ETA-Danmark A/S
Göteborg Plads 1
DK-2150 Nordhavn
Tel. +45 72 24 59 00
Fax +45 72 24 59 04
Internet www.etadanmark.dk

Authorised and notified according to Article 29 of the Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011

MEMBER OF EOTA

European Technical Assessment ETA-23/0001 of 2023/02/16

I General Part

Technical Assessment Body issuing the ETA and designated according to Article 29 of the Regulation (EU) No 305/2011: ETA-Danmark A/S

Trade name of the construction product:	Hilti S-BT-MR HL, S-BT-MF HL, S-BT-MF MT HL, S-BT-GR HL and S-BT-GF HL
Product family to which the above construction product belongs:	Threaded studs for connection of materials to structural steel and aluminium members
Manufacturer:	Hilti AG Feldkircherstrasse 100 FL 9494 SCHAAN Principality of Liechtenstein
Manufacturing plant:	Hilti AG – Plant 1
This European Technical Assessment contains:	18 pages including 13 annexes which form an integral part of this document
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of:	EAD 333037-00-0602 – Threaded studs for connection of materials to structural steel and aluminium members
This version replaces:	

Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and should be identified as such.

Communication of this European Technical Assessment, including transmission by electronic means, shall be in full (excepted the confidential annex(es) referred to above). However, partial reproduction may be made, with the written consent of the issuing Technical Assessment Body. Any partial reproduction has to be identified as such.

II SPECIFIC PART OF THE EUROPEAN TECHNICAL ASSESSMENT

1 Technical description of the product

The Hilti S-BT HL screw-in threaded studs are mechanical fasteners made of corrosion resistant stainless steel or galvanized and coated carbon steel with metric threads M8 or M10 or imperial thread W10 allowing connection of fixtures by means of a nut (Annex A3 to Annex A4). The studs feature a threaded tip which taps its own internal mating threads into the supporting base material and connects the stud with the base material made of steel or aluminium.

The Hilti S-BT HL screw-in threaded studs require a pre-drilled hole in the supporting steel or aluminium. For pre-drilling the hole in the base material, the corresponding stepped drill bit shall be used to achieve a defined hole geometry (hole depth and diameter).

In order to ensure the exact screw-in depth and a perfectly pressed sealing washer, the S-BT HL studs shall be installed according to the manufacturer's specifications with the installation tools and devices defined therein.

The Hilti S-BT HL screw-in threaded studs are equipped with a sealing washer, which consists of a metal washer with a sealing ring made of chloroprene rubber. The purpose of the sealing washer is to protect the pre-drilled location in the base material against corrosion.

The product description and installed condition are given in Annex A3.

2 Specification of the intended use in accordance with the applicable European Assessment Document (hereinafter EAD)

The intended use of Hilti threaded studs S-BT HL is specified in Annex B1. Fastenings are made to construction steel and aluminium.

The performances given in section 3 are only valid if the threaded studs are used in compliance with the specifications and conditions given in Annex B1 to Annex B6.

The intended use of the fastener regarding environmental conditions results from its corrosion resistance class (CRC) according to EN 1993-1-4.

The provisions made in this European Technical Assessment are based on an assumed working life of the threaded studs of at least 25 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer or Assessment Body, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

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

Essential characteristic	Performance
3.1 Mechanical resistance and stability (BWR 1)	
Tension resistance	see Annex C1
Shear resistance of individual threaded studs	see Annex C2
Shear Resistance of groups of threaded stud connections	see Annex C2
Bending moment resistance	see Annex C3
Resistance in case of combined loading (interaction)	see Annex B2
Application limits	see Annexes B1, B3, B4 and C1 to C3
Fatigue classification of base material	Detail category 100, m = 5 acc. to EN 1993-1-9 see Annex C3
3.2 Safety in case of fire (BWR 2)	
Reaction to fire	Class A1 - EN 13501-1
Resistance to fire	No performance assessed

4 Assessment and verification of constancy of performance (AVCP)

4.1 AVCP system

According to the decision 97/161/EC of the European Commission, the system(s) of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) is 2+.

5 Technical details necessary for the implementation of the AVCP system, as foreseen in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at ETA-Danmark prior to CE marking.

Issued in Copenhagen on 2023-02-16 by

Thomas Bruun
Managing Director, ETA-Danmark

Terms and symbols used in this ETA

General

Fixed material (component I) = component to be fixed to the base material

Base material (component II) = member made from steel or aluminium, into which the threaded studs are screwed-in

Threaded stud and threaded stud connections

L = total length of the threaded stud

L_1 = length of the fastening thread incl. the hexagon head

d_1 = nominal diameter of threaded tip screwed-in to the base material

d_2 = thread diameter of the threaded stud or flange nut

d_a = outer diameter of the flange nut

d_w = outer diameter of the sealing washer

AF = width across flats

h_{NVS} = fastener standoff (distance from top of the threaded stud to the surface of either coated or uncoated base material)

c = edge distance

s = spacing

T = installation torque of the flange nut, grating fastener or checker plate fastener

Fixed material (component I) and base material (component II)

t_I = thickness of fixed material (component I)

t_{II} = thickness of base material (component II)

t_c = coating thickness of base material (component II)

d_c = diameter of the clearance hole in the fixed material (component I)

Design

N_{Rk} = characteristic tension resistance

$N_{Rk,I}$ = characteristic pull-over resistance of fixed material (component I)

$N_{Rk,II}$ = characteristic tension resistance, addressing pull-out from base material (component II) and fastener failure

V_{Rk} = characteristic shear resistance

$V_{Rk,I}$ = characteristic bearing resistance of fixed material (component I)

$V_{Rk,II}$ = characteristic shear resistance, addressing failure of base material (component II) and fastener failure

$V_{Rk,II,g}$ = characteristic shear resistance of a group of fasteners, addressing failure of base material (component II) and fastener failure

M_{Rk} = characteristic bending resistance of fastener

Design (continued)

N_{Rd}	=	design tension resistance
$N_{Rd,I}$	=	design pull-over resistance of fixed material (component I)
$N_{Rd,II}$	=	design tension resistance, addressing pull-out from base material (component II) and fastener failure
V_{Rd}	=	design shear resistance
$V_{Rd,I}$	=	design bearing resistance of fixed material (component I)
$V_{Rd,II}$	=	design shear resistance, addressing failure of base material (component II) and fastener failure
$V_{Rd,II,g}$	=	design shear resistance of a group of fasteners, addressing failure of base material (component II) and fastener failure
M_{Rd}	=	design bending resistance of fastener
N_{Ed}	=	design value of the acting tensile force
V_{Ed}	=	design value of the acting shear force
M_{Ed}	=	design value of the acting bending moment
α	=	reduction factor to consider the group effect
n	=	total number of threaded studs in a group of fasteners
γ_M	=	partial factor
γ_{MII}	=	partial factor for considering base material variations
γ_{M2}	=	partial factor according to EN 1993-1-3, EN 1993-1-8 and EN 1999-1-1
$\Delta\sigma_C$	=	reference value of the fatigue strength at $N_C = 2 \cdot 10^6$ cycles
m	=	slope of fatigue strength curve

Product description: Hilti S-BT-MR HL, S-BT-MF HL, S-BT-MF MT HL, S-BT-GR HL, S-BT-GF HL

Figure A1: S-BT-MR HL, S-BT-MF HL, S-BT-MF MT HL

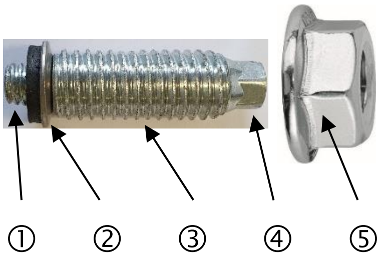


Figure A2: S-BT-GR HL, S-BT-GF HL

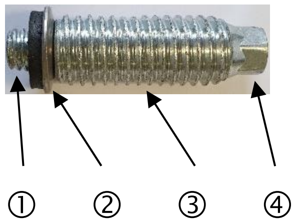


Table A1: Product description

Position	Description
①	Screw-in thread
②	Sealing washer consisting of metal washer with vulcanized sealing ring made of chloroprene rubber
③	Fastening thread (M8, M10 and W10 thread sizes)
④	Hexagon head with embossing (head mark) Stainless steel S-BT-MR HL and S-BT-GR HL: **HI** Coated carbon steel S-BT-MF HL, S-BT-MF MT HL and S-BT-GF HL: **H**
⑤	Flange nut (M8, M10 and W10)

Installed condition

Figure A3: S-BT-MR HL, S-BT-MF HL, S-BT-MF MT HL

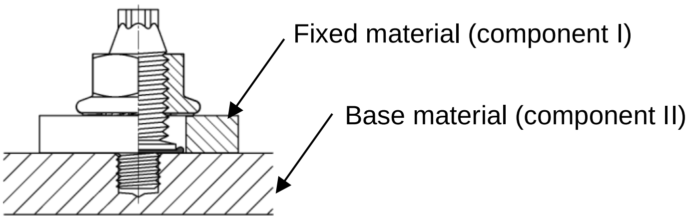
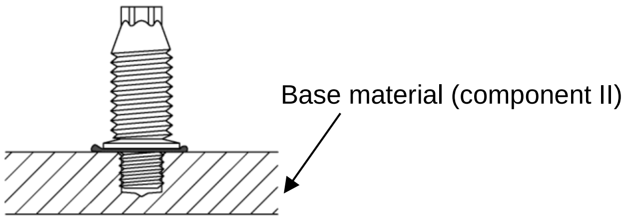


Figure A4: S-BT-GR HL, S-BT-GF HL



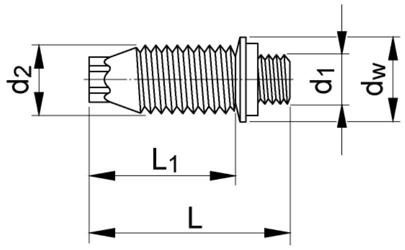
The threaded studs S-BT-MR HL, S-BT-MF HL and S-BT-MF MT HL are supplied with a flange nut, which shall be used for connecting the fixed material.

Group fastenings:
Row Setup: Positioning of maximum 4 studs in a row with shear load introduction along the row.
Rectangular Plate Setup: 2 rows with maximum 4 studs per row and symmetrical load introduction with uniform load distribution on all rows.

The threaded studs S-BT-GR HL and S-BT-GF HL are intended for fixing gratings or floor plates and are combined with a suitable grating plate or checker plate fastener after installation. The threaded studs S-BT-GR HL and S-BT-GF HL are not supplied with a flange nut. The grating plate and checker plate fastener are not part of this ETA.

Dimensions:

Figure A5: Hilti S-BT-MR HL, S-BT-MF HL, S-BT-MF MT HL, S-BT-GR HL, S-BT-GF HL and flange nuts M8, M10, W10



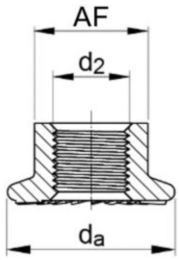


Table A2: Dimensions threaded studs

Threaded studs	L [mm]	L_1 [mm]	d_1 [mm]	d_2	d_w [mm]
S-BT-MR M8/7 SN 6 HL	23,2	17,05	5,8	acc. to M8	12
S-BT-MR M8/7 SN 6 HL AL [1)]	23,2	17,05	5,8	acc. to M8	12
S-BT-MR M8/15 SN 6 HL	33,9	27,75	5,8	acc. to M8	12
S-BT-MR M8/15 SN 6 HL AL [1)]	33,9	27,75	5,8	acc. to M8	12
S-BT-MR M10/15 SN 6 HL	33,9	27,75	5,8	acc. to M10	12
S-BT-MR M10/15 SN 6 HL AL [1)]	33,9	27,75	5,8	acc. to M10	12
S-BT-MR W10/15 SN 6 HL	33,9	27,75	5,8	acc. to W10	12
S-BT-MR W10/15 SN 6 HL AL [1)]	33,9	27,75	5,8	acc. to W10	12
S-BT-MF M8/7 AN 6 HL	23,2	17,05	5,8	acc. to M8	10
S-BT-MF M8/15 AN 6 HL	33,9	27,75	5,8	acc. to M8	10
S-BT-MF M10/15 AN 6 HL	33,9	27,75	5,8	acc. to M10	10
S-BT-MF W10/15 AN 6 HL	33,9	27,75	5,8	acc. to W10	10
S-BT-MF MT M10/15 AN 6 HL	33,9	27,75	5,8	acc. to M10	12
S-BT-MF MT W10/15 AN 6 HL	33,9	27,75	5,8	acc. to W10	12
S-BT-GR M8/7 SN 6 HL [2)]	23,2	17,05	5,8	acc. to M8	12
S-BT-GR M8/7 SN 6 HL AL [1) 2)]	23,2	17,05	5,8	acc. to M8	12
S-BT-GF M8/7 AN 6 HL [2)]	23,2	17,05	5,8	acc. to M8	10

[1)] for use in aluminum base material [2)] package does not include serrated flange nuts

Table A3: Dimensions flange nut

Flange nut	d_a [mm]	d_2	AF [mm]
M8	17,9	acc. to M8	13
M8	21,8	acc. to M8	13
M10	21,8	acc. to M10	15
W10	21,8	acc. to 3/8 UNC	14 (9/16”)

Table A4: Materials

Designation	Material	
	S-BT-MR HL, S-BT-GR HL	S-BT-MF HL, S-BT-MF MT HL, S-BT-GF HL
Threaded stud	Stainless steel 1.4462 - EN 10088-2, zinc-coated	Carbon steel grade acc. to EN ISO 16120-4 or AISI C1038, galvanized and coated
Sealing washer	Stainless steel 1.4404 - EN 10088-2 with vulcanized sealing ring made of chloroprene rubber CR 3.1107	Aluminium EN AW-5754 - EN 573-3 or stainless steel 1.4404 - EN 10088-2 with vulcanized sealing ring made of chloroprene rubber CR 3.1107
Flange nut	Stainless steel A4-70 - EN ISO 3506-2	Carbon steel, HDG, grade 8 - EN ISO 898-2

Specifications of intended use

General:

The S-BT HL threaded studs are intended to be used for redundant multiple fastening and group fastening of non-structural components.

Examples:

- Fastening of non-structural components in mechanical and electrical installations (e.g. pipes, electric conduits, installation channels etc.)
- Group fastenings (base plates of brackets or footings or other members e.g. electrical switch box)
- Fastening floor gratings and floor plates in conjunction with grating fasteners or checker plate fasteners
- Fastening of the substructure of suspended ceilings

Use of the fastening:

- Static and quasi static loading

Material of the fixed material (component I):

- non-alloy structural steel, e.g. covered by EN 1993-1-1 and the material codes given there and EN 10346, or
- corrosion resistant steel according to EN 10088-2, or
- Aluminium, e.g. according to EN 755-2 or EN 485-2

Material of the base material (component II):

- non-alloy structural steel, according to EN 1993-1-1 and the material codes given there, EN 10025, EN 10346, EN 10149 with tensile strength $360 \leq R_m \leq 760$ N/mm²
- Aluminium according to EN 1999-1-1 and the material codes given there with tensile strength $R_m \geq 270$ N/mm²
- The base material may be paint coated, hot-dipped galvanized or duplex-coated (duplex = paint applied over zinc coating) up to a maximum coating thickness of 0.75 mm.

Use conditions (environmental conditions):

- S-BT-MF HL, S-BT-MF MT HL and S-BT-GF HL threaded studs made from galvanized and coated carbon steel:
  Use in corrosivity category C1 according to EN ISO 9223 (dry internal conditions).
- S-BT-MR HL and S-BT-GR HL threaded studs made of stainless steel:
  Use in dry internal conditions and in corrosive environments. The threaded studs are allocated to the corrosion resistance class (CRC) IV according to EN 1993-1-4.
- All S-BT HL threaded studs can be used in the temperature range from −40 °C to +100 °C.

Design:

- The fasteners are designed under the responsibility of an engineer experienced in fasteners work.
- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored. The position of the threaded studs, their designation and the ETA number is indicated on the design drawings.
- The verification concept in EN 1990:2002 + A1:2005 + A1:2005/AC:2010 is used for the design of connections with S-BT HL threaded studs.
- The partial factors γ_M and γ_{MII} specified in the Annexes of this ETA are used to determine the design values of the load carrying capacity provided no other values are given in national regulations of the member states.

Design (continued)

- The design tension resistance value N_{Rd} shall be determined as follows:

$$N_{Rd} = \min \begin{cases} N_{Rd,I} \\ N_{Rd,II} \end{cases} \qquad N_{Rd,I} = \frac{N_{Rk,I}}{\gamma_{M2}} \qquad N_{Rd,II} = \frac{N_{Rk,II}}{\gamma_M \cdot \gamma_{MII}}$$

$N_{Rk,I}$ shall be calculated according to EN 1993-1-3, Table 8.3 (for fixed material made of steel with thickness $t_I \leq 3$ mm) or EN 1993-1-8, Table 3.4 (for fixed material made of steel with thickness $t_I > 3$ mm) or EN 1999-1-1, section 8.5.5 for fixed material made of aluminium applying γ_{M2} according to EN 1993-1-3, EN 1993-1-8 and EN 1999-1-1. When combining the S-BT-GR or S-BT-GF threaded studs with grating plates or checker plate fasteners, the load capacity of grating plates or checker plate fasteners can be found in the manufacturer's specifications. $N_{Rk,II}$, γ_M and γ_{MII} are listed in Annex C1.

- The design shear resistance value V_{Rd} and $V_{Rd,g}$ shall be determined as follows:

V_{Rd} for single threaded stud:

$$V_{Rd} = \min \begin{cases} V_{Rd,I} \\ V_{Rd,II} \end{cases}$$

$$V_{Rd,I} = \frac{V_{Rk,I}}{\gamma_{M2}} \qquad V_{Rd,II} = \frac{V_{Rk,II}}{\gamma_M \cdot \gamma_{MII}}$$

$V_{Rd,g}$ for a group of threaded studs:

$$V_{Rd,g} = \min \begin{cases} n \cdot V_{Rd,I} \\ V_{Rd,II,g} \end{cases}$$

$$V_{Rd,II,g} = \frac{V_{Rk,II,g}}{\gamma_M \cdot \gamma_{MII}} \qquad V_{Rk,II,g} = \alpha \cdot n \cdot V_{Rk,II}$$

$V_{Rk,I}$ shall be calculated according to EN 1993-1-3, Table 8.4 (for fixed material made of steel with thickness $t_I \leq 3$ mm) or EN 1993-1-8, Table 3.4 (for fixed material made of steel with thickness $t_I > 3$ mm) or EN 1999-1-1, section 8.5.5 for fixed material made of aluminium applying γ_{M2} according to EN 1993-1-3, EN 1993-1-8 and EN 1999-1-1.
In order to develop a joint group resistance, the shear force of every stud of the group is introduced via the sealing washer into the stud (Annex B4). $V_{Rk,II}$, α, γ_M and γ_{MII} are listed in Annex C2.

- The design moment resistance value M_{Rd} shall be determined as follows:

$$M_{Rd} = \frac{M_{Rk}}{\gamma_M \cdot \gamma_{MII}}$$

- In case of combined tension and shear loading, the resistance of the fixed material (component I) shall be calculated according to EN 1993-1-3, EN 1993-1-8 or EN 1999-1-1 by the interaction formula given there.
- In case of combined tension and shear loading and/or bending moment, the resistance – related with failure of the base material (component II) and the fastener failure - can be calculated by the interaction formulas in Table B1.

Table B1: Interaction

Load combination	Interaction provision
Shear - Tension	$\frac{V_{Ed}}{V_{Rd}} + \frac{N_{Ed}}{N_{Rd}} \leq 1{,}0$
Shear – Bending moment	$\frac{V_{Ed}}{V_{Rd}} + \frac{M_{Ed}}{M_{Rd}} \leq 1{,}0$
Tension – Bending moment	$\frac{N_{Ed}}{N_{Rd}} + \frac{M_{Ed}}{M_{Rd}} \leq 1{,}0$
Shear − Tension – Bending moment	$\frac{V_{Ed}}{V_{Rd}} + \frac{N_{Ed}}{N_{Rd}} + \frac{M_{Ed}}{M_{Rd}} \leq 1{,}0$

Design (continued)

- When using S-BT HL threaded studs installed into structural steel base elements that are subjected to cyclic loading, the effect of the threaded studs on the fatigue strength of the steel base material has to be considered. The design is carried out according to EN 1993-1-9.
  The construction detail „Steel base material with S-BT HL threaded studs" and the corresponding detail category $\Delta\sigma_C$ is listed in Annex C3, Table C4.

Installation:

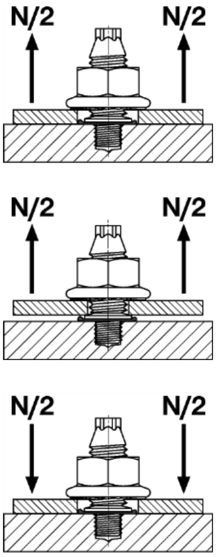
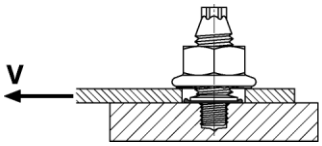
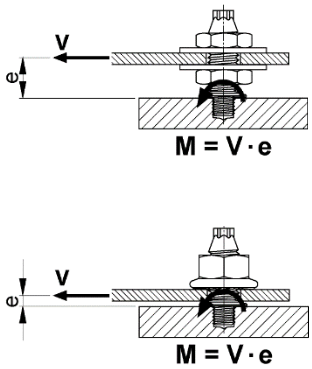
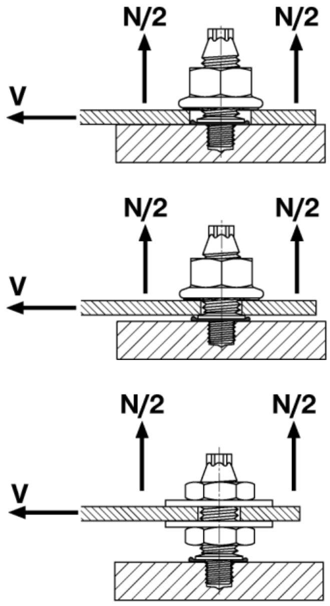
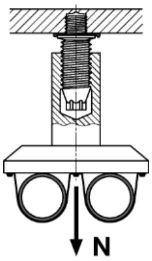
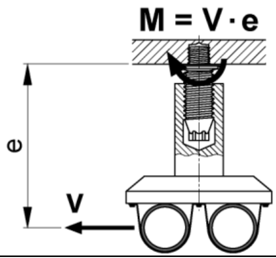
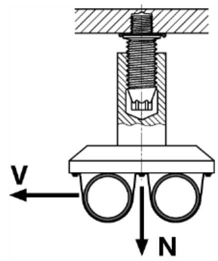
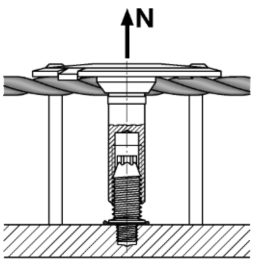
- The installation is carried out according to the manufacturer's specifications with the tools and devices defined therein.
- The installation is carried out by appropriately qualified personnel and under the supervision of the site manager.
- The S-BT HL threaded stud and the bore hole in the base material may only be used once.
- When installing the S-BT HL threaded studs in steel base material with a thickness of 3,0 mm ≤ t_{II} < 6,0 mm, any corrosion protection coating on the reverse side of the base material will be damaged. A repair of the existing corrosion protection coating may have to be considered.
- Only S-BT-MR HL and S-BT-GR HL threaded studs made of stainless steel are to be used for fixings on aluminium base materials.
- The application limits (maximum and minimum tensile strength as well as minimum thickness of component I and component II) must be observed.
- The tightening torque T for the flange nut and grating fastener depends on the type of base material and the thickness of the base material. These details can be found in the installation instructions for the S-BT HL threaded studs or in Table B2 of this ETA. The tightening torque T must not be exceeded. Exceeding the tightening torque T leads to damage of the S-BT HL stud's anchorage with negative impact on the load values and the sealing function.

Table B2: Installation parameters

<table>
<tr><th rowspan="2">Threaded studs</th><th rowspan="2">$t_{I,min}$ [mm]</th><th rowspan="2">$t_{I,max}$ [mm]</th><th rowspan="2">$d_{c,max}$ [mm]</th><th rowspan="2">$t_{II,min}$ [mm]</th><th rowspan="2">$t_{c,max}$ [mm]</th><th colspan="2">T_{max} [Nm]</th><th rowspan="2">AF [mm]</th></tr>
<tr><th>t_{II} ≥ 3 mm < 5 mm</th><th>t_{II} ≥ 5 mm</th></tr>
<tr><td>S-BT-MR M8/7 SN 6 HL</td><td rowspan="14">2,5</td><td rowspan="2">7</td><td rowspan="8">14 [1)]</td><td>3</td><td rowspan="17">0,75 [2)]</td><td>8</td><td>16</td><td rowspan="4">13</td></tr>
<tr><td>S-BT-MR M8/7 SN 6 HL AL</td><td>5</td><td>n.a.</td><td>8</td></tr>
<tr><td>S-BT-MR M8/15 SN 6 HL</td><td rowspan="6">15</td><td>3</td><td>8</td><td>16</td></tr>
<tr><td>S-BT-MR M8/15 SN 6 HL AL</td><td>5</td><td>n.a.</td><td>8</td></tr>
<tr><td>S-BT-MR M10/15 SN 6 HL</td><td>3</td><td>8</td><td>16</td><td rowspan="2">15</td></tr>
<tr><td>S-BT-MR M10/15 SN 6 HL AL</td><td>5</td><td>n.a.</td><td>8</td></tr>
<tr><td>S-BT-MR W10/15 SN 6 HL</td><td>3</td><td>8</td><td>16</td><td rowspan="2">14 (9/16")</td></tr>
<tr><td>S-BT-MR W10/15 SN 6 HL AL</td><td>5</td><td>n.a.</td><td>8</td></tr>
<tr><td>S-BT-MF M8/7 AN 6 HL</td><td>7</td><td rowspan="3">12 [1)]</td><td rowspan="6">3</td><td rowspan="7">8</td><td rowspan="7">16</td><td rowspan="2">13</td></tr>
<tr><td>S-BT-MF M8/15 AN 6 HL</td><td rowspan="5">15</td></tr>
<tr><td>S-BT-MF M10/15 AN 6 HL</td><td rowspan="2">15</td></tr>
<tr><td>S-BT-MF MT M10/15 AN 6 HL</td><td>14 [1)]</td></tr>
<tr><td>S-BT-MF W10/15 AN 6 HL</td><td>12 [1)]</td><td rowspan="2">14 (9/16")</td></tr>
<tr><td>S-BT-MF MT W10/15 AN 6 HL</td><td>14 [1)]</td></tr>
<tr><td>S-BT-GR M8/7 SN 6 HL</td><td rowspan="3">-</td><td rowspan="3">-</td><td rowspan="3">-</td><td>3</td><td rowspan="3">-</td></tr>
<tr><td>S-BT-GR M8/7 SN 6 HL AL</td><td>5</td><td>n.a.</td><td>8</td></tr>
<tr><td>S-BT-GF M8/7 AN 6 HL</td><td>3</td><td>8</td><td>16</td></tr>
</table>

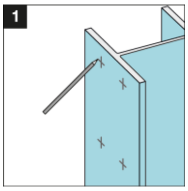
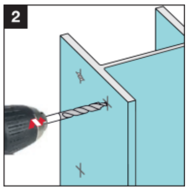
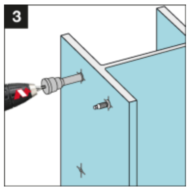
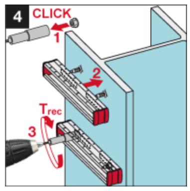
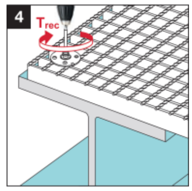
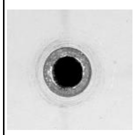
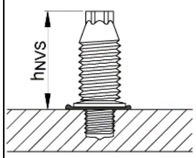
[1)] $d_{c,max}$ = 18 mm if only tensile or pressure loading apply and in combination with the flange nut M8 with d_a = 21,8 mm or flange nut M10, W10.
[2)] Value only applies to steel base material.

Table B3: Type of connections and loading conditions

Fastening of components to base material with nut			
Tensile / pressure loading	Lateral shear loading (Introduction of the shear load via the sealing washer)	Bending loading (Introduction of the shear load via the thread)	Interaction
			
Fastening of components in mechanical and electrical installations [1)]			
Tensile loading	-	Bending loading	Interaction
			
Fastening of gratings and floor plates [1)]			
Tensile loading			
	-	-	-

[1)] The components for fastening mechanical and electrical installations, grating plate fastener and checker plate fastener are not part of this ETA.

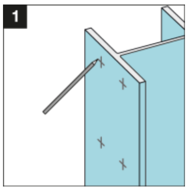
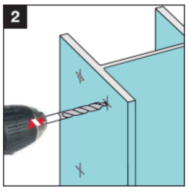
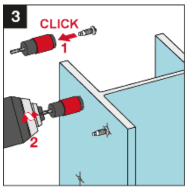
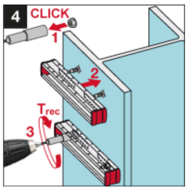
Table B4: General installation instruction. Installation with calibrated depth gauge S-DG BT.
Hilti S-BT-MR HL, S-BT-MF HL, S-BT-MF MT HL, S-BT-GR HL, S-BT-GF HL

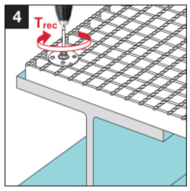
Mark location for each fastening	Pre-drill with TS-BT stepped drill bit	Screw-in S-BT HL stud into drilled hole	Fasten component or grating on base material
			 
	Usage of drill driver SBT 4-A22 or SF 6-(A)22. Pre-drill until the shoulder grinds a shiny ring to assure proper drilling depth.  Before fastener installation: The drilled hole and the area around the drilled hole must be clear of liquids and debris.	Usage of drill driver SBT 4-A22 or SF 6-(A)22 in combination with the calibrated depth gauge S-DG BT. Verify stud stand-off h_{NVS} with check gauge S-CG BT  Sealing washer must be properly compressed.	Position component or grating on S-BT HL studs and hold in place. Tighten the nuts or grating fastener with the suited tightening torque T. Tighten the nuts using: • Torque wrench and wrench socket, or • Torque tool S-BT 1/4" - 8 Nm or S-BT 1/4" - 16 Nm, or • Drill driver SBT 4-A22 or SF 6-(A)22 and suitable wrench socket S-NS

Hilti drill driver:	T	
	8 Nm	16 Nm
	Torque-setting:	
SBT 4-A22	7	n.a.
SF 6-(A)22	3	4

Note: Table B4 shows only the general installation steps, which may vary depending on the S-BT HL threaded stud type and application. Always follow the installation instructions accompanying the respective S-BT HL threaded stud.

**Table B5: General installation instruction. Installation with Hilti SBT 6-22 cordless drill driver.
Hilti S-BT-MR HL, S-BT-MF HL, S-BT-MF MT HL, S-BT-GR HL, S-BT-GF HL**

<table>
<tr><th>Mark location for each fastening</th><th>Pre-drill with TS-BT stepped drill bit</th><th>Screw-in S-BT HL stud into drilled hole</th><th>Fasten component or grating on base material</th></tr>
<tr><td>
</td><td>
</td><td>
</td><td>


</td></tr>
<tr><td></td><td>Usage of drill driver Hilti SBT 6-22.
Using “Drill assist” mode.
Set the gear selector switch to 2 and BT clutch setting.
Speed of the tool reduces automatically when the hole is drilled to the correct depth. A shiny ring should be visible around the borehole after the drilling process.

Before fastener installation:
The drilled hole and the area around the drilled hole must be clear of liquids and debris.</td><td>Usage of drill driver Hilti SBT 6-22 in combination with the stud holder S-SH BT.
Using “Fasten S-BT stud” mode.
Set the gear selector switch to 1 and BT clutch setting. Insert the S-BT stud into the stud holder. The torque limiter trips when the stud reaches the correct depth.
Sealing washer must be properly compressed.</td><td>Position component or grating on S-BT HL studs and hold in place. Tighten the nuts or grating fastener with the suited tightening torque T.
Tighten the nuts using:
• Torque wrench and wrench socket, or
• Torque tool S-BT 1/4” - 8 Nm or S-BT 1/4” - 16 Nm, or
• Drill driver SBT 6-22 and suitable wrench socket S-NS
<table>
<tr><td rowspan="3">Hilti drill driver:</td><td colspan="2">T</td></tr>
<tr><td>8 Nm</td><td>16 Nm</td></tr>
<tr><td colspan="2">Torque-setting:</td></tr>
<tr><td>SBT 6-22</td><td>3</td><td>4</td></tr>
</table></td></tr>
</table>

Note: Table B5 shows only the general installation steps, which may vary depending on the S-BT HL threaded stud type and application. Always follow the installation instructions accompanying the respective S-BT HL threaded stud.

Table C1: Characteristic tension resistance for Hilti S-BT-MR HL, S-BT-MF HL, S-BT-MF MT HL, S-BT-GR HL, S-BT-GF HL

			S-BT-MR HL, S-BT-GR HL	S-BT-MF HL, S-BT-GF HL, S-BT-MF MT HL
Steel failure threaded studs and pull-out				
Steel S235 to S500 - EN 10025, S280GD to S550GD - EN 10346, S315MC to S550MC - EN 10149 Thickness 3,0 mm ≤ t_{II} < 5,0 mm				
Characteristic tension resistance	$N_{Rk,II}$ [1]	[kN]	6,50	6,50
Steel S235 to S500 - EN 10025, S280GD to S550GD - EN 10346, S315MC to S550MC - EN 10149 Thickness t_{II} ≥ 5,0 mm				
Characteristic tension resistance	$N_{Rk,II}$ [1]	[kN]	10,10	11,30
Aluminium [2] - EN 1999-1-1 Thickness t_{II} ≥ 5,0 mm				
Characteristic tension resistance	$N_{Rk,II}$	[kN]	5,90	- [3]
Spacing	s	[mm]	≥ 18,0 for nut M8 with d_a = 17,9 mm ≥ 22,0 for nut M8 with d_a = 21,8mm ≥ 22,0 for nut M10 and W10	
Edge distance	c	[mm]	≥ 6,0	
Coating thickness of steel base material	t_c	[mm]	≤ 0,75	
Partial factor [4]	γ_M	[-]	1,25	
Partial factor [4]	γ_{MII}	[-]	1,60	

[1] The characteristic tension resistance $N_{Rk,II}$ may be increased by 20% when using steel base material S355 to S500 - EN 10025, S390GD to S550GD - EN 10346, S420MC to S550MC - EN 10149.

[2] Tensile strength R_m ≥ 270 N/mm²

[3] Only S-BT-MR HL and S-BT-GR HL threaded studs made of stainless steel are to be used for fixings on aluminium base materials.

[4] In the absence of national regulations.

Table C2: Characteristic shear resistance for Hilti S-BT-MR HL, S-BT-MF HL, S-BT-MF MT HL, S-BT-GR HL, S-BT-GF HL

			S-BT-MR HL S-BT-GR HL	S-BT-MF HL S-BT-GF HL	S-BT-MF MT M10/15 AN 6 HL S-BT-MF MT W10/15 AN 6 HL
Steel failure threaded studs and pull-out					
Steel S235 to S500 - EN 10025, S280GD to S550GD - EN 10346, S315MC to S550MC - EN 10149 Thickness 3,0 mm ≤ t_{II} < 5,0 mm					
Characteristic shear resistance	$V_{Rk,II}$ [1]	[kN]	11,10	7,70	11,10
Reduction factor considering group effect	α [3]	[-]	0,96	0,85	0,60
Steel S235 to S500 - EN 10025, S280GD to S550GD - EN 10346, S315MC to S550MC - EN 10149 Thickness t_{II} ≥ 5,0 mm					
Characteristic shear resistance	$V_{Rk,II}$ [1]	[kN]	11,40	7,70	11,10
Reduction factor considering group effect	α [3]	[-]	0,96	0,98	0,71
Aluminium [2] - EN 1999-1-1 Thickness t_{II} ≥ 5,0 mm					
Characteristic shear resistance	$V_{Rk,II}$ [1]	[kN]	8,40	- [4]	- [4]
Reduction factor considering group effect	α [3]	[-]	0,76	- [4]	- [4]
Spacing	s	[mm]	≥ 18,0 for nut M8 with d_a = 17,9 mm ≥ 22,0 for nut M8 with d_a = 21,8mm ≥ 22,0 for nut M10 and W10		≥ 22,0
Edge distance	c	[mm]	≥ 6,0		
Coating thickness of steel base material	t_c	[mm]	≤ 0,75		
Partial factor [5]	γ_M	[-]	1,25		
Partial factor [5]	γ_{MII}	[-]	1,60		

[1] The characteristic shear resistance $V_{Rk,II}$ is related to a shear load introduction via the sealing washer according to Table B3. In case of a shear load introduction via the fastening thread, the additional bending moment due to the resulting eccentricity has to be considered in design.

[2] Tensile strength R_m ≥ 270 N/mm²

[3] The maximum clearance hole d_c in the fixed material amounts to 14 mm for S-BT-MR HL, S-BT-GR HL, S-BT-MF MT HL and 12 mm for S-BT-MF HL, S-BT-GF HL.
The shear load is introduced via the sealing washer as shown in Table B3.
The performance reduction factor α covers group effects with a row-setup of maximum 4 studs or a rectangular plate setup of 2 rows with maximum 4 studs per row and symmetrical load introduction with uniform load distribution on all rows.

[4] Only S-BT-MR HL and S-BT-GR HL threaded studs made of stainless steel are to be used for fixings on aluminium base materials.

[5] In the absence of national regulations.

Table C3: Characteristic bending resistance for Hilti S-BT-MR HL, S-BT-MF HL, S-BT-MF MT HL, S-BT-GR HL, S-BT-GF HL

			S-BT-MR HL, S-BT-GR HL	S-BT-MF HL, S-BT-GF HL, S-BT-MF MT HL
Steel failure with lever arm				
Steel S235 to S500 - EN 10025, S280GD to S550GD - EN 10346, S315MC to S550MC - EN 10149 Thickness ≥ 3,0 mm				
Characteristic bending resistance	M_{Rk}	[Nm]	19,50	11,80
Aluminium [1] - EN 1999-1-1 Thickness t_{II} ≥ 5,0 mm				
Characteristic bending resistance	M_{Rk}	[Nm]	19,50	- [2]
Spacing	s	[mm]	≥ 18,0 for nut M8 with d_a = 17,9 mm ≥ 22,0 for nut M8 with d_a = 21,8mm ≥ 22,0 for nut M10 and W10	
Edge distance	c	[mm]	≥ 6,0	
Coating thickness of steel base material	t_c	[mm]	≤ 0,75	
Partial factor [3]	γ_M	[-]	1,25	
Partial factor [3]	γ_{MII}	[-]	1,00	

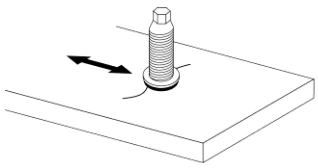
[1] Tensile strength R_m ≥ 270 N/mm²

[2] Only S-BT-MR HL and S-BT-GR HL threaded studs made of stainless steel are to be used for fixings on aluminium base materials.

[3] In the absence of national regulations.

Fatigue classification of steel base material for thickness t_{II} ≥ 3 mm

Table C4: Construction detail „Steel base material with Hilti S-BT HL threaded studs“ in compliance with EN 1993-1-9

Detail category	Construction detail	Description	Requirements
100 m = 5		Hilti threaded studs S-BT-MR HL, S-BT-MF HL, S-BT-MF MT HL, S-BT-GR HL and S-BT-GF HL with pre-drilled hole in structural steel base material. Imperfect fastener installations as e.g. overwound or pulled-out fasteners are covered.	$\Delta\sigma$ to be calculated on the gross cross section. Base material thickness t_{II} ≥ 3 mm. Steel base material S235 to S355 according to EN 10025.