-15-6 SN 12 R	377074
Fastener	X-BT-GR M8/7 SN 8	2194344
Fastener	S-BT-GR M8/7 SN 6	2140529



X-PGR-RU Grating fastening system (pre-drilled)

Product data

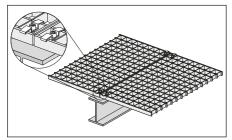


Recommended fastening tools DX 6 GR, DX 5 GR and DX 460 GR



• See fastener program in the next pages.

Application



Fastening of grating

For fastenings exposed to weather and mildly corrosive conditions. Not for use in marine atmospheres (upstream)!





Performance data

Recommended resistance under tension load N_{rec} = 0.8 kN (180 lb)

- Tensile loading is limited by plastic deformation of the saddle clip.
 - X-PGR-RU resists shear by friction and is not suitable for explicit shear load designs.

Application recommendation

Base material thickness

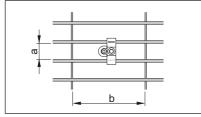
 $t_{II} \ge 6 \text{ mm} (0.24'')$

Fastened material thickness

Grating height: H_G = 25–40 mm (0.98"–1.57")

Grating opening types

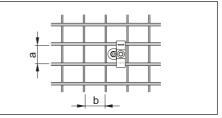
Bearing bar spacing (a)



a from 25 to 32 mm (1" to 11/4")

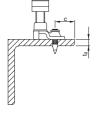
Fastener positioning in base material

Cross bar spacing (b)



b ≥ 30 mm (1.18")

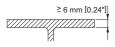
Edge distance: $c \ge 15 \text{ mm} (0.59'')$





Application limits

X-PGR-RU with DX 460 GR, DX 5 GR, DX 6 GR



- pre-drilled
- base material thickness: t_{II} ≥ 6 mm [0.24"]
- steel strength: 350 N/mm² \leq R_m \leq 630 N/mm²





Corrosion information

- For fastenings exposed to weather and mildly corrosive conditions.
- Not for use in marine atmospheres (upstream) or in heavily polluted environments.
- For more details, please refer to following technical document: Hilti Corrosion Handbook.

System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

Fastener program

Fastener	ltem no.	L mm (inch)	Grating height mm (inch)
X-PGR-RU 25/30	2061313	32 (1.26")	25–30 (0.98"–1.18")
X-PGR-RU 11/4"	2061314	34 (1.34")	27-32 (1.06"-1.26")
X-PGR-RU 35/40	2061315	42 (1.65")	35–40 (1.38''–1.57'')

Cartridge recommendation

Base materia	l	Cartridge color (tool power level)		
		Tool type:	Tool type:	
		Tool type: DX 6 GR	DX 5 GR, DX 460 GR	
		Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M	
S235, S275, S355	6 ≤ t ≤ 20 mm	titanium 🔳 (4-6)	red 📕 (1-2)	

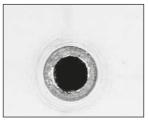
- Tool power level adjustment by setting tests on site.
 - Start tool energy selection with lowest recommended tool power level.
 - Correct according requirement from chapter quality assurance.





Quality assurance

Pre-drill

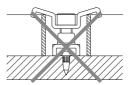


Pre-drill with TX-PGR-RU-4/10-93 step shank drill bit (Item no. 2061802), until shoulder grinds a shiny ring (to ensure proper drilling depth).

Fastening inspection



h_{NVS} = 8–10 mm (0.31"–0.39")



The saddle of the fastener should not been bent, see installation instruction above.

These are abbreviated instructions which may vary by application. **<u>ALWAYS</u>** review/follow the instructions accompanying the product.





Installation recommendation

Tightening torque

	Fastener: Pre-mounted X-CR 20	
Element: X-PGR-RU	3–5 Nm	

Tightening tool recommendation for tightening with cordless screwdriver

Cordless	Clutch type	Gear	Clutch
screwdriver	(stop detection)		
SF 2-A12	TRC	1	15
SF 2H-A12	TRC	1	15
SF 4-A22	TRC	1	4
SF 6-A22	ESC (SJ)	1	5
SF 6H-A22	ESC (SJ)	1	5
SFC 14-A	TRC	1	4-7
SF 18-A	TRC	1	3-5
SFC 18-A	TRC	1	3-5
SFC 22-A	TRC	1	3-5
SBT 4-A22	TRC	1	3-5



Tool power level adjustment: Gear:

1	$\overline{\Delta}$



- The setting of the torque via the Hilti screwdriver with torque release coupling (TRC) can change as the clutch wears over time. The specified torque setting is only a rough guide value and applies to a new Hilti screwdriver.
 To ensure recommended torque is applied, Hilti recommends the use of a calibrated torque wrench or the Hilti torque tool.
- The specified torque setting for the Hilti screw drivers with electronic slip clutch (ESC) is only a rough guide value as the ESC has 2 stop detections; Soft Joint (SJ) detection and Hard Joint (HJ) detection. The hard joint detection is activated due to drop in speed (fast stop) and can lead to a torque spike. The installation torque may vary depending on the user and the application. To ensure recommended torque is applied, Hilti recommends the use of a calibrated torque wrench or the Hilti torque tool.

Tightening tool recommendation for tightening with Hilti torque tool

Hilti torque tool	
Torque tool S-BT 1/4" – 5 Nm	





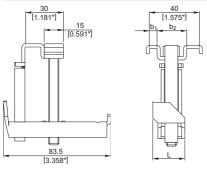




X-MGR Grating fastening system

Product data

Dimensions

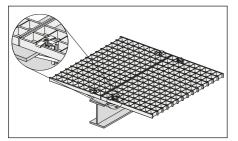


Material specificati	ons
Screw:	
Carbon steel	
Zinc coating:	60 µm HDG
Upper part:	
Carbon steel:	SPCC-S
Zinc coating:	65 µm HDG
Bottom part:	
Carbon steel:	SPCC-S
Zinc coating:	65 µm HDG
Nut:	
Carbon steel	
Zinc coating:	45 µm HDG
Nut-holder:	
Stainless steel:	SS304

Recommended fastening tools SF 121-A, SF150-A, SF 14, SFC 14-A, SF 18-A, SFC 18-A, SF 22-A

 For more details, please refer to X-MGR fastener program and to the chapter Accessories and consumables compatibility in the Direct Fastening Technology Manual (DFTM).

Applications



For fastenings exposed to weather and mildly corrosive conditions. Not for use in marine atmospheres (upstream)!

Fixing of grating





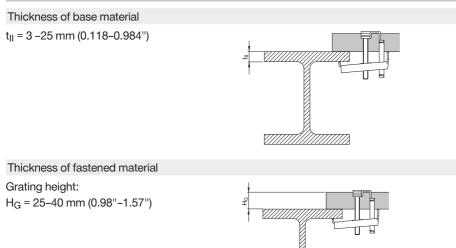
Performance data

Recommended tensile loads N_{rec} = 0.6 kN (135 lb)

• Tensile loading is limited by plastic deformation of the saddle clip.

• X-MGR resists shear by friction and is not suitable for explicit shear load designs.

Application recommendation

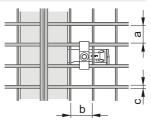


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Total fastening height $H_G + t_{II} \le 65 \text{ mm} (2.56'')$

Grating opening types

Fastener	a mm (inch)	-	c mm (inch)
X-MGR M60	30 (1.18")	≥ 30 (1.18'')	≤ 3 (0.118'')
X-MGR W60	25 (0.98'')	≥ 30 (1.18'')	≤ 4.8 (³/¹6'')



Spacing and edge distances

No general restriction exists.





Corrosion information

For fastenings exposed to weather and mildly corrosive conditions. Not for use in marine atmosphere (Upstream) or in heavily polluted environment.

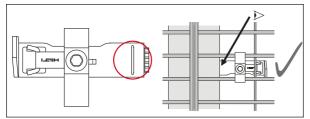
Fastener program and system recommendation

Fastener program

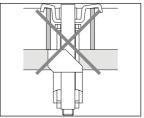
Fastener	Item-no.	Steel flange	Grating	Fastening
		thickness	height	tool
		t∥ mm (inch)	mm (inch)	
X-MRG-M60	384233	3–25	25–40	SF 121-A,
		(0.12"–0.98")	(0.98''-1.57'')	SF 150-A
X-MRG-W60	384234	3–25	25–40	SF 121-A,
		(0.12''-0.98'')	(0.98''–1.57'')	SF 150-A

Quality assurance

Fastening inspection



The sign on the clip has to be positioned under the steel flange



The saddle of the fastener should not been bent, see installation instructions below.





Installation recommendation

Tightening torque

Element:	X-MGR
----------	-------

5-8 Nm

Tightening tool recommendation for tightening with cordless screwdriver

Cordless	Clutch type	Gear	Clutch
screwdriver	(stop detection)		
SF 2-A12	TRC	1	15
SF 2H-A12	TRC	1	15
SF 4-A22	TRC	1	8
SF 6-A22	ESC (SJ)	1	7
SF 6H-A22	ESC (SJ)	1	7
SFC 14-A	TRC	1	6-10
SF 18-A	TRC	1	5-8
SFC 18-A	TRC	1	5-8
SF 22-A	TRC	1	5-8
SFC 22-A	TRC	1	4-5
SBT 4-A22	TRC	1	5-7



Tool power level adjustment: Gear:





- The setting of the torque via the Hilti screwdriver with torque release coupling (TRC) can change as the clutch wears over time. The specified torque setting is only a rough guide value and applies to a new Hilti screwdriver.
 To ensure recommended torque is applied, Hilti recommends the use of a calibrated torque wrench or the Hilti torque tool.
- The specified torque setting for the Hilti screw drivers with electronic slip clutch (ESC) is only a rough guide value as the ESC has 2 stop detections; Soft Joint (SJ) detection and Hard Joint (HJ) detection. The hard joint detection is activated due to drop in speed (fast stop) and can lead to a torque spike. The installation torque may vary depending on the user and the application. To ensure recommended torque is applied, Hilti recommends the use of a calibrated torque wrench or the Hilti torque tool.

Tightening tool recommendation for tightening with Hilti torque tool

Hilti torque tool
Torque tool S-BT 1/4" – 5 Nm
Torque tool X-BT 1/4" – 8 Nm





X-FCP Checker plate fastening system

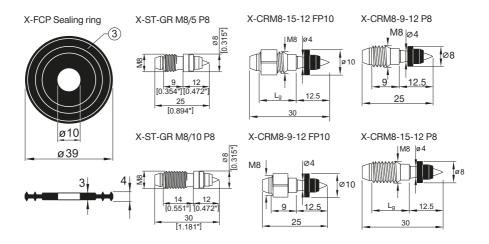
Product data

Dimensions Material specifications See fastener selection for more details. X-FCP-R 5/10 X-FCP-F 5/10 (1)(1)Recommended fastening tools · See fastener program in the next pages. ни т (2) 2 1.25 10 10 ø 45 ø 45

Approvals

LR: X-FCP ABS, LR: X-FCP-R ABS: X-FCP-F

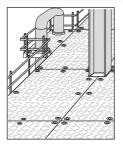
> Not all information presented in this product data sheet might be subject to approval/certificate content. Please refer to approval/certificate for further information.





Application





Checker plate

Application areas for X-FCP system

X-FCP-R

- Marine, offshore, petrochemical, caloric (coal, oil) power plants, etc.
- Not for use in automobile tunnels, swimming pools or similar environments.

X-FCP-F

- Indoors, mildly corrosive environment, or for limited lifetime use.
- Not for use in marine atmosphere or in heavily polluted environment.

Sealing ring

• Drip-through of water/oil needs to be prevented.

Performance data

Recommended resistance under tension load

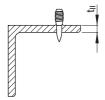
N_{rec} = 1.8 [kN]

- Limited by the strength of the X-CRM8 and X-ST-GR threaded stud.
 - Recommended loads are valid for fastenings of steel and aluminium with 20 mm pre-drilling.
 - X-FCP-F and X-FCP-R are not intended for shear loading.

Application recommendation

Base material thickness

X-CRM8, X-ST-GR



Steel thickness: $t_{\mu} \ge 6 \text{ mm}$

Fastened material thickness

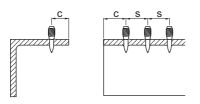
Thickness of checker plates: $t_l \cong 5.0\text{--}13.0 \text{ mm}$





Fastener positioning in base material

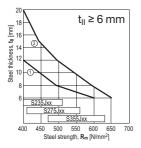
X-CRM8, X-ST-GR



Edge distances:	c ≥ 15 mm
Spacing:	s≥15 mm

Application limits for X-CRM8

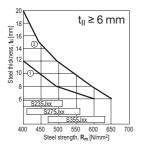
DX 76, DX 76 PTR



 Fastener: 	X-CRM812 FP10 /
Tool type:	DX 76 (impact)

- ② Fastener: X-CRM8-__-12 FP10/
- Tool type: DX 76 (co-acting)

DX 6, DX 5, DX 460



- ① Fastener: X-CRM8-__-12 P8 / Tool type: DX 6, DX 5 (impact), DX 460
 ② Fastener: X-CRM8-__-12 P8 /
- Tool type: DX 5 (co-acting), DX 460



• For co-acting operation push the fastener all the way back against the piston with a ramrod.

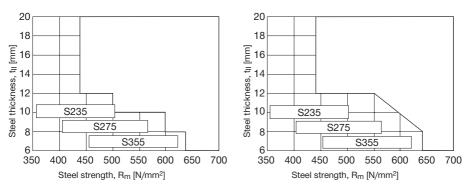




Application limits for X-ST-GR

Tool type: DX 76 PTR

Tool type: DX 6, DX 5, DX 460

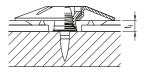


System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

Threaded studs

Designation	Fastened material thickness	Tools
	t _i	
X-CRM8-15-12	9–13 mm	DX 6, DX 5, DX 460, DX 76, DX 76 PTR
X-CRM8-9-12	5– 8 mm	DX 6, DX 5, DX 460, DX 76, DX 76 PTR
X-ST-GR M8/10 P8	9–13 mm	DX 6, DX 5, DX 460, DX 76 PTR
X-ST-GR M8/5 P8	5- 8 mm	DX 6, DX 5, DX 460, DX 76 PTR



Cartridge selection and tool energy setting

- Fastener setting information (e.g. cartridge recommendation, tool power level adjustment, base material properties and fastend material properties) and installation information (e.g. quality assurance) are part of the corresponding product data sheet for fastener.
- Tool power level adjustment by setting tests on site.
- Start tool energy selection with lowest recommended tool power level.
- · Correct according requirement from chapter quality assurance.





Material specification and coatings

X-FCP-R system

	1 Disk	2 Screw	③ Sealing ring
Material designation	X5CrNiMo17122	X2CrNiMo17132	Neoprene, black
Coating	none	none	

X-FCP-F system

	1 Disk	2 Screw	③ Sealing ring
Material designation	ST2K40 BK	9SMnPb28 K	Neoprene, black
Coating	Duplex	Duplex	



• Duplex: 480 h Salt spray test per DIN 50021 and 10 cycles Kesternich test per DIN 50018/2.0 (comparable to 45 μm HDG steel).

X-ST-GR

	Shank	Threaded sleeve
Material designation	P558 (CrMnMo ally)	A4 (AISI316)
Coating	none	none

X-CRM8

	Shank	Threaded sleeve
Material designation	Stainless steel wire,	X2CrNiMo17132
	CR 500 (A4/AISI316)	X5CrNiMo17122+2H
		(A4/AISI316)
Coating	none	none

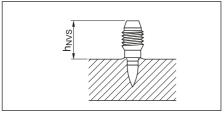




Quality assurance

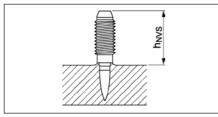
Fastening inspection

X-CRM8-9-12



h_{NVS} = 12.0–15.0 mm

X-ST-GR

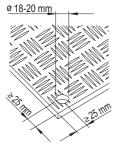


X-ST-GR M8/5 P8, h_{NVS} = 12.0–15.0 mm X-ST-GR M8/10 P8, h_{NVS} = 17.0–20.0 mm

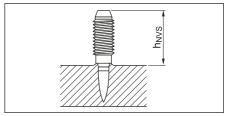
Pre-drill

Plates must be

pre-drilled or pre-punched



X-CRM8-15-12



h_{NVS} = 17.0–20.0 mm





Installation recommendation

Tightening torque

	Fastener: X-ST-GR, X-CRM8
Element: X-FCP	5–8 Nm

Tightening tool recommendation for tightening with cordless screwdriver

Cordless	Clutch type	Gear	Clutch
screwdriver	(stop detection)		
SF 2-A12	TRC	1	15
SF 2H-A12	TRC	1	15
SF 4-A22	TRC	1	8
SF 6-A22	ESC (SJ)	1	7
SF 6H-A22	ESC (SJ)	1	7



• Tool power level adjustment: Gear:

-	



- The setting of the torque via the Hilti screwdriver with torque release coupling (TRC) can change as the clutch wears over time. The specified torque setting is only a rough guide value and applies to a new Hilti screwdriver.
 To ensure recommended torque is applied, Hilti recommends the use of a calibrated torque wrench or the Hilti torque tool.
- The specified torque setting for the Hilti screw drivers with electronic slip clutch (ESC) is only a rough guide value as the ESC has 2 stop detections; Soft Joint (SJ) detection and Hard Joint (HJ) detection. The hard joint detection is activated due to drop in speed (fast stop) and can lead to a torque spike. The installation torque may vary depending on the user and the application. To ensure recommended torque is applied, Hilti recommends the use of a calibrated torque wrench or the Hilti torque tool.

Tightening tool recommendation for tightening with Hilti torque tool

Hilti torque tool	
Torque tool S-BT 1/4" – 5 Nm	
Torque tool X-BT 1/4" – 8 Nm	

Fastener program

Item no. and description

Designation	Item no.	Description
X-FCP-R	308860	Checker plate
X-FCP-F	308859	Checker plate







X-IE-G 6 and X-IE-G 9 insulation fasteners

Product data



Dimensions

۱.		Designation	Diameter Ø	Nail length L_s	
ĥ		X-IE-G 6	60 mm	36 mm	
	L _s	X-IE-G 9	90 mm	36 mm	

Material properties for plastic parts

Element	Designation	Material	Color	Other properties
Plate	X-IE-G 6	HDPE	Colorless	UV stabilized material
Plate	X-IE-G 9	HDPE	Black	UV stabilized material





Material properties for carbon steel parts

Element	Designation	Material	Coating	Minimum coating	Hardness
				thickness	
Nail	X-P 36 G3	Carbon steel	Zinc	2 µm	57.5 HRC

Approvals and certificates

Authority	Approval / certificate no.	Date of issue	Country of issue
Socotec	180668080000010	09/2018	France

Not all information presented in this product data sheet might be subject to approval / certificate content. Please refer to approval/certificate for further information.

Applications

 Curtain wall insulation
 Ceiling insulation
 Basement perimeter insulation

 Image: Curtain wall insulation
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 Image: Curtain wall insulation

Base materials



Soft



Medium concrete



Solid sandlime masonry



Solid brick





Fastened materials





wool









board

Soft mineral wool

• Soft core multilayer board: hard top layer with insulation core of mineral wool

• Rigid core multilayer board: hard top layer with insulation core of EPS, XPS, PIR, PUR

Load condition



quasi-static

Environmental conditions

- The intended use comprises fastening in dry conditions.
- During construction, exposure to UV due to solar radiation of the fixing element not protected by rendering shall not exceed the time of 6 weeks.
- \bullet The temperature during installation of the fixing element shall not be less than 5 °C.

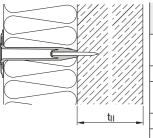
Application requirements

Fastened material properties

	Fastened	Compressive	Fastened
	material	strength	material
			thickness t _i
	Soft mineral wool	< 500 kN/m ²	25–200 mm
	Mineral wool	< 500 kN/m ²	25–200 mm
	EPS, XPS, PIR,		
	PUR, soft core	< 500 kN/m ²	25–200 mm
	multilayer board		
<u> </u>	Rigid core multilayer board	< 500 kN/m²	19–197 mm

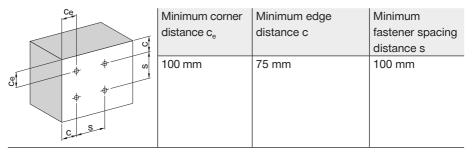


Base material properties



Base material	Base material	Base material
	strength	thickness t _{II}
Soft, medium	f _{cc} = 15–45 N/mm ²	≥ 80 mm
concrete	$T_{cc} = 10-40$ N/IIIII	2 00 11111
Tough concrete	f _{cc} = 45–65 N/mm ²	≥ 80 mm
Solid sand-lime	f _b = 15–45 N/mm ²	
masonry	$h_{b} = 10-40 \text{ N/mm}^{-1}$	-
Solid brick	f _b = 28–45 N/mm ²	-
Steel	f _u = 360–450 N/mm ²	4–6 mm

Fastener edge distance and spacing in base material



Fastener edge distance and spacing in insulation material

Ø

Please consult insulation material supplier

Number of fasteners per m²

Fastened material	Fastened material weight	Minimum number of fasteners per m ²
Soft mineral wool, mineral	< 10 kg/m ²	4
wool, EPS, XPS, PIR, PUR,	10–15 kg/m ²	5
soft core multilayer board,	> 15 kg/m ²	7
rigid core multilayer board		

Fastened material	Fastened material density	Minimum number of
		fasteners per m ²
Soft mineral wool, mineral	< 50 kg/m ³	4
wool, EPS, XPS, PIR, PUR,	50–75 kg/m ³	5
soft core multilayer board,	> 75 kg/m ³	7
rigid core multilayer board		





Performance data

Recommended resistance under tension and shear load

		Base material	Tension	Shear
N		Soft, medium concrete Solid sand-lime masonry Solid brick	N _{rec} 0.1 kN 0.1 kN 0.1 kN	V _{rec} 0.1 kN 0.1 kN 0.1 kN
	•			L

- For more details in relation to base material properties, please refer to the chapter **Fastener selection guide** in the Direct Fastening Technology Manual (DFTM).
 - The above data value for solid sand-lime masonry and solid brick are based on laboratory and field experience. Because of the wide variety of types and forms of masonry in use worldwide, users are advised to carry out tests on site or on masonry of the type and form on which the fastenings are to be made.
 - The above data refers to the fastener pull-out failure mode.
 - For pull-over under tension load please consult insulation material supplier.

Stick rate estimation

0	Soft, medium concrete $15 \le f_{c,cube} \le 45 \text{ N/mm}^2$
X-IE-G 6, X-IE-G 9	Up to 90 %

The stick rate indicates the percentage of nails that were driven correctly to carry a load. Stick rate can vary from the above values depending on job site conditions

Thermal efficiency according to EOTA TR 025

Application	Insulation thickness	Point thermal transmittance
	t,	x
Curtain wall insulation	60–90 mm	0.002 W/K
Curtain wall insulation	100–200 mm	0.001 W/K
Ceiling insulation	60–90 mm	0.002 W/K
	100–200 mm	0.001 W/K
Basement perimeter insulation	60 mm	0.003 W/K
	70–100 mm	0.002 W/K
	120–200 mm	0.001 W/K



F



System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

Tool and energy recommendation

Designation		Tools		Gas can	
			GX-IE	GX-IE XL	GC 52
X-IE-G 6	X-IE-G 6-25	X-IE-G 6-150			
X-IE-G 0	X-IE-G 6-160	X-IE-G 6-200			
	X-IE-G 9-40	X-IE-G 9-150			
X-IE-G 9	X-IE-G 9-160	X-IE-G 9-200			

 \blacksquare = recommended, \square = feasible



/

Fastener selection

Fastened material	Insulation thickness t _i	Designation	Nail	Item number
	40 mm	X-IE-G 9-40	X-P 36 G3	2172154
	50 mm	X-IE-G 9-50	X-P 36 G3	2172155
	60 mm	X-IE-G 9-60	X-P 36 G3	2172156
	80 mm	X-IE-G 9-80	X-P 36 G3	2172157
	100 mm	X-IE-G 9-100	X-P 36 G3	2172158
Soft mineral wool	120 mm	X-IE-G 9-120	X-P 36 G3	2172159
	140 mm	X-IE-G 9-140	X-P 36 G3	2163823
	150 mm	X-IE-G 9-150	X-P 36 G3	2192919
	160 mm	X-IE-G 9-160	X-P 36 G3	2163824
	180 mm	X-IE-G 9-180	X-P 36 G3	2163825
	200 mm	X-IE-G 9-200	X-P 36 G3	2163826

Fastened material	Insulation thickness t _i	Designation	Nail	Item number
	25 mm	X-IE-G 6-25	X-P 36 G3	2192914
	30 mm	X-IE-G 6-30	X-P 36 G3	2163810
	40 mm	X-IE-G 6-40	X-P 36 G3	2212514
	50 mm	X-IE-G 6-50	X-P 36 G3	2212515
	60 mm	X-IE-G 6-60	X-P 36 G3	2163813
	70 mm	X-IE-G 6-70	X-P 36 G3	2163814
	75 mm	X-IE-G 6-75	X-P 36 G3	2192915
Mineral wool, EPS,	80 mm	X-IE-G 6-80	X-P 36 G3	2163815
XPS, PIR, PUR,	90 mm	X-IE-G 6-90	X-P 36 G3	2192916
soft core multilayer board	100 mm	X-IE-G 6-100	X-P 36 G3	2163816
	120 mm	X-IE-G 6-120	X-P 36 G3	2192917
	130 mm	X-IE-G 6-130	X-P 36 G3	2192918
	140 mm	X-IE-G 6-140	X-P 36 G3	2163817
	150 mm	X-IE-G 6-150	X-P 36 G3	2163818
	160 mm	X-IE-G 6-160	X-P 36 G3	2163819
	180 mm	X-IE-G 6-180	X-P 36 G3	2163820
	200 mm	X-IE-G 6-200	X-P 36 G3	2163821





Fastened material	Insulation thickness t _i	Designation	Nail	Item number
	19–22 mm	X-IE-G 6-25	X-P 36 G3	2192914
	24–27 mm	X-IE-G 6-30	X-P 36 G3	2163810
	34–37 mm	X-IE-G 6-40	X-P 36 G3	2212514
	44–47 mm	X-IE-G 6-50	X-P 36 G3	2212515
	54–57 mm	X-IE-G 6-60	X-P 36 G3	2163813
	64–67 mm	X-IE-G 6-70	X-P 36 G3	2163814
	69–72 mm	X-IE-G 6-75	X-P 36 G3	2192915
	74–77 mm	X-IE-G 6-80	X-P 36 G3	2163815
Rigid core multilayer board	84–87 mm	X-IE-G 6-90	X-P 36 G3	2192916
	94–97 mm	X-IE-G 6-100	X-P 36 G3	2163816
	114–117 mm	X-IE-G 6-120	X-P 36 G3	2192917
	124–127 mm	X-IE-G 6-130	X-P 36 G3	2192918
	134–137 mm	X-IE-G 6-140	X-P 36 G3	2163817
	144–147 mm	X-IE-G 6-150	X-P 36 G3	2163818
	154–157 mm	X-IE-G 6-160	X-P 36 G3	2163819
	174–177 mm	X-IE-G 6-180	X-P 36 G3	2163820
	194–197 mm	X-IE-G 6-200	X-P 36 G3	2163821

Insulation board thickness tolerance: ±3 mm

• Soft mineral wool, mineral wool: for intermediate thicknesses use next shorter fastener, example: for mineral wool insulation thickness 110 mm, use X-IE-G 6-100

• EPS, XPS, PIR, PUR, soft core multilayer board: for intermediate thicknesses use next longer fastener, example: for PIR insulation thickness 110 mm, use X-IE-G 6-120

• Rigid core multilayer board: for thicknesses not specified, please contact Hilti

H



Fastening quality assurance

Fastening inspection

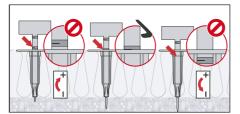
x her	Designation	Embedment depth	Distance between nail head and X-IE-G plate
		h _{ET}	x
	X-IE-G 6-25	12–19 mm	3–10 mm
	X-IE-G 6-30	12–19 mm	3–10 mm
	X-IE-G 6-40, X-IE-G 9-40	12–19 mm	14–21 mm
	X-IE-G 6-50, X-IE-G 9-50	12-19 mm	24–31 mm
	X-IE-G 6-60, X-IE-G 9-60	12-19 mm	34–41 mm
	X-IE-G 6-70	12–19 mm	44–51 mm
tı	X-IE-G 6-75	12–19 mm	49–56 mm
	X-IE-G 6-80, X-IE-G 9-80	12–19 mm	54– 61 mm
	X-IE-G 6-90	12–19 mm	64–71 mm
	X-IE-G 6-100, X-IE-G 9-100	12-24 mm	74–81 mm
	X-IE-G 6-120, X-IE-G 9-120	12-24 mm	94–100 mm
	X-IE-G 6-130	12-24 mm	104–111 mm
	X-IE-G 6-140, X-IE-G 9-140	12-24 mm	114–121 mm
	X-IE-G 6-150, X-IE-G 9-150	12-24 mm	124–131 mm
	X-IE-G 6-160, X-IE-G 9-160	12-24 mm	134–141 mm
	X-IE-G 6-180, X-IE-G 9-180	12-24 mm	154–161 mm
	X-IE-G 6-200, X-IE-G 9-200	12–24 mm	174–181 mm





Setting depth control and power tool adjustment

Check setting depth with the gauge immediately after fastening



- Visible setting failures must be replaced with a new fastener, not in the same hole
- These are abbreviated instructions which may vary by application.
- ALWAYS review/follow the instructions accompanying the product



X-IE 6 and X-IE 9 insulation fasteners

Product data



Dimensions

Ø	Ls	Designation	Diameter Ø	Nail length L_s	
		X-IE 6	60 mm	47–62 mm	
		X-IE 9	90 mm	47-62 mm	

Material properties for plastic parts

Element	Designation	Material	Color	Other properties
Plate	X-IE 6	HDPE	Colorless	UV stabilized material
Plate	X-IE 9	HDPE	Black	UV stabilized material







Material properties for carbon steel parts

Element	Designation	Material	Coating	Minimum coating thickness	Hardness
Nail	X-PX 37, X-PX 47, X-PX 52, X-PX 62	Carbon steel	Zinc	5 µm	58 HRC

Approvals and certificates

Authority	Approval/certificate no.	Date of issue	Country of issue
Socotec	1601601R0000003	07/2019	France
ITB	AT-15-7235/2015	06/2016	Poland
ITB	AT-15-7696/2016	12/2016	Poland
Russian Ministry/FCS	TS/TO 5851-19	10/2019	Russia

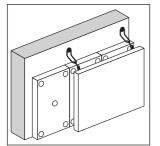
Not all information presented in this product data sheet might be subject to approval / certificate content. Please refer to approval/certificate for further information.

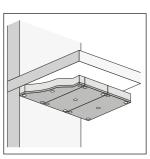
Applications

R

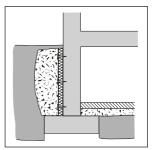
Curtain wall insulation

Ceiling insulation





Basement perimeter insulation



Base materials



Soft concrete



Medium concrete



Tough concrete



lime masonry

Solid brick



Steel





Fastened materials







Mineral wool









board

wool

• Soft core multilayer board: hard top layer with insulation core of mineral wool

• Rigid core multilayer board: hard top layer with insulation core of EPS, XPS, PIR, PUR

Load condition



quasi-static

Environmental conditions

- The intended use comprises fastening in dry conditions.
- During construction, exposure to UV due to solar radiation of the fixing element not protected by rendering shall not exceed the time of 6 weeks.
- The temperature during installation of the fixing element shall not be less than 5 °C.

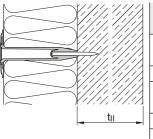
Application requirements

Fastened material properties

	Fastened	Compressive	Fastened
	material	strength	material
			thickness t _i
	Soft mineral wool	< 500 kN/m ²	50–200 mm
	Mineral wool	< 500 kN/m ²	20–200 mm
	EPS, XPS, PIR,		
	PUR, soft core	< 500 kN/m ²	20–200 mm
	multilayer board		
tı 🛌	Rigid core multilayer board	< 500 kN/m²	14–197 mm

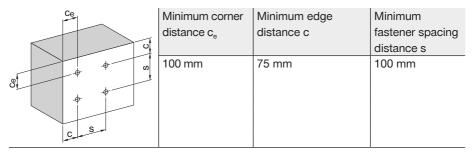


Base material properties



Base material	Base material	Base material
	strength	thickness t _{II}
Soft, medium	f _{cc} = 15–45 N/mm ²	≥ 80 mm
concrete		- 00 1111
Tough concrete	f _{cc} = 45–65 N/mm ²	≥ 80 mm
Solid sand-lime	f _b = 15–45 N/mm ²	
masonry	1 _b = 13=43 N/IIIII	
Solid brick	f _b = 28–45 N/mm ²	-
Steel	f _u = 360–450 N/mm ²	4–6 mm

Fastener edge distance and spacing in base material



Fastener edge distance and spacing in insulation material

8

Please consult insulation material supplier

Number of fasteners per m²

Fastened material	Fastened material weight	Minimum number of
		fasteners per m ²
Soft mineral wool, mineral	≤ 15 kg/m²	4
wool, EPS, XPS, PIR, PUR,	> 15 kg/m ²	5
soft core multilayer board,		
rigid core multilayer board		

Fastened material	Fastened material density	Minimum number of
		fasteners per m ²
Soft mineral wool, mineral	≤ 75 kg/m ³	4
wool, EPS, XPS, PIR, PUR,	> 75 kg/m ³	5
soft core multilayer board,		
rigid core multilayer board		



Performance data

Recommended resistance under tension and shear load

	V////	Base material	Tension	Shear
			N _{rec}	V _{rec}
N		Soft, medium concrete	0.4 kN	0.4 kN
—		Tough concrete	0.2 kN	0.2 kN
ļ		Solid sand-lime masonry	0.2 kN	0.2 kN
		Solid brick	0.2 kN	0.2 kN
		Steel	0.6 kN	0.6 kN
	•			

• For more details in relation to base material properties, please refer to the chapter **Fastener selection guide** in the Direct Fastening Technology Manual (DFTM).

- The above data value for solid sand-lime masonry and solid brick are based on laboratory and field experience. Because of the wide variety of types and forms of masonry in use worldwide, users are advised to carry out tests on site or on masonry of the type and form on which the fastenings are to be made.
- The above data refers to the fastener pull-out failure mode.
- For pull-over under tension load please consult insulation material supplier.

Stick rate estimation

	Designation	Soft, medium concrete	Tough concrete
		$15 \le f_{c,cube} \le 45 \text{ N/mm}^2$	45 < f _{c,cube} ≤ 65 N/mm²
0000000000	X-IE 6, X-IE 9	90%-95%	85%-90%

The stick rate indicates the percentage of nails that were driven correctly to carry a load. Stick rate can vary from the above values depending on job site conditions

Thermal efficiency according to EOTA TR 025

Application	Insulation thickness	Point thermal transmittance
	t,	x
Curtain wall insulation	60–90 mm	0.002 W/K
Curtain wai insulation	100–200 mm	0.001 W/K
	60–90 mm	0.002 W/K
Ceiling insulation	100–200 mm	0.001 W/K
Pacament perimeter	60 mm	0.003 W/K
Basement perimeter	70–100 mm	0.002 W/K
insulation	120–200 mm	0.001 W/K





System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

Tool and energy recommendation

Desig	nation		Tools and equipment					
			DX 6 IE		DX 5 IE		DX 460 IE	
			L equipment Fastener guide: X-6-FIE-L Piston: X-6-5-PIE-L	XL equipment Fastener guide: X-6-FIE-XL Piston: X-6-5-PIE-XL	L equipment Fastener guide: X-5-460-FIE-L Piston: X-5-460-PIE-L	XL equipment Fastener guide: X-5-460-FIE-XL Piston: X-5-460-PIE-XL	L equipment Fastener guide: X-5-460-FIE-L Piston: X-5-460-PIE-XL	XL equipment Fastener guide: X-5-460-FIE-XL Piston: X-5-460-PIE-XL
X-IE 6	X-IE 6-20	X-IE 6-140						
	X-IE 6-150	X-IE 6-200						
	X-IE 9-50	X-IE 9-140						
X-IE 9	X-IE 9-160	X-IE 9-200						

= recommended,
= feasible

Cartridge recommendation

Base material	Cartridge color (tool power level)			
	Tool type:	Tool type:		
	DX 6 IE	DX 5 IE, DX 460 IE		
	Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M		
Soft, medium concrete	titanium 🔳 (2–8)	yellow 📙, red 📕		
Tough concrete	titanium 🔳 (2–8)	yellow <mark>,</mark> red 		
Solid sand-lime masonry	titanium 🔳 (1–5)	green 🔳, yellow 📒		
Solid brick	titanium 🔳 (1–5)	green 📕, yellow 📙		
Steel	titanium 🔳 (2–8)	yellow <mark>,</mark> red =		

• Tool power level adjustment by setting tests on site.

• Start tool energy selection with lowest recommended tool power level.

• Correct according requirement from chapter quality assurance.



Fastener selection

Fastened material	Insulation thickness t _i	Designation	Nail	Item number
	50 mm	X-IE 9-50	X-PX 62	2092034
	60 mm	X-IE 9-60	X-PX 62	2041746
	80 mm	X-IE 9-80	X-PX 62	2041747
	90 mm	X-IE 9-90	X-PX 62	2041748
Soft mineral wool	100 mm	X-IE 9-100	X-PX 62	2041749
Soft mineral wool	120 mm	X-IE 9-120	X-PX 62	2041750
	140 mm	X-IE 9-140	X-PX 62	2041751
	160 mm	X-IE 9-160	X-PX 62	2041752
	180 mm	X-IE 9-180	X-PX 62	2041753
	200 mm	X-IE 9-200	X-PX 62	2041754

Fastened material	Insulation thickness t _i	Designation	Nail	Item number
	20 mm	X-IE 6-20	X-PX 47	2143956
	25 mm	X-IE 6-25	X-PX 47	2041714
	30 mm	X-IE 6-30	X-PX 52	2041715
	35 mm	X-IE 6-35	X-PX 52	2041716
	40 mm	X-IE 6-40	X-PX 52	2041717
	50 mm	X-IE 6-50	X-PX 62	2041718
	60 mm	X-IE 6-60	X-PX 62	2041719
	70 mm	X-IE 6-70	X-PX 62	2041740
Mineral wool, EPS,	75 mm	X-IE 6-75	X-PX 62	2041741
	80 mm	X-IE 6-80	X-PX 62	2041742
XPS, PIR, PUR,	90 mm	X-IE 6-90	X-PX 62	2041743
soft core multilayer board	100 mm	X-IE 6-100	X-PX 62	2041744
	120 mm	X-IE 6-120	X-PX 62	2041745
	125 mm	X-IE 6-125	X-PX 62	2323244
	140 mm	X-IE 6-140	X-PX 62	2041393
	150 mm	X-IE 6-150	X-PX 62	2048523
	160 mm	X-IE 6-160	X-PX 62	2041394
	175 mm	X-IE 6-175	X-PX 62	2323245
	180 mm	X-IE 6-180	X-PX 62	2041395
	200 mm	X-IE 6-200	X-PX 62	2041396



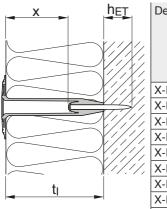
Fastened material	Insulation thickness t	Designation	Nail	Item number
	14–17 mm	X-IE 6-20	X-PX 37	2143956
	19–22 mm	X-IE 6-25	X-PX 47	2141714
	24–27 mm	X-IE 6-30	X-PX 52	2141715
	29–32 mm	X-IE 6-35	X-PX 52	2141716
	34–37 mm	X-IE 6-40	X-PX 52	2141717
	44–47 mm	X-IE 6-50	X-PX 62	2141718
	54–57 mm	X-IE 6-60	X-PX 62	2141719
	64–67 mm	X-IE 6-70 X-PX 62 2141		2141740
	69–72 mm	X-IE 6-75	X-PX 62	2141741
Digid core multilever board	74–77 mm	X-IE 6-80	X-PX 62	2141742
Rigid core multilayer board	84–87 mm	X-IE 6-90	X-PX 62	2141743
	94–97 mm	X-IE 6-100	X-PX 62	2141744
	114–117 mm	X-IE 6-120	X-PX 62	2141745
	119–122 mm	X-IE 6-125	X-PX 62	2323244
	134–137 mm	X-IE 6-140	X-PX 62	2041393
	144–147 mm	X-IE 6-150	X-PX 62	2048523
	154–157 mm	X-IE 6-160	X-PX 62	2041394
	169–172 mm	X-IE 6-175	X-PX 62	2323245
	174–177 mm	X-IE 6-180	X-PX 62	2041395
	194–197 mm	X-IE 6-200	X-PX 62	2041396

- Insulation board thickness tolerance: ±3 mm
 - Soft mineral wool, mineral wool: for intermediate thicknesses use next shorter fastener, example: for mineral wool insulation thickness 110 mm, use X-IE 6-100
 - EPS, XPS, PIR, PUR, soft core multilayer board: for intermediate thicknesses use next longer fastener, example: for PIR insulation thickness 110 mm, use X-IE 6-120
 - Rigid core multilayer board: for thicknesses not specified, please contact Hilti



Quality assurance

Fastening inspection



Designation	Embedment depth	Distance between nail head and X-IE plate
	h _{ET}	x
X-IE 6-20	19-24 mm	4–9 mm
X-IE 6-25	24-29 mm	4–9 mm
X-IE 6-30	24–29 mm	4–9 mm
X-IE 6-35	24–29 mm	4–9 mm
X-IE 6-40	24-29 mm	9–14 mm
X-IE 6-50, X-IE 9-50	24–29 mm	9–14 mm
X-IE 6-60, X-IE 9-60	24–29 mm	19–24 mm
X-IE 6-70	24-29 mm	29-34 mm
X-IE 6-75	24–29 mm	34-39 mm
X-IE 6-80, X-IE 9-80	24-29 mm	39–44 mm
X-IE 6-90, X-IE 9-90	24–29 mm	49–54 mm
X-IE 6-100, X-IE 9-100	24-29 mm	59-64 mm
X-IE 6-120, X-IE 9-120	24–29 mm	79-84 mm
X-IE 6-125	24-29 mm	84-89 mm
X-IE 6-140, X-IE 9-140	24–29 mm	99–104 mm
X-IE 6-150	24–29 mm	109–114 mm
X-IE 6-160, X-IE 9-160	24-29 mm	119–124 mm
X-IE 6-175	24–29 mm	134–139 mm
X-IE 6-180, X-IE 9-180	24–29 mm	139–144 mm
X-IE 6-200, X-IE 9-200	24-29 mm	159–164 mm

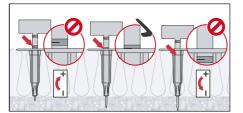


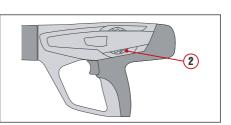




Setting depth control and power tool adjustment

Check setting depth with the gauge immediately after fastening





Adjust the power setting if required

- Visible setting failures must be replaced with a new fastener, not in the same hole
- These are abbreviated instructions which may vary by application.
- ALWAYS review/follow the instructions accompanying the product



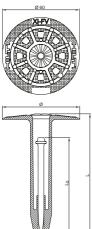


XI-FV ETICS Insulation fastener

Product data

Dimensions

XI-FV



Material specifications

Plate: XI-FV - HDPE, Orange HDT-FV - HDPE, Orange Nail: Carbon steel shank: HRC 58 Zinc coating: Delta-Tone

Recommended fastening tools

DX 6 IE, DX 6 IE XL, DX 5 IE, DX 5 IE XL, DX 460 IE, DX 460 IE XL



• See fastener program in the next pages.

Approvals

ETA-17/0304, DOP no. Hilti-DX-DoP-006

• Not all information presented in this product data sheet might be subject to approval/certificate content. Please refer to approval/certificate for further information.

HDT-FV 90

HDT-FV 140

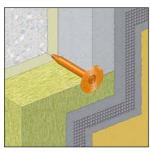




Applications

External Thermal Insulation Composite System (ETICS)

Examples



The XI-FV fastener is used to transfer wind suction loads acting on the thermal insulation composite system. The base material is normal weight concrete, which is either uncoated or coated with plaster or tiles. Coatings with plaster or tiles is often met if existing buildings are renovated and are improved with regards to their thermal insulation properties.



Performance data and application recommendation

Fixing element		XI-FV
Characteristic tension resistance in uncoated concrete	N _{Rk,p} =	1.0 kN
fastener pull-out		
Partial safety factor, fastener pull-out	$\gamma_M =$	2.0
Partial safety factor for variable action	$\gamma_Q =$	1.5
of wind suction forces		
Mean anchorage depth	h _V =	30 mm
Spacing	s _c ≥	100 mm
Edge distance	C _c ≥	75 mm
Corner distance	c _e ≥	100 mm
Thickness of concrete member	h ≥	100 mm

Characteristic resistance in concrete which is coated with plaster or tiles, see ETA-17/0304

Design value of resistance: $N_{Rd} = N_{Rk,p} / \gamma_M$

Design value of action:

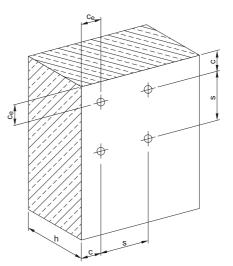
Please refer to ETA-17/0304 for detailed information on:

- the intended use (e.g. thickness of plaster and adhesive layer)
- verification of setting energy by means of control tests
- plate stiffness and point thermal transmittance

In case of concrete coated with plaster and tiles, the characteristic tension pull-out resistance needs in general be verified by job-site tests in accordance with EOTA Technical Report TR52: Recommendations for job-site tests of powder-actuated fasteners for ETICS for use in concrete.

Applicable insulation material are EPS and mineral wool.

Base material Concrete: C12/15 to C35/45 Schematic illustration of spacings of fixing elements







Corrosion information

The intended use comprises fastenings of thermal insulation composite systems which are subject to external atmospheric exposure.

During construction, exposure to UV due to solar radiation of the fixing element not protected by rendering shall not exceed the time of 6 weeks.

The temperature during installation of the fixing element shall not be less than 5 °C.

System recommendation

0

 For more details, please refer to the chapter Accessories and consumables compatibility in the Direct Fastening Technology Manual (DFTM).

Fastener program

Designation	Fastener	Item no.	Insulation thickness
			h _D
XI-FV 60	X-CPH 72	376484	60 mm
XI-FV 80	X-CPH 72	376485	80 mm
XI-FV 100	X-CPH 72	376489	100 mm
XI-FV 120	X-CPH 72	376490	120 mm
XI-FV 130	X-CPH 72	2360104	130 mm
XI-FV 140	X-CPH 72	376491	140 mm
XI-FV 150	X-CPH 72	2360105	150 mm
XI-FV 160	X-CPH 72	2069160	160 mm
XI-FV 180	X-CPH 72	2069161	180 mm
XI-FV 200	X-CPH 72	2069162	200 mm
HDT-FV 90	-	285628	-
HDT-FV 140	-	372907	-



• For soft mineral wool use XI-FV with HDT-FV 90 and HDT-FV 140.

Cartridge recommendation

Base material	Cartridge color (tool power level)		
	Tool type: DX 6 IE, DX 6 IE XL	Tool type: DX 5 IE, DX 5 IE XL, DX 460 IE, DX 460 IE XL	
Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M		
Soft/medium concrete	titanium 🔳 (2-8)	yellow <mark>–</mark> , red –	
Tough concrete	titanium 🔳 (6-8)	yellow 🗕, red 📕	

• Tool power level adjustment by setting tests on site.

• Start tool energy selection with lowest recommended tool power level.

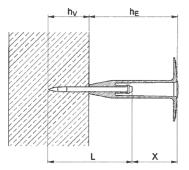
• Correct according requirement from chapter quality assurance.



Quality assurance

Cartridge colour and tool energy selection

Example in case of uncoated concrete (Annex B4 of ETA-17/0304: By means of the control tests made to uncoated concrete, the cartridge colour and tool energy required for driving in XI-FV for achieving the mean anchorage depth, hv, is determined. Please refer to XI-FV ETA approval for more details.



 $h_V = (\ell_N + X) - h_E = 30 \text{ mm}$

where

 h_V = mean anchorage depth

 h_E = length of plastic part

L = length of powder actuated fastener

X = control dimension

Designation	Insulation thickness	Control dimension
	tı	X
XI-FV 60	60 mm	≥ 12.5 mm
XI-FV 80	80 mm	≥ 32.5 mm
XI-FV 100	100 mm	≥ 52.5 mm
XI-FV 120	120 mm	≥ 72.5 mm
XI-FV 130	130 mm	≥ 82.5 mm
XI-FV 140	140 mm	≥ 92.5 mm
XI-FV 150	150 mm	≥ 102.5 mm
XI-FV 160	160 mm	≥ 112.5 mm
XI-FV 180	180 mm	≥ 132.5 mm
XI-FV 200	200 mm	≥ 152.5 mm

These are abbreviated instructions which may vary by application.

<u>ALWAYS</u> review/follow the instructions accompanying the product.





X-SW Soft washer

Product data

Product description

X-SW 30 MX	X-SW 30-C	Bearing surface engineered for better clamping of thin
		 membranes Helps to prevent tearing or ripping of thin or soft membranes Soft washer conforms to uneven surfaces 30 mm soft washer – suitable for fastening fabric waterproofing membranes to concrete surfaces
X-SW 60 MX	X-SW 60-C	 60 mm soft washer – provides large bearing surface for superior clamping of thin and delicate membranes

Dimensions for plastic elements

Technical drawing	Designation	Diameter	Height
		d	h
	X-SW 30 MX,	36 mm	13.8 mm
	X-SW 30-C 37		
	X-SW 60 MX,	68 mm	15 mm
	X-SW 60-C 37		
d			

Dimensions

Technical drawing	Designation	Shank	Head	Shank	Head
		length	length	diameter	diameter
		Ls	L _h	ds	d _h
d d	X-C 37	37 mm	2 mm	3.5 mm	8 mm

Info for single nails are part the corresponding Product Data Sheets.





Material specification and material properties for plastic elements

Designation	Elements	Material	Color	Others
X-SW 30 MX	Soft washer	PE	Light grey, RAL 7035	
X-SW 60 MX	Soft washer	PE	Light grey, RAL 7035	

Material specification and material properties for steel elements

Designation	Elements	Material	Coating	Minimum	Hardness
				coating	
				thickness	
X-C 37	Nail	Carbon	Zinc	5 µm	56.5 HRC
		steel			

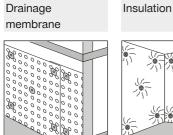
• Info for single nails are part of the corresponding Product Data Sheets.

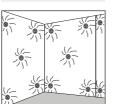
Approvals and certificates

Authority	Approval / certificate no.	Date of issue	Country of issue
ITB	AT-15-7696/2016	12/2016	Poland
Rom. Ministry,	AT 016-01_420-2020	03/2020	Romania
ICECON			

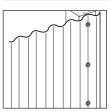
Not all information presented in this product data sheet might be subject to approval / certificate content. Please refer to approval/certificate for further information.

Applications









Plastic sheets





Base materials





Soft concrete

Medium Tough concrete

Load conditions



Static/ quasi static

Environmental conditions



Dry indoor



- The intended use comprises fastening in dry conditions or temporary outdoor conditions.
- For more details, please refer to following technical document: Hilti Corrosion Handbook.

Fastener program

Item no. and description

Designation	Item no.	Description
X-SW 30 MX	371370	Coftworker
X-SW 60 MX	371371	Soft washer
X-SW 30-C 37	40614	
X-SW 30-C 47	40615	
X-SW 30-C 62	40616	Soft washer
X-SW 60-C 37	40643	with pre-mounted nail
X-SW 60-C 47	40644	
X-SW 60-C 62	40645	

X-SW Soft washer – Fastening drainage membrane to concrete

Application recommendation

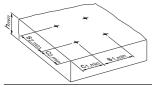
Fastened material propertiesl

200	Fastened material	Drainage membrane
	Fastened material thickness t _i	2–10 mm

Fastener positioning in fastened material

• Please consult drainage membrane supplier for data with regard to fastener edge distance, spacing and minimum number of fasteners per m².

Base material properties and fastener positioning in base material



Base material	Concrete
Base material thickness h _{min}	80 mm
Edge distance c _{1,min} , c _{2,min}	70 mm
Fastener spacing s _{1,min} , s _{2,min}	100 mm

• For more details in relation to base material properties, please refer to the chapter **Fastener selection guide** in the Direct Fastening Technology Manual (DFTM).

Fastener shank length recommendation







Performance data

A

• Temporary application, no load data required.

Stick rate estimation

	Designation	Soft/medium	Tough
		concrete	concrete
$\bigcirc \bigcirc $	X-SW MX + X-X 27 MX	-	70-80 %
	X-SW MX + X-C MX	-	-
	X-SW MX + X-GN MX	-	-

- The stick rate indicates the percentage of nails that were driven correctly to carry a load.
- Stick rate can vary from the above values depending on job site conditions.

System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

Recommendation for fastening collated nails with powder-actuated tool

Designation	Powder-actuated tool			gnation Powder-actuated tool Base material			
	DX 6 MX	DX 5 MX	DX 460 MX	Soft concrete	Medium concrete	Tough concrete	
X-SW 30, 60 MX + X-X 27 MX							
X-SW 30, 60 MX + X-C 27 to 37 MX							

 \blacksquare = recommended \square = feasible



Designation	Powder-actuated tool			Base n	naterial			
	DX 6 F8	DX 5 F8	DX 460 F8	DX 2	Soft concrete	Medium concrete	Tough concrete	
X-SW 30, 60 MX +								
X-X 27 P8								
X-SW 30, 60 MX + X-C 37 P8								
X-SW 30-C 37, X-SW 60-C 37								

■ = recommended □ = feasible

Cartridge recommendation

Base material	Cartridge color (tool power level)				
	Tool type:	Tool type:			
	DX 6 MX	DX 5 MX, DX 460 MX			
	DX 6 F8	DX 5 F8, DX 460 F8, DX 2			
	Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M			
Soft/medium concrete	titanium 🔳 (2-4)	yellow <mark>,</mark> red			
Tough concrete	titanium 🔳 (2-6)	yellow <mark>,</mark> red 			



Recommendation for fastening collated nails with gas-actuated tool

Designation	Gas-actuated tool		Base material					
	GX 120-ME	GX 2	GX 3		Soft concrete	Medium concrete		
X-SW 30, 60 + X-GN 39 MX								
X-SW 30, 60 +						_		
X-C 39 G2 MX								
X-SW 30, 60 +								
X-C 39 G3 MX								

 \blacksquare = recommended \square = feasible

• Tool power level adjustment by setting tests on site.

- Start tool energy selection with lowest recommended tool power level.
- Correct according requirement from chapter quality assurance.

Quality assurance

Setting depth control



- Visible setting failures must be replaced with a new fastener, not in the same hole.
- These are abbreviated instructions which may vary by application.
- Always review/follow the instructions accompanying the product.



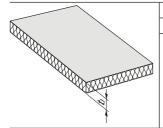
H

X-SW

X-SW Soft washer – Fastening insulation to concrete

Application recommendation

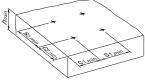
Fastened material properties



Fastened material	Insulation
Fastened material thickness $t_{\scriptscriptstyle I}$	2–30 mm

• Please consult insulation supplier for data with regard to fastener edge distance, spacing and minimum number of fasteners per m².

Base material properties and fastener positioning in base material

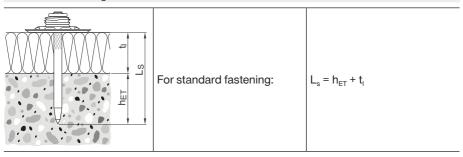


	Base material	Concrete
	Base material thickness h_{min}	80 mm
)	Edge distance $c_{1,min}$, $c_{2,min}$	70 mm
	Fastener spacing s _{1,min} , s _{2,min}	100 mm

Base material properties

• For more details, please refer to the chapter **Fastener selection guide** in the Direct Fastening Technology Manual (DFTM).

Fastener shank length recommendation







Performance data

Recommended resistance under tension and shear load

Designation	Tension load N _{rec}	↓ Nrec	Shear load V _{rec}	↓ V _{rec}
	Soft/medium concr	ete	Soft/medium	concrete
X-SW + X-C	0.30 kN		0.30 kN	
X-SW 30-C	0.30 kN		0.30 kN	
X-SW 60-C	0.30 kN		0.30 kN	

- Redundancy of fastening points is required.
- Minimum number of fastening points for safety relevant fastenings: ≥ 5.
- Predominantly static loading.
- Design loads valid for nail pull-out strength.
- Fastened material has to be considered separately.
- Valid for concrete C 30/37.
- For more details in relation to base material properties, please refer to the chapter **Fastener selection guide** in the Direct Fastening Manual (DFTM).

Stick rate estimation

 Designation	Soft/medium	Tough
	concrete	concrete
X-SW + X-C	-	-
X-SW 30-C	-	-
X-SW 60-C	-	-

- The stick rate indicates the percentage of nails that were driven correctly to carry a load.
 - Stick rate can vary from the above values depending on job site conditions.





System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

System recommendation for fastening collated nails with powder-actuated tool

Designation	Powder-actuated tool			ed tool Base material				
	DX 6 MX	DX 5 MX	DX 460 MX		Soft concrete	Medium concrete		
X-SW 30 + X-C 37 MX								
X-SW 60 + X-C 37 MX								

 \blacksquare = recommended \square = feasible

System recommendation for fastening single nails with powder-actuated tools

Designation	Powder-actuated tool E			Base n	naterial		
	DX 6 F8	DX 5 F8	DX 460 F8	DX 2	Soft concrete	Medium concrete	
X-SW 30 MX + X-C 37 F8							
X-SW 60 MX + X-C 37 F8							
X-SW 30-C 37							
X-SW 30-C 47							
X-SW 30-C 62							
X-SW 60-C 37							
X-SW 60-C 47							
X-SW 60-C 62							

 \blacksquare = recommended \square = feasible





Cartridge recommendation

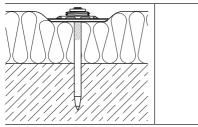
Base material	Cartridge color (tool power le	Cartridge color (tool power level)				
	Tool type:	Tool type:				
	DX 6 MX	DX 5 MX, DX 460 MX				
	DX 6 F8	DX 5 F8, DX 460 F8, DX 2				
	Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M				
Soft/medium concrete	titanium 🔳 (2-6)	yellow <mark>,</mark> red 				
Tough concrete	titanium 🔳 (2-6)	yellow <mark>,</mark> red =				

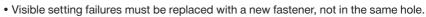
- Tool power level adjustment by setting tests on site.
- Start tool energy selection with lowest recommended tool power level.
- Correct according requirement from chapter quality assurance.

Quality assurance

R

Setting depth control





- These are abbreviated instructions which may vary by application.
- Always review/follow the instructions accompanying the product.







X-FS Form stop

Product data

Product description



X-FS C 52



- Facilitates quick and easy positioning of formwork panels on concrete
- Designed for extremely high productivity up to five times faster than traditional methods
- · Easy to install even on rough concrete surfaces
- Stronger bond with the concrete due to large openings
- Formwork spacers remain hardly visible or fully hidden in concrete after removing formwork

Dimensions for plastic elements

Technical drawing	Designation	Diameter d	Height h
	X-FS MX	50 mm	35.2 mm
	X-FS C 52	50 mm	35.2 mm

Dimensions for nails

Technical drawing	Designation	Shank	Head	Shank	Head
		length	length	diameter	diameter
		Ls	L _h	ds	d _h
	X-C 52	52 mm	2 mm	3.5 mm	8 mm





Material specification and material properties for plastic elements

Designation	Elements	Material	Color	Others
X-FS MX	Form stop	HDPE	Light grey, RAL 7035	
X-FS C 52	Form stop	HDPE	Light grey, RAL 7035	

Material specification and material properties for steel elements

Designation	Elements	Material	Coating	Minimum	Hardness
				coating	
				thickness	
X-C 52	Nail	Carbon	Zinc	5 µm	56.5 HRC
		steel			

• Info for single nails are part of the corresponding Product Data Sheets.

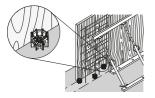
Approvals and certificates

Authority	Approval / certificate no.	Date of issue	Country of issue
ITB	AT-15-7696/2016	12/2016	Poland
Rom. Ministry,	AT 016-01_420-2020	03/2020	Romania
ICECON			

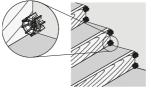
Not all information presented in this product data sheet might be subject to approval / certificate content. Please refer to approval/certificate for further information.

Applications

Formwork to concrete



Minor formwork to concrete







Base materials





Soft concrete

Medium Tough concrete

Load conditions



Static/ quasi static

Environmental conditions



Dry indoor



- The intended use comprises fastening in dry conditions or temporary outdoor conditions.
- For more details, please refer to following technical document: Hilti Corrosion Handbook.

Fastener program

Item no. and description

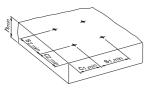
Designation	Item no.	Description
X-FS MX	408022	Form stop
X-FS C 52	407346	Form stop with pre-mounted
		nail



X-FS Form stop – Fastening formwork

Application recommendation

Fastened material properties and fastener positioning in fastened material



Base material	Concrete
Base material thickness h _{min}	80 mm
Edge distance $c_{1,min}$, $c_{2,mi}$	70 mm
Fastener spacing s _{1,min} , s _{2,min}	100 mm

Performance data

Recommended resistance under shear load

Designation	Shear load V _{rec}	Vrec
	Soft/medium concrete	Tough concrete
X-FS MX + X-X 52 MX	0.50 kN	0.50 kN
X-FS MX + X-C 52 MX	0.40 kN	-
X-FS MX + X-X 52 P8	0.50 kN	0.50 kN (DX 2: 0.20 kN)
X-FS C 52 pre-mounted	0.40 kN	-



- Redundancy of fastening points is required.
- Minimum number of fastening points for safety relevant fastenings: \geq 5.
- For more details, please refer to the chapter **Fastener selection guide** in the Direct Fastening Technology Manual (DFTM).





Stick rate estimation

 Designation	Soft/medium	Tough
	concrete	concrete
X-FS MX + X-X 52 MX	90-95 %	85-95 %
X-FS MX + X-C 52 MX	-	-
X-FS MX + X-X 52 P8	90-95 %	85-95%
X-FS C 52	-	-

• The stick rate indicates the percentage of nails that were driven correctly to carry a load.

• Stick rate can vary from the above values depending on job site conditions.

System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

System recommendation for fastening collated nails with powder-actuated tool

Designation	Powder-actuated tool			Base material				
	DX 6 MX	DX 5 MX	DX 460 MX		Soft concrete	Medium concrete	Tough concrete	
X-FS MX + X-X 52 MX								
X-FS MX + X-C 52 MX								

 \blacksquare = recommended \square = feasible



System recommendation for fastening single nails with powder-actuated tools

Designation	Powder-actuated tool			Base material				
	DX 6 F8	DX 5 F8	DX 460 F8	DX 2	Soft concrete	Medium concrete	Tough concrete	
X-FS MX + X-X 52 P8								
X-FS MX + X-X 52 P8								
X-FS C 52								

 \blacksquare = recommended \square = feasible

Cartridge recommendation

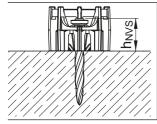
Base material	Cartridge color (tool power level)			
	Tool type:	Tool type:		
	DX 6 MX	DX 5 MX, DX 460 MX		
	DX 6 F8	DX 5 F8, DX 460 F8, DX 2		
	Cartridge type: 6.8/11 M Cartridge type: 6			
Soft/medium concrete	titanium 🔳 (2-6)	yellow 📕, red 📕		
Tough concrete	titanium 🔳 (6-8)	yellow 📕, red 📕		

- Tool power level adjustment by setting tests on site.
- Start tool energy selection with lowest recommended tool power level.
 - Correct according requirement from chapter quality assurance.

Quality assurance

н

Setting depth control



Fastener stand-off h_{NVS}

22-32 mm

- Visible setting failures must be replaced with a new fastener, not in the same hole.
- These are abbreviated instructions which may vary by application.
 - Always review/follow the instructions accompanying the product.

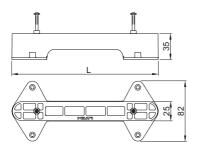




X-DFS Double form stop

Product data

Dimensions



Material specifications X-DFS: polypropylene (halogen and silicone free) grey (RAL 7030), green (RAL 6018), light brown (RAL 8001) Nails (pre-mounted):

X-C 62: Carbon steel, HRC 56.5, $d_{nom} = 3.5 \text{ mm},$ zinc coating 5–20 μm

Recommended fastening tools DX 6 F8, DX 5 F8, DX 460 F8, DX 351 ME, DX 2



• See fastener program in the next pages.

Material specification and material properties for carbon steel elements

Nail recommendation for concrete base material

Nail type	Length	Тір	Shank Ø	Material	Hardness	Coating
X-C 62	62 mm	Cut	3.5 mm	Carbon	56.5 HRC	Zinc,
				steel		5–20 µm

• Two X-C 62 nails are pre-mounted to each X-DFS element.

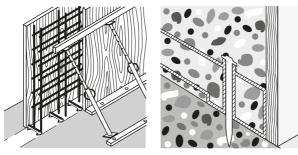
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Applications

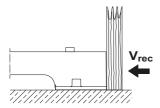
Example



- Positioning concrete forms on concrete surfaces.
- Leave in place formwork spacer, polypropylene is non rusting, nearly invisible and non-conductive.
- Fixed-length form stops for soft concrete base material.

Performance data

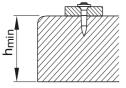
Recommended resistance under shear load



- Predominantly static, however, vibration from concrete compacting is allowed.
- Valid for soft concrete, medium concrete with strength of f_{c. cube} = 25-45 N/mm².
- For more details in relation to base material properties, please refer to the chapter **Fastener selection guide** in the Direct Fastening Technology Manual (DFTM).

Application recommendation

Base material thickness

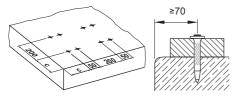


Concrete: h_{min} = 80 mm





Fastener positioning in base material



Edge distance: $c \ge 70 \text{ mm}$

Corrosion information

- For temporary fixations no restrictions exist.
 - For more details, please refer to following technical document: Hilti Corrosion Handbook.

System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

Cartridge recommendation

Base material	Cartridge color (tool power level)				
	Tool type:	Tool type:			
	DX 6 F8	DX 5 F8, DX 460 F8,			
		DX 351 ME, DX 2			
	Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M			
Soft/medium concrete	titanium 🔳 (1-5)	green 🔳, yellow 📙, red 📕			
Tough concrete	titanium 🔳 (4-8)	yellow 🗕, red 📕			

- Tool power level adjustment by setting tests on site.
- Start tool energy selection with lowest recommended tool power level.
- Correct according requirement from chapter quality assurance.

Fastener program

Designation	Item no.	Length	Nail shank
		L	d _{nom}
X-DFS 160 C62	2159751	160 mm	3.5 mm
X-DFS 180 C62	2159752	180 mm	3.5 mm
X-DFS 200 C62	2159753	200 mm	3.5 mm





X-EGN, X-GHP, X-GN Fastener for gas-actuated tool

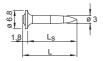
Product data

Dimensions

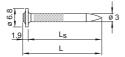
X-FGN 14



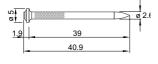
X-GHP 17/20/24



X-GN 20/27/32



X-GN 39



Material specifications Carbon steel shank: Zinc coating:

X-EGN HRC 57.5 X-GHP HRC 57.5 X-GN HRC 56.5 2-13 um

Recommended fastening tools

GX 120, GX 120-ME GX 100, GX 100 E

> • For more details, please refer to X-EGN, X-GHP, X-GN fastener program and to the chapter Accessories and consumables compatibility in the Direct Fastening Technology Manual (DFTM).

Approvals

ICC-ESR 1752 (USA):

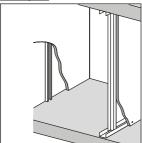
X-GN 20/27/32, X-EGN 14, X-GHP 16/17/20/24 X-GHP, X-GN

IBMB

 Not all information presented in this product data sheet might be subject to approval/certificate content. Please refer to approval/certificate for further information.

Applications

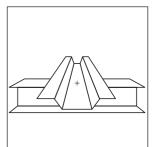
Examples



Drywall tracks to concrete and steel



Electrical applications

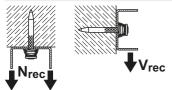


Temporary tacking of composite deck to steel beams



Performance data

Recommended resistance under tension and shear load for drywall track fastening



X-EGN (Base material: steel)

Tension N _{rec}	Shear V _{rec}		
0.4 kN	0.4 kN		

X-GHP, X-GN (Base material: concrete / sand-lime masonry)

Embedment	Tensic	on N _{rec} Shear		r V _{rec}	Tension N _{rec}	Shear V _{rec}
		Concrete Type				
	Soft/ medium	Tough	Soft/ medium	Tough	Sand-lime	e masonry
≥ 22 mm	-	-	-	-	0.3 kN	0.3 kN
≥ 18 mm	0.2 kN	-	0.2 kN	-	0.2 kN	0.2 kN
≥ 14 mm	0.1 kN	0.1 kN	0.1 kN	0.1 kN	0.1 kN	0.1 kN

Conditions

- For safety relevant fastenings sufficient redundancy of the entire system is required; Minimum of 5 nails per fastened track. All visible setting failures must be replaced
- Sheet metal failure is not considered in recommended loads and must be assessed separately
- Soft, medium concrete up to $f_{c,cube} = 45 \text{ N/mm}^2$ (C35/45), some tough concrete up to $f_{c,cube} = 60 \text{ N /mm}^2$ (C50/60).
- Concrete with aggregate like granite or river rock or softer, and up to 16 mm diameter

Stick rate estimation



Designation	Soft/medium concrete	Tough concrete
X-GHP	85–98%	70–85%
X-GN	75–90%	55-70%

- The stick rate indicates the percentage of nails that were driven correctly to carry a load.
 - Stick rate can vary from the above values depending on job site conditions.



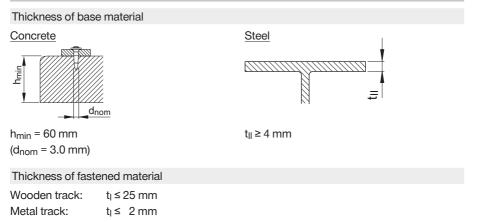
X-EGN 14 MX for temporary tacking of composite decks

Tension N _{rec}	Shear V _{rec}	
0.4 kN	0.4 kN	

Conditions

- The intended use of the fastenings is to secure the deck position and to ensure a safe working platform during the erection state only. The fasteners serve as temporary fixation until the shear connectors of the composite beams are attached.
- At each permanent composite deck support, it is recommended to drive at least one fastener per trough.
- Every deck panel must be fixed at least with two fasteners at every permanent support.
- Single layer sheet with a maximum thickness of 1.25 mm.
- Sheeting grade up to S450 acc. to EN 10346.
- Minimum base material thickness: 6 mm.
- Minimum steel grade: S235 acc. to EN 10025-2.

Application recommendation





All track ends (cut-outs for doors),

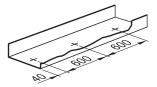
80

secure with 2 nails

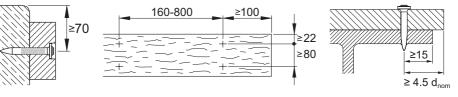
Spacing and edge distances (mm)

Spacing along track

(as per U.S. Gypsum Handbook)



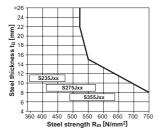
Distance to edge of concrete / Fastener spacings on wood: sandlime masonry



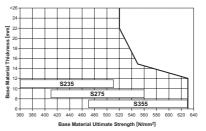
Application limits

X-EGN 14

For fastening on steel



For temporary tacking of composite decks



Design conditions:

- Single layer sheet with a maximum thickness of 1.25 mm.
- Sheeting grade up to S450 acc. to FN 10346.
- Minimum base material thickness: 6 mm
- Minimum steel grade: S235 acc. to FN 10025-2



Corrosion information



- The intended use only comprises fastenings which are not directly exposed to external weather conditions or moist atmospheres.
- For more details, please refer to following technical document: Hilti Corrosion Handbook.

Fastener program and system recommendation

Fastener program for fastening to concrete/sandlime masonry					
Designation	Application	Base material			
X-GN 39 MX	Wooden track (t ₁ \leq 25 mm)	Concrete/sandlime masonry			
X-GN 27MX	Metal track	Concrete/sandlime masonry	stre		
X-GN 20 MX	Metal track	Concrete/sandlime masonry	increasing strength		
X-GHP_MX	Metal track	Concrete/sandlime masonry	√		

Fastener programm for fastening to steel

Designation	Application	Base material	
X-EGN 14	Metal track	Steel	

Item numbers and technical information

Designation	Item no.	L _s	L	d _{nom}
X-EGN 14 MX	340231	14 mm	15.8 mm	3.0 mm
X-GHP 16 MX	2071471	16 mm	17.8 mm	3.0 mm
X-GHP 17 MX	340228	18 mm	19.8 mm	3.0 mm
X-GHP 20 MX	285724	20 mm	21.8 mm	3.0 mm
X-GHP 24 MX	438945	24 mm	25.8 mm	3.0 mm
X-GN 20 MX	340232	19 mm	20.9 mm	3.0 mm
X-GN 27 MX	340230	27 mm	28.9 mm	3.0 mm
X-GN 32 MX	340233	32 mm	33.9 mm	3.0 mm
X-GN 39 MX	340234	39 mm	40.9 mm	2.6 mm

Tool and gas can

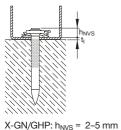
Tool designation	Gas can
GX 120 / GX 120 ME	GC 20, GC 21 and GC 22
GX 100 / GX 100 E	GC 11 and GC 12 (for USA)

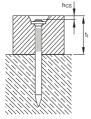


Quality assurance

Fastening inspection

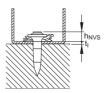
Fastening to concrete / sandlime masonry





X-GN 39: h_{CS} = 2-3 mm

Fastening to steel



X-EGN 14: h_{NVS} = 2-9 mm



GX 3 System Fastener for interior finishing, building construction, mechanical and electrical application

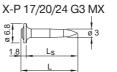
Product data

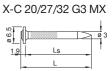
GX 3 gas tool

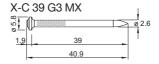


GX 3, GX 3-ME









Nails for fastening to steel X-S 14 G3 MX



Material specification for nails X-P G3 MX, X-S G3 MX X-C G3 MX

Carbon steel, HRC 57.5, 2-13 μm zinc coating Carbon steel, HRC 56.5, 2-13 μm zinc coating

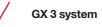
Approvals and certificates ICC-ESR 1752 (USA) IBMB ETA-16/0301

X-P 17/20/24 G3 MX, X-C 20/27/32 G3 MX and X-S 14 G3 MX X-P 17/20/24 G3 MX, X-C 20/27/32/39 G3 MX X-P 20/24 G3 MX



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Applications

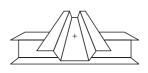
Examples



Drywall tracks



Light-duty building construction applications



Temporary tacking of composite deck to steel beams

Product data

Electrical elements to be used with nails



Material specifications for plastic parts

X-ECT MX, X-EKS, X-EKSC MX, ECH MX	PA, halogen free, silicone free, light grey RAL 7035
X-EKB MX	PA, halogen free, light grey RAL 7035
X-ECT-FR MX	PBT, silicone free, flame retardant, stone grey RAL 7030
X-EKB-FR MX	PBT, silicone free, flame retardant, stone grey RAL 7030
X-UCT MX, X-ET MX	HDPE, halogen free, silicone free, light grey RAL 7035
Х-ТТ	PET
X-FB MX, X-DFB MX	Galvanized steel sheet f _u = 270-420 N/mm², 10-20 μm zinc coating
X-ECC MX, X-EHS MX	Galvanized steel sheet f _u = 270-420 N/mm², 10-20 µm zinc coating

Approvals and certificates ICC-ESR 1752 (USA), IBMB, ETA-16/0301



Applications



Conduits and light-duty pipes



Electrical cables

Product data

GX 3 gas tool



Studs for fastening to concrete

X-M6-7-24 G3 P7



X-W6-12-20 G3 P7



Studs for fastening to steel X-M6-7-14 G3 P7



X-W6-12-14 G3 P7



Material specifications for studsCarbon steel shankHRC 57.5Zinc coating2-10 µm

Applications

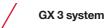


Junction boxes, switch boxes, etc.



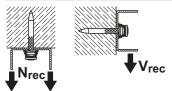
Pipe rings for light-duty pipes





Performance data

Recommended resistance under tension and shear load for drywall track fastening



X-S 14 G3 MX (Base material: steel)

Tension N _{rec}	Shear V _{rec}	
0.4 kN	0.4 kN	

X-P G3, X-C G3 (Base material: concrete / sand-lime masonry)

Embedment	Tensic	on N _{rec} Shear V _{rec}		Tension N _{rec}	Shear V _{rec}	
	Concrete Type					
	Soft/ medium	Tough	Soft/ medium	Tough	Sand-lime	e masonry
≥ 22 mm	-	-	-	-	0.3 kN	0.3 kN
≥ 18 mm	0.2 kN	-	0.2 kN	-	0.2 kN	0.2 kN
≥ 14 mm	0.1 kN	0.1 kN	0.1 kN	0.1 kN	0.1 kN	0.1 kN

Conditions

- For safety relevant fastenings sufficient redundancy of the entire system is required; Minimum of 5 nails per fastened track. All visible setting failures must be replaced
- Sheet metal failure is not considered in recommended loads and must be assessed separately
- Soft, medium concrete up to $f_{c,cube} = 45 \text{ N/mm}^2$ (C35/45), some tough concrete up to $f_{c,cube} = 60 \text{ N/mm}^2$ (C50/60).
- Concrete with aggregate like granite or river rock or softer, and up to 16 mm diameter

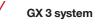
Stick rate estimation



Designation	Soft/medium concrete	Tough concrete
X-P G3	85-98%	70-85%
X-C G3	75–90%	55–70%

- The stick rate indicates the percentage of nails that were driven correctly to carry a load.
 - Stick rate can vary from the above values depending on job site conditions.





Recommended loads and tightening torque for threaded studs

Designation	N _{rec}	V _{rec}	T _{rec}	Base material
X-M6-7-24 G3 P7	0.05 kN	0.05 kN	3.0 Nm	Concrete, sand-lime
X-W6-12-20 G3 P7	0.05 kN	0.05 kN	3.0 Nm	masonry
X-M6-7-14 G3 P7	0.2 kN	0.2 kN	3.0 Nm	Steel
X-W6-12-14 G3 P7	0.2 kN	0.2 kN	3.0 Nm	

Recommended tension and shear load for fastening electrical elements

Designation	Tension load N _{rec}	Shear load V _{rec}
X-ECT 40 MX, X-ECT MX, X-ECT FR MX	0.040 kN	0.040 kN
X-UCT MX	0.040 kN	0.040 kN
X-EKS MX	0.011 kN	0.011 kN
X-EKSC MX	0.032 kN	0.032 kN
X-FB MX / X-DFB MX	0.020 kN	0.020 kN
X-ECC MX	0.050 kN	0.050 kN
X-EHS MX	0.080 kN	0.080 kN
X-EKB 4 MX, X-EKB FR 4 MX	0.090 kN	
X-EKB 8 MX, X-EKB FR 8 MX	0.014 kN	
X-EKB 16 MX, X-EKB FR 16 MX	0.018 kN	
X-ECH MX	0.040 kN	0.040 kN

Recommended tension and shear load for fastening pipes

Designation	Tension load N _{rec}	Shear load V _{rec}
X-ECT 40 MX, X-ECT MX, X-ECT FR MX	0.040 kN	0.040 kN
X-EKSC MX	0.032 kN	0.032 kN

• copper pipes and plastic pipes, e.g. PEX pipes

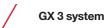
• pipes filled with 90°C hot fluid

• tests according to Kiwa standard BRL-K506

Recommended tension and shear load for fastening cable trunking

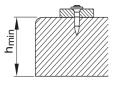
Designation	Tension load N _{rec}	Shear load V _{rec}	
X-ET MX	0.10 kN	0.10 kN	





Application recommendation

Thickness of base material



Concrete (for nails	
and threaded studs)	
h _{min} = 60 mm	<u> </u>

 $\begin{array}{c|c} \underline{Steel} \\ t_{II} \geq 4.0 \text{ mm (for nails)} \\ t_{II} \geq 6.0 \text{ mm (for } \\ \hline \end{array}$

All track ends (cut-outs for doors),

Thickness of fastened material

Wooden track: Metal track: t_l ≤ 25 mm t_l ≤ 2 mm

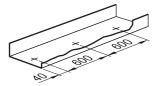


secure with 2 nails

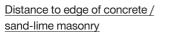
Deflection head: $t_{l.tot.} \le 21 \text{ mm}$ (gypsum strip + metal track and sealant)

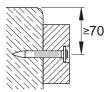
Spacing and edge distances (mm)

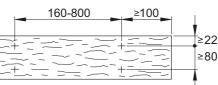
Spacing along track



Fastener spacing max. 30 cm for proprietary light non-load-bearing partition walls with fire classification





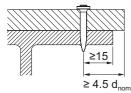




Spacing between nails when fastening



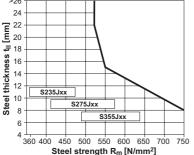
Distance to edge of fastened material (steel base material)



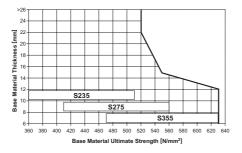


Application limits





For temporary tacking of composite decks

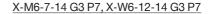


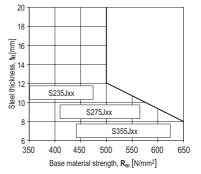
Design conditions

- Single layer sheet with a maximum thickness of 1.25 mm.
- Sheeting grade up to S450 acc. to EN 10346.
- Minimum base material thickness: 6 mm
- Minimum steel grade: S235 acc. to EN 10025-2

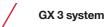
Corrosion information

- The intended use only comprises fastenings which are not directly exposed to external weather conditions or moist atmospheres, i.e. only intended for dry indoor areas.
 - For more details, please refer to following technical document: Hilti Corrosion Handbook.









Fastener program and system recommendation

Fastener program

Nails

Designation	Item no.	Shank	Shank	Base	Length
		length	diameter	material	recommendation
X-S 14 G3 MX	2101547	14 mm	3 mm	Steel	
X-P 17 G3 MX	2101046	17 mm	3 mm		
X-P 20 G3 MX	2101047	20 mm	3 mm		
X-P 24 G3 MX	2101048	24 mm	3 mm	Concrete /	ncreasing t
X-C 20 G3 MX	2100955	20 mm	3 mm	Sand-lime	
X-C 27 G3 MX	2100956	27 mm	3 mm	masonry	d material
X-C 32 G3 MX	2100957	32 mm	3 mm		d material strength
X-C 39 G3 MX	2100958	39 mm	2.6 mm		<u>ه</u> ا

Threaded studs

Designation	Item no.	Thread	Thread	Shank	Shank	Base
		size	length	length	diameter	material
X-M6-7-14 G3 P7	2101052	M6	7 mm	14 mm	3 mm	Steel
X-M6-7-24 G3 P7	2101053	M6	7 mm	24 mm	3 mm	Concrete
X-W6-12-14 G3 P7	2101054	W6	12 mm	14 mm	3 mm	Steel
X-W6-12-20 G3 P7	2101055	W6	12 mm	20 mm	3 mm	Concrete



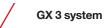


Fastener selection

GX 3						
	Base material					
	Hollow Brick	Concrete Wall/Floor	Concrete Ceiling	Steel		
Track fastening	X-C 27 G3 MX X-C 20 G3 MX	X-C 20 G3 MX	X-C 20 G3 MX X-P 17 G3 MX	X-S 14 G3 MX		
Wood fastening		G3 MX G3 MX				
Electrical fastening	X-C 27 G3 MX X-C 20 G3 MX	X-C 20 G3 MX		X-S 14 G3 MX		
Modul fastening	X-C 20	G3 MX	X-C 20 G3 MX X-P 17 G3 MX	X-S 14 G3 MX		
Tape fastening	X-C 20	G3 MX	X-C 20 G3 MX X-P 17 G3 MX	X-S 14 G3 MX		
Equipment fastening	X-W6-12-20 G3 P7 X-M6-7-24 G3 P7			X-W6-12-14 G3 P7 X-M6-7-14 G3 P7		
Gas can	GC 40/GC 41/GC 42					

For more details and information, please contact your nearest Hilti representative.



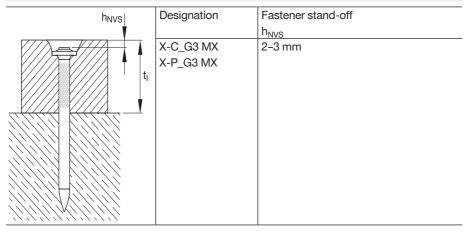


Fastening quality assurance

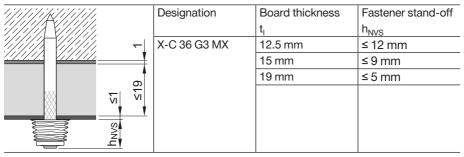
Fastener stand-off for fastening to concrete and sand-lime masonry

<u>р</u>	Designation	Fastener stand-off
		h _{NVS}
	X-C_G3 MX	2–5 mm
h _{NVS}	X-P_G3 MX	

Fastener stand-off for fastening to concrete and sand-lime masonry



Fastener stand-off for fastening deflection head to concrete







Fastener stand-off for fastening to steel

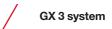
	Designation	Fastener stand-off
h _{NVS}	X-S 14 G3 MX	h _{NVS} 2-9 mm

Fastener stand-off for cable claps

	Designation	Fastener star	nd-off
hef		h _{NVS}	
		Concrete	Steel
	X-EKB 4/8 MX	6–11 mm	6-9 mm
hef hNVS	X-EKB 16 MX	6–11 mm	6-9 mm
	X-ECT MX	6–11 mm	6-9 mm
hef	X-UCT MX	6–11 mm	6-9 mm
hnvs	X-ECH MX	6–11 mm	6-9 mm
	X-EKS MX	6–11 mm	6-9 mm
	X-EKSC MX	6–11 mm	6-9 mm
	X-FB MX	7–11 mm	7-9 mm
	X-DFB MX	7–11 mm	7-9 mm
	X-ECC MX	7–11 mm	7–9 mm
	X-EHS MX	7–11 mm	7–9 mm
	X-ET MX	5-10 mm	5-9 mm

- \bullet Fastener stand-off h_{NVS} for X-ET MX is measured against the cable trunk.
- Visible setting failures must be replaced with a new fastener, not in the same hole.
- These are abbreviated instructions which may vary by application.
- Always review/follow the instructions accompanying the product.





Fastener program

Item no. and description

Designation	Item no.	Description
X-S 14 G3 MX	2156392, 2156393	Nails for fastening to steel
X-P 17 G3 MX	2156216, 2156219	
X-P 20 G3 MX	2156217, 2156390	
X-P 24 G3 MX	2156218, 2156391	
X-C 20 G3 MX	2123993	Nails for fastening
X-C 24 G3 MX	2123994	to concrete
X-C 27 G3 MX	2224568	
X-C 30 G3 MX	2149988	
X-C 36 G3 MX	2149989	
X-FG G3	2102280	Fastener guide for use
X-FG G3	2102280	with nails or studs only
X-FG G3-ME	2102281	Fastener guide for use with
V-LG CO-INE	2102201	nails + elements or only studs



GX 2 System Fastener for interior finishing application

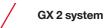
Product data						
Dimensions						
X-P 14 G2 MX	X-P 17/20	G2 MX	X-C 20 / 27 /	32 G2 MX	X-C 39 G2 MX	
		3		0 2.75		2.6
Material specific	ations					
Carbon steel sha	ank:	X-P G2 X-C G2		HRC 57.5 HRC 56.5		
Zinc coating:				2–13 µm		
		(X-P 14	G2 MX)	up to 16 µ	m	
Recommended	fastening tool					
GX 2						
Approvals and	certificates					
ICC ESR-1752 (l	USA):	X-C 20	/ 27 / 32 G2, X	-P 14 / 17 / 2	20 G2	
	val/certificate				might be subject /certificate for fu	
Applications						
Evamples						





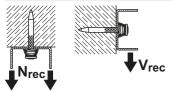
Light-duty applications in construction





Performance data

Recommended resistance under tension and shear load for drywall track fastening



X-P 14 G2 MX (Base material: steel)

Tension N _{rec}	Shear V _{rec}
0.4 kN	0.4 kN

X-P G2, X-C G2 (Base material: concrete / sand-lime masonry)

Embedment	Tensio	on N _{rec} Shear V _{rec}		Tension N _{rec}	Shear V _{rec}		
		Concre	te Type				
	Soft/ medium	Tough	Soft/ medium	Tough	Sand-lime masonry		
≥ 22 mm	-	-	-	-	0.3 kN	0.3 kN	
≥ 18 mm	0.2 kN	-	0.2 kN	-	0.2 kN	0.2 kN	
≥ 14 mm	0.1 kN	0.1 kN	0.1 kN	0.1 kN	0.1 kN	0.1 kN	

Conditions

- For safety relevant fastenings sufficient redundancy of the entire system is required; Minimum of 5 nails per fastened track. All visible setting failures must be replaced
- · Sheet metal failure is not considered in recommended loads and must be assessed separately
- Soft, medium concrete up to $f_{C,CUDe} = 45 \text{ N/mm}^2$ (C35/45), some tough concrete up to $f_{C,CUDe} = 60 \text{ N/mm}^2$ (C50/60).
- Concrete with aggregate like granite or river rock or softer, and up to 16 mm diameter

Stick rate estimation



Designation	Soft/medium concrete	Tough concrete
X-P G2	85-98%	70–85%
X-C G2	75–90%	55–70%

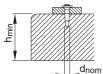
- The stick rate indicates the percentage of nails that were driven correctly to carry a load.
 - Stick rate can vary from the above values depending on job site conditions.

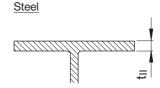


Application recommendation

Thickness of base material







 $t_{||} \ge 4.0 \text{ mm}$ (for nail)

(d_{nom} ≤ 3.0 mm)

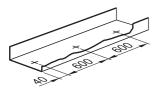
 $h_{min} = 60 \text{ mm}$

Thickness of fastened material

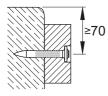
Wooden track:	t _l ≤ 25 mm
Metal track:	t _l ≤ 2 mm

Spacing and edge distances (mm)

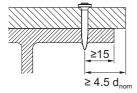
Spacing along track



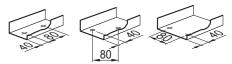
Edge distance for concrete/sand-lime masonry



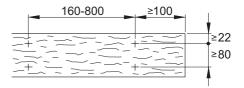
Edge distance for steel



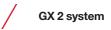
All track ends (cut-outs for doors), secure with 2 nails



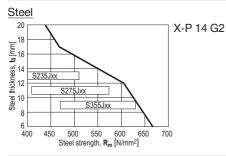
Fastener spacing on wood







Application limits



Corrosion information

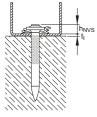
- The intended use only comprises fastenings which are not directly exposed to external weather conditions or moist atmospheres.
- For more details, please refer to following technical document: Hilti Corrosion Handbook.

Fastener selection

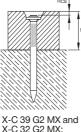
	Nail Select	or for GX 2		
	Brick	Con Wall / Floor	Ceiling	Steel
+ 6000000000	X-C 27 G2 MX X-C 20 G2 MX	X-C 20 G2 MX	X-C 20 G2 MX X-P 17 G2 MX	X-P 14 G2 MX
+ 5000500000	X-C 39 G2 MX X-C 32 G2 MX			
Gas can		📙 GC 52 - For a	all base materials	

Quality assurance

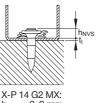
Nails in concrete / sand-lime masonry



X-C / X-P G2 MX: $h_{NVS} = 2-5 mm$



X-C 39 G2 MX and X-C 32 G2 MX: $h_{CS} = 2-3 \text{ mm}$ Nails in steel



 $h_{NVS} = 2-9 \text{ mm}$



BX 3 System Fastener for interior finishing, building construction, mechanical and electrical application

Product data

Product description

BX 3-ME-22	 Hilti's combustion-free direct fastening technology for
	driving nails into concrete, steel and some types of solid masonryHigh user comfort thanks to low levels of compression force, noise and recoil
BX 3-22, BX 3-L-22	 No disposal of (used) propellant cartridges or gas cans Hilti's 22V NURON platform

Applications

For fastenings with nails



Drywall tracks to concrete and steel



Fastening wood, e.g. Placopan[®], to concrete



Junction boxes, switch boxes, etc

For fastenings with elements



Flexible or rigid cable conduits with cable ties



Fastening cables



Cable conduits or light-duty pipes

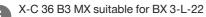




Fastener selection

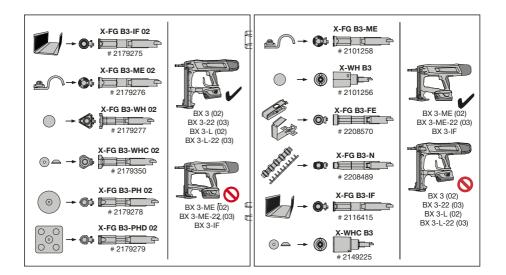
BX 3-ME (02), BX 3-ME-22 (03), BX 3-IF	Base material			
	Brick	Concrete Floor	Concrete Wall/Ceiling	Steel
Track fastening	X-C 24 B3 MX	X-C 20 B3 MX X-C 24 B3 MX	X-C 20 B3 MX X-P 17 B3 MX	X-S 14 B3 MX
Wood fastening		X-C 36 B3 P7		
Electrical fastening	X-C 24 B3 MX X-C 20 B3 MX		X-P 20 B3 MX	X-S 14 B3 MX
Modul fastening	X-P 20 B3 MX X-P 17 B3 MX		X-P 17 B3 MX	X-S 14 B3 MX
Tape fastening	X-C 24 B3 MX X-C 20 B3 MX			X-S 14 B3 MX
		X-W6-12-20 B3 P7		X-W6-12-14 B3 P7
Equipment fastening	X-M6-7-24 B3 P7			X-M6-7-14 B3 P7

BX 3 (02), BX 3-22 (03), BX 3-L (02), BX 3-L-22 (03)	Base material			
R	Brick	Concrete Floor	Concrete Wall/Ceiling	Steel
Track fastening	X-C 24 B3 MX X-C 36 B3 MX	X-C 20 B3 MX X-C 24 B3 MX	X-C 20 B3 MX X-P 17 B3 MX	X-S 14 B3 MX
Wood fastening	X-C 36 B3 MX			
Electrical fastening	X-C 24 B3 MX X-C 20 B3 MX		X-P 20 B3 MX	X-S 14 B3 MX
Modul fastening	X-P 20 B3 MX X-P 17 B3 MX		X-P 17 B3 MX	X-S 14 B3 MX
Tape fastening		X-C 24 B3 MX X-C 20 B3 MX		X-S 14 B3 MX





BX 3 system



Approvals and certificates			
Authority	Approval/certificate	Date of issue	Short description
ICC-ES	ESR 1752	09/2021	X-P 20 B3 MX,
DIBt	ETA 10/0201	06/2021	X-P 24 B3 MX,
	ETA-16/0301		electrical fastening
			X-P 17 B3 MX,
	ETA-20-0886	08/2021	X-P 20 B3 MX,
			track fastening

 Not all information presented in this product data sheet might be subject to approval/certificate content. Please refer to approval/certificate for further information.

Applications

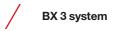
Environmental conditions



Dry indoor

- The intended use comprises fastening in dry conditions.
- For more details, please refer to following technical document: Hilti Corrosion Handbook.





B3 nails for fastening to concrete and steel

Dimension for fastening nails to steel

)		
Technical drawing	Designation	Shank length	Shank
			diameter
		Ls	d _s
0 0 0 0 0 1.8 15.8 0 3 0 3 0 3	X-S 14 B3 MX	14 mm	3.00 mm

Dimension for fastening nails to concrete

Technical drawing	Designation	Shank length	Shank	
			diameter	
		Ls	d _s	
	X-P 17 B3 MX	17 mm		
	X-P 20 B3 MX	20 mm		
10.00	X-P 24 B3 MX	24 mm		
5,8 6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	X-P 30 B3 P7	30 mm		
××1.8 Ls	X-P 36 B3 P7	36 mm	3.00 mm	
	X-C 20 B3 MX	20 mm		
	X-C 24 B3 MX	24 mm		
	X-C 27 B3 MX	27 mm		
	X-C 30 B3 MX	30 mm		
С С 1.8 37.8 С С С С С С С С С С С С С С С С С С С	X-C 36 B3 MX	36 mm	2.75 mm	

Material specification and material properties for carbon steel elements

Designation	Element	Material	Coating	Minimum	Hard-
·				coating	ness
				thickness	
X-S 14 B3 MX	Nail	Carbon steel	Zinc	2 µm	57.5 HRC
X-P 17/20/24 B3 MX	Nail	Carbon steel	Zinc	5 µm	57.5 HRC
X-C 20/24/27/30 B3 MX	Nail	Carbon steel	Zinc	5 µm	56.5 HRC
X-C 36 B3 MX	Nail	Carbon steel	Zinc	2 µm	56.5 HRC



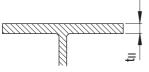
Application recommendation

Fastened material properties and fastener positioning in fastened material

≤ t _{i, tot}
P _{NVS}

and lastener positioning in lastened material		
Deflection head	t _{l, tot} ≤ 21 mm (gypsum strip +metal track and sealant)	
Metal track	t _l ≤2 mm	
Wooden track	$t_l \le 27 \text{ mm}$ (conditions: head of the nail is countersunked flat to the surface)	

Base material properties and fastener positioning in base material



Base material	Steel
Base material thickness t _{II}	≥ 4 mm

	यात्रिस्य य	Base material	Concrete
		Base material thickness h _{min}	60 mm
hmin			

• For more details in relation to base material properties, please refer to the chapter **Fastener selection guide** in the Direct Fastening Manual (DFTM).

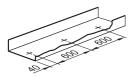
н





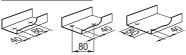
Spacing and edge distances (mm)

Max. spacing along track



All track ends (cut-outs for doors),

secure with 2 nails

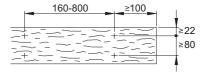


Edge distance for fastening to concrete / sand-lime masonry

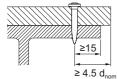


Spacing between nails for fastening wood to concrete





Edge distance for fastening to steel

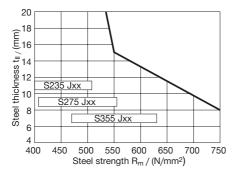


- Fastener spacing max. 300 mm for proprietary light non-load-bearing partition walls with fire classification.
 - Based on common practice, spacing needs to be adjusted based on specific load requirement and achieved embedment depth.
 - All dimensions in mm.



For fastening to steel with X-S 14 B3 MX

Application limitation for fastening on steel



Performance data

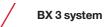
Recommended resistance under tension and shear load

Designation	Tension load	Shear load
	N _{rec}	V _{rec}
X-S 14 B3 MX	0.40 kN	0.40 kN

Recommended resistance under shear load for track fastening

Designation	Embedment depth	Shear load
	h _{ET}	V _{rec}
X-P 17 B3 MX	≥ 11 mm	0.38 kN
X-P 20 B3 MX		0.38 KN





For fastening to concrete and sand-lime masonry with X-P B3, X-C B3

Recommended resistance under tension and shear load

Embedment depth ^h ET	Tension load N _{rec}	Vrec↓	Shear load V _{rec}	↓ Vrec
	Soft/medium	Tough	Soft/medium	Tough
	concrete	concrete	concrete	concrete
≥ 14 mm	0.10 kN	0.10 kN	0.10 kN	0.10 kN
≥ 18 mm	0.20 kN	-	0.20 kN	-
	Sand-lime maso	nd-lime masonry		onry
≥ 14 mm	0.10 kN		0.10 kN	
≥ 18 mm	0.20 kN		0.20 kN	
≥ 22 mm	0.30 kN	.30 kN 0.30 kN		

- Redundancy of fastening points is required.
- Minimum number of fastening points for safety relevant fastenings: ≥ 5 .
- Sheet metal failure is not considered in recommended loads and must be assessed separately.

Stick rate estimation

1	Designation	Soft/medium concrete	Tough concrete
0000000	X-P B3	85-98%	70-85%
	X-C B3	75-90%	55-70%

- The stick rate indicates the percentage of nails that were driven correctly to carry a load.
- Stick rate can vary from the above values depending on job site conditions.



System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

System recommendation for fastening nails

Designation	Battery-actuated too	Battery-actuated tool		
	BX 3-ME	BX 3	BX 3-L	
X-S 14 B3 MX				
X-P 17 B3 MX				
X-P 20 B3 MX				
X-P 24 B3 MX				
X-P 30 B3 P7				
X-P 36 B3 P7				
X-C 20 B3 MX				
X-C 24 B3 MX				
X-C 30 B3 MX				
X-C 36 B3 MX				

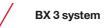
 \blacksquare = recommended \square = possible

Quality assurance

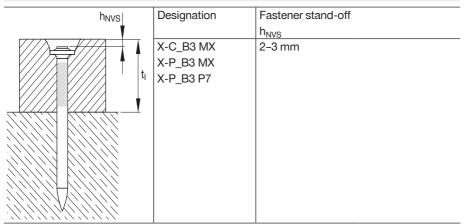
Fastener stand-off for fastening to concrete and sand-lime masonry

Designation	Fastener stand-off
	h _{NVS}
	2–5 mm
X-P_B3 MX	
X-P_B3 P7	
	X-C_B3 MX X-P_B3 MX

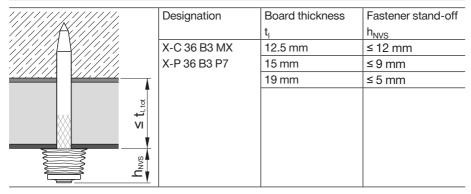




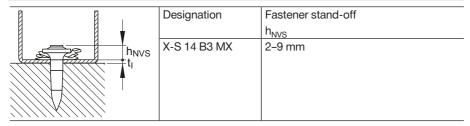
Fastener stand-off for fastening to concrete and sand-lime masonry



Fastener stand-off for fastening deflection head to concrete



Fastener stand-off for fastening to steel



- Visible setting failures must be replaced with a new fastener, not in the same hole.
- These are abbreviated instructions which may vary by application.
- Always review/follow the instructions accompanying the product.





Fastener program

Item no. and description

Designation	ltone no	Description
Designation	Item no.	Description
X-S 14 B3 MX	2156392, 2156393	Fastening to steel
X-P 17 B3 MX	2156216, 2156219	
X-P 20 B3 MX	2156217, 2156390	
X-P 24 B3 MX	2156218, 2156391	
X-P 30 B3 P7	2105406	
X-P 36 B3 P7	2105407	Factoring to concrete
X-C 20 B3 MX	2123993	 Fastening to concrete
X-C 24 B3 MX	2123994	
X-C 27 B3 MX	2224568	
X-C 30 B3 MX	2149988	
X-C 36 B3 MX	2149989	





B3 threaded studs for fastening to steel and concrete

Dimension for fastening threaded studs to steel

Technical drawing	Designation	Shank length	Shank
			diameter
		L _s	ds
1.5 [0.059"] 7 [0.276"] 0.551"]	X-M6-7-14 B3 P7	14 mm	3.00 mm
	X-W6-12-14 B3 P7	14 mm	3.00 mm

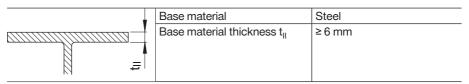
Dimension for fastening threaded studs to concrete

Technical drawing	Designation	Shank length	Shank
			diameter
		Ls	d _s
1.5 [0.059"] 7 [0.276"] 24 [0.944"]	X-M6-7-24 B3 P7	24 mm	3.00 mm
0 0 0 0 0 0 0 0 0 0 0 0 0 0	X-W6-12-20 B3 P7	24 mm	3.00 mm



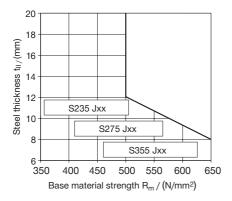
Application recommendation

Base material properties and fastener positioning in base material



For fastening to steel with X-M6-7-14 B3 P7, X-W6-12-14 B3 P7

Application limitation for fastening on steel

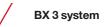


Performance data

Recommended resistance under tension and shear load

Designation	Tension	Shear	Tightening	Base
	load	load	torque	material
	N _{rec}	V _{rec}	T _{rec}	
X-M6-7-24 B3 P7	0.05 kN	0.05 kN	3.00 Nm	Concrete, sand-
X-W6-12-20 B3 P7	0.05 KN	0.05 KN	3.00 MIT	lime masonry
X-M6-7-14 B3 P7	0.20 kN	0.20 kN	3.00 Nm	Steel
X-W6-12-14 B3 P7	0.20 KIN	0.20 KIN	3.00 NM	Sieei





System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

System recommendation for fastening threaded studs

Designation	Battery-actuated tool	Battery-actuated tool	
	BX 3-ME	BX 3-IF	
X-M6-7-14 B3 P7			
X-W6-12-14 B3 P7	_		
X-M6-7-24 B3 P7			
X-W6-12-20 B3 P7			

 \blacksquare = recommended \square = possible

Quality assurance

Fastener stand-off for fastening to concrete and sand-lime masonry

	Designation	Fastener stand-off
φ (γ	T	h _{NVS}
h _{NVS}	X-M6-7-24 B3 P7	7–11 mm
	X-W6-12-20 B3 P7	12–15 mm



Fastener stand-off for fastening to steel

	Designation	Fastener stand-off
SVI SVI	X-M6-7-14 B3 P7	h _{NVS} 7–11 mm
	X-W6-12-14 B3 P7	12–15 mm

- Visible setting failures must be replaced with a new fastener, not in the same hole.
- These are abbreviated instructions which may vary by application.
- Always review/follow the instructions accompanying the product.

Fastener program

Item no. and description

Designation	Item no.	Description
X-M6-7-14 B3 P7	2105408	Eastening to steel
X-W6-12-14 B3 P7	2105800	Fastening to steel
X-M6-7-24 B3 P7	2105409	Eastoning to concrete
X-W6-12-20 B3 P7	2105801	Fastening to concrete





BX 3 system for fastening elements

Fastening	element	examples
-----------	---------	----------

Holding systems for cables

X-EKB MX	X-ECH	X-ECH-FE
Cable clamp	Cable holder with nail	Metal cable holder
et la		

Holding systems for conduits



Holding systems for cables and conduits

X-ECT MX	X-EKS MX	X-EKSC MX
Cable tie mount	Pipe clamp with nail	Pipe clamp with nail
E.		

Holding systems for trunkings

X-ET MX	
Cable trunking fastener	
0.00	



• Material specifications are described in the corresponding Product Data Sheet(s) for element(s).

Application recommendation

Spacing

Fastener spacing ≤ 100 mm





Performance data

Maximum service load

Designation	Service load
	F _{max}
X-ECT (FR) MX	0.040 kN
X-UCT MX	0.040 kN
X-EKS MX	0.011 kN
X-EKSC MX	0.032 kN
X-FB MX / X-DFB MX	0.020 kN
X-ECC MX	0.050 kN
X-EHS MX	0.080 kN
X-EKB (FR) 4 MX	0.090 kN
X-EKB (FR) 8 MX	0.014 kN
X-EKB (FR) 16 MX	0.018 kN
X-ECH MX	0.040 kN
X-ET MX	0.010 kN



• Recommended service load is determined by the serviceability of the plastic part.

System recommendation

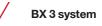
• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

System recommendation for fastening elements

Designation	Battery-actuated to	Battery-actuated tool		
	3X 3-ME	3X 3	3X 3-L	
ME MX elements				

 \blacksquare = recommended \square = possible





Quality assurance

Fastener stand-off

11111111111111111111111111111111111111	Designation	Fastener star	nd-off
hef		h _{NVS}	
INVS		Concrete	Steel
	X-EKB 4/8 MX	6–11 mm	6-9 mm
hef hnvs	X-EKB 16 MX	6–11 mm	6-9 mm
	X-ECT MX	6–11 mm	6-9 mm
hef	X-UCT MX	6–11 mm	6-9 mm
hnvs	X-ECH MX	6–11 mm	6-9 mm
	X-EKS MX	6–11 mm	6-9 mm
	X-EKSC MX	6–11 mm	6-9 mm
	X-FB MX	7–11 mm	7-9 mm
	X-DFB MX	7–11 mm	7–9 mm
	X-ECC MX	7–11 mm	7–9 mm
	X-EHS MX	7–11 mm	7–9 mm
	X-ET MX	5-10 mm	5-9 mm

- Fastener stand-off h_{NVS} for X-ET MX is measured against the cable trunk.
- Visible setting failures must be replaced with a new fastener, not in the same hole.
- These are abbreviated instructions which may vary by application.
- Always review/follow the instructions accompanying the product.

Fastener program

Item no. and description

• Item no. and description is provided in the corresponding Product Data Sheet(s) for element(s).



BX-Kwik Electrical hanger system

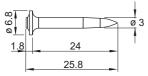
BX-Kwik

Product data

X-EHS MX



X-P 24 B3 MX



Features and benefits

A special hanger system with pre-drilled pilot hole optimized for higher load and close to **100% stick rate** for applications on **soft & tough** concrete.

General information

The system consists of:

- X-EHS MX hanger
- X-P 24 B3 MX nail
- TX-C-5/10B drill bit
- BX 3 ME

Material Specifications

Hanger:

Zinc coating ≥ 10 mm

Nail: Carbon Steel 57.5 HRC Zinc Coating 2-10 µm

Applications

Examples



Threaded rod attachments to concrete



Cable trays



Small pipes

These zinc coated fasteners are not suitable for long-term service outdoors or in otherwise corrosive environments. For further detailed information on corrosion see chapter **Direct Fastening Principles and Technique**.

These fasteners are not recommended for fastening of suspended ceilings.





Performance data on concrete



Recommended Tension Load N _{rec} [kN]			
Concrete Toughness 1)			
Soft	Tough		
0.3	0.45		

Stick rate estimation 1)		
Soft Concrete	Tough Concrete	
95-100 %	95-100 %	

Conditions:

- A sufficient redundancy has to be ensured, that a failure of a single fastening will not lead to collapse of the entire system.
- Soft concrete up to $f_{c,cube} = 45 \text{ N/mm}^2$ (C35/45).
- Tough concrete up to $f_{c,cube} = 60 \text{ N/mm}^2 (C50/60)$.
- Concrete with aggregate like granite or river rock or softer, and up to 16 mm diameter.
- Loads valid for cracked and uncracked concrete.

¹⁾ The stick rate indicates the percentage of nails that were driven correctly to carry a load. Stick rate can vary from the above value depending on job site conditions. For more details regarding fastener behaviour and concrete types, please refer to **Concrete Fastener Selection** section.

Application requirements

Thickness of base material Concrete:

h_{min} = 60 mm

Edge distance and fastener spacing

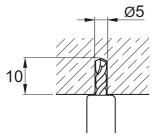
Edge distance: $c \ge 70 \text{ mm}$ Spacing: $s \ge 100 \text{ mm}$





Installation

Pre-drilling details

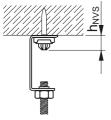


Pre-drilling with Hilti drill bit **TX-C-5/10B** until a ring on the concrete surface is visible.

Fastener selection and system recommendation

Fastener program			
m no.			
3367			
2073			
3368			
m no.			
05405			
m no.			
78329			

Fastening quality assurance



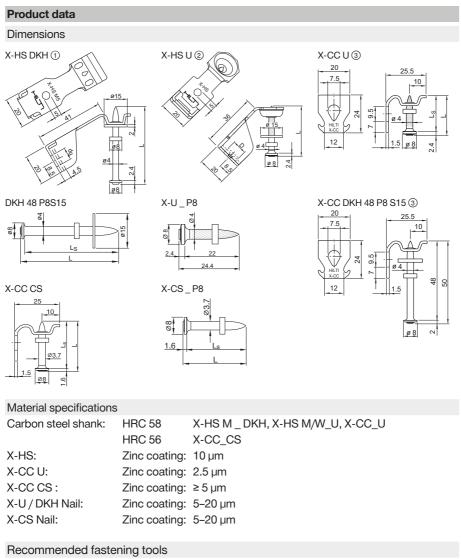
h_{NVS} = 4.0 – 7.0 mm



BX-Kwik



X-HS and X-CC Threaded hanger and loop hanger system



DX 6 F8, DX 5 F8, DX 460-F8, DX 351-F8, DX 36, DX 2, DX E72

• See system recommendation in the next pages.





Approvals and certificates

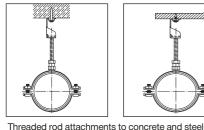
Lloyds Register: X-HS ICC, UL, FM:

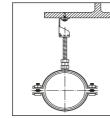
X-HS W6/10

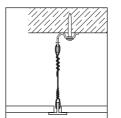
Not all information presented in this product data sheet might be subject to approval / certificate content. Please refer to approval/certificate for further information.

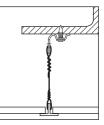
Applications

Examples







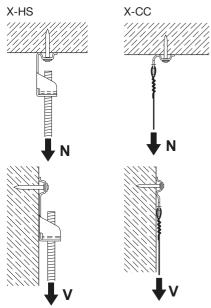


Wire attachments to concrete and steel

Performance data

Recommended resistance under tension and shear load

Concrete (DX-Kwik with pre-drilling) or steel



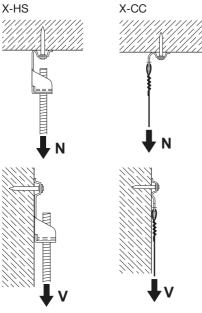
Designation	$N_{rec} = V_{rec}$	Base
		material
X-HS DKH 48	0.9 kN	Concrete
X-HS_U19	0.9 kN	Steel
X-CC DKH 48	0.9 kN	Concrete
X-CC U16	0.9 kN	Steel

Conditions

- · Predominantly static loading.
- Concrete C20/25–C50/60
- Strength of fastened material is not limiting.
- Observance of all application limitations and recommendations (especially predrilling requirements).



Concrete (DX Standard without pre-drilling)



Designation	N _{rec}	V _{rec}	h _{ET}
X-HS_U32	0.4 kN	0.4 kN	27 mm
X-HS_U27	0.3 kN	0.3 kN	22 mm
X-HS_U22	0.2kN	0.2 kN	18 mm
X-CC_U27	0.2* kN	0.3 kN	22 mm
X-CC_U22	0.15* kN	0.2 kN	18 mm
X-CC CS27	0.2 kN	0.3 kN	22 mm
X-CC CS22	0.15 kN	0.2 kN	18 mm

*) eccentric loading considered

Conditions

- Minimum 5 fastenings per fastened unit (normal weight concrete).
- All visible failures must be replaced.
- With lightweight concrete base material and appropriate washers, greater loading may be possible, please contact Hilti.
- Predominantly static loading.
- Observance of all application limitations and recommendations.

• For more details in relation to base material properties, please refer to the chapter **Fastener selection guide** in the Direct Fastening Manual (DFTM).

Application recommendation

Base material thick	kness	
Concrete		Steel
DX-Kwik		t _{II} ≥ 4 mm
(with pre-drilling) DX Standard	h _{min} = 100 mm	
(w/o pre-drilling)	h _{min} = 80 mm	

Fastener positioning

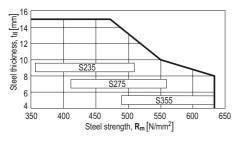
Minimum spacing and edge distances: See corresponding nail data sheet of X-U and X-DKH.





Application limits

Fastening to steel - X-HS U19 with DX351



Application limit may increase in case of specific applications, like the fastening of wire mesh to steel, which is connected with X-CC U16 P8 fasteners. That wire mesh acts as reinforcement for fire protective sprayed coating. In such cases also different fastener stand-offs apply. Inquire at Hilti related with the use of X-CC U16 P8 in that specific application.

Corrosion information

- These zinc-coated fasteners are not suitable for long-term service outdoors or in otherwise corrosive environments.
- For more details, please refer to following technical document: Hilti Corrosion Handbook.



System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

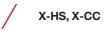
Technical information

Designation	Shank diameter d _s	Shank length L _S	Fastener length L	Base material	Tools
① X-HS_DKH 48 P8S15	4.0 mm	48 mm	50.0 mm	Concrete pre-drilled	DX 6 F8, DX 5 F8, DX 460-F8
2 X-HS_U 32 P8S15	4.0 mm	32 mm	34.4 mm	Concrete	DX 6 F8,
2 X-HS_U 27 P8S15	4.0 mm	27 mm	29.4 mm	Concrete	DX 5 F8,
2 X-HS_U 22 P8S15	4.0 mm	22 mm	24.4 mm	Concrete	DX 460-F8,
② X-HS_U 19 P8S15	4.0 mm	19 mm	21.4 mm	Steel	DX 351-F8, DX 36, DX 2
③ X-CC DKH 48 P8S15	4.0 mm	48 mm	50.0 mm	Concrete	DX 6 F8,
				pre-drilled	DX 5 F8,
					DX 460-F8
③ X-CC U 27 P8	4.0 mm	27 mm	29.4 mm	Concrete	DX 6 F8,
③ X-CC U 22 P8	4.0 mm	22 mm	24.4 mm	Concrete	DX 5 F8,
③ X-CC U 16 P8	4.0 mm	16 mm	18.4 mm	Steel	DX 460-F8,
					DX 351-F8,
					DX 36, DX 2

Cartridge recommendation for fastening on concrete

Base material	Cartridge color (tool power level)		
	Tool type:	Tool type:	
	DX 6 F8	DX 5 F8, DX 460 F8, DX 2,	
		DX 351 F8	
	Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M	
Soft/medium concrete	titanium 🔳 (2-5)	yellow 📒, red 📕	
Tough concrete	titanium 🔳 (4-8)	yellow 📒, red 📕	





Cartridge recommendation for fastening on steel

Base materia	l	Cartridge color (tool power level)		
		Tool type: DX 6 F8	Tool type: DX 5 F8, DX 460 F8, DX 2, DX 351 F8	
		Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M	
S235,	4 ≤ t _{II} ≤ 6 mm	titanium 🔳 (1-3)	green 🗖	
S275, S355	6 < t _{ll} ≤ 14 mm	titanium 🔳 (4-8)	red 📕	

- Tool power level adjustment by setting tests on site.
 - Start tool energy selection with lowest recommended tool power level.
 - Correct according requirement from chapter quality assurance.

Quality assurance

Installation

<u>X-HS</u>



2.

1. Attach the threaded rod to the X-HS before fastening



2. For DKH 48 pre-drill (Ø 5 x 23)



3. Load the assembly into the tool



4. Locate the nail, compress the tool, pull the trigger and the fastening is complete



5. Bend the X-HS assembly down to the vertical position

X-CC



1. Assemble the wire with the X-CC



2. For DKH 48 pre-drill (Ø 5 x 23)



3. Load the assembly into the tool



4. Locate the nail, compress the tool, pull the trigger and the fastening is complete



5. Adjust the wire as required



Setting depth control





X-CC DKH48 P8 S15



 $h_{NVS} = 6-10 \text{ mm}$

 $h_{NVS} = 4-7 \text{ mm}$

h_{NVS} = 6-10 mm

These are abbreviated instructions which may vary by application. ALWAYS review/follow the instructions accompanying the product.

Fastener program

Item no. and description

X-HS order information

Item no.	Designation	ltem no.	Designation
361788	X-HS M6 U32 P8 S15	386214	X-HS M8 U19 P8 S15
386223	X-HS M6 U27 P8 S15	386215	X-HS M10 U19 P8 S15
361789	X-HS M8 U32 P8 S15	386217	X-HS W10 U19 P8 S15
386224	X-HS M8 U27 P8 S15	386218	X-HS M6 U22 P8 S15
361790	X-HS M10 U32 P8 S15	386219	X-HS M8 U22 P8 S15
386225	X-HS M10 U27 P8 S15	386222	X-HS W10 U22 P8 S15
386226	X-HS W6 U27 P8 S15	386216	X-HS W6 U19 P8 S15
386227	X-HS W10 U27 P8 S15	386220	X-HS M10 U22 P8 S15
386213	X-HS M6 U19 P8 S15	386221	X-HS W6 U22 P8 S15



• Type of threading: M = metric; W6, W10 = Whitworth 1/4"; 3/8"

X-CC order information

Item no.	Designation
386229	X-CC U22 P8
386230	X-CC U27 P8
299937	X-CC DKH P8 S15
386228	X-CC U16 P8
2006454	X-CC CS22 P8
2005065	X-CC CS27 P8



х-нѕ, х-сс





X-MW MX, X-MW ALH Wire hanging system

X-WS Wire hanging system designation

X - MW	- MX -	
Technology Fastening sy		L Lock type
Technology: X	Direct Fastening (DX) solution	on
Fastening system: MW MX MW ALH	Wire hanging system fasten magazined fastener Wire hanging system with p fastener	ed with battery-actuated re-mounted powder-actuated
Fastening type: MX ALH Lock type: L	Magazined fastener Pre-mounted fastener Loop lock	



X-MW MX, X-MW ALH Wire hanging system

Product data

Product description

 X-MW MX fastening system for fastening heating, ventilation, and air condition (HVAC), cable tray, conduit rack and lighting to ceiling System can be mounted with battery-actuated fasteners X-P 20 B3 MX, X-P 24 B3 MX, X-S 14 B3 MX Wire length: 2 m, 3 m and 6 m Loop lock
 X-MW ALH fastening system for fastening heating, ventilation, and air condition (HVAC), cable tray, conduit rack and lighting to ceiling System can be mounted with powder-actuated pre-mounted fasteners X-ALH 22/27/32 Wire length: 2 m, 3 m and 6 m Loop lock

Fastening system

	Designation				
			Pre-mounted		
Designation	X-P 20/24 B3 MX	X-S 14 B3 MX	X-ALH 22/27/32		
X-MW MX					
X-MW ALH					

= suitable for combination

= suitable for combination, requires expert evaluation





Dimensions

Dimensions for elements

Technical drawing	Designation	Width	Length	Height	Thickness
		w	1	h	t
	X-MW MX	30 mm	65 mm	21 mm	1.2 mm
	X-MW ALH	20 mm	30 mm	22.5 mm	1.5 mm
	Loop lock	12.5 mm	23 mm	18 mm	-

• Wire diameter d ≤ 2 mm

Material specification and material properties for steel elements

Designation	Element	Material	Coating	Minimum
				coating
				thickness
X-MW MX	Wire holder	Carbon steel	Zinc	3µm
	plate			
X-MW ALH	Wire holder	Carbon steel	Zinc	3µm
	plate			
	Wire	Carbon steel	Zinc	3µm
	Loop lock	Aluminum,	Nickel	-
		brass		





Approvals and certificates

Authority	Approval/	Date	Short description
	certificate no.	of issue	
UL Listing	E522519	09/2021	Luminaire fittings certified for
			Canada, model(s):
			X-MW ALH27 L 10ft/3m,
			X-MW ALH27 L 20ft/6m,
			X-MW ALH27 L 6ft/2m,
			X-MW ALH32 L 10ft/3m,
			X-MW MX L 10ft/3m,
			X-MW MX L 20ft/6m,
			X-MW MX L 6ft/2m.

• Not all information presented in this product data sheet might be subject to approval/certificate content. Please refer to approval/certificate for further information.

Application

Spiral HVAC





Lighting









Base materials







Soft concrete

Medium concrete

Tough concrete

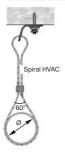
h Steel

Load conditions



Static/ quasi static

Recommended angle between wires at loop lock



Maximum angle between wires: $a \le 60^{\circ}$

Environmental conditions

	Designation			
	X-MW MX	X-MW MX	X-MW ALH	
Environmental condition	combined with	combined with	combined with	
Environmental condition	X-P 20/24 B3 MX,	X-S 14 B3 MX,	X-ALH 22/27/32,	
	loop lock and wire	loop lock and wire	loop lock and wire	
Dry indoor				

= suitable

= requires expert evaluation



• For more details, please refer to following technical document(s): Hilti Corrosion Handbook.





Fastener program

Item no. and description

Designation	Item no.	Description
X-MW MX, Ø 2 mm, L 6ft/2m	2325727	
X-MW MX, Ø 2 mm, L 10ft/3m	2325728	
X-MW MX, Ø 2 mm, L 20ft/6m	2325729	
X-MW ALH 22, Ø 2 mm, L 10ft/3m	2325738	Wire hanging system
X-MW ALH 27, Ø 2 mm, L 6ft/2m	2325730	with loop lock and wire
X-MW ALH 27, Ø 2 mm, L 10ft/3m	2325731	
X-MW ALH 27, Ø 2 mm, L 20ft/6m	2325732	
X-MW ALH 32, Ø 2 mm, L 10ft/3m	2325733	





X-MW MX, X-MW ALH for fastening to concrete

Performance data

Recommended resistance under tension and shear load

Designation	Embedment	Tension load		Shear load	
	depth h _{ET}	N _{rec}		V _{rec}	
		Soft/	Tough concrete	Soft/	Tough
Fastening system		medium		medium	concrete
	concrete		concrete	concrete	
X-MW MX + X-P 20/24 B3 MX	≥ 16 mm	0.05 kN	-	0.05 kN	-
X-MW ALH22 (X-ALH22)	≥ 18 mm	0.1 kN	0.1 kN	0.1 kN	0.1 kN
X-MW ALH27 (X-ALH27)	≥ 22 mm	0.1 kN	0.1 kN	0.1 kN	0.1 kN
X-MW ALH 32 (X-ALH 32)	≥ 26 mm	0.1 kN	0.1 kN	0.1 kN	0.1 kN



- Redundancy of fastening points is required.
- Minimum number of fastening points for safety relevant fastening: \geq 5.
- For more details in relation to base material properties, please refer to the chapter Fastener selection guide in the Direct Fastening Manual (DFTM).

Stick rate estimation

000000000	Designation	Soft/medium	Tough
		concrete	concrete
	X-MW MX +	95-100 %	-
	X-P 20/24 B3 MX		
	X-MW ALH 22 (X-ALH 22)	95-100 %	90-95 %
	X-MW ALH 27 (X-ALH 27)	95-100 %	90-95 %
	X-MW ALH 32 (X-ALH 32)	90-95%	85-95 %
	•	·	

- The stick rate indicates the percentage of nails that were driven correctly to carry a load.
 - Stick rate can vary from the above values depending on job site conditions.





System recommendation

System recommendation for fastening collated nails with battery-actuated tools

Designation	Battery-actuated tool	Base material		
	BX 3 ME 02	Soft concrete	Medium concrete	Tough concrete
X-MW MX + X-P 20/24 B3 MX				

= recommended

= feasible

System recommendation for fastening pre-mounted nails with powder-actuated tools

Designation	Powd	Powder-actuated tool				Base	materia	al	
	DX 6 F8	DX 5 F8	DX 460 F8	DX 351 CT	DX 351 ME	DX 2	Soft concrete	Medium concrete	Tough concrete
X-MW ALH 22 (X-ALH 22)									
X-MW ALH 27 (X-ALH 27)									
X-MW ALH 32 (X-ALH 32)									

= recommended

= feasible

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).





Cartridge recommendation

	Cartridge color (tool power level)					
	Fastening system:	Fastening system:	Fastening system:			
	X-MW ALH 22	X-MW ALH 27	X-MW ALH 32			
Base material	(X-ALH 22)	(X-ALH 27)	(X-ALH 32)			
	Tool type:	Tool type:	Tool type:			
	DX 6 F8	DX 6 F8 DX 6 F8				
	Cartridge type:	Cartridge type:	Cartridge type:			
	6.8/11 M	6.8/11 M	6.8/11 M			
Soft/medium concrete	titanium 🔳 (4-5)	titanium 🔳 (4-5)	titanium 🔳 (6-8)			
			to black 🔳 (7-8)			
Tough concrete	titanium 🔳 (4-5)	titanium 🔳 (6-8)	titanium 🔳 (6-8)			
			to black 🔳 (7-8)			
	Cartridge color (too	power level)				
	Fastening system:	Fastening system:	Fastening system:			
	X-MW ALH 22	X-MW ALH 27	X-MW ALH 32			
	(X-ALH 22)	(X-ALH 27)	(X-ALH 32)			
Dese meterial	Tool type:	Tool type:	Tool type:			
Base material	DX 5 F8, DX 460 F8,	DX 5 F8, DX 460 F8,	DX 5 F8, DX 460 F8			
	DX 351 CT,	DX 351 CT ¹⁾ ,				
	DX 351 ME, DX 2	DX 351 ME ¹⁾ , DX 2 ¹⁾				
	Cartridge type:	Cartridge type:	Cartridge type:			
	6.8/11 M	6.8/11 M	6.8/11 M			
Soft/medium concrete	yellow 📕, red 📕	red 📕	red 📕, black 🔳			
Tough concrete	red 📕	red 📕, black 🔳	black 🔳			

¹⁾ Black cartridges do not apply for this tool.



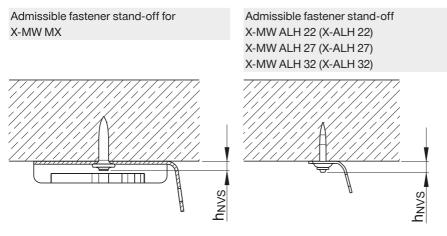
• Tool power level adjustment by setting tests on site.

• Start tool energy selection with lowest recommended tool power level.

• Correct according requirement from chapter quality assurance.



Quality assurance



 $h_{NVS, min} = 3 mm$ $h_{NVS, max} = 9 mm$

 $h_{NVS, min} = 6 mm$ $h_{NVS, max} = 11 mm$

- Visible setting failures must be replaced with a new fastener, not in the same hole.
- These are abbreviated instructions which may vary by application.
- Always review/follow the instructions accompanying the product.





X-MW MX, X-MW ALH for fastening to steel

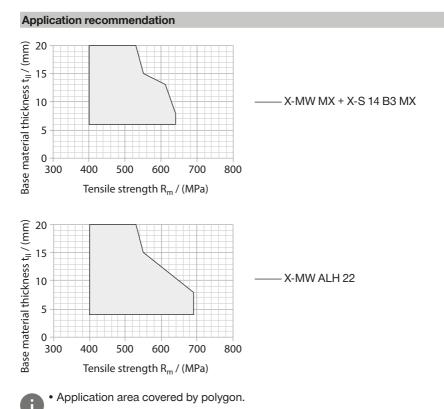
Performance data

Recommended resistance under tension and shear load

Designation	Embedment	Tension load	Shear load
	depth h _{ET}	N _{rec}	V _{rec}
Fastening system		S235, S275, S355	S235, S275, S355
X-MW MX + X-S 14 B3 MX	≥ 5 mm	0.45 kN	0.45 kN
X-MW ALH 22 (X-ALH 22)	≥ 15 mm	0.45 kN	0.45 kN



- · Redundancy of fastening points is required.
- Minimum number of fastening points for safety relevant fastening: \geq 5.
- For more details in relation to base material properties, please refer to the chapter Fastener selection guide in the Direct Fastening Manual (DFTM).







System recommendation

System recommendation for fastening collated nails with battery-actuated tools

Designation	Battery-actuated tool	Base material		
	BX 3 ME 02	Steel S235	Steel S275	Steel S355
X-MW MX + X-S 14 B3 MX				

= recommended

= feasible

System recommendation for fastening pre-mounted nails with powder-actuated tools

Designation	Powder-actuated tool			Base material		
	DX 6 F8	DX 5 F8	DX 460 F8	Steel S235	Steel S275	Steel S355
X-MW ALH 22 (X-ALH 22)						

= recommended

= feasible

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).





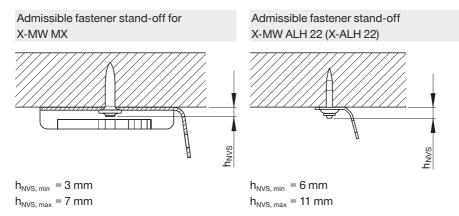
Cartridge recommendation

		Cartridge color (tool power level)			
		Fastening system:			
		X-MW ALH 22 (X-ALH 22)			
Base material		Tool type:	Tool type:		
		DX 6 F8 DX 5 F8, DX 460 F8			
		Cartridge type:	Cartridge type:		
		6.8/11 M	6.8/11 M		
S235 to	6 ≤ t _{II} ≤ 20 mm	titanium 🔳 (6-8),	red 📕, black 🔳		
S355		black 🔳 (7-8)			

• Tool power level adjustment by setting tests on site.

- Start tool energy selection with lowest recommended tool power level.
- Correct according requirement from chapter quality assurance.

Quality assurance



- Visible setting failures must be replaced with a new fastener, not in the same hole.
 - These are abbreviated instructions which may vary by application.
 - Always review/follow the instructions accompanying the product.







X-EHS MX, X-ECC MX Electrical hanger system

Product data Material specifications Dimensions X-EHS MX / X-ECC MX: X-EHS MX X-ECC MX Zinc coating: ≥ 5 µm Recommended fastening tools DX 6 MX, DX 5 MX, DX 460 MX, DX 351 MX, DX 6 F8, DX 5 F8, DX 460 F8, DX 351, DX 2, GX 120 ME, GX 3 ME, BX 3 ME • See fastener program in the next pages. X-GHP 20/24 X-EGN 14 X-P 20/24 G3 MX X-P 20/24 B3 MX ø 6.8 α ø 6.8 3 ø 3 ø3 Ls <u>...1.8</u> 1.8 1.8 1.8 14 L 15.8 X-P 22 X-U 16/22 X-S 14 G3 MX X-S 14 B3 MX 4.0 8 8 2.4 2.4 15.8 15.8

Applications

Example



- Hanger systems for light cable trays, etc. threaded rod attachments, wire attachments
- These fasteners are not recommended for fastening of suspended ceilings.
- These zinc coated fasteners are not suitable for long-term service outdoors or in otherwise corrosive environments.



Performance data

Recommended resistance under tension and shear load on concrete

Designation	N _{rec}	V _{rec}
X-EHS MX	0.1 kN	0.1 kN
X-ECC MX	0.05 kN*	0.1 kN

*) eccentric loading considered

Conditions

- Fastened with X-P 20/24 G3 MX, X-P 20/24 B3 MX, X-GHP 20/24 MX, X-U 22 or X-P 22.
- Minimum 5 fastenings per fastened unit (normal weight concrete).
- All visible failures must be replaced.
- With lightweight concrete base material and appropriate washers, greater loading may be possible, please contact Hilti.
- Predominantly static loading.
- Observance of all application limitations and recommendations.



• For more details in relation to base material properties, please refer to the chapter **Fastener selection guide** in the Direct Fastening Manual (DFTM).

Recommended resistance under tension and shear load on steel

Designation	N _{rec}	V _{rec}
X-EHS MX	0.45 kN	0.45 kN
X-ECC MX	0.45 kN	0.45 kN

Conditions

Concrete X-U, X-P:

X-GHP:

• Fastened with X-S 14 G3 MX, X-S 14 B3 MX, X-EGN 14 or X-U 16.

Application recommendation

 $h_{min} = 80 \text{ mm}$

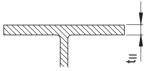
 $h_{min} = 60 \text{ mm}$

Base material thickness

X-P G3 MX: $h_{min} = 60 \text{ mm}$ X-P B3 MX: $h_{min} = 60 \text{ mm}$

Steel

t_{ll}≥ 4 mm



Fastener positioning

Spacing and edge distances depending on job site requirements.

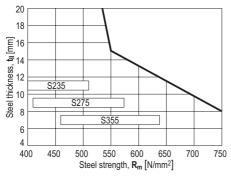




Application limits

Fastening to steel

X-EGN 14, X-S 14 G3 MX, X-S 14 B3 MX

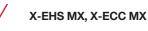


Corrosion information

- These zinc-coated fasteners are not suitable for long-term service outdoors or in otherwise corrosive environments.
- For more details, please refer to following technical document: Hilti Corrosion Handbook.



F



System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

Fastener selection

Designation	Shank	Shank	Fastener	Base material
	diameter	length	length	
	ds	Ls	L	
X-P 20 G3 MX	3.0 mm	20 mm	21.8 mm	Concrete
X-P 24 G3 MX	3.0 mm	24 mm	25.8 mm	
X-P 20 B3 MX	3.0 mm	20 mm	21.8 mm	
X-P 24 B3 MX	3.0 mm	24 mm	25.8 mm	
X-GHP 20 MX	3.0 mm	20 mm	21.8 mm	
X-GHP 24 MX	3.0 mm	24 mm	25.8 mm	
X-P 22 MX	4.0 mm	22 mm	24.4 mm	
X-U 22 MX	4.0 mm	22 mm	24.4 mm	
X-S 14 G3 MX	3.0 mm	14 mm	15.8 mm	
X-S 14 B3 MX	3.0 mm	14 mm	15.8 mm	Steel
X-EGN 14 MX	3.0 mm	14 mm	15.8 mm	0.661
X-U 16 MX	4.0 mm	16 mm	18.4 mm	

Cartridge recommendation

Base material	Cartridge color (tool power level)			
Tool type: DX 6 MX		Tool type: DX 6 MX, DX 5 MX, DX 460 MX, DX 351 MX		
	DX 6 F8	DX 6 F8, DX 5 F8, DX 460 F8, DX 351, DX 2		
	Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M		
Soft/medium concrete	titanium 🔳 (2-5)	yellow <mark>,</mark> red =		
Tough concrete	titanium 🔳 (4-8)	yellow <mark>–</mark> , red –		





Cartridge recommendation

Base material		Cartridge color (tool power level)	
		Tool type: DX 6 MX	Tool type: DX 6 MX, DX 5 MX, DX 460 MX, DX 351 MX
		DX 6 F8	DX 6 F8, DX 5 F8, DX 460 F8, DX 351, DX 2
		Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M
S235, S275, S355	4 ≤ t _{II} ≤ 20 mm	titanium 🔳 (2-8)	yellow –, red 📕

• Tool power level adjustment by setting tests on site.

• Tool power level augustments by section 2. • Start tool energy selection with lowest recommended tool power level.

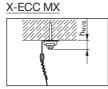
• Correct according requirement from chapter quality assurance.

Quality assurance

X-EHS MX



 $h_{NVS} = 4-8 \text{ mm}$



 $h_{NVS} = 4-8 \text{ mm}$

Fastener program

Item no. and description

Designation	Item no.	Description
X-EHS M4 MX	273367	
X-EHS M6 MX	272073	
X-EHS W6 MX	228341	Threaded Rod Hanger
X-EHS M8 MX	273368	
X-EHS W10 MX	386468	
X-ECC MX	228342	Ceiling clip







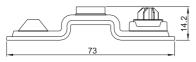


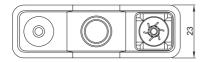
X-DHS MX Pipe support system

Product data

Dimensions

X-DHS 3/8" MX





Features and benefits

- Securely fastened threaded rod hangers to steel and concrete (soft and tough) base material
- Easy installation of threaded rods on floors, walls and ceiling

General informationMaterial specificationX-DHS:Zinc coating10-20 µm

Applications

Example





Hanger system for:

- Light-duty fastenings of pipes on ceilings
- Supporting pipes on floors
- Positioning of vertical pipes on walls

These fasteners are not recommended for fastening of suspended ceilings. These zinc coated fasteners are not suitable for long-term service outdoors or in otherwise corrosive environments.





Load data

Recommended loads (Base material = concrete)

Number of X-DHS MX elem	ients per pipe	N _{rec} [kN] per X-DHS MX
≥ 5	** ***	0.2
1 to 4 with fixed end supports	***	0.2

Design conditions:

- · Each X-DHS MX element has to be fastened with 2 nails
- All visible failures must be replaced.
- Predominantly static loading.
- Valid for soft and tough concrete with strength of f_{C, Cube} = 25-60 N/mm². For more details regarding concrete types, please refer to Concrete Fastener Selection section in Hilti Direct Fastening Technology Manual (DFTM).
- Observance of all application limitations and recommendations.
- For wall application (i.e. vertical pipes on walls), X-DHS MX is used for positioning purpose only, with NO imposed loading.
- Maximum spacing = 100 cm

Recommended loads (Base material = steel)

Fastener	N _{rec} [kN]
Recommended load per X-DHS MX element (fastened with 2 Nails)	0.8



Nail recommendations

For <u>concrete</u> base material							
Fastening tool	Nail types	Length [mm]	Tip	Shank Ø [mm]	Material	Hardness [HRC]	Coating [µm]
BX3	X-P B3 MX					57.5	Zinc, 2-13 µm
GX3	X-P G3 MX	24	Balistic	3.0	Carbon steel	57.5	Zinc, 2-13 µm
GX120	X-GHP MX					57.5	Zinc, 2-13 µm

• For X-DHS MX element, only 24 mm length nails are recommended for concrete base material to ensure sufficient embedment depth.

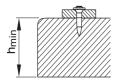
 Premium nails (as listed above) are the only recommended nails based on intended use of X-DHS element (soft and some tough concrete, GX/BX tools). For more details regarding nail classification and concrete types, please refer to Concrete Fastener Selection section in Hilti Direct Fastening Technology Manual (DFTM).

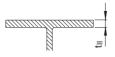
For <u>steel</u> base material								
Fastening tool	Nail types	Length [mm]	Tip	Shank Ø [mm]	Material	Hardness [HRC]	Coating [µm]	
BX3	X-P B3 MX	17				57.5	Zinc, 2-13 µm	
GX3	X-P G3 MX	17	Balistic	Balistic	3.0	Carbon steel	57.5	Zinc, 2-13 µm
GX120	X-GHP MX	18			0.000	57.5	Zinc, 2-13 µm	

 For X-DHS MX element, only 17-18 mm length nails are recommended for steel base material to ensure sufficient embedment depth.

Application requirements

Thickness of base material





Steel

Concrete

X-GHP MX, X-P G3 MX, X-P B3 MX



X-GHP MX, X-P G3 MX, X-P B3 MX

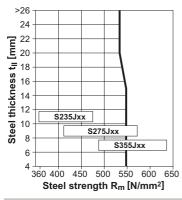
t_{II} ≥ 4.0 mm





Application limits

X-P 17 G3 MX, X-P 17 B3 MX, X-GHP 18 MX



Corrosion information

These zinc-coated fasteners are not suitable for long-term service outdoors or in otherwise corrosive environments. For further detailed information on corrosion see relevant chapter in **Direct Fastening Principles and Technique** section.

Fastener selection and system recommendation

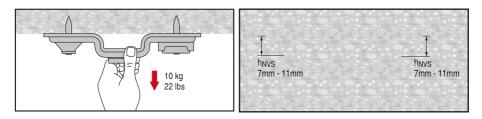
Fastener program

Designation	Item no.
X-DHS 3/8" MX	2161569

System recommendation

GX 120-ME	Gas can GC 20, GC 21 and GC 22 $$
GX 3-ME	Gas can GC 40, GC 41 and GC 42 $$
BX 3-ME	No gas can required

Fastening quality assurance







X-HS-W Wire hanging system

Product data

Dimensions		Material specification	S		
Pre assembled		X-HS-W:			
Au B	X-GHP 20/24	Zinc coating	≥ 2.5 µm		
HILL T		-			
		Recommended faste	-		
	<u>1.8 Ls</u>	DX 6 F8, DX 5 F8, DX			
		GX 120 ME, GX 3 ME	, BX 3 ME		
	X-P 20/24 G3 MX	See fastener p	program in the next		
	[∞] [∞] [∞] [∞]	pages.			
	1.8 Ls				
Magazined					
Hun					
HILTI	X-P 20/24 B3 MX				
	⁸ . 6				
q	∝ <u>L</u> Ψ				
d]	×				
	X-EGN 14	X-S 14 G3 MX	X-S 14 B3 MX		
	1	1	1		
	© 3				
Locking Mechanism	1.8 14	<u>1.8 14 </u>	1.8 14		
	15.8	15.8	15.8		
\$ THE					
W					

Approvals and certificates					
Authority	Approval / certificate no.	Fastener			
CSTB	AT 3/09-639	X-HS-W			



• Not all information presented in this product data sheet might be subject to approval/certificate content. Please refer to approval/certificate for further information.



Applications

Examples





Square Air Ducts



Light weight Cable Trays / Lights

Performance data

Round Air Ducts

Recommended resistance under tension and shear load

DX Standard for concrete

Designation	N _{rec}	V _{rec}	h _{ET}
X-HS-W U27	0.20 kN	0.3 kN	22 mm
X-HS-W U22	0.15 kN	0.2 kN	18 mm
X-HS-W MX with X-P 20/24 G3 MX,	0.05 kN	0.1 kN	14 mm
X-P 20/24 B3 MX, X-GHP 20/24 MX			

Conditions

- Minimum 5 fastenings per fastened unit (normal weight concrete).
- All visible failures must be replaced.
- Predominantly static loading.
- Observance of all application limitations and recommendations.

DX Standard for steel

Fastener designation	Nrec	Vrec
X-HS-W U16	0.90 kN	0.90 kN
X-HS-W MX with X-S 14 G3 MX,	0.45 kN	0.45 kN
X-S 14 B3 MX, X-EGN 14 MX		

Conditions

- Predominantly static loading.
- Observance of all application limitations and recommendations.



• For more details in relation to base material properties, please refer to the chapter **Fastener selection guide** in the Direct Fastening Manual (DFTM).





Application recommendation

Base material thickness					
Concrete		Steel			
X-U:	h _{min} = 80 mm	$t_{\mu} \ge 4 \text{ mm}$			
X-P G3 MX:	h _{min} = 60 mm				
X-P B3 MX:	h _{min} = 60 mm	V V			
X-GHP MX:	h _{min} = 60 mm				

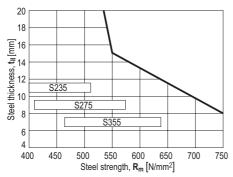
Fastener positioning in base material

Spacing and edge distances depending on job site requirements.

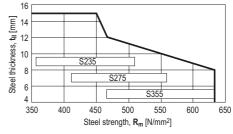
Application limits

Steel

X-HS-W MX with X-S 14 G3 MX, X-S 14 B3 MX, X-EGN 14 MX



X-HS-W U16 P8



Corrosion information

- These zinc-coated fasteners are not suitable for long-term service outdoors or in otherwise corrosive environments.
- For more details, please refer to following technical document: Hilti Corrosion Handbook.





System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

Cartridge recommendation for fastening on concrete

Base material	Cartridge color (tool power lev	oower level)	
	Tool type: DX 6 F8	Tool type: DX 5 F8, DX 460 F8, DX 351 F8, DX 2	
	Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M	
Soft/medium concrete	titanium 🔳 (1-5)	green 📕, yellow 📒	
Tough concrete	titanium 🔳 (4-8)	yellow <mark>,</mark> red =	

Cartridge recommendation for fastening on steel

Base material		Cartridge color (tool power level)		
		Tool type: DX 6 F8	Tool type: DX 5 F8, DX 460 F8, DX 351, DX 2	
		Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M	
S235, S275, S355	4 ≤ t _{ll} ≤ 15mm	titanium 🔳 (2-8)	yellow 🗕, red 🗖	

• Tool power level adjustment by setting tests on site.

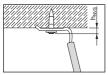
• Start tool energy selection with lowest recommended tool power level.

• Correct according requirement from chapter quality assurance.



Quality assurance

X-HS-W



h_{NVS} = 5.5-8.5 mm



- No lifting: do not use for lifting, such as in a crane or pully situation.
- No movement: Hilti hangers are to be used to suspend stationary loads only. Do not use to suspend moving services, or services likely to be subject to movement.
- No joining: Hilti hangers must not be used as an in-line joint using a Hilti fastener, or any other joining device. A Hilti hanger assembly must comprise one length of cable and one Hilti fastener only. If a longer length is needed, do not join two assemblies together.

Fastener program

Item no. and description

Designation	Item no.	Description
X-HS-W U16 P8 1m/3ft	387430	For DX tools
X-HS-W U22 P8 1m/3ft	387431	
X-HS-W U27 P8 1m/3ft	387432	
X-HS-W U16 P8 2m/7ft	387919	
X-HS-W U22 P8 2m/7ft	387920	
X-HS-W U27 P8 2m/7ft	387921	
X-HS-W U16 P8 3m/10ft	387433	
X-HS-W U22 P8 3m/10ft	387434	
X-HS-W U27 P8 3m/10ft	387435	
X-HS-W MX 1m/3ft	387436	For GX tools
X-HS-W MX 2m/7ft	387922	and BX tools
X-HS-W MX 3m/10ft	387437]

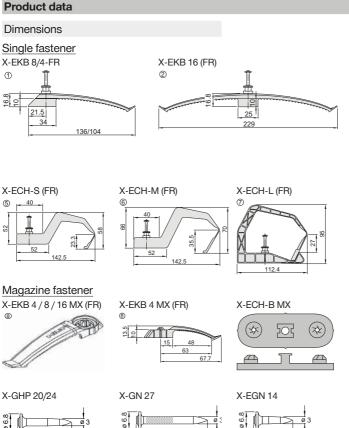


X-HS-W



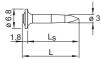
X-EKB, X-ECH Electrical fastener

Product data

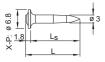




X-P 20/24 G3 MX

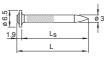


X-P 20/24 B3 MX



X-C 27 G3 MX

1.9



27

28.9

Ø 6.8 1.8 14 15.8 X-S 14 B3 MX

1.8

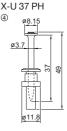
14

15.8

ø3

X-S 14 G3 MX





X-ECH-15/30 MX



X-U 16/22/27 84 80 2.4





Material specifications



• See fastener program in the next pages.

Recommended fastening tools DX 6 MX, DX 5 MX, DX 460 MX, DX 351 MX, DX 6 F8, DX 5 F8, DX 460-F8, DX 351 F8, DX 36, DX 2, GX 120 ME, GX 3 ME, BX 3 ME



See fastener program in the next pages.

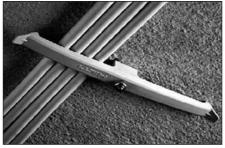
Approvals and certificates

UL (USA):	X-EKB MX, X-ECH / FR_U37
CSTB (France):	X-EKB_U 37, X-ECH_U37

Not all information presented in this product data sheet might be subject to approval / certificate content. Please refer to approval/certificate for further information.

Applications

Examples



X-EKB for fastening cables



X-ECH for fastening bunched cables

Performance data

Fastener capacity for X-EKB: Securing electrical cables to concrete ceilings and walls

Designation	Number of wires/cables and wire sizes		
	NYM 3 x 1.5 mm ² (Ø 8 mm) NYM 5 x 1.5 mm ² (Ø 10 mm		
X-EKB 4	4	3	
X-EKB 8	8	5	
X-EKB 16	16	10	

• Max. capacity (number of cables in one X-EKB) at spacing of 50–100 cm.

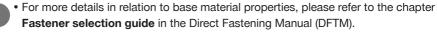


Fastener capacity for X-ECH: Securing electrical cable to ceilings and walls

Designation		No. of nails	Number of cables
X-ECH-S	and X-ECH/FR-S		max. 15 NYM 5x1.5 ² (Ø 10 mm)
X-ECH-M	and X-ECH/FR-M		max. 25 NYM 5x1.5 ² (Ø 10 mm)
X-ECH-L	and X-ECH/FR-L		max. 35 NYM 5x1.5 ² (Ø 10 mm)
X-ECH-15 MX	and X-ECH-B	1 or 2	max. 15 NYM 3x1.5 ² (Ø 10 mm)
X-ECH-30 MX	and X-ECH-B	1 or 2	max. 30 NYM 3x1.5 ² (Ø 10 mm)

Conditions

- Max. capacity at spacing of 60-80 cm.
- For concrete C12/15 to C45/55 (f_{cc} = 15 to 55 N/mm²)
- · All visible placing failures have to replaced
- Damaged X-ECH have to replaced



Application recommendationBase material thicknessConcreteX-U, X-P: $h_{min} = 80 \text{ mm}$ X-P G3 MX: $h_{min} = 60 \text{ mm}$ X-P B3 MX: $h_{min} = 60 \text{ mm}$ X-GHP MX, X-GN MX: $h_{min} = 60 \text{ mm}$

Fastened material thickness

• Fasteners recommended for cable Ø 8 mm and 10 mm.

Spacing and edge distances

X-EKB:	approximately 50–100 cm
X-FCH·	approximately 60- 80 cm

(Adjust as necessary to control cable sag) (Adjust as necessary to limit sagging)

Corrosion information



- These zinc-coated fasteners are not suitable for long-term service outdoors or in otherwise corrosive environments.
- For more details, please refer to following technical document: Hilti Corrosion Handbook.





System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

Cartridge recommendation for fastening on concrete

Base material	Cartridge color (tool power level)		
	Tool type:	Tool type:	
	DX 6 MX		
		DX 460 MX, DX 351 MX	
	DX 6 F8	DX 5 F8,	
		DX 460 F8, DX 351, DX 2	
	Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M	
Soft/medium concrete	titanium 🔳 (2-5)	yellow <mark>,</mark> red 	
Tough concrete	titanium 🔳 (4-8)	yellow 🗕, red 📕	

Cartridge recommendation for fastening on steel

Base material		Cartridge color (tool power level)		
		Tool type:	Tool type:	
		DX 6 MX	DX 5 MX,	
			DX 460 MX	
		DX 6 F8	DX 5 F8,	
			DX 460 F8, DX 351, DX 2	
		Cartridge type: 6.8/11 M Cartridge type: 6.8/11 M		
S235, S275, S355	$4 \le t_{ } \le 20 \mathrm{mm}$	titanium 🔳 (4-8)	red 📕	

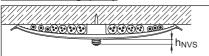
• Tool power level adjustment by setting tests on site.

• Start tool energy selection with lowest recommended tool power level.

• Correct according requirement from chapter quality assurance.

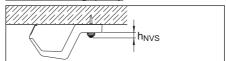
Quality assurance





 h_{NVS} = 7 ± 2 mm











Fastener program

Fastener with pre-mounted DX-nail: Technical information

	Designation	Shank	Shank	Tools
		Ø	length	
		ds	Ls	
1	X-EKB8 U 37	4.0 mm	37 mm	
2	X-EKB16 U 37	4.0 mm	37 mm	
5	X-ECH-S U 37	4.0 mm	37 mm	
6	X-ECH-M U 37	4.0 mm	37 mm	DX 6 F8,
\bigcirc	X-ECH-L U 37	4.0 mm	37 mm	DX 5 F8,
1	X-EKB4-FR U 37	4.0 mm	37 mm	DX460 F8,
1	X-EKB8-FR U 37	4.0 mm	37 mm	DX351 F8,
2	X-EKB16-FR U 37	4.0 mm	37 mm	DX36, DX 2
5	X-ECH/FR-S U 37	4.0 mm	37 mm	
6	X-ECH/FR-M U 37	4.0 mm	37 mm	
7	X-ECH/FR-L U 37	4.0 mm	37 mm	

(3), (4) All nail shanks: carbon steel, HRC 58, galvanized 2–20 μm Sleeve/thimble: carbon steel, not hardened, galvanized 5–13 μm

 $\textcircled{10}-\Delta$ See Product data in previous pages

Fastener with pre-mounted DX-nail: Order information

Designation	Item no.	Plastic material
X-EKB 4-FR U37	361581	Polyamide (PA) ²⁾
X-EKB 8 U37	386231	Polyamide (PA) ¹⁾
X-EKB 8-FR U37	386233	Polyamide (PA) ²⁾
X-EKB 16 U37	386232	Polyamide (PA) ¹⁾
X-EKB 16-FR U37	386234	Polyamide (PA) ²⁾
X-ECH-S U37	386235	Polyamide (PA) ¹⁾
X-ECH-M U37	386236	Polyamide (PA) ¹⁾
X-ECH-L U37	386237	Polyamide (PA) ¹⁾
X-ECH/FR-S U37	386238	Polyamide (PA) ²⁾
X-ECH/FR-M U37	386239	Polyamide (PA) ²⁾
X-ECH/FR-L U37	386240	Polyamide (PA) ²⁾

¹⁾ halogen and silicone free, light grey (RAL 7035)

²⁾ halogen and silicone free, flame retardant, stone grey (RAL 7030)





Fastener without pre-mounted nail: Technical information

Base material	Cable Holder	Fastening Technology	Nail
		GX	X-P 20/24 G3 MX
	X-EKB 4 MX	GX	X-C 27 G3 MX
	X-EKB 8 MX	GX	X-GHP 20/24 MX
Concrete	X-EKB 16 MX	GX	X-GN 27 MX
	X-EKB 4 FR MX	BX	X-P 20/24 B3 MX
		DX	X-U 22/27 MX
X-EKB 8 FR MX	DX	X-P 22/27 MX	
	X-EKB 16 FR MX	GX	X-S 14 G3 MX
Steel X-ECH-15 MX* X-ECH-30 MX*		GX	X-EGN 14 MX
	X-ECH-30 MX [*]	BX	X-S 14 B3 MX
		DX	X-U 16 MX

* To be used with GX or BX technology ONLY

Fastener without pre-mounted nail: Order information				
Designation	Item no.	Plastic material Descrip		
X-EKB 4 MX	285712	Polyamide (PA) ¹⁾		
X-EKB 8 MX	285713	Polyamide (PA) ¹⁾		
X-EKB 16 MX	285714	Polyamide (PA) ¹⁾		
X-EKB 4 FR MX	285715	Polybutylenterephthalate (PBT) ²		
X-EKB 8 FR MX	285716	Polybutylenterephthalate (PBT) ² Elect		
X-EKB 16 FR MX	285717	Polybutylenterephthalate (PBT) ²⁾ Cable		
X-ECH-15 MX	2018247	Polyamide (PA) ³ Holde		
X-ECH-30 MX	2018248	Polyamide (PA) ³⁾		
X-ECH-15/B MX	2018729 (kit)	it) Polyamide (PA) ³		
X-ECH-30/B MX	2018891 (kit)	t) Polyamide (PA) ³⁾		
X-ECH-B MX	2018391	Polyamide (PA) ³]	

¹⁾ halogen free, light grey (RAL 7035)

²⁾ silicone free, stone grey (RAL 7030)

³⁾ halogen and silicone free, light grey (RAL 7035)



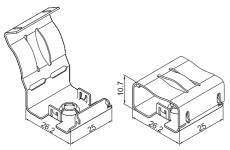


X-DFC Double fire clip

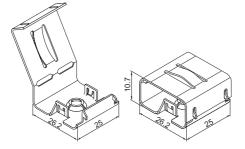
Product data

Dimensions

X-DFC 8 MX/ X-DFC-W 8 MX



X-DFC 9 MX / X-DFC-W 9 MX



Features and benefits

- Easy and convenient installation to concrete (soft and some tough) and sandlime stone base material
- · Quick, cost-efficient fastening
- Can be clicked on BX fastener guide, no adaptor needed
- · Tested by an external, certified test institute

General information

Material specifications

X-DFC-MX:

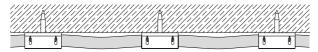
Stainless steel with 50 µm red or white colour coating

Approval and standards

Product qualification according to BS EN 50200, BS EN 50200 Annex E and BS 8434-2

In compliance with cable support requirements of BS 5839-1, BS 5839-8 and BS 5266-1

Applications



Installation of fire alarm and emergency lighting cables.





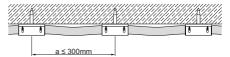
Performance data

Fire rating

Cable	Fastener	Cable size	Classification	Test standard
Prysmian FP200	X-DFC 8 MX /	2 core x 1.5 mm ²	PH 60	BS EN 50200 (dry)
Gold (standard)	X-DFC-W 8 MX	3 core x 1.5 mm ²	PH 30	BS EN 50200 Annex E (wet)
Prysmian FP plus (enhanced)	X-DFC 9 MX / X-DFC-W 9 MX	2 core x 1.5 mm ²	PH 120	BS EN 50200 (dry) BS 8434-2 (wet)
	X-DFC 8 MX /	· · · · · · · · · · · · · · · · · · ·	PH 60	BS EN 50200 (dry)
Ventcroft NoBurn	X-DFC-W 8 MX		PH 30	BS EN 50200 Annex E (wet)
Platinum (standard)	X-DFC 9 MX /	2 core x 2.5 mm ²	PH 60	BS EN 50200 (dry)
	X-DFC-W 9 MX 4 core x 1.5 mm ²	4 core x 1.5 mm ²	PH 30	BS EN 50200 Annex E (wet)
Ventcroft NoBurn plus (enhanced)	X-DFC 8 MX / X-DFC-W 8 MX	2 core x 1.5 mm ²	PH 120	BS EN 50200 (dry) BS 8434-2 (wet)

Conditions:

- · Pre-loading of the elements after setting
- All visible failures must be replaced.
- Observance of all application limitations and recommendations.



Recommended fastener spacing a: horizontal ≤ 300 mm, vertical ≤ 400 mm

Fastener selection and system recommendation

Fastener program

Designation	Item no.	Colour	Cable diameter
X-DFC 8 MX	2143695	Red	8 mm ≤ D ≤ 8.5 mm
X-DF-W 8 MX	2143699	White	
X-DFC 9 MX	2143696	Red	8.5 mm ≤ D ≤ 9 mm
X-DFC-W 9 MX	2143730	White	0.5 mm ≤ U ≤ 9 mm

Tool selection

X-P B3 MX:	BX 3-ME	No gas can required
X-P G3 MX:	GX 3-ME	Gas can GC 40, GC 41 and GC 42





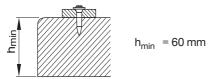
Nail recommendation

Fastening tool	Nail types	Length [mm]	Тір	Shank Ø [mm]	Material	Hardness [HRC]	Coating [µm]
BX3-ME	X-P B3 MX	17 00	20 Long- conical 3.0	2.0	Carbon	57.5	Zinc, 2-13
GX3-ME	X-P G3 MX	17 - 20		3.0	steel	57.5	Zinc, 2-13

- For the X-DFC MX element, only 17 mm and 20 mm pin lengths are recommended in order to ensure sufficient embedment depth.
- Nails (as listed above) are recommended for wall and ceiling application (soft and some tough concrete and sandlime stone, GX/BX tools). For more details regarding nail classification and concrete types, see Concrete Fastener Selection chapter in Direct Fastening Technology Manual (DFTM).

Application requirements

Thickness of base material



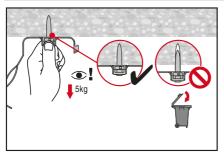
Edge distance

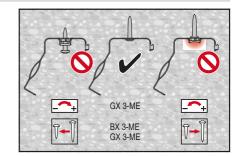
Min. edge distance = 70 mm

Corrosion information

Zinc-coated nails are not suitable for long-term service outdoors or in otherwise corrosive environments. For further detailed information on corrosion see relevant chapter in Direct Fastening Principles and Technique section.

Fastening quality assurance











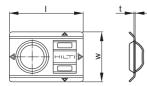


X-MCT-FE MX Metal cable tie holder

Product data

Wiring system		Features and benefits	Environmental condition
Cable tie holder X-MCT-FE MX	Cable tie Metal cable tie Plastic cable tie	 Maintaining function of the fastener during fire Magnetic interface Bi-direction cable tying Fire test method following BS 7671 Testing acc. to EN 1363-1: 2020-05 	Dry Indoor

Dimension



_	Width of	Length of	Thickness	Admissibl	е
	the cable	the cable tie	cable tie	cable tie v	vidth
	tie holder	holder	holder		
	W	1	t	W _{min}	W _{max}
	32.5 mm	48 mm	0.8 mm	4.9 mm	8 mm

w_{min} is based on testing requirements

Material specification and material properties

Item no.	Element	Material	Coating	Process	Minimum
					coating
					thickness
2276133	X-MCT-FE MX	DX51D	zinc	Pre-galvanizing	5 µm

Corrosion resistance

For fastenings not directly exposed to external weather conditions or moist atmosphere.

Base material







Masonry Solid brick

Load condition

Static/

quasi static



Fire resistance

Soft concrete

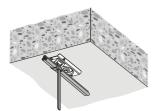
Tough concrete

Steel





Application



Fastening electrical installation to ceiling and wall

Admissible electrical installation

Electrical installations

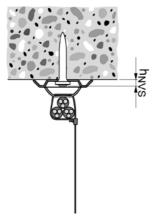
General cables

Load data

Recommended resistance under tension and shear load for fastening on soft and tough concrete and steel based on working load concept

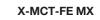
Wiring system	Tension	Shear	Fire rating	Fire rating
	load N _{rec}	load V _{rec}	cable tie holder	cable tie
X-MCT-FE MX	0.04 kN	0.04 kN	120 min.	Utilization of suitable cable tie
				acc. to national standards

Fastening quality assurance



 $\begin{array}{l} \mbox{Admissible fastener stand-off} \\ \mbox{$h_{\text{NVS, min}}$} &= 5 \mbox{ mm} \\ \mbox{$h_{\text{NVS, max}}$} &= 11 \mbox{ mm} \end{array}$





System recommendation

Minima average manuated with bottom contrated feature

Wiring system mounted with battery-actuated fastener											
Element						Battery- actuated tool	Base	mater	ial		
Name	X-P 17 B3 MX	X-P 20 B3 MX	X-P 24 B3 MX	X-C 20 B3 MX	X-C 24 B3 MX	X-S 14 B3 MX	BX 3-ME	Soft concrete	Tough concrete	Steel	Masonry Solid brick
X-MCT-FE MX											
X-MCT-FE MX											
X-MCT-FE MX											
recommended											

Setting information

Fastener setting information (e.g. base material properties, fastened material properties and setting energy) is part of the corresponding Product Data Sheet for fastener.

Fastener guide X-GF B3-FG required for fastener setting with battery-actuated tool.









X-MCT MX Metal cable tie holder

Product data

Product description

X-MCT MX	
Stall 2	
and the second s	

- Maintaining function of the fastener during fire
- · Bi-direction cable tying
- Classification of Hilti X-MCT-MX cable tie holder in accordance with AS/NZS 3013 2015, Appendix C

D ¹	
1)ime	nsions
DIIIIC	130113

Technical drawing	Designa-	Width	Length	Thickness	Admicai	bla tia
recrimical drawing	Designa-	width	Length	Thickness		ole lie
	tion				width	
		w	I	t	W _{min}	W _{max}
	X-MCT MX	32.4 mm	44 mm	1 mm	4.9 mm	8 mm



• w_{min} is based on testing requirements.

Material specification and material properties for carbon steel elements

Designation	Element	Material Coating F		Process	Minimum coating
					thickness
X-MCT MX	Cable tie	DX51D	Zinc	Pre-	5 µm
	holder			galvanizing	





Applications

Fastening electrical installation to ceiling



Admissible electrical installation				
Electrical installations	General cables			
	 Flame retardant cables 			
	• Fire rated cables in accordance with Australian standards			

Base materials





Tough concrete

Load conditions





Static/ quasi static Fire rated

Environmental conditions



Dry indoor



• For more details, please refer to following technical document: Hilti Corrosion Handbook.





Approvals/certificates

Authority	Approval/certificate no.	Date of issue	Country of issue
CSIRO	FCO-3417	03/2021	Australia

 Not all information presented in this product data sheet might be subject to approval/certificate content. Please refer to approval/certificate for further information.

Performance data

Recommended resistance under tension and shear load

Designation	Tension load	Shear load	Fire rated
	N _{rec}	V _{rec}	
X-MCT MX	0.02 kN	0.02 kN	120 min.

• Utilization of suitable cable tie acc. to national standards.

- Redundancy of fastening points is required.
 - Minimum number of fastening points for safety relevant fastenings: \geq 5.

System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

Wiring system mounted with battery-actuated fastener

Element designation	Fastener					Battery-actuated			Base		
	desi	gnatio	n			tool				mate	erial
	X-P 17 B3 MX	X-P 20 B3 MX	X-P 24 B3 MX			BX 3 ME				Soft concrete	Tough concrete
X-MCT MX											
X-MCT MX											

= recommended





Wiring system mounted with gas-actuated fastener

Element designation	Fastener designation					Gas-actuated tool			Base material		
	X-P 17 G3 MX	X-P 20 G3 MX	X-P 24 G3 MX	X-GHP 18 MX	X-GHP 20 MX	GX 3 ME	GX 120 ME			Soft concrete	Tough concrete
X-MCT MX											
X-MCT MX											
X-MCT MX											
X-MCT MX											

= recommended

Wiring system mounted with powder-actuated collated fastener

Element designation						Powder-actuated tool				Base material	
	desi	gnalio				1001				mate	nai
	X-P 22 MX	X-P 27 MX				DX 6 MX	DX 5 MX	DX 460 MX	DX 351 DX	Soft concrete	Tough concrete
X-MCT MX											

= recommended

Wiring system mounted with powder-actuated single fastener

Element designation	Fast	Fastener				Powder-actuated				Base	
	desi	gnatic	n			tool				material	
	X-P 22 P8	Х-Р 27 Р8				DX 6 F8	DX 5 F8	DX 460 F8	DX 351 CT	Soft concrete	Tough concrete
X-MCT MX											

= recommended



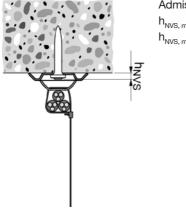


Setting information

• Fastener setting information (e.g. base material properties, fastend material properties and setting energy is part of the corresponding product data sheet for fastener.

Quality assurance

Setting depth control



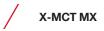
$\begin{array}{l} \mbox{Admissible fastener stand-off} \\ \mbox{$h_{\rm NVS,\,min}$} &= 4\mbox{ mm} \\ \mbox{$h_{\rm NVS,\,max}$} &= 11\mbox{ mm} \end{array}$

- Visible setting failures must be replaced with a new fastener, not in the same hole.
 - These are abbreviated instructions which may vary by application.
 - Always review/follow the instructions accompanying the product.

Performance data

Designation	Item no.	Description
X-MCT MX	2276132	Metal cable tie holder



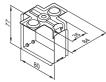


X-ECH-FE MX, X-EKB-FE MX Circuit integrity fastener

Product data

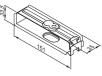
Dimensions

X-ECH-FE 30 MX



X-ECH-FE 15 MX

X-EKB-FE 15 MX



X-EKB-FE 8 MX



General information Material specifications Galvanized \geq 5 µm zinc coating steel sheet X-GHP Carbon steel, HRC 57.5, zinc coating 2-10 um X-P G3 MX Carbon steel, HRC 57.5, zinc coating 2-10 um **X-P B3 MX** Carbon steel, HRC 57.5, zinc coating 2-10 µm

X-P 17 B3 MX

X-P 17 G3 MX

1.8





X-GHP 18 MX

Recommended fastening tools GX 120-ME, GX 3-ME, BX 3-ME

Approval

AbP P-MPA-E-16-010 AbP P-2401/198/16-MPA BS AbP P-1023 DMT DO

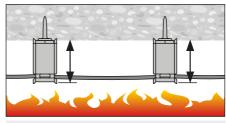
Expert review on MLAR application by MPA IBMB Braunschweig

Expert review on nail load in circuit integrity applications by MPA IBMB Braunschweig

Applications



Circuit integrity system (CIS) application with fire rating and load data according to AbP



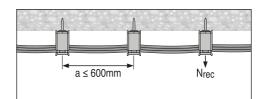
Application to non-circuit integrity cables in escape routes (according to MLAR)



Load Data

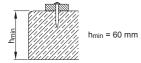
Application \rightarrow	Escape rout	es (MLAR)	Circuit integ		
Fastener ↓	Load N _{rec} [kN]	Fire Rating	Cable weight [kg/m]	Fire Rating	Spacing a [mm]
X-ECH-FE 30 MX	0.04*		According to Ab		
X-ECH-FE 15 MX	0.02**	F90	fire rating (E30 - weights specific	,	a ≤ 600 mm
X-EKB-FE 15 MX	0.02**		combination of: - Fastener ele	ement	
X-EKB-FE 8 MX	0.02**		 Cable type Ceiling or w 	and size all application	

- * 6.6 kg/m with spacing a = 600 mm
- ** 3.3 kg/m with spacing a = 600 mm
- Pre-loading of the elements with load $\ge N_{rec}$ after setting
- All visible failures must be replaced (see "Fastening quality assurance")



Fastener selection and system recommendation

Thickness of base material



Corrosion Information

The intended use only comprises fastenings which are not directly exposed to external weather conditions or moist atmospheres.

Application requirements

Fastener program

Designation	Item no.
X-ECH-FE 30 MX	2142822
X-ECH-FE 15 MX	2142823
X-EKB-FE 15 MX	2142824
X-EKB-FE 8 MX	2142825



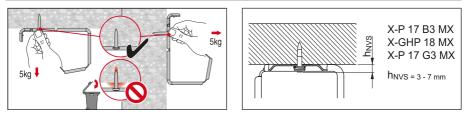
Fastener program

Base material	Nail designation	Shank length Ls [mm]	Nail length L [mm]	Tool
	X-GHP 18 MX	18	19.8	GX 120-ME
Concrete	X-P 17 G3 MX	17	18.8	GX 3-ME
	X-P 17 B3 MX	17	18.8	BX 3-ME

System recommendation

GX 120-ME	Gas can GC 20, GC 21 and GC 22
GX 3-ME	Gas can GC 40, GC 41 and GC 42
BX 3-ME	No gas can required

Fastening quality assurance











X-EAS-FE MX Stand-off single cable holder

Designation

X – EAS-FE	6–10	MX
Technology Application	Cable diameter Fas	tening type
Technology: X	DX solution	
Application: EAS-FE	Stand-off single cable	holder
Cable diameter: 6 10	Minimum admissible o Maximum admissible	
Fastening type: MX	Collated fastening	





Product data

Product description

X-EAS-FE MX (Type 1)	 X-EAS-FE MX fastening system for securing circuit
Ŷ	integrity and operability of electrical circuits during fire.
Vel -	 Approved fire resistance according to DIN 4102-12.
and all a	Easy assembling.
	Compatible with magnetic tool interface.
X-EAS-FE MX (Type 2)	

Fastening system

Designation		Battery-actuated fastener			
		X-P 17 B3 MX	X-P 20 B3 MX	X-P 24 B3 MX	
X-EAS-FE 6-10 MX					
X-EAS-FE 11-14 MX	Type 1	•	•	•	
X-EAS-FE 15-19 MX					
X-EAS-FE 20-25 MX	Tupo 2				
X-EAS-FE 26-31 MX	Type 2	•		-	

Dimensions for cable holders

		Designation	Width	Length	Thickness	Height
			w	I	t_1/t_2	h
		6-10 MX	40 mm	72 mm	0.8/1.2 mm	28 mm
	Rì	11-14 MX	44 mm	72 mm	0.8/1.2 mm	30 mm
	h -	15-19 MX	48 mm	72 mm	0.8/1.2 mm	35 mm

	Designation	Width	Length	Thickness	Height	
		w	1	t	h	
	20-25 MX	52 mm	65 mm	1 mm	48 mm	
	26-31 MX	57 mm	65 mm	1 mm	52 mm	
	h					





Material specification and material properties for steel elements

Designation	Element	Material	Coating	Minimum coating
				thickness
X-EAS-FE MX (Type 1, 2)	Cable holder	SPCC	Zinc	5 µm

• SPCC = Cold rolled steel sheet

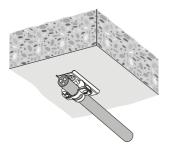
• Info for nails and anchors are part of the corresponding Product Data Sheets.

Approvals and certificates

Authority	Approval/	Date	Description
	certificate no.	of issue	
MPA IBMB	2401/462/21	06/2021	Expert opinion norm construction
Braunschweig			
	P-2401/468/21-MPA BS	07/2021	CIS test certificate (abP)

• Not all information presented in this product data sheet might be subject to approval/certificate content. Please refer to approval/certificate for further information.

Applications



Fastening (Type 1)



Fastening (Type 2)





Base materials







Soft concrete

Standard Tough concrete

Sand lime masonry

Load conditions





Static/ quasi static

ire resistai

Environmental conditions

		Designation			
Environmental condition		X-EAS-FE MX	X-EAS-FE MX	X-EAS-FE MX	
		(Type 1, 2)	(Type 1, 2)	(Type 1, 2)	
		combined with	combined with	combined with	
		X-P 17 B3 MX	X-P 20 B3 MX	X-P 24 B3 MX	
	Dry indoor				

= suitable for corrosion protection

• For more details, please refer to following technical document: Hilti Corrosion Handbook.

Fastener program

Item no. and description

Designation	Item no.	Description
X-EAS-FE 6-10 MX	2325722	
X-EAS-FE 11-14 MX	2325723	
X-EAS-FE 15-19 MX	2325724	Cable holder
X-EAS-FE 20-25 MX	2325725	
X-EAS-FE 26-31 MX	2325726	
X-P 17 B3 MX	2156216	
X-P 20 B3 MX	2156217	Fastener
X-P 24 B3 MX	2156218	
X-FG B3-ME	2101258	Fastener guide
X-FG B3-FE	2208570	Magnetic fastener guide





X-EAS-FE MX – Fastening electrical installation

Application recommendation

Fastened material dimensions

	Ø	in a				
Designation	1 cable		2 cables		3 cables	
Designation	Ø min	Ø max	Ø min	Ø max	Ø min	Ø max
X-EAS-FE 6-10 MX	6 mm	10 mm	3 mm	5 mm	3 mm	5 mm
X-EAS-FE 11-14 MX	11 mm	14 mm	6 mm	7 mm	5 mm	6 mm
X-EAS-FE 15-19 MX	15 mm	19 mm	8 mm	9 mm	7 mm	8 mm
X-EAS-FE 20-25 MX	20 mm	25 mm	10 mm	12 mm	9 mm	11 mm
X-EAS-FE 26-32 MX	26 mm	32 mm	13 mm	16 mm	12 mm	14 mm

to DIN 4102-12	
Buil	_
juration accorc	
dard config	
ations for norm-/standard config	
rations for I	
ted configu	
Test	

Cable manufacturer	VDE Nr.	VDE Cable type Nr.	 Cable dimension	Clip type	Spacing	Cable per clip	Spacing Cable Classification per clip
Dätwyler KERAM	7780	7780 (N)HXCH FE 180 E90	n x 1.5/1.5- n x 35/16	n x 1.5/1.5- X-EAS-FE MX 30 cm n x 35/16	30 cm	-	E30-E90
Dätwyler KERAM	7780	7780 (N)HXH FE 180 E90	 n x 1.5- n x 35	n x 1.5- X-EAS-FEMX 30 cm n x 35	30 cm	1	E30-E90
Eupen EUCASAFE	6563	6563 JE-H(ST)HBd FE 180 E90	n x 2 x 0.8	n x 2 x 0.8 X-EAS-FEMX 30 cm 1	30 cm		E30-E90

Cable specific constructions according to DIN 4102-12

Cable manufacturer	VDE	Cable type	Number	Number Number Cable	Cable	Clip type	Spacing Cable	Cable	Classification
	Nr.		of pairs (n)	of cores (n)	of cores dimension (n)			per clip	
Dätwyler KERAM	9361	JE-H(St)H FE 180 E30-E90	2	2	n x 2 x 0.8	X-EAS-FE 11-14 MX	30 cm	2	E30-E60
Dätwyler KERAM	9361	JE-H(St)H FE 180 E30-E90	4	2	n x 2 x 0.8	X-EAS-FE 15-19 MX	30 cm	2	E30-E60
Dätwyler KERAM	9361	JE-H(St)H FE 180 E30-E90	8; 12	2	n x 2 x 0.8	X-EAS-FE 26-31 MX	30 cm	2	E30-E60
Loeni Studer BETAflam	9593	JE-H(St)H FE 180/E30-E90	2	2	n x 2 x 0.8	X-EAS-FE 15-19 MX	30 cm	2	E30-E90
Loeni Studer BETAflam	9593	JE-H(St)H FE 180/E30-E90	4	2	n x 2 x 0.8	X-EAS-FE 26-31 MX	30 cm	2	E30-E90
Loeni Studer BETAflam	9593	JE-H(St)H FE 180/E30-E90	2	2	n x 2 x 0.8	X-EAS-FE 20-25 MX	30 cm	з	E30-E90
Eupen EUCASAFE	6563	JE-H(ST)HBd FE 180 E90	2	2	n x 2 x 0.8	X-EAS-FE 20-25 MX	30 cm	2	E30-E90
Eupen EUCASAFE	6563	JE-H(ST)HBd FE 180 E90	4	2	n x 2 x 0.8	X-EAS-FE 26-31 MX	30 cm	2	E30-E90
Loeni Studer BETAflam	8238	JE-H(St)HRH FE 180/E30-E90	2	2	n x 2 x 0.8	X-EAS-FE 20-25 MX	30 cm	2	E30-E90
Loeni Studer BETAflam	8238	JE-H(St)HRH FE 180/E30-E90	2	2	n x 2 x 0.8	X-EAS-FE 26-31 MX	30 cm	3	E30-E90
Prysmien SIENOPYR- PLUS	7787	JE-H(ST)H Bd FE 180 E30	2	2	n x 2 x 0.8	X-EAS-FE 26-31 MX	30 cm	2	E30-E60
Helukabel	8553	JE-H(St)H Bd FE 180/E30-E90	4	2	n x 2 x 0.8	X-EAS-FE 6-10 MX	30 cm	1	E30-E90
Sauter-Brandmelde- Systemkabel	8336	JE-H(St)H FE 180/E30		2	n x 2 x 1.5	X-EAS-FE 6-10 MX	30 cm		E30-E60



Cable specific const	ructior	Cable specific constructions according to UIN 4102-12						
Cable manufacturer	Nr. Nr.	Cable type	Number of cores (n)	Cable dimension	Clip type	Spacing	Cable per clip	Classification
Dätwyler KERAM	7780	(N)HXH FE 180 E30-E60	2	n x 1.5- n x 2.5	X-EAS-FE 11-14 MX	60 cm	-	E30-E90
Dätwyler KERAM	7780	(N)HXH FE 180 E30-E60	ю	n x 1.5- n x 4	X-EAS-FE 11-14 MX	60 cm	-	E30-E90
Dätwyler KERAM	7780	(N)HXH FE 180 E30-E60	ю	n x 6- n x 10	X-EAS-FE 15-19 MX	60 cm	-	E30-E90
Dätwyler KERAM	7780	(N)HXH FE 180 E30-E60	4	n x 1.5- n x 2.5	X-EAS-FE 11-14 MX	60 cm	-	E30-E90
Dätwyler KERAM	7780	(N)HXH FE 180 E30-E60	4	n x 6	X-EAS-FE 15-19 MX	60 cm	-	E30-E90
Dätwyler KERAM	7780	(N)HXH FE 180 E30-E60	5	n x 1.5	X-EAS-FE 11-14 MX	60 cm	-	E30-E90
Dätwyler KERAM	7780	(N)HXH FE 180 E30-E60	5	n x 2.5- n x 10	X-EAS-FE 15-19 MX	60 cm	-	E30-E90
Dätwyler KERAM	7780	7780 (N)HXH FE 180 E30-E60	7	n x 1.5- n x 6	X-EAS-FE 15-19 MX	60 cm	-	E30-E90
Dätwyler KERAM	7780	(N)HXH FE 180 E30-E60	10	n x 2.5	X-EAS-FE 20-25 MX	60 cm	-	E30-E90
Dätwyler KERAM	7780	(N)HXH FE 180 E30-E60	12	n x 1.5	X-EAS-FE 15-19 MX	60 cm	-	E30-E90
Dätwyler KERAM	7780	(N)HXH FE 180 E30-E60	12	n x 2.5	X-EAS-FE 20-25 MX	60 cm	-	E30-E90
Dätwyler KERAM	7780	(N)HXH FE 180 E30-E60	24	n x 1.5	X-EAS-FE 20-25 MX	60 cm	-	E30-E90
Dätwyler KERAM	7780	(N)HXCH FE 180 E30-E60	e	n x 10/10	X-EAS-FE 15-19 MX	60 cm	-	E30-E90
Dätwyler KERAM	7780	(N)HXCH FE 180 E30-E60	3	n x 25/16- n x 35/16	X-EAS-FE 26-31 MX	60 cm	-	E30-E90
Dätwyler KERAM	7780	(N)HXCH FE 180 E30-E60	4	n x 10/10	X-EAS-FE 20-25 MX	60 cm	-	E30-E90
Dätwyler KERAM	7780	(N)HXCH FE 180 E30-E60	4	n x 16/16	X-EAS-FE 20-25 MX	60 cm	.	E30-E90
Dätwyler KERAM	7780	(N)HXCH FE 180 E30-E60	4	n x 25/16- n x 35/16	X-EAS-FE 26-31 MX	60 cm	-	E30-E90

Cable specific constructions according to DIN 4102-12

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Image: A state of cores n ≥ 2.







Base material properties and fastener positioning in base material

Regulation	Fastener spacing
Norm-/standard construction	s = 300 mm
Cable specific construction	s ≥ 300 mm

• For more details in relation to base material properties, please refer to the chapter Fastener selection guide in the Direct fastening Technology Manual (DFTM).

Performance data

Recommended resistance under tension and shear load

Designation	Tension	Shear	Fire rating	Testing according to
	load	load	cable holder	
	N _{rec}	V _{rec}		
X-EAS-FE MX (Type 1, 2)	0.02 kN	0.02 kN	90 min	EN 1363-1: 2020-05



F

• Redundancy of fastening points is required.

System recommendation

System recommendation for fastening collated nails with battery-actuated tool

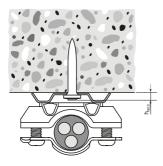
Designation				Batter tool	y-actua	ated	Base	materia	al
	X-P 17 B3 MX	X-P 20 B3 MX	X-P 24 B3 MX	BX 3 ME			Soft concrete	Standard concrete	Tough concrete
X-EAS-FE MX (Type 1/2)									

= recommended



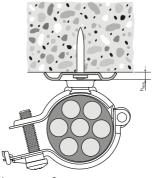


Quality assurance





Admissible fastener stand-off (Type 1)



 $h_{NVS, min} = 3 mm$ $h_{NVS, max} = 6 mm$

Admissible fastener stand-off (Type 2)





Fastening position (Type 1)



Fastening position (Type 2)



Fastener and achor setting and installation information

- Fastener and anchor setting information (e.g. base material properties, fastened material properties and setting energy) and installation information (e.g. quality assurance) are part of the corresponding Product Data Sheet for fasteners and anchors.
 - Fastener guide X-FG B3-ME recommended for fastener setting with batteryactuated tool. Holding the cable holder by hand no longer necessary.
 - Visible setting failures must be replaced with a new fastener, not in the same hole.
 - These are abbreviated instructions which may vary by application.
 - Always review/follow the instructions accompanying the product.





X-FB Electrical conduit fastener

Product data

Product description

X-FB MX	 Quick, cost-efficient fastening of conduits and pipes Friction-fit in the nose of BX/GX/DX nailers for easy handling Bracing rib for high rigidity and a tight, secure hold on flexible conduits Engineered for high-quality, reliable fastening Virtually dust-free fastening
X-FB C-27	 Quick, cost-efficient fastening of conduits and pipes Integrated top hat for high-quality, more reliable fastenings High-grade, preassembled C27 nail for more secure fastenings on concrete Reinforcing rib to increase the conduit clip's rigidity

Dimensions for elements

Technical drawing	Designation	Diameter	Length	Width	Height
		d	L	w	h
X-FB MX	X-FB 5 MX	5 mm	28.3 mm	17.5 mm	7 mm
	X-FB 6 MX	6 mm	29.4 mm	17.5 mm	8 mm
	X-FB 7 MX	7 mm	30.4 mm	17.5 mm	9 mm
	X-FB 8 MX	8 mm	31.3 mm	17.5 mm	10 mm
	X-FB 9 MX	9 mm	32.3 mm	17.5 mm	10 mm
	X-FB 10 MX	10 mm	33.3 mm	17.5 mm	11 mm
	X-FB 11 MX	11 mm	34.4 mm	17.5 mm	11.5 mm
	X-FB 13 MX	13 mm	36.5 mm	17.5 mm	15 mm
	X-FB 16 MX	16 mm	39.6 mm	17.5 mm	18 mm
	X-FB 20 MX	20 mm	43.8 mm	17.5 mm	22 mm
	X-FB 22 MX	22 mm	45.9 mm	17.5 mm	24 mm
≤	X-FB 25 MX	25 mm	49.0 mm	17.5 mm	27 mm
	X-FB 28 MX	28 mm	52.2 mm	17.5 mm	30 mm
	X-FB 32 MX	32 mm	56.3 mm	17.5 mm	34 mm
	X-FB 40 MX	40 mm	64.7 mm	17.5 mm	42 mm



Dimensions for elements with pre-mounted nails

Technical drawing	Designation	Diameter	Length	Width	Height
		d	L	w	h
X-FB-C27	X-FB 8 C27	8 mm	31.3 mm	17.7 mm	10 mm
	X-FB 11 C27	11 mm	34.4 mm	17.7 mm	13 mm
	X-FB 13 C27	13 mm	36.5 mm	17.7 mm	15 mm
	X-FB 16 C27	16 mm	39.6 mm	17.7 mm	18 mm
	X-FB 18 C27	18 mm	46.0 mm	17.7 mm	20 mm
<u>Д ((())) </u>	X-FB 20 C27	20 mm	43.8 mm	17.7 mm	22 mm
	X-FB 22 C27	22 mm	45.9 mm	17.7 mm	24 mm
	X-FB 24 C27	24 mm	52.0 mm	17.7 mm	26 mm
	X-FB 25 C27	25 mm	49.0 mm	17.7 mm	27 mm
	X-FB 28 C27	28 mm	52.2 mm	17.7 mm	30 mm
	X-FB 32 C27	32 mm	56.3 mm	17.7 mm	34 mm
((○)) ≥	X-FB 35 C27	35 mm	64.0 mm	17.7 mm	37 mm
	X-FB 40 C27	40 mm	64.7 mm	17.7 mm	42 mm
	X-FB 50 C27	50 mm	77.0 mm	17.7 mm	52 mm
Dimensions for nails					

Technical drawing	Designation	Shank	Head	Shank	Head
		length	length	diameter	diameter
		Ls	L _h	ds	d _h
	X-C 27	27 mm	2 mm	3.5 mm	8 mm

Material specification and material properties for steel elements

Designation	Element	Material	Coating	Minimum	Tensile
				coating	strength
				thickness	f _u
X-FB MX	Element	Galvanized	Zinc	10 µm	270-420 N/mm ²
X-FB-C27		steel sheet		5 µm	270-420 N/mm ²

Material specification and material properties for nails

Designation	Element	Material	Coating	Minimum	Hardness
				coating	
				thickness	
X-C 27	Nail	Carbon	Zinc	5 µm	56.5 HRC
		steel			

• Info for single nails are part of the corresponding Product Data Sheets.



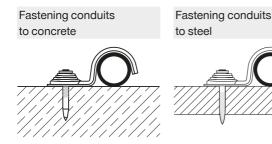


Approvals and certificates

Authority	Approval / certificate no.	Date of issue	Country of issue
ITB	AT-15-7696/2016	12/2016	Poland
DIBt	ETA-16/0301	05/2019	Europe

Not all information presented in this product data sheet might be subject to approval / certificate content. Please refer to approval/certificate for further information.

Applications



Base materials







Soft concrete

Medium concrete

Tough Steel concrete

Load conditions



Static/ quasi static

Environmental conditions



Dry indoor



- The intended use comprises fastening in dry conditions or temporary outdoor conditions.
- For more details, please refer to following technical document: Hilti Corrosion Handbook.





Fastener program

Item no. and description

Designation	Item no.	Description
X-FB 5 MX	2074366	
X-FB 6 MX	2074367	
X-FB 7 MX	2074368	
X-FB 8 MX	286797	
X-FB 9 MX	2331461	
X-FB 10 MX	2331462	
X-FB 11 MX	286798	
X-FB 13 MX	2813209	Element
X-FB 16 MX	286799	
X-FB 20 MX	286800	
X-FB 22 MX	286801	
X-FB 25 MX	286802	
X-FB 28 MX	286803	
X-FB 32 MX	286804	
X-FB 40 MX	286805	
X-FB 8 C27	401258	
X-FB 11 C27	401259	
X-FB 13 C27	401260	
X-FB 16 C27	401261	
X-FB 18 C27	401262	
X-FB 20 C27	401263	
X-FB 22 C27	401264	Element with
X-FB 24 C27	401265	pre-mounted nail
X-FB 25 C27	401266	
X-FB 28 C27	401267	
X-FB 32 C27	401268	
X-FB 35 C27	401269	
X-FB 40 C27	401270	
X-FB 50 C27	401271	





X-FB Electrical conduit fastener – Fastening to concrete

Application recommendation

Fastened material properties

Fastening conduits and pipes with $5 \le \emptyset \le 50$ mm.

Base material properties and fastener positioning in base material

	Base material	Concrete	
internet and inter	Base material thickness h _{min}	80 mm	
		(powder-actuated)	
	Base material thickness h _{min}	60 mm	
te company		(battery/gas-actuated)	
	Edge distance $c_{1,min}$, $c_{2,min}$	70 mm	
	Fastener spacing $s_{1,min}$, $s_{2,min}$	100 mm	

Performance data

Recommended resistance under tension load

Designation	Nail length	Tension load	
	Ls	N _{rec}	
		Soft/medium	Tough
		concrete	concrete
X-FB MX + X-X	22–27 mm	0.06 kN	0.06 kN
X-FB MX + X-P, X-U	22–27 mm	0.06 kN	0.06 kN
X-FB MX + X-C	22–27 mm	0.06 kN	0.06 kN
X-FB MX + X-P B3 MX	20–24 mm	0.02 kN	0.02 kN
X-FB MX + X-P G3 MX	20–24 mm	0.02 kN	0.02 kN
X-FB-C 27	27 mm	0.06 kN	0.06 kN



- Redundancy of fastening points is required.
- Minimum number of fastening points for safety relevant fastenings: \geq 5.
- For more details, please refer to the chapter **Fastener selection guide** in the Direct Fastening Technology Manual (DFTM).



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Stick rate estimation



Designation	Soft/medium	Tough
	concrete	concrete
X-FB MX + X-X	90-99%	85-90%
X-FB MX + X-P, X-U, X-C	-	-
X-FB MX + X-P B3 MX	85-98%	70-85%
X-FB MX + X-P G3 MX	75–90%	55-70%
X-FB-C 27	-	-

- The stick rate indicates the percentage of nails that were driven correctly to carry a load.
 - Stick rate can vary from the above values depending on job site conditions.

System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

System recommendation for fastening collated nails with powder-actuated tools

Designation	Powder-actuated tool			Base material				
	DX 6 MX	DX 5 MX	DX 460 MX		Soft concrete	Medium concrete	Tough concrete	
X-FB MX + X-X MX								
X-FB MX + X-P MX, X-U MX								
X-FB MX + X-C MX								

 \blacksquare = recommended \square = feasible





System recommendation for fastening single nails with powder-actuated tool

Designation	Powder-actuated tool				Base material			
	DX 6 F8	DX 5 F8	DX 460 F8	DX 2	Soft concrete	Medium concrete		
X-FB-C 27								
X-FB-C 27								

 \blacksquare = recommended \square = feasible

Cartridge recommendation

Base material	Cartridge color (tool power level)					
	Tool type:	Tool type:				
	DX 6 MX	DX 5 MX, DX 460 MX				
	DX 6 F8	DX 5 F8, DX 460 F8, DX 2				
	Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M				
Soft/medium concrete	titanium 🔳 (2-5)	yellow <mark>–</mark> , red –				
Tough concrete	titanium 🔳 (4-7)	yellow 🗕, red 📕				

• Tool power level adjustment by setting tests on site.

• Start tool energy selection with lowest recommended tool power level.

• Correct according requirement from chapter quality assurance.

System recommendation for fastening collated nails with battery-actuated tools

Designation	Battery-actuated tool			Base material				
	BX 3 ME				Soft concrete	Medium concrete	Tough concrete	
X-FB MX + X-P B3 MX								

 \blacksquare = recommended \square = feasible



System recommendation for fastening collated nails with gas-actuated tools

Designation	Gas-a	Gas-actuated tool			Base r	Base material			
	GX 3-ME	GX 120-ME			Soft concrete	Medium concrete	Tough concrete		
X-FB MX + X-P G3 MX									
X-FB MX + X-GHP MX									

 \blacksquare = recommended \square = feasible

Quality assurance

Setting depth control

HINNS IN THE REAL PROPERTY OF	Fastener stand-off h _{NVS}	7–11 mm
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- Visible setting failures must be replaced with a new fastener, not in the same hole.
 - These are abbreviated instructions which may vary by application.
 - Always review/follow the instructions accompanying the product.





X-FB Electrical conduit fastener – Fastening to steel

Application recommendation

Fastened material properties

Fastening conduits and pipes with $5 \le \emptyset \le 50$ mm.

Base material properties and fastener positioning in base material

	Base material	Steel
	Base material thickness t _{II, min}	6 mm (powder-actuated)
	Base material thickness t _{II, min}	4 mm (battery/gas-actuated)
	Edge distance c _{min}	15 mm
<u></u> =	Fastener spacing s _{min}	20 mm

Performance data

Recommended resistance under tension load

Designation	Nail length	Tension load
	L _s	N _{rec}
		Steel
		S235 to S355
X-FB MX + X-X 22 MX	22 mm	0.06 kN
X-FB MX + X-U 16 MX	16 mm	0.06 kN
X-FB MX + X-S 14 B3 MX	14 mm	0.06 kN
X-FB MX + X-S 14 G3 MX	14 mm	0.06 kN



• Redundancy of fastening points is required.

• Minimum number of fastening points for safety relevant fastenings: \geq 5.





System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

System recommendation for fastening collated nails with powder-actuated tools

Designation	Powder-actuated tool			Base material				
	DX 6 MX	DX 5 MX	DX 460 MX		Steel S235	Steel S275	Steel S335	
X-FB MX + X-X 22 MX								
X-FB MX + X-U 16 MX								

 \blacksquare = recommended \square = feasible

Cartridge recommendation for X-FB MX + X-X 22 MX

Base mate	erial	Cartridge color (tool power level)		
		Tool type:	Tool type:	
		DX 6 MX	DX 5 MX, DX 460 MX	
		Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M	
S235	6 ≤ t _∥ ≤ 12 mm	titanium 🔳 (4-8)	yellow <mark>,</mark> red , black	
S275	6 ≤ t _{II} ≤ 10 mm	titanium 🔳 (4-8), black 🔳 (7-8)	yellow <mark>,</mark> red , black	
S355	6 ≤ t _{II} ≤ 8 mm	titanium 🔳 (6-8), black 🔳 (7-8)	red 📕, black 📕	

Cartridge recommendation for X-FB MX + X-U 16 MX

Base ma	terial	Cartridge color (tool power level)		
		Tool type:	Tool type:	
		DX 6 MX	DX 5 MX, DX 460 MX	
		Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M	
0005	6 ≤ t _∥ ≤ 10 mm	titanium 🔳 (4-8)	red 📕	
S235	10 ≤ t _{II} ≤ 20 mm	titanium 🔳 (5-8), black 🔳 (7-8)	black 🔳	
S275,	6 ≤ t _{II} ≤ 8 mm	titanium 🔳 (5-8), black 🔳 (7-8)	black	
S355				

• Tool power level adjustment by setting tests on site.

• Start tool energy selection with lowest recommended tool power level.

• Correct according requirement from chapter quality assurance.





System recommendation for fastening collated nails with battery-actuated tool

Designation	Battery-actuated tool			Base material				
	BX 3-ME				Steel S235	Steel S275	Steel S335	
X-FB MX + X-S 14 B3 MX								

 \blacksquare = recommended \square = feasible

System recommendation for fastening collated nails with gas-actuated tool

Designation	Gas-actuated tool			Base material				
	GX 3-ME				Steel S235	Steel S275	Steel S335	
X-FB MX + X-S 14 G3 MX								

 \blacksquare = recommended \square = feasible

Quality assurance

Setting depth control

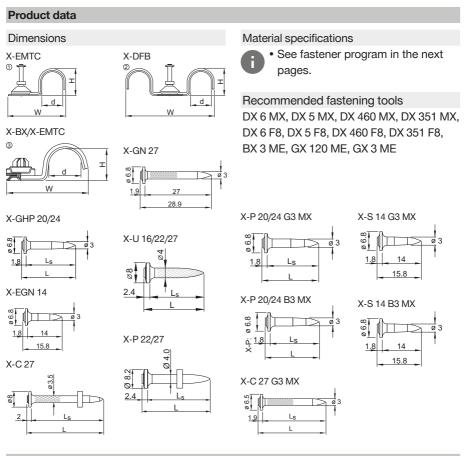


- Visible setting failures must be replaced with a new fastener, not in the same hole.
 - These are abbreviated instructions which may vary by application.
 - Always review/follow the instructions accompanying the product.



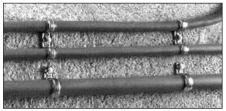


X-DFB, X-EMTC Electrical conduit fastener



Applications

Example







Performance data

Recommended loads under shear and tension

Designation	Concrete	Sandlime	Steel
		stone	
	N _{rec}	N _{rec}	N _{rec}
X-DFB (pre-mounted)	0.06 kN	0.06 kN	-
X-EMTC MX with X-U, X-P or X-C			
(L _s = 22-27 mm)	0.06 kN	0.06 kN	-
X-EMTC MX with X-U 16 MX	-	-	0.06 kN
X-EMTC MX with X-P B3 MX, X-P G3 MX			
or X-GHP (L _s = 20-24 mm)	0.02 kN	-	-
X-EMTC MX with X-C 27 G3 MX			
or X-GN 27 MX	-	0.06 kN	-
X-EMTC MX with X-S 14 B3 MX,			
X-S 14 G3 MX, X-EGN 14 MX or X-U 16 MX	-	-	0.06 kN

• For more details in relation to base material properties, please refer to the chapter **Fastener selection guide** in the Direct Fastening Manual (DFTM).

Application recommendation

Base material thickness

Concrete		Steel
X-U, X-P or X-C	h _{min} = 80 mm	t _{ll} ≥ 4 mm
X-P B3 MX, X-P G3 MX,	h _{min} = 60 mm	
X-GHP, X-C 27 G3 MX,		
X-GN 27 MX		
		N +

 Fastened material thickness

 X-BX, X-EMTC
 To fasten conduits, pipes and tubes of Ø 5 mm to 50 mm

Fastener positioning

Space fastenings as needed to control sag and maintain alignment.

Corrosion information

- These zinc-coated fasteners are not suitable for long-term service outdoors or in otherwise corrosive environments.
 - For more details, please refer to following technical document: Hilti Corrosion Handbook.



X-DFB, X-EMTC

System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

Cartridge recommendation for fastening to concrete

Base material	Cartridge color (tool power level)				
	Tool type:	Tool type:			
	DX 6 MX	DX 5 MX, DX 460 MX,			
		DX 351 MX			
	DX 6 F8	DX 5 F8, DX 460 F8,			
		DX 351 F8, DX 2			
	Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M			
Soft/medium concrete	titanium 🔳 (2-5)	yellow 🗕, red 📕			
Tough concrete	titanium 🔳 (4-7)	yellow <mark>–</mark> , red –			

Cartridge recommendation for fastening to steel

Base mater	ial	Cartridge color (tool power level)			
		Tool type:	Tool type:		
		DX 6 MX	DX 5 MX, DX 460 MX,		
			DX 351 MX		
		DX 6 F8	DX 5 F8, DX 460 F8,		
			DX 351 F8, DX 2		
		Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M		
S235,					
S275,	4 ≤ t _{II} ≤ 20 mm	titanium 🔳 (2-8)	yellow <mark>–</mark> , red 📕		
S355					

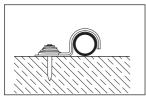
• Tool power level adjustment by setting tests on site.

• Start tool energy selection with lowest recommended tool power level.

• Correct according requirement from chapter quality assurance.

Quality assurance

Nailhead not protruding







Fastener program

Technical information

With pre-mounted nail	Without pre-mounted nail			
Designation	Designation	d	W	Н
① X-EMTC 3/8"-C27/-U22	③ X-EMTC 3/8" MX	10 mm (3/8")	33 mm	12 mm
① X-EMTC 3/8"-C27/-U22		13 mm (1/2")		
	③ X-EMTC 1/2" MX	13 mm (1/2")	42 mm	15 mm
① X-EMTC 3/4"-C27/-U22	③ X-EMTC 3/4" MX	19 mm (3/4")	47 mm	21 mm
	③ X-EMTC 1" MX	25 mm (1")	53 mm	27 mm
① X-EMTC 1"-C27/-U22		25 mm (1")		
	③ X-DFB 5 MX	5 mm	47 mm	7 mm
	③ X-DFB 6 MX	6 mm	50 mm	8 mm
	③ X-DFB 7 MX	7 mm	52 mm	9 mm
② X-DFB 8-C27	③ X-DFB 8 MX	8 mm		9.5 mm
	③ X-DFB 9 MX	9 mm	55.5 mm	11 mm
	③ X-DFB 10 MX	10 mm	57.5 mm	11.5 mm
② X-DFB 11-C27	③ X-DFB 11 MX	11 mm		12.5 mm
	③ X-DFB 13 MX	13 mm	64.2 mm	14.5 mm
② X-DFB 16-C27	③ X-DFB 16 MX	16 mm	66 mm	15 mm
② X-DFB 18-C27		18 mm	70 mm	18 mm
② X-DFB 20-C27	③ X-DFB 20 MX	20 mm	75 mm	20 mm
② X-DFB 22-C27	③ X-DFB 22 MX	22 mm	79 mm	22 mm
② X-DFB 24-C27	③ X-DFB 25 MX	24 mm	83 mm	24 mm
② X-DFB 25-C27		25 mm		
② X-DFB 28-C27	③ X-DFB 28 MX	28 mm	91 mm	28 mm
② X-DFB 35-C27		35 mm	106 mm	30 mm
② X-DFB 40-C27		40 mm	116 mm	37 mm

Material specification

(1) + (2) Galvanized steel sheet, f_u = 270-420 N/mm², 10–20 μ m zinc coating

③ Galvanized steel sheet, $f_u = 270-420$ N/mm², ≥ 5 µm zinc coating

Tools

DX 6 F8, DX 5 F8, DX 460 F8, DX 351 F8 for all X-DFB/EMTC with pre-mounted nails and DX 6 MX, DX 5 MX, DX 460 MX, DX 351 MX, GX 120 ME, GX 3 ME, BX 3 ME for X-DFB/EMTC __MX





Item no. and description

Designation	Item no.	Description
X-EMTC 3/8"-C27/-U22		
X-EMTC 3/8"-C27/-U22		
X-EMTC 3/4"-C27/-U22		
X-EMTC 1"-C27/-U22		
X-DFB 8-C27		
X-DFB 11-C27		
X-DFB 16-C27		
X-DFB 18-C27		With pre-mounted nail
X-DFB 20-C27		
X-DFB 22-C27		
X-DFB 24-C27		
X-DFB 25-C27		
X-DFB 28-C27		
X-DFB 35-C27		
X-DFB 40-C27		
X-EMTC 3/8" MX		
X-EMTC 1/2" MX		
X-EMTC 3/4" MX		
X-EMTC 1" MX		
X-DFB 5 MX		
X-DFB 6 MX		
X-DFB 7 MX		
X-DFB 8 MX		
X-DFB 9 MX	2331463	Without pre-mounted nail
X-DFB 10 MX	2331464	
X-DFB 11 MX		
X-DFB 13 MX	2331465	
X-DFB 16 MX		
X-DFB 20 MX		
X-DFB 22 MX		
X-DFB 25 MX		
X-DFB 28 MX		









X-FB-E, X-DFB-E Electrical conduit fastener

Product data

Dimensions





W d

X-DFB-E

X-GHP 20

X-P 20 G3 MX

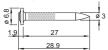
a 6.8

1.8

a 6.8

1.8

X-GN 20/27







X-P 20 B3 MX X-C 20 B3 MX





Material specificationsGalvanized steel sheet $f_u = 270-42$ $f_u = 270-42$

 $f_u = 270-420 \text{ N/mm}^2$ 10-20 µm zinc coating

Recommended fastening tools DX 6 MX, DX 5 MX, DX 460 MX, DX 351 MX, DX 6 F8, DX 5 F8, DX 351 F8, DX 460 F8, GX 120 ME, GX 3 ME, BX 3 ME

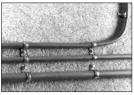


3

• See fastener program in the next pages.

Applications

Example



X-FB-E for rigid conduits



X-FB-E for flexible conduits



Performance data

Recommended resistance under tension load

	Concrete	Sandlime stone
Designation	N _{rec}	N _{rec}
X-FB-E or X-DFB-E	0.02 kN	0.02 kN
with X-GN 20, X-C 20 G3 MX or X-C 20 B3 MX	0.02 KN	0.02 KN
X-FB-E or X-DFB-E	0.06 kN	0.06 kN
with X-GN 27 or X-C 27 G3 MX	0.00 KN	0.00 KN
X-FB-E or X-DFB-E	0.02 kN	
with X-GHP 20, X-P 20 G3 MX or X-P 20 B3 MX	0.02 KN	-
X-FB-E or X-DFB-E	0.06 kN	0.06 kN
with X-C 22/27	0.00 KIN	0.00 KN

• For more details in relation to base material properties, please refer to the chapter **Fastener selection guide** in the Direct Fastening Manual (DFTM).

Base material thickness
X-GN, X-GHP, X-C G3 MX, X-P G3 MX:
X-C B3 MX, X-P B3 MX:
X-C:

 $h_{min} = 60 \text{ mm}$ $h_{min} = 60 \text{ mm}$ $h_{min} = 80 \text{ mm}$

Fastened material thickness

X-FB-E:To fasten conduits, pipes and tubes of Ø 16 mm to 25 mmX-DFB-E:To fasten conduits, pipes and tubes of Ø 20 mm to 25 mm

Fastener positioning

Space fastenings as needed to control sag and maintain alignment.

Corrosion information

- These zinc-coated fasteners are not suitable for long-term service outdoors or in otherwise corrosive environments.
 - For more details, please refer to following technical document: Hilti Corrosion Handbook.





System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

Cartridge recommendation for fastening to concrete and masonry

Base material	Cartridge color (tool power level)	
	Tool type:	Tool type:
	DX 6 MX	DX 5 MX, DX 460 MX,
		DX 351 MX
	DX 6 F8	DX 5 F8, DX 460 F8,
		DX 351 F8, DX 2
	Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M
Sand lime masonry	titanium 🔳 (1-5)	green 📕, yellow 📕
Soft/medium concrete	titanium 🔳 (2-5)	yellow 📕, red 📕
Tough concrete titanium (4-7)		yellow –, red 📕

• Tool power level adjustment by setting tests on site.

• Start tool energy selection with lowest recommended tool power level.

• Correct according requirement from chapter quality assurance.

System recommendation for gas-actuated and battery-actuated tools

GX tools	GX 120-ME	Gas can GC 20, GC 21 and GC 22	
	GX 3-ME	Gas can GC 40, GC 41 and GC 42	
BX tools	BX 3-ME	No gas can required	

Quality assurance

Nail head not protruding





Fastener program

Item no. and technical information

Designation	Item no.	d	W	Н
X-FB-E 16 MX	2112585	16 mm	44 mm	17.5 mm
X-FB-E 20 MX	2112586	20 mm	48 mm	21.5 mm
X-FB-E 25 MX	2112587	25 mm	55 mm	26.5 mm
X-DFB-E 20 MX	2112588	20 mm	80 mm	20 mm
X-DFB-E 25 MX	2112589	25 mm	90 mm	25 mm

Tool selection	
X-GN, X-GHP:	GX 120
X-C G3 MX, X-P G3 MX:	GX 3 ME
X-C B3 MX, X-C B3 MX	BX 3 ME
X-C _P8:	DX 6 F8, DX 5 F8, DX 460 F8, DX 351 F8
X-C_MX:	DX 6 MX, DX 5 MX, DX 460 MX, DX 351 MX



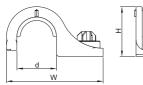


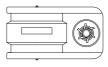
X-UCS MX Universal conduit saddle

Product data

Dimensions

X-UCS MX





Features and benefits

- Easy and convenient installation to concrete (soft and tough) and sandlime stone base material
- •• Quick, cost-efficient fastening

General information

Material specification

X-UCS:

PE (halogen and silicone free), light grey RAL 7035, free

Applications

Example



- Fastening flexible pipes and pipes with foam insulation for water and heating
- Fastening insulated injection hoses

The intended use only comprises fastenings which are not directly exposed to external weather conditions or moist atmospheres.





Load data

Recommended loads (Base material = concrete)

Fastener	Concrete / Sandlime stone N _{rec} [kN]
X-UCS MX	0.011

Design conditions:

- For pipes fastened with less than 5 fasteners and without any fixed end support, a test load has to be applied to each fastener, see Instruction For Use.
- All visible failures must be replaced.
- Predominantly static loading.
- Valid for soft and tough concrete with strength of f_{c, cube} = 25-60 N/mm², that may contain medium sized aggregate e.g. limestone, pit gravel. please refer to Concrete Fastener Selection section in Hilti Direct Fastening Technology Manual (DFTM).
- Valid for sandlime stone.
- Observance of all application limitations and recommendations.
- Long-term behavior of X-UCS MX plastic material considered.

Fastener capacity

Fastening designation	Pipe diameter [mm]	Recommended fastener spacing on ceilings and walls [cm]
X-UCS 19 MX	19.0	80
X-UCS 23 MX	23.0	60
X-UCS 27.5 MX	27.5	40
X-UCS 30.5 MX	30.5	30

Comments:

 Recommended fastener spacing is based on recommended load and average weight of intended pipes during duty





Nail recommendations

For <u>concrete</u> base material								
Fastening tool	Nail types	Length [mm]	Tip	Shank Ø [mm]	Material	Hardness [HRC]	Coating [µm]	
BX 3 ME	X-P B3 MX	20 - 24	Balistic 3	3.0	Carbon steel	57.5	Zinc, 2-13 µm	
GX 3 ME	X-P G3 MX					57.5	Zinc, 2-13 µm	
GX120	X-GHP MX					57.5	Zinc, 2-13 µm	

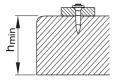
- •• For the X-UCS MX element, only 20 mm and 24 mm pin lengths are recommended in order to ensure sufficient embedment depth.
- Premium nails (as listed above) are recommended for wall and ceiling application (soft and some tough concrete and sandlime stone, GX/BX tools). For more details regarding nail classification and concrete types, please refer to Concrete Fastener Selection section in Hilti Direct Fastening Technology Manual (DFTM).

For <u>concrete</u> base material								
Fastening tool	Nail types	Length [mm]	Tip	Shank Ø [mm]	Material	Hardness [HRC]	Coating [µm]	
BX 3 ME	X-C B3 MX	20 - 24	Cut	3.0	Carbon steel	56.5	Zinc, 2-13 µm	
GX 3 ME	X-C G3 MX	20 - 27				56.5	Zinc, 2-13 µm	
GX120	X-GN MX	20 - 27				53.5	Zinc, 2-13 µm	

- •• For the X-UCS MX element, only 20 mm, 24 mm and 27 mm pin lengths are recommended in order to ensure sufficient embedment depth.
- Standard nails (as listed above) are recommended for floor application (soft concrete and sandlime stone, GX/BX tools). For more details regarding nail classification and concrete types, please refer to Concrete Fastener Selection section in Hilti Direct Fastening Technology Manual (DFTM).

Application requirements

Thickness of base material



Concrete X-P B3 MX, X-P G3 MX, X-GHP MX, X-C B3 MX, h_{min} = 60 mm X-C G3 MX, X-GN MX

Edge distance

Min. edge distance = 70 mm





Corrosion information

Zinc-coated nails are not suitable for long-term service outdoors or in otherwise corrosive environments.

For further detailed information on corrosion see relevant chapter in **Direct Fastening Principles and Technique** section.

Fastener selection and system recommendation

Fastener program

Designartion	Item no.	d [mm]	W [mm]	H [mm]
X-UCS 19 MX	2161565	19.0	46.5	24.0
X-UCS 23 MX	2161566	23.0	50.5	28.0
X-UCS 27.5 MX	2161567	27.5	55.0	32.5
X-UCS 30.5 MX	2161568	30.5	58.0	35.5

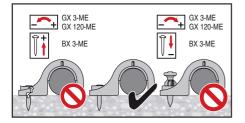
Tool selection

X-P B3 MX, X-C B3 MX:	BX 3-ME
X-P G3 MX, X-C G3 MX:	GX 3-ME
X-GHP MX, X-GN MX:	GX 120-ME

System recommendation

GX 3-ME	Gas can GC 40, GC 41 and GC 42
GX 120-ME	Gas can GC 20, GC 21 and GC 22
BX 3-ME	No gas can required

Fastening quality assurance









X-UCS-S MX Universal conduit saddle for rigid pipe

Product data

Dimensions

X-UCS-S MX







Features and benefits

The X-UCS-S MX enables easy and convenient installation to concrete floor (soft and some tough concrete).

General information

Material specification

X-UCS-S MX: HDPE (halogen and silicon free), light grey RAL 7035

Applications

Example



• Fastening rigid pipes and smooth surface pipes (without foam or grooved protection layer) for water and heating.

The intended use only comprises fastenings which are not directly exposed to external weather conditions or moist atmospheres.





Performance data

Fastener	Concrete / Sandlime stone V _{rec} [kN]
X-UCS-S MX	0.02

Design conditions:

- For pipes fastened with less than 5 fasteners and without any fixed end support, a test load has to be applied to each fastener, see Instruction For Use.
- All visible failures must be replaced.
- Predominantly static loading.
- Valid for soft and some tough concrete with strength of f_{c,cube} = 25-60 N/mm², that may contain medium sized aggregate e.g. limestone, pit gravel. Please refer to Concrete Fastener Selection section in Hilti Direct Fastening Technology Manual (DFTM).
- Observance of all application limitations and recommendations.
- Long-term behavior of X-UCS-S MX plastic material considered.



Stick rate estimation						
	Soft Concrete	Tough concrete				
X-P B3	85% - 98%	70% - 85%				
X-C B3	75% - 90%	55% - 70%				

• The stick rate indicates the percentage of nails that were driven correctly to carry a load. Stick rate can vary from the above values depending on job site conditions.

Nail recommendations

For <u>concrete</u> base material								
Fastening tool	Nail types	Length [mm]	Tip	Shank Ø [mm]	Material	Hardness [HRC]	Coating [µm]	
BX 3-ME (02)	X-P B3 MX	17 - 24	Long conical	3.0	Carbon steel	57.5	Zinc, 2-10	
	X-C B3 MX	20 - 24	Cut			56.5	Zinc, 5-13	

Design conditions:

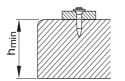
• For more details regarding nail classification and concrete types, please refer to **Concrete Fastener Selection** section in Hilti Direct Fastening Technology Manual (DFTM).





Application requirements

Thickness of base material



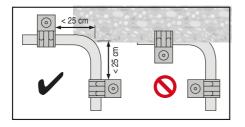
h_{min} = 60 mm

Edge distance

Min. edge distance = 70 mm

Spacing

- 50-100 cm along the pipe. Adjust spacing as needed to achieve stability of the pipe.
- At pipe turning 90 degree area, please refer to picture for distance between fasteners and orientation of fasteners.



Corrosion information

Zinc-coated nails are not suitable for long-term service outdoors or in otherwise corrosive environments. For further detailed information on corrosion see relevant chapter in **Direct Fastening Principles and Technique** section.





Fastener selection and system recommendation

Fastener program

Designartion	Item no.	Pipe Ø [mm]	d [mm]	W [mm]	H [mm]
X-UCS-S 13 MX	2212511	13.0	13.5	45.8	18.3
X-UCS-S 17 MX	2212512	17.0	17.4	49.4	22.2
X-UCS-S 21.5 MX	2212513	21.5	21.9	54.6	26.8
X-UCS-S 27 MX	2212429	27.0	27.4	59.6	32.3

Tool selection

X-P B3 MX, X-C B3 MX:

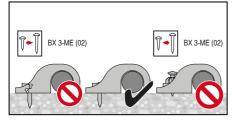
BX 3-ME (02)

System recommendation

BX 3-ME (02):

No gas can required

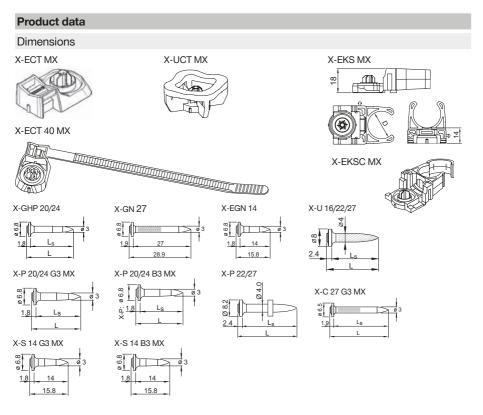
Fastening quality assurance







X-ECT MX, X-UCT MX, X-EKS MX Electrical cable tie and conduit clip fastener







Material specifications and material properties

Material specification		Material properties				
Designation	Material	Colour	Silicone free	Halogen free		-2-11,
X-EKS 16 MX	PA	light grey (RAL 7035)	V	I	Ø	
X-EKS 19 MX	PA	light grey (RAL 7035)	V	Ø	Ø	
X-EKS 20 MX	PA	light grey (RAL 7035)	Ø	Q	V	
X-EKS 25 MX	PA	light grey (RAL 7035)	Ø	Q	Ø	
X-EKS 32 MX	PA	light grey (RAL 7035)	Ø	Q	V	
X-EKS 40 MX	PA	light grey (RAL 7035)	Ø	Q	Ø	
X-EKSC 16 MX	PA	light grey (RAL 7035)	Ø	V	V	
X-EKSC 20 MX	PA	light grey (RAL 7035)	Ø	Q	Ø	
X-EKSC 25 MX	PA	light grey (RAL 7035)	Ø	V	V	
X-EKSC 32 MX	PA	light grey (RAL 7035)	Ø	Q	V	
X-EKSC 40 MX	PA	light grey (RAL 7035)	Ø	V	V	
X-ECT MX	PA	light grey (RAL 7035)	Ø	Q	V	
X-ECT UV MX	PA	black (RAL 9011)	Ø	V	I	
X-ECT FR MX	PBT	stone grey (RAL 7030)	Ø			I
X-ECT 40 MX	PA	light grey (RAL 7035)	V	Q	Ø	
X-ECT U22	PA	black (RAL 9011)	Ø	Z	I	
X-ECT UV 22	PA	black (RAL 9011)	Ø	Ø	Ø	
X-UCT MX	HDPE	light grey (RAL 7035)	Ø	Z		

• PA = Polyamide

• PBT = Polybutylenterephthalate

• HDPE = High-density polyethylene

Recommended fastening tools DX 6 MX, DX 5 MX, DX 351 MX, DX 460 MX DX 6 F8, DX 5 F8, DX 460 F8, DX 351 F8, DX 2 GX 120-ME, GX 3-ME, BX 3-ME



• See fastener program in the next pages.





Approvals and certificates

CSTB (France)

UL (USA)

X-ECT MX, X-EKS MX, X-EKSC MX (all with X-U22 MX nail) X-ECT MX

Not all information presented in this product data sheet might be subject to approval / certificate content. Please refer to approval/certificate for further information.

Applications

Examples



Flexible or rigid cable conduits with cable ties



Rigid conduits



Cable conduits or light duty pipes

Performance data

Recommended tension and shear load for fastening electrical elements

Designation	Tension load N _{rec}	Shear load V _{rec}
X-ECT 40 MX,	0.040 kN	0.040 kN
X-ECT MX, X-ECT FR MX		
X-UCT MX	0.040 kN	0.040 kN
X-EKS MX	0.011 kN	0.011 kN
X-EKSC MX	0.032 kN	0.032 kN

Recommended tension and shear load for fastening pipes

Designation	Tension load N _{rec}	Shear load V _{rec}
X-ECT 40 MX, X-ECT MX, X-ECT FR MX	0.040 kN	0.040 kN
X-EKSC MX	0.032 kN	0.032 kN



- pipes filled with 90°C hot fluid
- tests according to Kiwa standard BRL-K506





X-ECT MX, X-UCT MX, X-EKS MX

Application recommendation

Base material thickness		
Concrete		Steel
X-U, X-P:	h _{min} = 80 mm	t _{II} ≥ 4 mm
X-P B3 MX:	h _{min} = 60 mm	
X-P G3 MX, X-GHP:	h _{min} = 60 mm	
X-C 27 G3 MX, X-GN 27 MX:	h _{min} = 60 mm	

Spacing

50-100 cm along the cable tie. Adjust spacing as needed to achieve stability of cable tie

Corrosion information

- These zinc-coated fasteners are not suitable for long-term service outdoors or in otherwise corrosive environments.
- For more details, please refer to following technical document: Hilti Corrosion Handbook.

System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

Service installation information

Suitable cables with X-ECT MX, X-ECT 40 MX and X-UCT MX fastener

Cable type	Cable measure diameter	No. of cables
NYM 3x1.5	8 mm	14
NYM 5x1.5	10 mm	10

Suitable conduits with X-EKS/X-EKSC MX fastener

Conduit type	Conduit size	No. of conduits
Plastic conduit	16–40 mm	1



Power-actuated tool and fastener recommendation

Base material	Cable holder	Power-actuated tool	Fastener
	X-ECT MX X-EKS MX		X-P 20/24 G3 MX
		GX 3-ME	X-C 27 G3 MX
		OV 100 ME	X-GHP 20/24 MX
Concrete or	X-UCT MX	GX 120-ME	X-GN 27 MX
masonry		BX 3-ME	X-P 20/24 B3 MX
	X-ECT MX X-EKS MX	DX 6 MX, DX 5 MX,	X-U 22/27 MX
		DX 351 MX,	
	A-EKS IVIA	DX 460 MX	X-P 22/27 MX
	X-ECT MX	GX 3-ME	X-S 14 G3 MX
	X-EKS MX	GX 120-ME	X-EGN 14 MX
Steel	X-UCT MX	BX 3-ME	X-S 14 B3 MX
Sleel	Х-ЕСТ МХ	DX 6 MX, DX 5 MX,	
	X-EKS MX	DX 351 MX,	X-U 16 MX
	A-ENG MIA	DX 460 MX	

Cartridge recommendation for fastening to concrete and masonry

Base material	Cartridge color (tool power level)	
	Tool type:	Tool type:
	DX 6 MX	DX 5 MX, DX 460 MX,
		DX 351 MX
	DX 6 F8	DX 5 F8, DX 460 F8,
		DX 351 F8, DX 2
	Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M
Sand lime masonry	titanium 🔳 (1-5)	green 🔳, yellow 📒
Soft/medium concrete	titanium 🔳 (2-5)	yellow 📒, red 📕
Tough concrete	titanium 🔳 (4-7)	yellow 🗕, red 📕

• Tool power level adjustment by setting tests on site.

Start tool energy selection with lowest recommended tool power level.

System recommendation for gas-actuated tools

GX tools	GX 120-ME	Gas can GC 20, GC 21 and GC 22
	GX 3-ME	Gas can GC 40, GC 41 and GC 42





Fastener program

Item no. and description

Designation	Item no.	Description
X-EKS 16 MX	285719	
X-EKS 19 MX	2105391	Х-ЕКЅ
X-EKS 20 MX	285720	
X-EKS 25 MX	285721	A-EKS
X-EKS 32 MX	285722	
X-EKS 40 MX	285723	
X-EKSC 16 MX	274083	
X-EKSC 20 MX	274086	
X-EKSC 25 MX	274087	X-EKSC
X-EKSC 32 MX	386469	
X-EKSC 40 MX	386470	
X-ECT MX	285709	
X-ECT UV MX	285710	
X-ECT FR MX	285711	X-ECT
X-ECT 40 MX	432947	X-EC1
X-ECT U22	288312	
X-ECT UV 22	288313	
X-UCT MX	2095183	X-UCT



X-UCT-E MX Universal cable tie holder

Product data

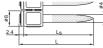
Dimensions

X-UCT-E MX

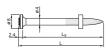


Fasteners for X-UCT-E MX on **concrete** base material





X-U 22/27 P8



X-GHP 20/24 MX

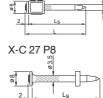


X-P 20/24 G3 MX



X-P 20/24 B3 MX X-C 20/24 B3 MX





X-C 20/27 MX

X-GN 20/27 MX



X-C 20/27 G3 MX



General information

iviaterial specifical	lions.
X-UCT-E MX	PE, light grey RAL 7035
X-U P8, X-U MX	Carbon steel, HRC 58.0,
	zinc coating 5-20 µm
X-C P8, X-C MX	Carbon steel, HRC 56.5,
	zinc coating 5-20 µm
X-GHP, X-EGN	Carbon steel, HRC 57.5,
	zinc coating 2-13 µm
X-GN	Carbon steel, HRC 53.5,
	zinc coating 2-13 µm
X-P G3 MX,	Carbon steel, HRC 57.5,
X-S G3 MX	zinc coating 2-13 µm
X-C G3 MX	Carbon steel, HRC 56.5,
	zinc coating 2-13 µm
X-P B3 MX,	Carbon steel, HRC 57.5,
X-S B3 MX	zinc coating 2-13 µm
X-C B3 MX	Carbon steel, HRC 56.5,
	zinc coating 2-13 µm

Recommended fastening tools

DX 351 MX, DX 351-F8, GX 120-ME, GX 3-ME, BX 3-ME

Fasteners for X-UCT-E MX on steel base material

X-U 16 MX



X-EGN 14 MX

X-S 14 G3 MX / X-S 14 B3 MX









Applications

Examples



X-UCT-E MX with cable ties for two pipes



X-UCT-E MX with cable tie for single pipe

Load data

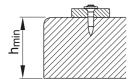
Recommended loads

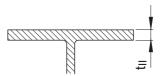
Fastener	Service load ¹⁾ [kN]
X-UCT-E MX	
X-UCT-E MX with 1 White cable tie	0.04
X-UCT-E MX with 1 Blue AND 1 Red cable ties	
X-UCT-E MX with EITHER 1 Blue OR 1 Red	0.02
cable tie	0.02

1) The recommended service load is determined by the serviceability of the plastic parts.

Application requirements

Thickness of base material





Concrete		Steel		
X-U MX, X-U P8,	h _{min} = 80 mm	X-U 16 MX	t _{II} ≥ 6.0 mm	
X-C MX, X-C P8	^m min [–] ^{oo} mm	X-U 16 P8	ll ≤ 0.0 mm	
X-GHP MX, X-GN MX,		X-EGN 14 MX		
X-P G3 MX, X-C G3 MX,	h _{min} = 60 mm	X-S 14 B3 MX	t _{II} ≥ 4.0 mm	
X-P B3 MX, X-C B3 MX		A-3 14 B3 MA		

Spacing and edge distances

Space fastenings (50 - 100 cm) as needed to control sag and maintain alignment of conduits.

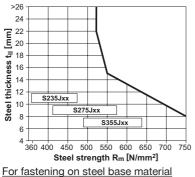


Corrosion information

These zinc-coated fasteners are not suitable for long-term service outdoors or in otherwise corrosive environments.

For further detailed information on corrosion see relevant chapter in Direct Fastening Principles and Technique section.

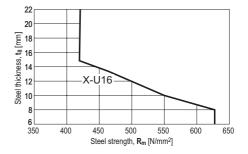
Application limits

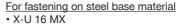


• X-EGN 14 MX

• X-S 14 B3 MX

• X-S 14 G3 MX





Fastener selection and system recommendation

Fastener program		
Designation	Item no.	
X-UCT-E MX	2149226	X-UCT-E MX element

Tool selection

X-U MX, X-C MX:	DX 351 MX
X-U P8, X-C P8:	DX 351-F8
X-GHP MX, X-GN MX, X-EGN 14 MX :	GX 120-ME
X-P G3 MX, X-S G3 MX, X-C G3 MX:	GX 3-ME
X-P B3 MX, X-C B3 MX, X-S B3 MX:	BX 3-ME





System recommendation

DX 351 MX, DX 351-F8

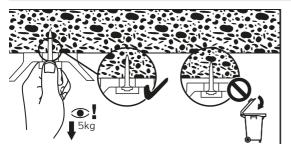
GX 120-ME

GX 3-ME

BX 3-ME

Soft concrete: 6.8/11M green, Tough concrete: 6.8/11M yellow, 6.8/11M red Gas can GC 20, GC 21 and GC 22 Gas can GC 40, GC 41 and GC 42 No gas can required

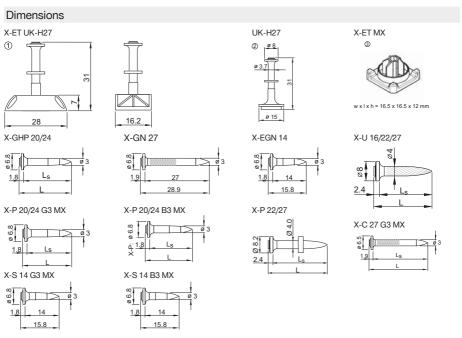
Fastening quality assurance





X-ET Nail for fastening plastic electrical cable tray and junction box

Product data



Material specifications

X-ET Polyethylene (PE)

X-ET MX Polyamide (PA), halogen and silicone free, light grey (RAL 7035) and Polybutylenterephthalate (PBT), silicone free, flame retardant, stone grey (RAL 7030)

Recommended fastening tools DX 6 MX, DX 5 MX, DX 460 MX, DX 351 MX DX 6 F8, DX 5 F8, DX 460 F8, DX 351, DX 2 GX 120-ME, GX 3-ME, BX 3-ME



• See fastener program in the next pages.



Applications

Examples





Cable trunking



Junction boxes



Conduits & pipes with metal or textile band

Performance data

Cable trunking

Recommended service load

Designation	Service load
X-ET MX	0.1 kN

Recommended service load is determined by the serviceability of the plastic part.

Application recommendation

Base material thickness



Corrosion information

- These zinc-coated fasteners are not suitable for long-term service outdoors or in otherwise corrosive environments.
 - For more details, please refer to following technical document: Hilti Corrosion Handbook.



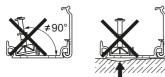


System recommendation

• For more details, please refer to the chapter **Accessories and consumables compatibility** in the Direct Fastening Technology Manual (DFTM).

Installation information

Conditions for use



Trunking dimensions and properties

• No fastenings on ribs

- Underside of trunking must be smooth
- X-ET MX only in pre-drilled holes

max. 60 mm

- Material thickness: $t_1 \le 2 \text{ mm}$
- Material: PVC

Power-actuated tool and fastener recommendation

Base material	Cable holder	Power-actuated tool	Fastener
		GX 3-ME	X-P 20/24 G3 MX
		GA 3-IVIE	X-C 27 G3 MX
	X-ET MX	OV 100 ME	X-GHP 20/24 MX
Concrete or		GX 120-ME	X-GN 27 MX
masonry		BX 3-ME	X-P 20/24 B3 MX
	X-ET UK-H27	DX 6 MX, DX 5 MX,	X-U 22/27 MX
		DX 460 MX,	X-P 22/27 MX
		DX 351 MX	
		GX 3-ME	X-S 14 G3 MX
	X-ET MX	GX 120-ME	X-EGN 14 MX
Steel		BX 3-ME	X-S 14 B3 MX
		DX 6 MX, DX 5 MX,	
	X-ET UK-H27	DX 460 MX,	X-U 16 MX
		DX 351 MX	



Base material	Cartridge color (tool power l	Cartridge color (tool power level)				
	Tool type:	Tool type:				
	DX 6 MX	DX 5 MX, DX 460 MX,				
		DX 351 MX				
	DX 6 F8	DX 5 F8, DX 460 F8,				
		DX 351 F8, DX 2				
	Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M				
Sand lime masonry	titanium 🔳 (1-5)	green 📕, yellow 📕				
Soft/medium concrete	titanium 🔳 (2-5)	yellow <mark>-</mark> , red -				
Tough concrete	titanium 🔳 (4-8)	yellow 📕, red 📕				

Cartridge recommendation for fastening to concrete and masonry

• Tool power level adjustment by setting tests on site.

• Start tool energy selection with lowest recommended tool power level.

Cartridge recommendation for fastening to steel

Base materia	1	Cartridge color (tool power level)		
		Tool type:	Tool type:	
		DX 6 MX	DX 5 MX, DX 460 MX,	
			DX 351 MX	
		DX 6 F8	DX 5 F8, DX 460 F8,	
			DX 351 F8, DX 2	
		Cartridge type: 6.8/11 M	Cartridge type: 6.8/11 M	
S235,				
S275,	4 ≤ t _{II} ≤ 14 mm	titanium 🔳 (2-8)	yellow <mark>-</mark> , red =	
S355				



• Tool power level adjustment by setting tests on site.

• Start tool energy selection with lowest recommended tool power level.

System recommendation for gas-actuated tools

GX tools	GX 120-ME	Gas can GC 20, GC 21 and GC 22
	GX 3-ME	Gas can GC 40, GC 41 and GC 42

Fastener program

Item no. and description

Designation	Item no.	Description
X-ET UK-H27	251705	X-ET
X-ET MX	285718	

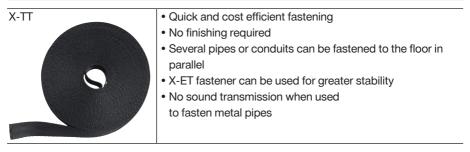




X-TT Textile tape

Product info

Product description



Application

Textile tape for cable and conduit fastening on floors.





Base material





Soft concrete

Tough concrete

Mas Soli

Steel



Environmental conditions



Dry indoor Floor application





Product data

Material properties for plastic parts

Designation	Item no.	Material	Material	Material	Material	Product	Tempe	rature
			colour	width	thick-	ultimate	resistar	nce
					ness	tensile force	T_{min}	T _{max}
Textile tape	362096	PET	black	19.3 mm	1.2 mm	2000 N	-30° C	+80°C

Fastener selection

Fastener length recommendation

Base material	Fastener					
	X-P 17 B3 MX	X-P 20 B3 MX	X-P 24 B3 MX	X-C 20 B3 MX	X-C 24 B3 MX	X-S 14 B3 MX
Soft/medium concrete						
Tough concrete						
Steel						
Masonry						
Solid brick						



System recommendation for fastening collated nails

Designation	Battery actuate	Battery actuated tools			
	BX 3-ME (03) BX 3-ME (02) BX 3-ME	BX 3-IF	BX 3 (02) BX 3-L (03) BX 3-L (02)		
X-P 17 B3 MX					
X-P 20 B3 MX					
X-P 24 B3 MX	_	_	_		
X-C 20 B3 MX			-		
X-C 24 B3 MX					
X-S 14 B3 MX					

GX3-ME system recommendation in line with BX3-ME recommendation. GX120-ME, GX3-ME, DX6MX, DX5MX, DX460MX, DX351MX system recommendation is part of the corresponding chapters within the Direct Fastening Technology Manual.

Installation recommendation

Fastener setting information (e.g. base material properties and setting energy) is part of the corresponding Product Data Sheets for fasteners.

Quality assurance

Fastener stand-off

	Designation	Fastener stand-off h _{NVS}
	X-P 17 B3 MX	
	X-P 20 B3 MX	
1.0 2 - 1, 1.0 2 - 1,	X-P 24 B3 MX	2.5 to 5 mm
	X-C 20 B3 MX	
	X-C 24 B3 MX	





GX-WF Wood framing nail

Wood nail de	signation					
GX -	WF	[l _n] × [d _n]	(R)	(D)	34	(HDG)
Technology	Application	Dimension	Profile	Head Shape	Collation	Material
Technology: GX		Gas driven				
Application: WF		Wood framin	ng			
Dimension: [l _n] [d _n]		Nail length [Nail diamete				
Profile: R ()		Profiled nail Smooth nail				
Head shape: D ()		D-head Round head	1			
Collation: 34		34° Collatio	n			
Material: () galv HDG A2		Bright steel Galvanized Hot dip galv Stainless ste	anized ste	eel		





Product data

GX-WF smooth nail	Product description
(example with D-head)	 Round cross-sectional smooth nails with straight shank for use in load bearing timber structures In accordance with EN 1995-1-1 smooth nails can be used for short to medium term withdrawal loads < 6 month or for shear loads only.
GX-WF profiled nail	Product description
(example with round head)	 Round cross-sectional profiled nails with straight shank for use in load bearing timber structures Collated nail for framing application In accordance with EN 1995-1-1 profiled nails can be used for permanent or long-term withdrawal loads > 6 month and/or shear loads.

Recommended fastening tool

GX 90 WF

Material specification for GX-WF smooth nail

Designation	A	Available material/coating							
	Bright	Bright Galvanized Hot-dip Stainless							
	steel								
GX-WF [In] × 2.8 D 34	•	•	•	N/A	600 N/mm ²				
GX-WF [ln] × 3.1 D 34	•	•	•	N/A	600 N/mm ²				

Material specification for GX-WF profiled nail

Designation	A	Available material/coating							
				tensile strength					
	Bright	Galvanized	Hot-dip	Stainless	f _u				
	steel steel galvanized stee								
			steel						
GX-WF [In] × 2.8 RD 34	•	•	•	•	600 N/mm ²				
GX-WF [I _n] × 2.8 R 34	N/A	N/A	•	•	600 N/mm ²				
GX-WF [ln] × 3.1 RD 34	•	•	•	•	600 N/mm ²				

Base material





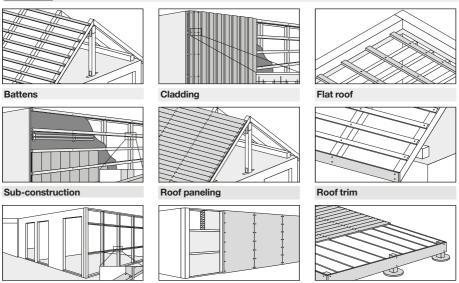
Static/quasi static





Application

Examples



Wall framing

Wall sheeting

Wood decking

Corrosion information

Suitable GX-WF material related to service classes according to EN 1995-1-1

Service class	1	2	3
Average moisture content of the wood specimen	≤12%	≤20%	>20%
Designation on package/label			
Requirements for nails with $d_n \leq 4 \text{ mm}$	No coating	Fe/Zn 12c	Fe/ZN 25c ¹⁾
Suitable GX-WF material	Bright steel Galvanized steel Hot-dip galva- nized steel	Stainless steel Galvanized steel Hot-dip galva- nized steel	Stainless steel Hot-dip galva- nized steel Stainless steel

1) according to EN 10147, for hot-dip galvanized steel nails FE/Zn 25 c is typically substituted by Z350.

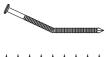
Certain wood treatments and species, like Oak, Douglas-fir or similar, require stainless steel nails due to acidity of the wood. independent of the service class.



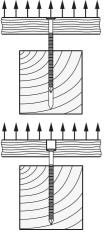


Mechanical strength and stiffness

Failures modes associated with design parameters, according to EN 1995-1-1



M_v Yield moment



f_{ax} Withdrawal parameter

f_{head} Head pull-through parameter

Smooth nail

Designation	Available length	Tensile loading	Shear loading	Char. yield moment	Char. withdrawal parameter	Char. head pull- through parameter
	l _n /mm			M _{y,k}	f _{ax,k}	f _{head,k}
GX-WF [l _n]×2.8 D 34	51, 63, 70, 75, 80			2617 Nmm	2.4 N/mm ²	8.5 N/mm ²
GX-WF $[I_n] \times 2.8 \text{ D} 34 \text{ gal}$	51, 63, 70, 75, 80	Medium term (<6 months)	Permanent	2617 Nmm	2.4 N/mm ²	8.5 N/mm ²
GX-WF [In] × 2.8 D 34 HDG	51, 63, 75		(>10 years)	2617 Nmm	2.4 N/mm ²	8.5 N/mm ²
GX-WF [l _n] × 3.1 D 34	80, 90			3410 Nmm	2.0 N/mm ²	8.5 N/mm ²
GX-WF [ln] × 3.1 D 34 galv	75, 80, 90]		3410 Nmm	2.0 N/mm ²	8.5 N/mm ²
GX-WF [ln] x 3.1 D 34 HDG	75, 80, 90			3410 Nmm	2.0 N/mm ²	8.5 N/mm ²





Profiled nail

Designation	Available length	Tensile loading	Shear loading	Char. yield moment	Char. withdrawal parameter	Char. head pull- through parameter
	l _n /mm			M _{y,k}	f _{ax,k}	f _{head,k}
GX-WF [l _n] × 2.8 RD 34	51, 63, 70, 75, 80			2320 Nmm	6.9 N/mm ²	12.5 N/mm ²
GX-WF $[I_n] \times 2.8$ RD 34 galv	51, 63, 70, 75, 80			2320 Nmm	6.9 N/mm ²	12.5 N/mm ²
GX-WF [I _n] × 2.8 RD 34 HDG	51, 63, 75, 80				2130 Nmm	6.9 N/mm ²
GX-WF [ln] × 2.8 RD 34 A2	51,63	Permanent	Permanent	1960 Nmm	6.8 N/mm ²	12.5 N/mm ²
GX-WF [l _n] × 2.8 R 34 A2	55, 65, 80	(>10 years)	(>10 years)	1960 Nmm	6.8 N/mm ²	15.7 N/mm ²
GX-WF [ln] × 2.8 R 34 HDG	50, 65, 75]		2130 Nmm	6.9 N/mm ²	13.9 N/mm ²
GX-WF [l _n] × 3.1 RD 34 A2	80			2830 Nmm	6.2 N/mm ²	13.9 N/mm ²
GX-WF [l _n]×3.1 RD 34	70, 75, 80, 90			2772 Nmm	6.7 N/mm ²	13.9 N/mm ²
GX-WF [In] × 3.1 RD 34 galv	70, 75, 80, 90]		2772 Nmm	6.3 N/mm ²	13.9 N/mm ²
GX-WF [I _n]×3.1 RD 34 HDG	63, 75, 80, 90			2772 Nmm	9.0 N/mm ²	13.9 N/mm ²

Dimension

Nail definition

Head shape

D-head





A_h

d_b

Head cross-sectional area

Nominal nail length

Length of profiling

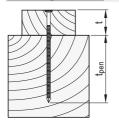
Nominal nail diameter

Head diameter

Profiled nail



Fastening definition



t Fastening height

Point length

 t_{pen} Pointside penetration depth





Bright steel nail, service class 1

Designation	Nominal nail length	Nominal nail diameter	Minimum head diameter	Minimum head cross- sectional area	Maximum fastening height	Length of profil- ing	Maximum point length
	l _n	d _n	d _h	A _{h, min}	t	l _g	l _p
GX-WF 51 × 2.8 D 34	51 mm	2.8 mm	7 mm	29.40 mm ²	28 mm	N/A	4.6 mm
GX-WF 63 × 2.8 D 34	63 mm	2.8 mm	7 mm	29.40 mm ²	40 mm	N/A	4.6 mm
GX-WF 70 × 2.8 D 34	70 mm	2.8 mm	7 mm	29.40 mm ²	47 mm	N/A	4.6 mm
GX-WF 75 × 2.8 D 34	75 mm	2.8 mm	7 mm	29.40 mm ²	52 mm	N/A	4.6 mm
GX-WF 80 × 2.8 D 34	80 mm	2.8 mm	7 mm	29.40 mm ²	57 mm	N/A	4.6 mm
GX-WF 80 × 3.1 D 34	80 mm	3.1 mm	7.2 mm	29.40 mm ²	55 mm	N/A	4.9 mm
GX-WF 90 × 3.1 D 34	90 mm	3.1 mm	7.2 mm	29.40 mm ²	65 mm	N/A	4.9 mm
GX-WF 51 × 2.8 RD 34	51 mm	2.8 mm	7 mm	29.40 mm ²	34 mm	34 mm	4.6 mm
GX-WF 63 × 2.8 RD 34	63 mm	2.8 mm	7 mm	29.40 mm ²	46 mm	46 mm	4.6 mm
GX-WF 70 × 2.8 RD 34	70 mm	2.8 mm	7 mm	29.40 mm ²	53 mm	53 mm	4.6 mm
GX-WF 75 × 2.8 RD 34	75 mm	2.8 mm	7 mm	29.40 mm ²	58 mm	58 mm	4.6 mm
GX-WF 80 × 2.8 RD 34	80 mm	2.8 mm	7 mm	29.40 mm ²	63 mm	63 mm	4.6 mm
GX-WF 70 × 3.1 RD 34	70 mm	3.1 mm	7.2 mm	29.40 mm ²	51 mm	53 mm	4.9 mm
GX-WF 75 × 3.1 RD 34	75 mm	3.1 mm	7,2 mm	29.40 mm ²	56 mm	58 mm	4.9 mm
GX-WF 80 × 3.1 RD 34	80 mm	3.1 mm	7.2 mm	29.40 mm ²	61 mm	63 mm	4.9 mm
GX-WF 90 × 3.1 RD 34	90 mm	3.1 mm	7.2 mm	29.40 mm ²	71 mm	73 mm	4.9 mm

Galvanized steel nail, service class 2

Designation	Nominal nail length	Nominal nail diameter	Minimum head diameter	Minimum head cross- sectional area	Maximum fastening height	Length of profiling	Maximum point length
	l _n	d _n	d _h	A _{h, min}	t	l _g	l _p
GX-WF 51 × 2.8 D 34 galv	51 mm	2.8 mm	7 mm	29.40 mm ²	28 mm	N/A	4.6 mm
GX-WF 63 × 2.8 D 34 galv	63 mm	2.8 mm	7 mm	29.40 mm ²	40 mm	N/A	4.3 mm
GX-WF 70 × 2.8 D 34 galv	70 mm	2.8 mm	7 mm	29.40 mm ²	47 mm	N/A	4.3 mm
GX-WF 75 × 2.8 D 34 galv	75 mm	2.8 mm	7 mm	29.40 mm ²	52 mm	N/A	4.3 mm
GX-WF 80 × 2.8 D 34 galv	80 mm	2.8 mm	7 mm	29.40 mm ²	57 mm	N/A	4.3 mm
GX-WF 75 × 3.1 D 34 galv	75 mm	3.1 mm	7.2 mm	29.40 mm ²	50 mm	N/A	4.8 mm
GX-WF 80 × 3.1 D 34 galv	80 mm	3.1 mm	7.2 mm	29.40 mm ²	55 mm	N/A	4.8 mm
GX-WF 90 × 3.1 D 34 galv	90 mm	3.1 mm	7.2 mm	29.40 mm ²	65 mm	N/A	4.8 mm
GX-WF 51 × 2.8 RD 34 galv	51 mm	2.8 mm	7 mm	29.40 mm ²	34 mm	34 mm	4.3 mm
GX-WF 63 × 2.8 RD 34 galv	63 mm	2.8 mm	7 mm	29.40 mm ²	46 mm	46 mm	4.3 mm
GX-WF 70 × 2.8 RD 34 galv	70 mm	2.8 mm	7 mm	29.40 mm ²	53 mm	53 mm	4.3 mm
GX-WF 75 × 2.8 RD 34 galv	75 mm	2.8 mm	7 mm	29.40 mm ²	58 mm	58 mm	4.3 mm
GX-WF 80 × 2.8 RD 34 galv	80 mm	2.8 mm	7 mm	29.40 mm ²	63 mm	63 mm	4.3 mm
GX-WF 70 × 3.1 RD 34 galv	70 mm	3.1 mm	7.2 mm	29.40 mm ²	51 mm	53 mm	4.8 mm
GX-WF 75 × 3.1 RD 34 galv	75 mm	3.1 mm	7.2 mm	29.40 mm ²	56 mm	58 mm	4.8 mm
GX-WF 80 × 3.1 RD 34 galv	80 mm	3.1 mm	7.2 mm	29.40 mm ²	61 mm	63 mm	4.8 mm
GX-WF 90 × 3.1 RD 34 galv	90 mm	3.1 mm	7.2 mm	29.40 mm ²	71 mm	73 mm	4.8 mm





Hot-dip galvanized steel nail, service class 3

Designation	Nominal nail length	Nominal nail diameter	Minimum head diameter	Minimum head cross- sectional area	Maximum fastening height	Length of profiling	Maximum point length
	l _n	d _n	d _h	A _{h, min}	t	l _g	l _p
GX-WF 51 × 2.8 D 34 HDG	51 mm	2.8 mm	7 mm	29.40 mm ²	28 mm	N/A	4.6 mm
GX-WF 63 × 2.8 D 34 HDG	63 mm	2.8 mm	7 mm	29.40 mm ²	40 mm	N/A	4.6 mm
GX-WF 75 × 2.8 D 34 HDG	75 mm	2.8 mm	7 mm	29.40 mm ²	52 mm	N/A	4.6 mm
GX-WF 75 × 3.1 D 34 HDG	75 mm	3.1 mm	7.2 mm	29.40 mm ²	50 mm	N/A	4.9 mm
GX-WF 80 × 3.1 D 34 HDG	80 mm	3.1 mm	7.2 mm	29.40 mm ²	55 mm	N/A	4.9 mm
GX-WF 90 × 3.1 D 34 HDG	90 mm	3.1 mm	7.2 mm	29.40 mm ²	65 mm	N/A	4.9 mm
GX-WF 51 × 2.8 RD 34 HDG	51 mm	2.8 mm	7 mm	29.40 mm ²	34 mm	34 mm	4.6 mm
GX-WF 63 × 2.8 RD 34 HDG	63 mm	2.8 mm	7 mm	29.40 mm ²	46 mm	46 mm	4.6 mm
GX-WF 75 × 2.8 RD 34 HDG	75 mm	2.8 mm	7 mm	29.40 mm ²	58 mm	58 mm	4.6 mm
GX-WF 80 × 2.8 RD 34 HDG	80 mm	2.8 mm	7 mm	29.40 mm ²	63 mm	63 mm	4.6 mm
GX-WF 63 × 3.1 RD 34 HDG	63 mm	3.1 mm	7.2 mm	29.40 mm ²	44 mm	46 mm	4.9 mm
GX-WF 75 × 3.1 RD 34 HDG	75 mm	3.1 mm	7.2 mm	29.40 mm ²	56 mm	58 mm	4.9 mm
GX-WF 80 × 3.1 RD 34 HDG	80 mm	3.1 mm	7.2 mm	29.40 mm ²	61 mm	63 mm	4.9 mm
GX-WF 90 × 3.1 RD 34 HDG	90 mm	3.1 mm	7.2 mm	29.40 mm ²	71 mm	73 mm	4.9 mm
GX-WF 50 × 2.8 R 34 HDG	50 mm	2.8 mm	6.4 mm	32.20 mm ²	33 mm	34 mm	4.6 mm
GX-WF 65 × 2.8 R 34 HDG	65 mm	2.8 mm	6.4 mm	32.20 mm ²	48 mm	49 mm	4.6 mm
GX-WF 75 × 2.8 R 34 HDG	75 mm	2.8 mm	6.4 mm	32.20 mm ²	59 mm	58 mm	4.6 mm

Stainless steel nail, service class 3

Designation	Nominal nail length	Nominal nail diameter	Minimum head diameter	Minimum head cross- sectional area	Maximum fastening height	Length of profiling	Maximum point length
	l _n	d _n	d _h	A _{h, min}	t	l _g	l _p
GX-WF 51 × 2.8 RD 34 A2	51 mm	2.8 mm	7.0 mm	29.40 mm ²	34 mm	34 mm	4.6 mm
GX-WF 63×2.8 RD 34 A2	63 mm	2.8 mm	7.0 mm	29.40 mm ²	46 mm	46 mm	4.6 mm
GX-WF 80 × 3.1 RD 34 A2	80 mm	3.1 mm	7.2 mm	29.40 mm ²	61 mm	63 mm	4.9 mm
GX-WF 55×2.8 R 34 A2	55 mm	2.8 mm	6.4 mm	32.20 mm ²	38 mm	38 mm	4.6 mm
GX-WF 65×2.8 R 34 A2	65 mm	2.8 mm	6.4 mm	32.20 mm ²	48 mm	48 mm	4.6 mm
GX-WF 80×2.8 R 34 A2	80 mm	2.8 mm	6.4 mm	32.20 mm ²	63 mm	63 mm	4.6 mm





Application requirement

Minimum pointside penetration depth, under tension load For smooth nail: $t_{nen} = 8 \times d_n$

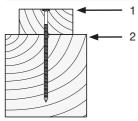
For profiled nail: $t_{pen} = 6 \times d_n$

Spacing and edge distance

Geometrical limitations, like spacing and edge distance, shall be in compliance with EN 1995-1-1 or other applicable regulations.

Fastening quality assurance

Fastening inspection for wood to wood connection



1 Nail head shall be flush with the wood surface

2 Fastened wood member should be fully in contact with the supporting wood member, if not differently required by the specific design of the connection.

Installation information

Pre-drilling

Pre-drilling requirements are described in EN 1995-1-1, section 8.3.1.2.





Bright steel nail, service class 1

Designation	Item no.
GX-WF 51 × 2.8 D 34	2281814, 2083658
GX-WF 63×2.8 D 34	2281815, 2083659
GX-WF 70×2.8 D 34	2281816, 2083750
GX-WF 75×2.8 D 34	2281817, 2083751
GX-WF 80×2.8 D 34	2281818, 2083752
GX-WF 80×3.1 D 34	2281819, 2083753
GX-WF 90×3.1 D 34	2281820, 2083754
GX-WF 51 × 2.8 RD 34	2281821, 2083755
GX-WF 63 × 2.8 RD 34	2281822, 2083756
GX-WF 70×2.8 RD 34	2281823, 2083757
GX-WF 75×2.8 RD 34	2281824, 2083758
GX-WF 80×2.8 RD 34	2281833, 2083759
GX-WF 70×3.1 RD 34	2281825, 2083760
GX-WF 75×3.1 RD 34	2083761
GX-WF 80×3.1 RD 34	2281826, 2083762
GX-WF 90 × 3.1 RD 34	2281827, 2083763

Galvanized steel nail, service class 2

Designation	Item no.
GX-WF 51 × 2.8 D 34 galv	2281835, 2083764
GX-WF 63 × 2.8 D 34 galv	2281836, 2083765
GX-WF 70 × 2.8 D 34 galv	2281837, 2083766
GX-WF 75 × 2.8 D 34 galv	2281838, 2083767
GX-WF 80 × 2.8 D 34 galv	2281839, 2083768
GX-WF 75 × 3.1 D 34 galv	2281840, 2083769
GX-WF 80 × 3.1 D 34 galv	2281841, 2083770
GX-WF 90 × 3.1 D 34 galv	2281842, 2083771
GX-WF 51 × 2.8 RD 34 galv	2281843, 2083772
GX-WF 63 × 2.8 RD 34 galv	2281844, 2083773
GX-WF 70 × 2.8 RD 34 galv	2281845, 2083774
GX-WF 75 × 2.8 RD 34 galv	2281846, 2083775
GX-WF 80 × 2.8 RD 34 galv	2281847, 2083776
GX-WF 70 × 3.1 RD 34 galv	2281848, 2083777
GX-WF 75 × 3.1 RD 34 galv	2281849, 2083778
GX-WF 80 × 3.1 RD 34 galv	2281615, 2083779
GX-WF 90 × 3.1 RD 34 galv	2281834, 2083780
GX-WF 80 × 2.8 RD 34 galv GX-WF 70 × 3.1 RD 34 galv GX-WF 75 × 3.1 RD 34 galv GX-WF 80 × 3.1 RD 34 galv	2281847, 2083776 2281848, 2083777 2281849, 2083778 2281615, 2083779

Hot-dip galvanized steel nail, service class 3

Designation Item no. GX-WF 51 × 2.8 D 34 HDG 2281616, 2083781 GX-WF 63 × 2.8 D 34 HDG 2281617, 2083782 GX-WF 75 × 2.8 D 34 HDG 2281618, 2083783 GX-WF 75 × 3.1 D 34 HDG 2281619, 2083784 GX-WF 80 × 3.1 D 34 HDG 2281800, 2083785 GX-WF 90 × 3.1 D 34 HDG 2281801, 2083786 GX-WF 51 × 2.8 RD 34 HDG 2281802, 2083787 GX-WF 63 × 2.8 RD 34 HDG 2281803, 2083788 GX-WF 75 × 2.8 RD 34 HDG 2281804.2083789 GX-WF 80 × 2.8 RD 34 HDG 2281805, 2083790 GX-WF 63 × 3.1 RD 34 HDG 2281806, 2083791 GX-WF 75 × 3.1 RD 34 HDG 2281807, 2083792 GX-WF 80 × 3.1 RD 34 HDG 2281808, 2083793 GX-WF 90 × 3.1 RD 34 HDG 2281809, 2083794 GX-WF 50 × 2.8 R 34 HDG 2281810 GX-WF 65 × 2.8 R 34 HDG 2281811 GX-WF 51 × 2.8 R 34 HDG 2281812

Stainless steel nail, service class 3

Designation	Item no.
GX-WF 51 × 2.8 RD 34 A2	2281828, 2006654
GX-WF 63 × 2.8 RD 34 A2	2281829, 2006655
GX-WF 80 × 3.1 RD 34 A2	2281830, 2006656
GX-WF 55 × 2.8 R 34 A2	2281831, 2006657
GX-WF 65 × 2.8 R 34 A2	2281832, 2006658
GX-WF 80 × 2.8 R 34 A2	2281813, 2006659



GX-WF





Part 5:

Approvals



Approvals





Nails → Approvals

Product	Approval	Country	Application
DNH	ITB-KOT-2021/2019 wydanie 1	Poland	Fastening to concrete
DS	ICC-ES ESR-1663	USA	Fastening to steel and concrete
	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel
	ITB-KOT-2021/2019 wydanie 1	Poland	Fastening to concrete
	LR 97/00077(E4)	Global	Fastening to steel
DSH	ITB-KOT-2021/2019 wydanie 1	Poland	Fastening to concrete
	DIBt Z-21.7-670	Germany	Suspended ceiling fastening
	ETA-14/0426	Europe	Fastening to concrete
DX-Kwik	IBMB 3041/8171	Germany	Fastening drywall track
	IBMB Gutachten 1498/166/13	Germany	Ceiling hanger fastening
	Rom. Ministry, ICECON: AT 016-01_389-2018	Romania	Fastening to concrete
EDS	DNV-GL TAS00002UR	Global	Fastening to steel, fastening to steel for shipbuilding
	ICC-ES ESR-1663	USA	Fastening to steel and concrete
	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel
	LR 97/00077(E4)	Global	Fastening to steel
E-Fastener	Rom. Ministry, ICECON: AT 003-05/950-2022	Romania	Cable and conduit fastening
M10	ITB-KOT-2021/2019 wydanie 1	Poland	Fastening to concrete
NPH2	BUtgb ATG 1824	Belgium	Metal deck fastening
	Socotec N 1601601R0000004	France	Deck fastening
	ITB-KOT-2019-0799	Poland	Fastening to steel and concrete
	ITB-KOT-2021/2019 wydanie 1	Poland	Fastening to concrete





Product	Approval	Country	Application
	ABS 21-2140400-PDA	Global	Fastening to steel, fastening to steel for offshore applications, fastening to steel for shipbuilding
	BV 45116/B0 BV	Global	Marine industry, offshore industry
	DNV-GL TAS00000N6	Global	Fastening to steel, fastening to steel for offshore applications, fastening to steel for shipbuilding
	ETA-20/0530	Global	Fastening to steel
S-BT	ITB-KOT-2019-0799	Poland	Fastening to steel and concrete
	LR 21394055TA	Global	Fastening to steel, fastening to steel for offshore applications, fastening to steel for shipbuilding
	Russian Maritime Register 18.40040.250	Global	Fastening to steel, fastening to steel for shipbuilding
	RINA FPE278318CS	Global	Fastening to steel, fastening to steel for offshore applications, fastening to steel for shipbuilding
	ABS 21-2140400-PDA	Global	Fastening to steel, fastening to steel for offshore applications, fastening to steel for shipbuilding
	BV 45116/B0 BV	Global	Fastening to steel, fastening to steel for shipbuilding
S-BT-ER / -EF (HC)	DNV-GL TAS00000N6	Global	Fastening to steel, fastening to steel for offshore applications, fastening to steel for shipbuilding
	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel
	Russian Maritime Register 18.40040.250	Global	Fastening to steel, fastening to steel for shipbuilding





Product	Approval	Country	Application
S-BT-ER / -EF (HC)	RINA FPE278318CS	Global	Fastening to steel,
	LR 21394055TA	Global	fastening to steel for offshore applications, fastening to steel for shipbuilding
S-BT-GF NG	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel
S-BT GR NG	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel
	FM Sprinkler Piper Listings	USA	Sprinkler pipe fastening
	ICC-ES ESR-1663	USA	Fastening to steel and concrete
W10	UL EX 2258	USA	Corinklar pipe factorian
	UL EX 2258	Canada	Sprinkler pipe fastening
	ITB-KOT-2021/2019 wydanie 1	Poland	Fastening to concrete
W6	ICC-ES ESR-1663	USA	Fastening to steel and concrete
Wood nails	BRANZ Appraisal 780 (2012)	New Zealand	Timber joints fastening
X-BT-ER	ABS 18-HS1755518- PDA	Global	Fastening to steel, fastening to steel for offshore applications, fastening to steel for shipbuilding
	BV 54054/A0 BV	Global	Fastening to steel, fastening to steel for shipbuilding
	DNV-GL TAS00001SV	Global	Fastening to steel, fastening to steel for offshore applications, fastening to steel for shipbuilding
	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel
	LR 19-00003-02	Global	Fastening to steel
	UL E257069	USA, Canada	Grounding
	Russian Maritime Register No. 20.40088.250	Global	Fastening to steel, fastening to steel for shipbuilding





Product	Approval	Country	Application	
X-BT-GR, -MR	ABS 18-HS1755518- PDA	Global	Fastening to steel, fastening to steel for offshore applications, fastening to steel for shipbuilding	
	BV 54054/A0 BV	Global	Fastening to steel, fastening to steel for shipbuilding	
	DNV-GL TAS00001SV	Global	Fastening to steel, fastening to steel for offshore applications, fastening to steel for shipbuilding	
	ETA-20/1042	Europe		
	LR 19-00003-02	Global	Fastening to steel	
	Rom. Ministry, ICECON: AT 016-01_417-2019	Russia		
	Russian Maritime Register No. 20.40088.250	Global	Fastening to steel, fastening to steel for shipbuilding	
	ICC ESR 2347	USA	Fastening to steel	
X-BT-MF	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel	
X-BT-MR-N M8	ABS 16-HS1545448- PDA	Global	Fastening to steel, fastening to steel for offshore applications, fastening to steel for shipbuilding	
	LR 03/00070(E4)	Global	Fastening to steel, fastening to steel for offshore applications, fastening to steel for shipbuilding	
Х-ВХ	UL E217969	USA	Pipe and ventilation duct fastening	
	UL E217969	Canada	Pipe and ventilation duct fastening	





Product	Approval	Country	Application
	IBMB 4850-2018	Germany	
	IBMB 4850-2018	Germany	
	IBMB 4708/2014	Germany	Fastening drywall track
	IBMB 6536/8173	Germany	
X A	IBMB 6537/8174	Germany	
X-C	ICC-ES ESR-1663	USA	Fastening to steel and
	ICC-ES ESR-1752	USA	concrete
	ITB-KOT-2021/2019 wydanie 1	Poland	
	Rom. Ministry, ICECON: AT 016-01/420-2020	Romania	Fastening to concrete
	IBMB 8300-2016	Germany	
	IBMB 8302-2016	Germany	Fastening drywall track
	IBMB 8304-2016	Germany	
X-C B3	ICC-ES ESR-1752	USA	Fastening to steel and
	ITB-KOT-2019-0799	Poland	concrete
	ITB-KOT-2021/2019 wydanie 1	Poland	Fastening to concrete
X-C G2	ICC-ES ESR-1752	USA	Fastening to steel and concrete
X-C G2	ITB-KOT-2021/2019 wydanie 1	Poland	Fastening to concrete
	ICC-ES ESR-1752	USA	Fastening to steel and
	ITB-KOT-2019-0799	Poland	concrete
X-C G3	ITB-KOT-2021/2019 wydanie 1	Poland	Fastening to concrete
	Rom. Ministry, ICECON: AT 016-01_435-2020	Romania	Fastening to steel and concrete
	CSTB AT 3/16-844	France	Cable and conduit fastening
	ITB-KOT-2019-0799	Poland	Fastening to steel and concrete
X-CC	LR 97/00077(E4)	Global	Fastening to steel
	Rom. Ministry, ICECON: AT 016-01/420-2020	Romania	Fastening to concrete
	ITB-KOT-2021/2019 wydanie 1	Poland	
X-CC U16 P8	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel
X-CF72	ICC-ES ESR-2379	USA	Sill plate fastening
X-CP72	ICC-ES ESR-2379	USA	Sill plate fastening





Product	Approval	Country	Application
	ABS 16-HS1545447- PDA	Global	Fastening to steel
	IBMB 3041/8171	Germany	Fastening drywall track
	ICC-ES ESR-1663	USA	Fastening to steel and concrete
	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel
X-CR	ITB-KOT-2021/2019 wydanie 1	Poland	Fastening to concrete
	LR 97/00078(E4)	Global	Fastening to steel, fastening to steel for offshore applications, fastening to steel for shipbuilding
	Rom. Ministry, ICECON: AT 016-01/420-2020	Romania	Fastening to concrete
X-CR 48 (DX-Kwik)	ETA-14/0426	Europe	Fastening to concrete
X-CR 52 (DX-Kwik)	ETA-14/0426	Europe	Fastening to concrete
X-CR M	ITB-KOT-2021/2019 wydanie 1	Poland	Fastening to concrete
	DIBt Z-21.7-1512	Germany	Facade fastening
X-CR M8	DIBt Z-21.7-670	Germany	Suspended ceiling fastening
	ICC-ES ESR-2347	USA	Fastening to steel
X-CT DP8	ITB-KOT-2021/2019 wydanie 1	Poland	Fastening to concrete
X-CX ALH	ICC-ES ESR-2184	USA	Suspended ceiling fastening
X-CX C27	ICC-ES ESR-2184	USA	Suspended ceiling fastening
X-DFB-MX	CNBOP-PIB-KOT-2019/ 0096-3703 wydanie 4	Poland	Circuit integrity fastening
	IBMB 3041/8171	Germany	Fastening drywall track
X-DKH	ITB-KOT-2021/2019 wydanie 1	Poland	Fastening to concrete
X-DKH48 (DX-Kwik)	DIBt Z-21.7-670	Germany	Suspended ceiling fastening
X-DR ALH	ICC-ES ESR-2795	USA	Ceiling hanger fastening
X-DR MX	ICC-ES ESR-2795	USA	Ceiling hanger fastening
X-ECC MX	ETA-16/0301	Europe	Cable and conduit fastening
	ITB-KOT-2019-0799	Poland	Fastening to steel and concrete





Product	Approval	Country	Application
X-ECH MX	ETA-16/0301	Europe	Cable and conduit fastening
X-ECH-FE	IBMB 2103/900-22 MLAR	Germany	E-Fastening
X-ECH	CSTB AT 3/16-844	France	Cable and conduit fastening
X-ECH/FR-L/-M/-S with	UL E201485	USA	Cable and conduit
X-U37	UL E201485	Canada	fastening
	abP P-MPA-E-16-010	Germany	
X-ECH-FE MX	abP P-2401/198/16- MPA-BS	Germany	 Circuit integrity fastening
	abP P-1023 DMT DO	Germany	
	CNBOP-PIB-KOT-2019/ 0096-3703 wydanie 4	Poland	
X-ECT	CSTB AT 3/16-844	France	Cable and conduit fastening
	UL E201485	USA	
X-ECT MX	ETA-16/0301	Europe	Cable and conduit fastening
	UL E201485	Canada	
X-EF	ABS 16-HS1545445- PDA	Global	Fastening to steel
	LR 97/00077(E4)	Global	
	IBMB 4708/2014	Germany	
	IBMB 6536/8173	Germany	Fastening drywall track
	IBMB 6537/8174	Germany	
X-EGN	ICC-ES ESR-1752	USA	Fastening to steel and concrete
	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel
	Rom. Ministry, ICECON: AT 016-01_388-2018	Romania	Fastening to steel and concrete
	ETA-16/0301	Europe	Cable and conduit fastening
X-EHS MX	ITB-KOT-2019-0799	Poland	Fastening to steel and concrete
X-EKB	CSTB AT 3/16-844	France	Cable and conduit fastening
	ETA-16/0301	Europe	Cable and conduit
X-EKB MX	UL E201485	USA, Canada	fastening





Product	Approval	Country	Application
	abP P-MPA-E-16-010	Germany	
	abP P-2401/198/16- MPA-BS	Germany	
X-EKB-FE MX	abP P-1023 DMT DO	Germany	Circuit integrity fastening
	CNBOP-PIB-KOT-2019/ 0096-3703 wydanie 4	Poland	
	IBMB 2103/900-22 MLAR	Germany	
X-EKS MX	ETA-16/0301	Europe	Cable and conduit
X-EKS MX	CSTB AT 3/16-844	France	fastening
	UL E201485	USA	
X-EKSC MX	UL E201485	Canada	Cable and conduit
	ETA-16/0301	Europe	laotonnig
X-EM	ABS 16-HS1545445- PDA	Global	Fastening to steel
	LR 97/00077(E4)	Global	
X-EMH	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel
X-EMH	Rom. Ministry, ICECON: AT 016-01/420-2020	Romania	Fastening to concrete
X-EMTSC	UL E217969	USA	Pipe and ventilation duct
X-ENTISC	UL E217969	France USA Canada Europe Global Global Poland Romania	fastening
X-ENK	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel
X-ENP	FM 3054498	USA	Deck fastening





Product	Approval	Country	Application
	ABS 16-HS1545445- PDA	Global	Fastening to steel
	DIN EN 1993-1-3/NA	Germany	Dock factoring
	ETA-04/0101	Europe	Deck fastening
	FM 3029102	USA	Form deck fastening
	IAPMO ER 2018, Verco Co-listing	USA	
X-ENP-19	IAPMO ER 161, ASC Co-listing	USA	Deck fastening
	ICC-ES ESR-1663	USA	
	ICC-ES ESR-2197	USA	
	ICC-ES ESR-2776	USA	
	LR 97/00077(E4)	Global	Fastening to steel
	MLIT 2005	Japan	
	SDI	USA	Deck fastening
	UL R 13203	UL R 13203 USA	
	ABS 16-HS1545445- PDA	Global	Fastening to steel
	BUtgb ATG 1824	Belgium	Metal Deck fastening
X-ENP2K	ABS 16-HS1545445- PDA Global BUtgb ATG 1824 Belgium ETA-13/0172 Europe	Deck fastening	
	LR 97/00077(E4)	Global	Fastening to steel
	Rom. Ministry, ICECON: AT 016-01/420-2020	Romania	Fastening to concrete
X-EW	ABS 16-HS1545445- PDA	Global	Fastening to steel
	LR 97/00077(E4)	Global	Fastening to steel
	FM Sprinkler Piper Listings	USA	
X-EW10	UL EX 2258	USA	Sprinkler pipe fastening
	UL EX 2258	Canada	
	UL EX 2258	Canada	
	FM 3026695	USA	
	ICC-ES ESR-2347	USA	Fastening to steel
X-EW10H	ITB-KOT-2021/1985 wydanie 1	Poland	
	UL EX 2258	USA	Sprinkler pipe festering
	UL EX 2258	Canada	Sprinkler pipe fastening





Product	Approval	Country	Application	
	FM 3026695	USA	Fortanian to start	
X-EW6H	ICC-ES ESR-2347	USA	- Fastening to steel	
X-EVV0П	UL EX 2258	USA	Cariakler size festering	
	UL EX 2258	Canada	- Sprinkler pipe fastening	
X-FB MX	CNBOP-PIB-KOT-2019/ 0096-3703 wydanie 4	Poland	Circuit integrity fastening	
	ETA-16/0301	Europe	Cable and conduit fastening	
X-FCI	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel	
	BV 71291-A0	Global	Fastening to steel	
	ABS 22-2285526- PDA	Global	Marine industry, offshore industry	
X-FCM	DNV TAS00001UJ Rev-3	Global	Fastening to steel, fastening to steel for offshore applications, fastening to steel for shipbuilding	
	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel	
	LR 97/00077(E4)	Global		
	Rom. Ministry, ICECON: AT 016-01/420-2020	Romania	Fastening to concrete	
	ABS 22-2285526-PDA	Global	Fastening to steel, fastening to steel for offshore applications, fastening to steel for shipbuilding	
X-FCM-F	BV 71291/A0 BV	Global	Marine industry, offshore industry	
	LR 21394055TA	Global	Fastening to steel,	
	DNV TAS00001UJ Rev-3	Global	fastening to steel for offshore applications, fastening to steel for shipbuilding	
	ABS 22-2285526-PDA	Global	Fastening to steel, fastening to steel for offshore applications, fastening to steel for shipbuilding	
X-FCM-R HL	BV 71291/A0 BV	Global	Marine industry, offshore industry	
	DNV TAS00001UJ Rev-3	Global	Fastening to steel,	
	LR 03/00070(E4)	Global	fastening to steel for offshore applications, fastening to steel for shipbuilding	





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Product	Approval	Country	Application
	IBMB 4850-2018	Germany	Fastening drywall track
	ICC-ES ESR-1752	USA	Fastening to steel and concrete
X-GHP	ITB-KOT-2021/2019 wydanie 1	Poland	Fastening to concrete
	Rom. Ministry, ICECON: AT 016-01_388-2018	Romania	Fastening to steel and concrete
	IBMB 4850-2018	Germany	
	IBMB 4708/2014	Germany	
	IBMB 6536/8173	Germany	- Fastening drywall track
	IBMB 6537/8174	Germany	
X-GN	ICC-ES ESR-1752	USA	Fastening to steel and concrete
	ITB-KOT-2021/2019 wydanie 1	Poland	Fastening to concrete
	Rom. Ministry, ICECON: AT 016-01_388-2018	Romania	Fastening to steel and concrete
X-GR	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel
X-HN	ITB-KOT-2021/2019 wydanie 1	Poland	Fastening to concrete
	CSTB AT 3/16-844	France	Cable and conduit fastening
	ITB-KOT-2019-0799	Poland	Fastening to steel and concrete
X-HS	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel
	LR 97/00077(E4)	Global	
	Rom. Ministry, ICECON: AT 016-01/420-2020	Romania	Fastening to concrete
X-HS DKH	ITB-KOT-2021/2019 wydanie 1	Poland	Fastening to concrete
X-HS U19	ICC-ES ESR-2795	USA	Ceiling hanger fastening
X-HS U32	ICC-ES ESR-2795	USA	Ceiling hanger fastening
X-HS W6/10 U19	FM 3031301	USA	Sprinkler pipe fastening
X-HS W6/10 U19/22/27	UL E217969	USA	Pipe and ventilation duct
A-113 W0/10 019/22/21	UL E217969	Canada	fastening





Product	Approval	Country	Application
	ABS 16-HS1545445- PDA	Global	Fastening to steel
	FM 3054498	USA	
	IAPMO ER 2018, Verco Co-listing	USA	
X-HSN 24	IAPMO ER 161, ASC Co-listing	USA	
	ICC-ES ESR-1169	USA	Deck fastening
	ICC-ES ESR-2197	USA	
	ICC-ES ESR-2776	USA	
	SDI	USA	
	UL R 13203	USA	
X-HS-W	CSTB AT 3/16-844	France	Cable and conduit fastening
X-HVB	ETA-15/0876	Europe	Composite shear connection
	ITB-KOT-2019-0799	Poland	Fastening to steel and concrete
X-IE	Socotec N 1601601R0000003	France	Insulation factoring
	Russian Ministry/FCS TS/TO 5851-19	Russia	Insulation fastening
X-IE-G	Socotec N 180668080000010	France	Insulation fastening
XI-FV	ETA-17/0304	Europe	Insulation fastening (ETICS)
X-M6	Rom. Ministry, ICECON: AT 016-01/420-2020	Romania	Fastening to concrete
X-M6 B3	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel
X-M6 D12	ITB-KOT-2021/2019 wydanie 1	Poland	Fastening to concrete
X-M6-7-24	ITB-KOT-2021/2019 wydanie 1	Poland	Fastening to concrete
X-M6 FP8	ITB-KOT-2021/2019 wydanie 1	Poland	Fastening to concrete
X-M6 G3	Rom. Ministry, ICECON: AT 016-01_435-2020	Romania	Fastening to steel and concrete
	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel
	IBMB 3041/8171	Germany	Fastening drywall track
X-M6H	ITB-KOT-2021/2019 wydanie 1	Poland	Fastening to concrete





Product	Approval	Country	Application
X-M8	ITB-KOT-2021/2019 wydanie 1	Poland	Fastening to concrete
	DIBt Z-21.7-670	Germany	Suspended ceiling fastening
X-M8H	IBMB 3041/8171	Germany	Fastening drywall track
	ITB-KOT-2021/2019 wydanie 1	Poland	Fastening to concrete
X-MGR	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel
X-NK	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel
X-INK	ITB-KOT-2021/2019 wydanie 1	Poland	Fastening to concrete
	IBMB 19210-2017	Germany	
	IBMB 19211-2017	Germany	Fastening drywall track
	IBMB 19212-2017	Germany	
	ICC-ES ESR-2269	USA	Fastening to steel and
	ITB-KOT-2019-0799	Poland	concrete
X-P	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel
	ITB-KOT-2021/2019 wydanie 1	Poland	
	Rom. Ministry, ICECON: AT 016-01/420-2020	Romania	Fastening to concrete
	VHT PZ-633-20	Germany	Fastening drywall track
	VHT PZ-809-15	Germany	Deflection head fastening
	IBMB 8300-2016	Germany	
	IBMB 8302-2016	Germany	Fastening drywall track
	IBMB 8304-2016	Germany	
X-P B3	ETA-16/0301	Europe	Cable and conduit fastening
ETA	ETA-20/0886	Europe	Track fastening to concrete
	ICC-ES ESR-1752	USA	Fastening to steel and concrete
X-P G2	ICC-ES ESR-1752	USA	Fastening to steel and concrete
A-P G2	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel





Product	Approval	Country	Application
	ICC-ES ESR-1752	USA	Fastening to steel and concrete
	ETA-16/0301	Europe	Cable and conduit fastening
X-P G3	ITB-KOT-2019-0799	Poland	Fastening to steel and concrete
	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel
	Rom. Ministry, ICECON: AT 016-01_435-2020	Romania	Fastening to steel and concrete
X-PGR-RU	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel
X-PN	ICC-ES ESR-3059	USA	Plywood fastening
X-PN 37 G2	ICC-ES ESR-3059	USA	Plywood fastening
X-PN 37 G3	ICC-ES ESR-3059	USA	Plywood fastening
X-PN G3	ITB-KOT-2019-0799	Poland	Fastening to steel and concrete
	ABS 16-HS1545447- PDA	Global	Fastening to steel
	DIBt Z-14.4-766	Germany	Glas facade fastening
	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel
X-R	LR 97/00078(E4)	Global	Fastening to steel, fastening to steel for offshore applications, fastening to steel for shipbuilding
	ICC-ES ESR-1663	USA	Fastening to steel and concrete
X C	ICC-ES ESR-1752	USA	Fastening to steel and concrete
X-S	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel
X-S B3	ICC-ES ESR-1752	USA	Fastening to steel and concrete
A-0 D0	ITB-KOT-2021/1985 wydanie 1	Poland USA USA Oland Global Germany Poland USA USA USA Voland USA USA USA USA USA Voland USA USA USA USA USA USA USA	Fastening to steel
X-S G2	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel





Product	Approval	Country	Application
	ICC-ES ESR-1752	USA	Fastening to steel and concrete
X-S G3	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel
	ITB-KOT-2019-0799	Poland	Festering to steel and
	Rom. Ministry, ICECON: AT 016-01_435-2020	Romania	Fastening to steel and concrete
	ABS 16-HS1545447- PDA	Global	
	ICC-ES ESR-2347	USA	Fastening to steel
X-ST-GR	ITB-KOT-2021/1985 wydanie 1	Poland	
	LR 97/00078(E4)	Global	Fastening to steel, fastening to steel for offshore applications, fastening to steel for shipbuilding
X-SW	Rom. Ministry, ICECON: AT 016-01/420-2020	Romania	Fastening to concrete
	ABS 16-HS1545445- PDA	Global	Fastening to steel
	DIBt Z-14.4-517	Germany	
	DNV-GL TAS00002UR	Global	Fastening to steel, fastening to steel for shipbuilding
	IBMB 2006/2011	Germany	
	IBMB 4708/2014	Germany	
	IBMB 6536/8173	Germany	Fastening drywall track
	IBMB 6537/8174	Germany	
X-U	ICC-ES ESR-2269	USA	Fastening to steel and
	ITB-KOT-2019-0799	Poland	concrete
	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel
	ITB-KOT-2021/2019 wydanie 1	Poland	Fastening to concrete
	LR 97/00077(E4)	Global	Fastening to steel
	Rom. Ministry, ICECON: AT 016-01/420-2020	Romania	Fastening to concrete
	VHT PZ-633-20	Germany	Eastoning downall track
	VHT PZ-809-15	Germany	Fastening drywall track





Product	Approval	Country	Application
X-U15	ICC-ES ESR-2269	USA	Fastening to steel and concrete
X-015	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel
X-U16 S12	ETA-16/0082	Europe	Siding
X-W6	ICC-ES ESR-1663	USA	Fastening to steel and concrete
X-100	ITB-KOT-2021/2019 wydanie 1	Poland	Fastening to concrete
X-X1	ETA-19/0439	Europe	Insulation fastening (ETICS)
	ETA-22/0876	Europe	Fastening drywall track and deflection head
X-X	ITB-KOT-2021/1985 wydanie 1	Poland	Fastening to steel
	ITB-KOT-2021/2019 wydanie 1	Poland	Fastening to concrete





Approvals → Nails

Approval	Product	Country	Application
abP P-MPA-E-16-010	X-ECH-FE MX, X-EKB- FE MX	Germany	Circuit integrity fastening
abP P-2401/198/16- MPA-BS	X-ECH-FE MX, X-EKB- FE MX	Germany	Circuit integrity fastening
abP P-1023 DMT DO	X-ECH-FE MX, X-EKB- FE MX	Germany	Circuit integrity fastening
18-HS1785836-1	X-FCM, X-FCM-R, X-FCM-M, X-FCP-R, X-FCP-F	Global	Fastening to steel, fastening to steel for offshore applications, fastening to steel for shipbuilding
ABS 21-2146146-PDA	EDS, X-U, X-ENP2K, X-ENP-19, X-HSN 24, X-EM, X-EW, X-EF, X-FCM	Global	Fastening to steel
ABS 21-2146145-PDA	X-CR, X-R14, X-ST-GR	Global	Fastening to steel
ABS 21-2140400-PDA	S-BT, S-BT-ER / -EF (HC), X-FCM-M, X-FCM-R	Global	Fastening to steel, fastening to steel for offshore applications, fastening to steel for shipbuilding
ABS 18-HS1755518-1 PDA	X-BT-MR, X-BT-GR, X-BT-ER	Global	Fastening to steel, fastening to steel for offshore applications, fastening to steel for shipbuilding
ABS 18-HS1755527- PDA	X-FCS-R	Global	Fastening to steel, fastening to steel for offshore applications, fastening to steel for shipbuilding
ABS 22-2285526- PDA	all X-FCM grating and X-FCP checker plate elements	Global	Marine industry, offshore industry
BRANZ Appraisal 780 (2012)	Wood nails	New Zealand	Timber joints fastening
BUtgb ATG 1824	NPH2, X-ENP2K	Belgium	Metal deck fastening
BV 45116/B0	X-BT, X-FCM-M, X-FCM-R	Global	Fastening to steel, fastening to steel for shipbuilding
BV 45116/B0 BV	S-BT	Global	Marine industry, offshore industry
BV 71291/A0 BV	All X-FCM grating elements	Global	Marine industry, offshore industry





Approval	Product	Country	Application
BV 54054/A0 BV	X-BT-MR, X-BT-GR, X-BT-ER, X-FCS-R, X-FCM-R HL	Global	Fastening to steel, fastening to steel for shipbuilding
Canadian Navy	Х-ВТ	Canada	Fastening to steel, fastening to steel for shipbuilding
CNBOP-PIB-KOT-2019/ 0096-3703 wydanie 4	X-ECH-FE MX, X-EKB-FE MX, X-FB MX, X-DFB-MX	Poland	Circuit integrity fastening
CSTB AT 3/16-844	X-EKB, X-ECH, X-ECT, X-EKS, X-EKSC, X-CC, X-HS, X-HS-W	France	Cable and conduit fastening
DIBt Z-14.4-517	X-U	Germany	Fastening to steel
DIBt Z-14.4-766	X-R14	Germany	Glas facade fastening
DIBt Z-21.7-1512	X-CR M8, X-CR 48	Germany	Facade fastening
DIBt Z-21.7-670	X-M8H, X-CR M8, X-DKH48 (DX-Kwik)	Germany	Suspended ceiling fastening
DIN EN 1993-1-3/NA	X-ENP-19 Lateral buckling	Germany	Deck fastening
DNV-GL TAS00002UR	X-U, EDS	Global	Fastening to steel, fastening to steel for shipbuilding
DNV-GL TAS00000N6	S-BT, S-BT-ER / -EF (HC), X-FCM-M, X-FCM-R	Global	Fastening to steel, fastening to steel for offshore applications, fastening to steel for shipbuilding
DNV-GL TAS00001SV	X-BT-GR, X-BT-MR, X-BT-ER	Global	Fastening to steel, fastening to steel for offshore applications, fastening to steel for shipbuilding
DNV TAS00001UJ Rev-3	all X-FCM grating elements, X-FCS-R	Global	Fastening to steel, fastening to steel for offshore applications, fastening to steel for shipbuilding
ETA-04/0101	X-ENP-19	Europe	Deck fastening
ETA-13/0172	X-ENP2K, DX 76 PTR	Europe	Deck fastening
ETA-14/0426	X-CR 48 P8 S15 (DX- Kwik), X-CR 52 P8 S15 (DX-Kwik)	Europe	Fastening to concrete
ETA-15/0876	X-HVB	Europe	Composite shear connection
ETA-16/0082	X-U16 S12	Europe	Siding





Approval	Product	Country	Application
ETA-16/0301	X-P 20 B3/G3, X-P 24 B3/G3, X-EKB MX, X-ECT MX, X-ECH MX, X-EKS MX, X-EKSC MX X-(D)FB MX, X-ECC MX, X-EHS MX	Europe	Cable an conduit fastening
ETA-17/0304	XI-FV	Europe	Insulation fastening (ETICS)
ETA-19/0439	X-X1	Europe	Insulation fastening (ETICS)
ETA-20/0530	S-BT	Global	Fastening to steel
ETA-20/0886	X-P 17 B3, X-P 20 B3	Europe	Track fastening to concrete
ETA-22/0876	X-X	Europe	Fastening drywall track and deflection head
ETA-20/1042	X-BT-MR, X-BT-GR	Europe	Fastening to steel
FM 3026695	X-EW6H, X-EW10H	USA	Fastening to steel
FM 3029102	X-ENP-19	USA	Form deck fastening
FM 3031301	X-HS W6/10 U19	USA	Sprinkler pipe fastening
FM 3054498	X-ENP, X-HSN 24	USA	Deck fastening
FM Sprinkler pipe fasteningr Listings	W10, X-EW10	USA	Sprinkler pipe fastening
IAPMO ER 2018, Verco Co-listing	X-ENP-19, X-HSN 24	USA	Deck fastening
IAPMO ER 161, ASC Co-listing	X-EDN19, X-EDNK2, X-ENP-19, X-HSN 24	USA	Deck fastening
IBMB 4850-2018	X-GN, X-GHP, X-C	Germany	Fastening drywall track
IBMB 4850-2018	X-GN, X-GHP, X-C	Germany	Fastening drywall track
IBMB 2006/2011	X-U	Germany	Fastening drywall track
IBMB 3041/8171	DX-Kwik, X-CR, X-DKH, X-M6H, X-M8H	Germany	Fastening drywall track
IBMB 19210-2017	X-P, DX5, GX3, Knauf- Trockenbauwände	Germany	Fastening drywall track
IBMB 19211-2017	X-P, DX5, GX3, Siniat- Trockenbauwände	Germany	Fastening drywall track
IBMB 19212-2017	X-P, DX5, GX3, Rigips- Trockenbauwände	Germany	Fastening drywall track
IBMB 8300-2016	X-P B3, X-C B3 Knauf- Trockenbauwände	Germany	Fastening drywall track
IBMB 8302-2016	X-P B3, X-C B3 Siniat- Trockenbauwände	Germany	Fastening drywall track
IBMB 8304-2016	X-P B3, X-C B3 Rigips- Trockenbauwände	Germany	Fastening drywall track





Approval	Product	Country	Application
IBMB 4708/2014	X-GN, X-EGN, X-C, X-U, Rigips- Trockenbauwände	Germany	Fastening drywall track
IBMB 6536/8173	X-GN, X-EGN, X-C, X-U, Knauf- Trockenbauwände	Germany	Fastening drywall track
IBMB 6537/8174	X-GN, X-EGN, X-C, X-U, Siniat-Trockenbauwände	Germany	Fastening drywall track
IBMB Gutachten 1498/166/13	DX-Kwik X-HS	Germany	Ceiling hanger fastenin
IBMB 2103/900-22 MLAR	X-ECH-FE, X-EKB-FE	Germany	E-Fastening
ICC-ES ESR-1663	X-ENP-19, EDS, DS, X-C, X-C22P8TH, X-C20THP, X-CR, X-W6, W10, X-R	USA	Fastening to steel and concrete
ICC-ES ESR-1752	X-GN, X-GHP, X-EGN, X-S, X-C, X-P G3, X-P G2, X-S G3, X-C G3, X-C G2, X-C B3, X-S B3, X-P B3	USA	Fastening to steel and concrete
ICC-ES ESR-2184	X-CX ALH, X-CX C27	USA	Suspended ceiling fastening
ICC-ES ESR-2197	X-ENP-19, X-HSN 24	USA	Deck fastening
ICC-ES ESR-2269	X-U, X-U15, X-P	USA	Fastening to steel and concrete
ICC-ES ESR-2347	X-EW6H, X-EW10H; X-CR M8, X-BT, X-ST- GR	USA	Fastening to steel
ICC-ES ESR-2379	X-CF72, X-CP72	USA	Sill plate fastening
ICC-ES ESR-2776	X-ENP-19, X-HSN 24	USA	Deck fastening
ICC-ES ESR-2795	X-HS U19, X-HS U32, X-DR ALH, X-DR MX	USA	Ceiling hanger fastenin
ICC-ES ESR-3059	X-PN, X-PN 37 G2, X-PN 37 G3	USA	Plywood fastening
ITB-KOT-2019-0799	X-U, X-P, X-CC, X-HS, X-ECC, X-EHS, NPH2, X-IE, S-BT, X-C B3, X-P B3, X-C G3, X-P G3, X-PN G3	Poland	Fastening to steel and concrete





Approval	Product	Country	Application
ITB-KOT-2021/2019 wydanie 1	DNH, DS, DSH, X-DKH, NPH2, X-C P8/MX, X-C 20THP, X-C P8S23, X-C P8S23T, X-C P8S36, X-C P8TH, X-C THP, X-C P8 S15TH, X-C B3/ G2/G3 MX, X-CC DKH, X-CC CS, X-CC U, X-CR P8 S15, X-CT DP8, X-GHP, X-GN, X-HN, X-HS DKH, X-NK, X-P P8/MX, X-P B3 P7/MX, X-HS DKH, X-NK, X-P P8/MX, X-P B3 P7/MX, X-HS DKH, X-NK, X-P P8/MX, X-U 27 P8TH, X-U S12, X-U P8 S15, X-U P8S36, X-X P8/MX, X-M6H37 P8, X- M8H37P8, X-M8H P8, M10-24-32P10, W10 P10, X-M8 P8, X-M6 FP8, X-W6 FP8, X-M6-7-24 B3 P7, X-W6-12-20 B3 P7, X-W6-12-20 G3 P7, X-W6-12-20 G3 P7, X-CR M, XG-M6	Poland	Fastening to concrete
ITB-KOT-2021/1985 wydanie 1	DS, EDS, X-CR D12, X-CR S12, X-CR P8, X-R P8, X-EGN, X-U P8/ MX, X-U P8TH, X-U 15, X-U P8S15, X-U S12, X-U P8S36, X-X P8/ MX, X-ENK, X-NK S12, X-P P8/ MX, X-P G2/ G3 MX, X-S, X-S B3/ G3/ G2 MX, S-BT-EF, S-BT-ER, S-BT-GF NG, S-BT-GR NG, X-BT-ER, X-BT-MF, X-ST GF, X-M6 B3/ G3, X-EM6H, X-EM8H, X-EM10H, X-EW10H, X-FCM, X-GR, X-FCI, X-FCS-R, X-PGR-RU, X-MGR, X-HS, X-CC U16 P8	Poland	Fastening to steel
LR 03/00070(E4)	X-BT, X-BT-ER, X-BT- MR-N M8, X-FCM-R, X-FCS-R	Global	Fastening to steel, fastening to steel for offshore applications, fastening to steel for shipbuilding
LR 97/00077(E4)	X-U, EDS, DS, X-ENP-19, X-ENP2K, X-EM, X-EW, X-EF, X-HS, X-CC, X-FCM, X-FCP-F	Global	Fastening to steel





Approval	Product	Country	Application
LR 97/00078(E4)	X-CR, X-R14, X-CRM, X-ST-GR, X-FCM-R, X-FCP-R	Global	Fastening to steel, fastening to steel for offshore applications, fastening to steel for shipbuilding
LR 21394055TA	S-BT	Global	Fastening to steel, fastening to steel for offshore applications, fastening to steel for shipbuilding
LR 19-00003-02	X-BT-GR, X-BT-MR, X-BT-ER, X-FCM-R, X-FCM-R-HL, X-FCS-R	Global	Fastening to steel
MLIT 2005	X-ENP-19	Japan	Deck fastening
RINA FPE278318CS	S-BT, S-BT-ER / -EF (HC), X-FCM-M, X-FCM-R, X-FCS-R	Global	Fastening to steel, fastening to steel for offshore applications and for shipbuilding
Rom. Ministry, ICECON: AT 003-05/500-2016	E-fasteners	Romania	Cable and conduit fastening
Rom. Ministry, ICECON: AT 003-05/950-2022	E-fasteners	Romania	Cable and conduit fastening
Rom. Ministry, ICECON: AT 016-01_435-2020	X-C G3, X-P G3, X-S G3, X-M6 G3	Romania	Fastening to steel and concrete
Rom. Ministry, ICECON: AT 016-01_388-2018	X-GN, X-EGN, X-GHP	Romania	Fastening to steel and concrete
Rom. Ministry, ICECON: AT 016-01_389-2018	DX-Kwik	Romania	Fastening to concrete
Rom. Ministry, ICECON: AT 016-01_417-2019	X-BT-MR, X-BT-GR, X-BT-ER, X-FCM-R HL	Romania	Fastening to steel
Rom. Ministry, ICECON: AT 016-01/420-2020	X-U, X-C, X-P, X-CR, X-CRM, X-M6, X-ENP2K, X-EMH, X-FCM, X-SW, X-FS, X-HS, X-CC, etc.	Romania	Fastening to concrete
Rom. Ministry, ICECON: AT 016-01/435-2020	X-C G3, X-P G3, X-S G3, X-M6 G3	Romania	Cable and conduit fastening
Russian Maritime Register 18.40040.250	S-BT, S-BT-ER / -EF (HC)	Global	Fastening to steel, fastening to steel for shipbuilding
Russian Maritime Register	X-FCM-M, X-FCM-R	Global	Fastening to steel, fastening to steel for shipbuilding
Russian Maritime Register No. 20.40088.250	X-BT-MR, X-BT-GR, X-BT-ER, X-FCM-R, X-FCM-R HL, X-FCM-M	Global	Fastening to steel, fastening to steel for shipbuilding





Approval	Product	Country	Application
Russian Ministry/FCS TS/TO 5851-19	X-IE	Russia	Insulation fastening
SDI	X-ENP-19, X-HSN 24	USA	Deck fastening
Socotec N 1601601R0000003	X-IE	France	Insulation fastening
Socotec N 1601601R0000004	NPH2	France	Deck fastening
Socotec N 180668080000010	X-IE-G	France	Insulation fastening
U.S. Navy 61/09-220	Х-ВТ	USA	Fastening to steel, fastening to steel for shipbuilding
UL E257069	X-BT-M6, X-BT-W6, X-BT-M10-SN12-R, X-BT-W10-SN12-R, X-BT-R	Canada	Grounding
UL E201485	X-ECH/FR-L/-M/-S with X-U37, X-EKB MX, X-ECT MX, X-EKSC MX	USA	Cable and conduit fastening
UL E201485	X-ECH/FR-L/-M/-S with X-U37, X-EKB MX, X-ECT MX, X-EKSC MX	Canada	Cable and conduit fastening
UL E217969	X-HS W6/10 U19/22/27, X-RH, X-EMTSC, X-BX	USA	Pipe and ventilation duct fastening
UL E217969	X-HS W6/10 U19/22/27, X-RH, X-EMTSC, X-BX	Canada	Pipe and ventilation duct fastening
UL EX 2258	W10, X-EW10, X-EW6H, X-EW10H	USA	Sprinkler pipe fastening
UL EX 2258	W10, X-EW10, X-EW6H, X-EW10H	Canada	Sprinkler pipe fastening
UL R 13203	X-ENP-19, X-HSN 24	USA	Deck fastening
VHT PZ-633-20	X-U, X-P	Germany	Fastening drywall track
VHT PZ-809-15	X-U, X-P	Germany	Deflection head fastening



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