TYPE APPROVAL CERTIFICATE

Certificate No:
TAS00001SV
Revision No:
4

This is to certify:

That the Structural Connecting Elements

with type designation(s)
HILTI X-BT-GR, X-BT-MR and X-BT-ER Threaded Fasteners

Issued to
Hilti AG
Schaan, **Liechtenstein**

is found to comply with
EN 1993-1-9:2005 Eurocode 3: Design of steel structures – Part 1-9: Fatigue
IEC 62561-1:2023 Lightning protection system components (LPSC) – Part 1: Requirements for connection components
IEC 60947-7-1:2009 Low-voltage switchgear and controlgear – Part 7-1: Ancillary equipment – Terminal blocks for copper conductors
IEC 60947-7-2:2009 Low-voltage switchgear and controlgear – Part 7-2: Ancillary equipment – Protective conductor terminal blocks for copper conductors

Application :

Refer to section Application in the certificate.

Issued at **Hamburg** on **2024-07-08**
This Certificate is valid until **2028-10-05** .
DNV local unit: **Augsburg**

Approval Engineer: **Thilo Pabst**

for **DNV**

Sven Klinger
Head of Section

PRODUCT DESCRIPTION

The X-BT threaded stud product family are manufactured, assembled and used acc. specification:
“New Generation X-BT-GR, X-BT-MR and X-BT-ER Threaded Fastener Specification“ (01/2024).
The X-BT threaded stud fasteners are from austenitic-ferritic (Duplex) stainless steel, with a conical shank for attachment on one end and a threaded tip on the other end. All studs are supplied with a SN washer - stainless steel sealing washer.
The sealing ring made from rubber offers weather resistant fastenings against moisture or condensation. The sealing washer protects the fastener, the fastener hole and the area around the hole from moisture and corrosion.
The X-BT fastener will be pressed in into a pre-drilled hole.
For drilling the hole into the base material, a special stepped drill bit is needed to guarantee an accurately defined hole in terms of the borehole (depth and diameter) and the surface of the base material in the area of sealing washer.
For the installation process (pressing of stud into the hole) special piston-type tools are needed.
Detailed information to be found in the Installation Instruction of manufacturer.

Abbreviation description:
-MR: Multipurpose, stainless steel
-GR: Grating, stainless steel
-ER: Electrical connection, stainless steel

Scope / Technical data

Designation	Item Description	Application
X-BT-MR M6/10 SN 8	Stainless steel threaded stud M6 with sealing washer	Multipurpose
X-BT-MR W6/10 SN 8	Stainless steel threaded stud W6 with sealing washer	Multipurpose
X-BT-MR M8/14 SN 8	Stainless steel threaded stud M8 with sealing washer	Multipurpose
X-BT-MR M10/15 SN 8	Stainless steel threaded stud M10 with sealing washer	Multipurpose
X-BT-MR W10/15 SN 8	Stainless steel threaded stud W10 with sealing washer	Multipurpose
X-BT-GR M8/7 SN 8	Stainless steel threaded stud M8 with sealing washer	Gratings
X-BT-ER M6/3 SN 8	Stainless steel threaded stud M6 with sealing washer	Electrical connections
X-BT-ER W6/3 SN 8	Stainless steel threaded stud W6 with sealing washer	Electrical connections
X-BT-ER M8/7 SN 8	Stainless steel threaded stud M8 with sealing washer	Electrical connections
X-BT-ER M10/7 SN 8	Stainless steel threaded stud M10 with sealing washer	Electrical connections
X-BT-ER W10/7 SN 8	Stainless steel threaded stud W10 with sealing washer	Electrical connections

Material specification X-BT fasteners:

Shank and Thread:
Upper part (thread): metric (M) or inch (W) thread from 6 to 10
Lower part (shank): conical shaft with a diameter of 4.9 mm (0.19”) to 5.4 mm (0.21”)
Material: 1.4462 / S31803 (minimum equivalent to grade AISI 316 or A4) acc. DIN-EN 10088-1

SN Washer:
Dimensions: outer Ø 12.0 mm (0.47”), thickness 1.0 mm (0.04”)
Material: austenitic-ferritic (Duplex) stainless steel 1.4404 / 316L / S31603 or 1.4571 / 316Ti / S31635

Sealing ring:
Dimensions: outer Ø 10.5 mm (0.41”), inner Ø 3.9 mm (0.15”)
properties: black; resistant to UV, salt water, water, ozone, oils etc.
Material: chloroprene rubber CR 3.1107

TOOLS AND COMPONENTS OF X-BT FASTENING SYSTEM

Fastening tools and components

Designation	Item Description Tool	Item Description Component
DX 351 BTG (powder-actuated)	Fastening tool for X-BT-GR	Fastener guide: X-351-BT FG G Piston: X-351-BT P G
DX 351 BT (powder-actuated)	Fastening tool for X-BT-MR and X-BT-ER (Metric threads: M6 to M10)	Fastener guide: X-351-BT FG M1024 Piston: X-351-BT P 1024
	Fastening tool for X-BT-MR and X-BT-ER (Withworth threads W6, W10)	Fastener guide: X-351-BT FG W1024 Piston: X-351-BT P 1024
BX 3-BT (accumulator-actuated)	Fastening tool for X-BT-MR and X-BT-ER (Metric threads: M6 to M10)	Fastener guide: X-FG B3-BT M accumulator: B22 (with diverse charges)
	Fastening tool for X-BT-MR and X-BT-ER (Withworth threads W6, W10)	Fastener guide: X-FG B3-BT W accumulator: B22 (with diverse charges)
BX 3-BTG (accumulator-actuated)	Fastening tool for X-BT-GR	Fastener guide: X-FG B3-BTG accumulator: B22 (with diverse charges)
6.8/11 M brown High Precision	Hilti high precision cartridge	The recommended tool energy setting = 1 (if required, increase of energy setting based on job site tests).

Drilling tools and bits

Designation	Item Description	Application
SF BT 22-A SF BT 18-A	Hilti drilling tool	Accumulator-actuated power drill in varied sizes of series B22 (or B18).
TX-BT 4.7/7-80	Stepped shank drill bit	Drilling in steel. The three step shank drills only differ in their length. Their use depends on the accessibility condition on the jobsite.
TX-BT 4.7/7-110		
TX-BT 4.7/7-150		

APPLICATION/LIMITATION

Conditions of applications, installation instructions and load data are to be observed according to the „New Generation Hilti X-BT-GR, X-BT-MR and X-BT-ER Threaded Fastener Specification" (01/2024) and „X-BT-ER Stainless steel threaded stud for electrical connection (01/2024)"

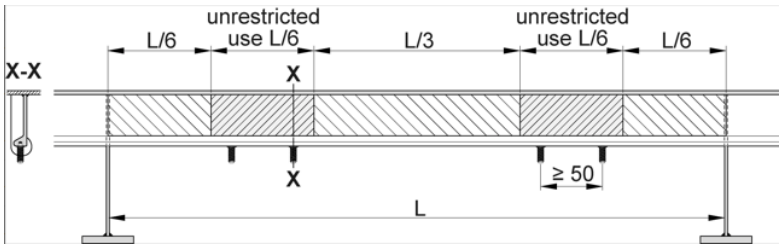
In general, the installation of the fasteners may be carried out in areas where drilling for bolting is permissible.

The fasteners may also be used for applications other than those listed below, subject to special consideration by the local DNV Surveyor.

CARBON STEEL BASE MATERIAL

The HILTI X-BT Fastening System is type examined for fastening various materials to base metals of carbon steel on board ships and other structures classed by DNV for example:

- Metal and fiberglass gratings to steel
- Cable, conduit and tubing connectors to steel
- Trays, channels and struts to steel for cable, conduit and tubing runs
- Instrumentation, junction boxes, lighting
- Pipe hangers
- Signage
- Door frames
- Mounting cabinets, securing furniture, utensils, etc.
- Grounding and bonding equipment (e.g. for equipment, pipe flanges, storage tanks, junction boxes etc.)
- Connection at stiffeners:
  Using in bulb stiffeners possible.
  Provided following conditions are observed, no further design check of the bulbs to consider the presence of the X-BT fastener is required:
  - Distance between fasteners ≥ 50 mm and not closer to stiffener end connection than L/6, where L is the length between stiffener end connections.
  - For strength decks there may be further limitations based on actual global stresses.



Base Material:

Thickness t_{II}:	t_{II} ≥ 8 mm (5/16") - without through penetration/damage of backside coating. For thinner base material thickness (4 mm ≤ t_{II} < 8 mm). the load reduction factor α (for tensile and shear forces of X-BT fastener) applies.
Tensile Strength:	No limits with regard to steel strength.
Coating:	coating thickness ≤ 500 µm

Fasteners should be installed with a distance of ≥ 10 mm (3/8") from the edge of a flange or cutout (for bulb stiffeners see details above). In case of edge distance 6 mm (1/4") ≤ c < 10 mm (3/8"), tension, shear and moment need to be reduced with the reduction factor: α = 0.65.

CAST IRON BASE MATERIAL

The HILTI X-BT Fastening System (except X-BT-ER fasteners) may also be used for fastening various materials to spheroid graphite cast-iron on-board ships and other structures classed by DNV for example:

- Cable, conduit and tubing connections
- Trays, channels and struts for cable, conduit and tubing runs
- Instrumentation, junction boxes, lighting
- T-bars for cable and conduit connections
- Pipe hangers
- Signage

Base Material:

Material thickness t_{II}:	≥ 20 mm
Minimum edge distance:	10 mm
Minimum fastener spacing:	15 mm

Cast iron specification: EN-GJS-400 to EN-GJS-600 according to EN 1563

The recommended working loads as given in the “New Generation Hilti X-BT-GR, X-BT-MR and X-BT-ER Threaded Fastener Specification” (01/2024) cover the effect of dynamic loading on the fasteners.

The X-BT fasteners are not to be used for the following locations:

- Where drilling/reducing material thickness is not permitted in general.
- For attachment of structural fire protection insulation
- On bulkheads and decks with a thickness less than 8 mm (5/16”), if through penetration of the base material is not accepted.
  If through penetration is accepted, the base material thickness can be reduced to minimum of 4 mm.
  The load reduction factor α for tensile and shear forces of X-BT fastener applies.
- On the shell plating, sea chests and collision bulkheads.

Using on watertight bulkheads and tank boundaries should be avoided.
If necessary or requested, this has to be decided case by case by the DNV Surveyor.

The selection of the Hilti X-BT Fastening System for the corresponding application and the proper assembly are to be in accordance with the instructions of the manufacturer.

FATIGUE DESIGN OF CARBON STEEL BASE MATERIAL

The X-BT fasteners are type examined to be used on structural members made from carbon steel that require fatigue verification.

Description of constructional detail:
Structural steel base material with Hilti X-BT-GR, X-BT-MR and X-BT-ER power-actuated fastener driven in pre-drilled hole.

The fatigue detail categories apply for both Ship- and Offshore steel structures as well as constructions according to Eurocode 3 (e.g. crane structures or steel towers for wind turbines).

The fatigue detail categories shall be used in combination with a fatigue assessment procedure based on summation of cumulative damage taking care of the different slopes (m_1 and m_2).

Standard fatigue detail category for steel grades S235 to S960
Fatigue verification of structural members in ship and offshore steel structures in compliance with:
DNV Recommended practices "Fatigue design of offshore steel structures": RP-C203 (2016)
For fatigue verification the characteristic fatigue S-N curve (detail category) "X-BT" as described in the "Hilti Report XE-18-12", dated 2018-05-22.
The format as specified DNVGL RP-C203 (2016) shall be used:

Parameter of S-N curve for detail category X-BT					
Detail category	**$N \leq 10^7$ cycles**		**$N > 10^7$ cycles log a_2 $m_2 = 5.0$**	**Fatigue limit at 10^7 cycles [MPa]**	**Thickness exponent k**
	m_1	**log a_1**			
X-BT*	5.0	16.300	16.300	72.4	0

*Alternatively to the proposed detail class 100 with m = 5, detail category D with m = 3 may be used for $\Delta\sigma \leq 200$ N/mm² (DNVGL RP-C203 (2016), Table 2-1, S-N curves in air).

Other constructions (e.g. crane structures or steel towers for wind turbines)" which require fatigue verification are to be made in compliance with:
Eurocode 3 (EN 1993-1-9: Eurocode 3: Design of Steel structures – Part 1.9: Fatigue)
For Fatigue verification of normal stresses, the detail category 100 (m=5) acc. to EN 1993-1-9 applies.

Requirement / Limitation

The nominal stress range [N/mm²] is to be calculated by the gross cross-section fulfilling the requirements of the nominal stress approach and limited to:

Material thicknesses t_{II}: ≥ 8 mm
Minimum edge distance: 15 mm
Minimum spacing of fasteners: 15 mm

Structural steel grades: S235 up to S960Q grades acc. to EN 10025-2, EN 10025-3, EN 10025-4, EN 10025-6 and EN 10225.

Imperfect fastener installations up to an angle of 5°, pulled-out fasteners or pre-drilled holes without fasteners are covered.

The X-BT fastening system is to be observed in view of the project specific static and dynamic load in conjunction with the latest product data sheets.

Optimized fatigue detail category for steel grades S355 to S460

Fatigue verification in compliance with:
Eurocode 3 (EN 1993-1-9: Eurocode 3: Design of Steel structures – Part 1.9: Fatigue) and
DNVGL RP-C203 (2016):
For fatigue verification the optimized fatigue S-N curve and detail category as described in the Report "Optimized fatigue classification of the constructional detail "Structural steel base material with the HILTI power-actuated threaded fastener X-BT-GR, X-BT-MR and X-BT-ER" ", dated 2019-09-17 may be used:

According EN 1993-1-9:2005:

Parameter of S-N curve for		
Detail category	**N ≤ 5*10⁶ cycles**	**N > 5*10⁶ cycles [1]**
	m_1	**m_2**
125	7	5

[1] Note: No cut-off limit at N = 1*10⁸

In format of DNVGL RP-C203 (2016):

Parameter of S-N curve for detail category X-BT					
Detail category	**N ≤ 10^7 cycles**		**N > 10^7 cycles log a_2 m_2 = 5.0**	**Fatigue limit at 10^7 cycles [MPa]**	**Thickness exponent k**
	m_1	**log a_1**			
X-BT	7.0	20.979	16.985	99.32	0

Requirement / Limitation

The nominal stress range [N/mm²] is to be calculated by the gross cross-section fulfilling the requirements of the nominal stress approach and limited to:

Material thicknesses t_{II}: ≥ 14 mm
Minimum edge distance: 15 mm
Minimum spacing of fasteners: 15 mm
Maximum Stress ratio R: + 0.5

Structural steel grades: S355 up to S460 grades acc. to EN 10025-2, EN 10025-3, EN 10025-4 and EN 10225.

Inclined fastener installations up to an angle of 5° are covered.

The X-BT fastening system is to be observed in view of the project specific static and dynamic load in conjunction with the latest product data sheets.

Not covered are structural steel base material with imperfect Hilti X-BT-GR, X-BT-MR and X-BT-ER fastener installations as pulled-out fasteners or pre-drilled holes without fasteners.

TYPE APPROVAL DOCUMENTATION

TESTS CARRIED OUT

Documentation of tests performed are the basis for this Type Approval as referenced in the list above and DNV Ref.-No. 262.1-029495

MARKING OF PRODUCT

For traceability of products, marking shall be legible and indelible.
Products are to be marked at least as follows:

- Manufacturers name or trademark - Type / Designation - Lot-number	Marking sample: 

PERIODICAL ASSESSMENT

For retention of the Type Approval, a DNV Surveyor shall perform periodical assessment to verify that the conditions for the Type Approval are complied with (refer to the Class Programme DNV-CP-0338, Sec.4.).

To check the validity of this certificate, please look it up in https://approvalfinder.dnv.com

END OF CERTIFICATE