TYPE APPROVAL CERTIFICATE
No. **FPE278318CS/001**

This is to certify that the product identified below satisfies the requirements of the standard quoted under "Reference standard"

Description	**Fixing System with Screw-in Threaded Stud**
Type	**Hilti S-BT**
Applicant	**Hilti Italia S.p.A.** **Piazza Indro Montanelli, 20** **20099 Sesto San Giovanni (MI)** **ITALY**
Manufacturer *Place of manufacture*	**HILTI AKTIENGESELLSCHAFT** **FELDKIRCHERSTRASSE 100** **9494 Schaan** **LIECHTENSTEIN**
Reference standards	**Chap. II-2 of SOLAS 74 Convention, as amended; IMO 2010 FTP CODE Annex 1 Part 3; RINA Rules for Type Approval products, equipment and machinery; EN 1993-1-9:2005 Eurocode 3: Design of steel structures - Part 1-9: Fatigue; ISO 9227:2017 Corrosion tests in artificial atmospheres - Salt spray tests; ISO 16701:2015 corrosion of metals and alloys - Corrosion in artificial atmosphere - Accelerated corrosion test involving exposure under controlled conditions of humidity cycling and intermittent spraying of a salt solution; 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; IEC 62561-1:2017 Lightning protection system components (LPSC) - Part 1: Requirements for connection components; EAD 333037-00-0602: European Assessment Document (EAD): Threaded studs for connection of materials to structural steel and aluminium members**
Reference documents	**RINA Type Approval System**

Issued in **Genoa** on **June 22, 2021**. *This Certificate is valid until* **June 21, 2026**

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Technical characteristics and Description

S-BT fastening system alternative to welding, using threaded studs screwed in into a pre-drilled hole.

Materials		
Stud	hardened Carbon Steel 1038	
	Stainless steel 1.4462 DIN-EN 10088-1 (AISI 316 SS equivalent)	
Sealing (ship's structure side)	Carbon Steel studs	D. 10 mm Aluminum washer with chloroprene rubber CR 3.1102 sealing ring
	Stainless Steel studs	D. 12 mm Stainless Steel washer with chloroprene rubber CR 3.1102 sealing ring
Couplings		
Type	***Side of stud***	***Size***
Threaded (male)	embedment to ship's structure	D. 5.8 mm
	side for fastening	M8, M10 (male)
		W 10 (male)
Application		
Hull/Structure material	***Thickness (t_n) mm [inches]***	***Treatment***
Steel	3 [0.12] ≤ $\mathbf{t_n}$ < 6 [0.24]	re-coating on back side[(1)]
Aluminum	5 [0.20] ≤ $\mathbf{t_n}$ < 6 [0.24]	
All materials	$\mathbf{t_n}$ ≥ 6 [0.24]	none
Grating fastener	***Grating height (HG) mm [inches]***	***Material***
X-FCM-R	25 [0.98] ≤ **HG** ≤ 50 [1.97]	Stainless steel
X-FCM-R (+ extension adapter)	55 [2.16] ≤ **HG** ≤ 80 [3.15]	Stainless Steel
X-FCM-M	25 [0.98] ≤ **HG** ≤ 50 [1.97]	Carbon steel duplex coated
X-FCS-R	31 [1.22] ≤ **HG** ≤ 41 [1.61]	Stainless steel
X-FCM-R NG	28 [1.10] ≤ **HG** ≤ 53 [2.09]	Stainless steel
X-FCM-R NG (+ extension coupler)	58 [2.28] ≤ **HG** ≤ 83 [3.27]	Stainless steel
X-FCM-M NG	28 [1.10] ≤ **HG** ≤ 53 [2.09]	Carbon steel duplex coated

(1): pre drilled-through holes

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Product Types and Models

Type of fastening	*Stud material*	*Code and Size*
Multipurpose	Carbon Steel	S-BT-MF M8/7 AN 6
		S-BT-MF MT M8/7 AN 6
		S-BT-MF M8/15 AN 6
		S-BT-MF M10/15 AN 6
		S-BT-MF MT M10/15 AN 6
		S-BT-MF W10/15 AN 6
	Stainless Steel	S-BT-MR M8/7 SN 6
		S-BT-MR MT M8/7 SN 6
		S-BT-MR M8/7 SN 6 AL
		S-BT-MR M8/15 SN 6
		S-BT-MR M8/15 SN 6 AL
		S-BT-MR M10/15 SN 6
		S-BT-MR MT M10/15 SN 6
		S-BT-MR M10/15 SN 6 AL
		S-BT-MR W10/15 SN 6
		S-BT-MR W10/15 SN 6 AL
Gratings fastening	Carbon Steel	S-BT-GF M8/7 AN 6
		S-BT-GF NG M8/7 AN 6
	Stainless Steel	S-BT-GR M8/7 SN 6
		S-BT-GR NG M8/7 SN 6
		S-BT-GR M8/7 SN 6 AL
Electrical connections	Carbon Steel	S-BT-EF M8/15 AN 6
		S-BT-EF M10/15 AN 6
		S-BT-EF W10/15 AN 6
	Stainless Steel	S-BT-ER M8/15 SN 6
		S-BT-ER M10/15 SN 6
		S-BT-ER W10/15 SN 6
Electrical connections (high current)	Carbon Steel	S-BT-EF M10 HC 35
		S-BT-EF W10 HC AWG2
		S-BT-EF M10 HC 120
		S-BT-EF W10 HC AWG4/0
	Stainless Steel	S-BT-ER M10 HC 35
		S-BT-ER W10 HC AWG2
		S-BT-ER M10 HC 120
		S-BT-ER W10 HC AWG4/0

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Reference documents

1. Drawings (RINA Approval N.)

- N. CSST-19312 : Specification and Technical Binder - Hilti_S-BT - Rev. 12/2020
- N. CSST-19313 : Threaded stud S-BT F - 5181496 / 10 / 654341
- N. CSST-19314 : Threaded Stud S-BT R - 5179696 / 08 / 620401
- N. PSST-20302 : Nut HDG - 5249460 / 01 / 603918
- N. PSST-20304 : Nut A4 - 5249450 / 01 / 603918
- N. PSST-20305 : Washer SN/AN assy - 5179764 / 01 / 607297
- N. CSST-19315 : Tech. Manual S-BT Product Pages Ed. 12/2020
- N. CSST-19316 : Tech. Manual S-BT-ER/EF (for Electrical Connect.) Product Pages Ed. 12/2020
- N. CSST-19317 : Tech. Manual S-BT X-FCM NG - Grating Fastening System Ed. 12/2020
- N. CSST-19318 : Tech. Data Sheet X-FCM - Grating Fastening System
- N. PSST-20309 : Application Fields in Shipbuilding - Hilti S-BT App

2. Declarations and Test Reports (RINA Filing N.)

- N. PSST-20310 : Hilti Declaration on use in shipbuilding - Hilti S-BT 17_01_2018
- N. PSST-20311 : Hilti Declaration annotations by Shipyard - LR PRJ11074092
- N. PSST-20312 : Test Report FTP Code No.1 - 2016614_en
- N. PSST-20313 : Test Report FTP Code No.2 (Water-tightness) - 20161614-01_en
- N. PSST-20314 : Test Report FTP Code No.3 - 20170384_en
- N. PSST-20315 : Test Report Corrosion - UB_903 0160 000/Bf
- N. PSST-20316 : Test Report Galvan. Corrosion - TM_414-14_2
- N. PSST-20317 : Test Report Fatigue Loading - 5214011585/e
- N. PSST-20318 : Test Report Fatigue Loading - 5214014601/e
- N. PSST-20319 : Test Report Fatigue Loading - 5214013022/e
- N. PSST-20320 : Test Report Tension Shear & Bending - 279-15
- N. CSST-19319 : Test Report Tension Shear & Bending - 118-19
- N. CSST-19320 : Test Report Tension & Bending S-BT-GF - 115-19
- N. CSST-19321 : Test Report Tension Bending Moment Resistance - 214-20
- N. CSST-19322 : Evaluation Report Tension & Shear Load - XSMSse-1/2019
- N. CSST-19323 : Evaluation Report Tension & Shear Load - Studs w/coupler RC-MF/MR - XSMSse-01/2020
- N. CSST-19324 : Evaluation Report Tension & Shear Load - Standoff adapter RC-MF/MR - XSMSse-02/2020
- N. CSST-19331 : Evaluation Report on Fixing System - 2020-23X
- N. CSST-19332 : QN Report Narrow Grating System X-FCM NG - 201013_NGR X-FCM NG QN
- N. CSST-19333 : Report on "Pull-out" testing S-BT/X-BT Studs - XSEdp_11-20
- N. PSST-20321 : Test Report Fatigue loading - 2017-38X
- N. PSST-20322 : Test Report High Current M10 - 1795_FRM_02
- N. PSST-20323 : Test Report High Current M10 50 kA - FRM-1648
- N. PSST-20324 : Test Report High Current M10 50 kA - FRM-1649
- N. PSST-20325 : Test Report High Current M10 100 kA - FRM-1650
- N. PSST-20326 : Test Report Short-time Current - FRM-1689
- N. PSST-20327 : Electrosuisse Testing Plan S02 - 16-IK-0021.S02 Annex
- N. PSST-20328 : Electrosuisse Experts Report S02 - 17-IK-0093.S02
- N. PSST-20798 : Test Report Lighting Current M10 100 kA - 1798_FRM_00
- N. PSST-20798 : Test Report Lighting Current M10 HC35 100 kA - 1834_PAM_1
- N. PSST-20798 : Hilti Evaluation Report Electrical Connections - XSMSse-02-18
- N. PSST-20798 : Electrosuisse Testing Plan S04 - 17-IK-0021.S04 Annex
- N. PSST-20798 : Electrosuisse Experts Report S04 - 17-IK-0021.S04
- N. CSST-19334 : EAD 333037-00-0602 Threaded Studs for connection - 19-33-3037-06.2
- N. CSST-19335 : ETA-20/0530 Threaded Studs for connection - 8.06.02-414/17
- N. CSST-19336 : ISO Certification Production Site - H12455

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Fields of application and Acceptance conditions

1.
Locations and conditions for use in shipbuilding as per following table:

Aluminum Base Materials			
Threaded Stud	**Base Material Characteristics**	**Thickness (t_{II}) mm**	**Recommended Loads[1]**
S-BT-MR/S-BT-GR Stainless Steel	$R_m \geq 270$ N/mm^2	$\mathbf{t_{II}} \geq 5$	• Tension: 1.9 kN • Shear[2]: 2.9 kN/3.5 kN • Moment: 11.1 Nm
Steel Base Materials			
Threaded Stud	**Base Material Characteristics**	**Thickness (t_{II}) mm**	**Recommended Loads[1]**
S-BT-MR/S-BT-GR Stainless Steel	S235 A36	$\mathbf{t_{II}} \geq 5$	• Tension: 1.9 kN • Shear: 2.5 kN/4.0 kN • Moment: 11.1 Nm
	S355, S420 Grade 50		• Tension: 2.3 kN • Shear: 2.8 kN/4.0 kN • Moment: 11.1 Nm
	S235 A36	$3 \leq \mathbf{t_{II}} < 5$	• Tension: 1.8 kN • Shear: 2.4 kN/3.8 kN • Moment: 11.1 Nm
	S355, S420 Grade 50		• Tension: 2.1 kN • Shear: 2.5 kN/3.8 kN • Moment: 11.1 Nm
S-BT-MF/S-BT-GF duplex-coated carbon steel	S235 A36	$\mathbf{t_{II}} \geq 5$	• Tension: 2.0 kN • Shear: 2.5 kN/2.7 kN • Moment: 6.7 Nm
	S355, S420 Grade 50		• Tension: 2.4 kN • Shear: 2.8 kN/2.9 kN • Moment: 6.7 Nm
	S235 A36	$3 \leq \mathbf{t_{II}} < 5$	• Tension: 1.9 kN • Shear: 2.4 kN/2.7 kN • Moment: 6.7 Nm
	S355, S420 Grade 50		• Tension: 2.3 kN • Shear: 2.5 kN/2.9 kN • Moment: 6.7 Nm

Conditions:
1. Minimum edge distance = 6 mm, spacing ≥ 18 mm 2. Redundancy (multiple fastening) to be provided

[1] **Design Resistance:** as per indications given in Hilti SB-T Specification and Technical Binder Edition 12/2020
[2] **Shear values:** for edge distances "c" respectively of **(**6 mm ≤ **c** < 15 mm) and (c ≥ 15 mm), separated by "/"

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Steel Fire resisting A0 to A60 Class Boundaries			
Material Characteristics	**Thickness (t_{II}) mm**	**Drill Hole Type**	**Recommended Loads**[(1)]
Ultimate Tensile Strength $\mathbf{R_m}$ $340 \leq \mathbf{R_m} \leq 630$ Mpa	$\mathbf{t_{II}} \geq 6$	Pilot (no through)	• Tension R60: 0.50 kN • Shear R60: 0.50 kN
	$5 \leq \mathbf{t_{II}} < 6$	Drill through	
	$3 \leq \mathbf{t_{II}} < 5$	Drill through	• Tension R60: 0.25 kN • Shear R60: 0.25 kN

Conditions:
1. Minimum edge distance = 6 mm, spacing ≥ 18 mm
2. Redundancy (multiple fasten.) to be provided and studs installed on the unexposed face of the bulkhead
3. Insulation turn-up typical for 450 mm and over standard brackets to be applied

Watertight Boundaries and Tanks			
Material Characteristics	**Thickness (t_{II}) mm**	**Drill Hole Type**	**Recommended Loads**[(1)]
Standard for Tanks	$\mathbf{t_{II}} \geq 6$	Pilot (no through)	---

Conditions:
1. On curved surfaces: minimum outer diameter ≥ 150 mm
2. Maximum pressure in tanks: 3.0 bar

Structural Members requiring Fatigue design		
Material Characteristics	**Thickness (t_{II}) mm**	**Design S-N Curve and Fatigue Class (EN 1993-1-9)**
Ultimate Tensile Strength $\mathbf{R_m}$ $340 \leq \mathbf{R_m} \leq 630$ Mpa	$\mathbf{t_{II}} \geq \mathbf{3}$	Category 100 m = 5

Note
A detailed verification of the fatigue stress is considered not necessary in case of:

1. Decks "*Micro Openings* ": circular openings with D ≤ 250 [mm] (e.g. scuppers, small pipes, etc.
2. Transversal bulkheads "*Micro Openings* ": inside and outside the Construction Monitoring Area: circular openings D < 250 [mm] may be accepted if isolated (and plasma cut or equivalent when in Construction Monitoring Area only.
3. Longitudinal bulkheads "*Micro Openings* ": inside and outside the Construction Monitoring Area: circular openings D < 250 [mm] may be accepted if isolated (and plasma cut or equivalent).

2.
For all installation cases the S-BT studs must not be positioned in the thickness change areas (e.g. reinforcements in the corners of the holes) or positioned so as to pierce the welding seam.

3.
Adequate corrosion resistance of both the base and fastened materials are to be checked by the installation user for their suitability to the environment in which they are provided.

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Hilti S-BT screw-in threaded studs, are approved in shipbuilding for fastening of:

- Electrical Systems: fastening of brackets and supports for cables (e.g. cables, cable trays, ladders and baskets, etc.) and fastening of electrical equipment (electrcial and junction boxes, lamps, switches, CCTV cameras, telephones, instrumentation, etc.).
- Piping Systems: fastening of brackets and support for piping and accessories (drains, scuppers, etc.).
- HVAC Systems: fastening of brackets and support for heating, ventilation and air conditioning systems and relevant accessories (e.g. internal and external grilles, etc.).
- Safety and Ship's Equipment: supports and brackets for safety and ship equipment (e.g. portable fire-extinguishers, hydrants, fire boxes, low-location lighting supports and frames, manholes, handrails, etc.) and furniture (e.g. tables, seats, etc.).
- Gratings, bulkhead structures, balcony separation panels, C class bulkheads.
- Grounding and bonding equipment.

Remarks

The validity of this Certificate refers to the design, rating, and installations parameters of the equipment specimens tested as per Reference Documents section. The manufacturer shall notify RINA of any modification or changes to the equipment in order to request for a valid certificate.

All approved drawings, test reports and other documents mentioned in the approval letters PSST/2018/00448/PBR, dated September 4, 2018, and CSST/2021/00205/PBR, dated June 22, 2021.
The documents form part of the present Type Approval Certificate.

On board of RINA Classified ships, the location, system and conditions are to be verified for their compliance with the present Certificate to the satisfaction of the attending surveyor in charge.

This Certificate annuls and replaces the previous no. FPE278318CS.

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