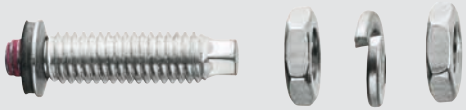
S-BT-ER (HC), S-BT-EF (HC) DATA SHEET

Screw-in stainless steel and carbon steel threaded stud



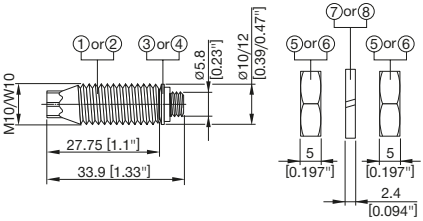
December 2020

S-BT-ER (HC) and S-BT-EF (HC) screw-in stainless steel and carbon steel threaded studs for electrical connections

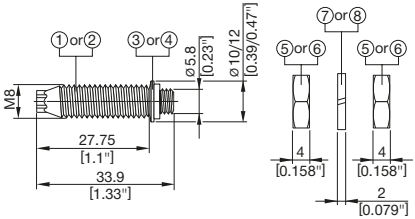
Product data

Dimensions

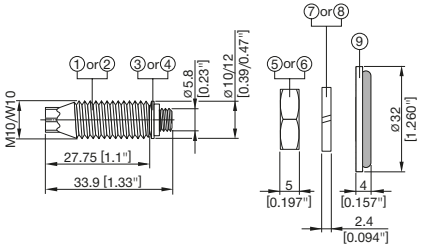
S-BT-ER M10/15 SN6
S-BT-ER W10/15 SN6
S-BT-EF M10/15 AN6
S-BT-EF W10/15 AN6



S-BT-ER M8/15 SN6
S-BT-EF M8/15 SN6



S-BT-ER M10 HC120
S-BT-ER W10 HC AWG4/0
S-BT-EF M10 HC120
S-BT-EF W10 HC AWG4/0



Material specifications

①	Threaded shank:	Stainless steel (S-BT-ER) "S 31803 (1.4462)" zinc-coated
②	Threaded shank:	Carbon steel (S-BT-EF) "1038/duplex-coated"
③	SN12-R washers:	Ø 12 mm [0.47"] Stainless steel (S-BT-ER) "S 31603 (1.4404)"
④	AN10-F washers:	Ø 10 mm [0.39"] Aluminum (S-BT-EF)
⑤	Nut:	Stainless steel (S-BT-ER) grade A4/AISI 316 material
⑥	Nut:	Carbon steel (S-BT-EF) HDG
⑦	Lock washer:	Stainless steel (S-BT-ER) grade A4/AISI 316 material
⑧	Lock washer:	Carbon steel (S-BT-EF) HDG
⑨	Conductivity disc:	Ø 32 mm [1.260"] Copper alloy CuSn8 (tin-coated) with sealing ring
	Sealing ring: Sealing washers:	Chloroprene rubber CR3.1107, black, resistant to UV, salt water, water, ozone, oils etc.
	Conductivity discs:	FKM, Resistant to UV, salt water, water, ozone, oils, etc.

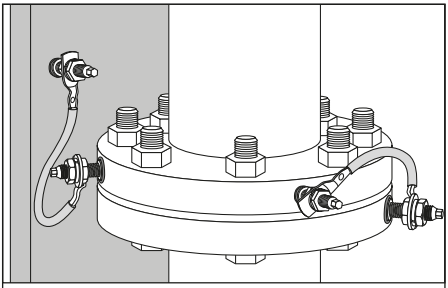
Recommended fastening tool

Refer to section "Fastener selection and system recommendation" for more details.

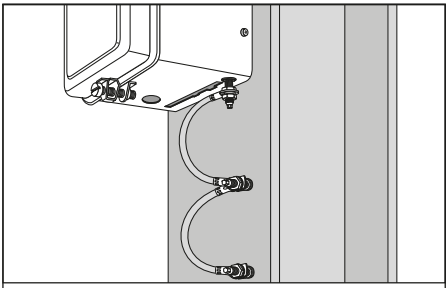
Listings and type approvals

Applications

Examples



Functional and protective bonding of pipes *)
(outer diameter of installed surface ≥ 150 mm)
*) only for Type A cable connections

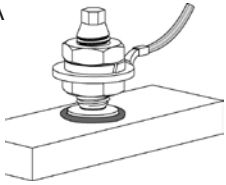
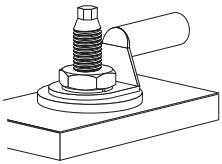


Protective bonding circuit – Double point connection

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

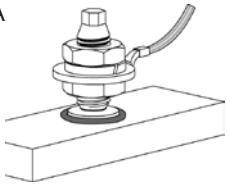
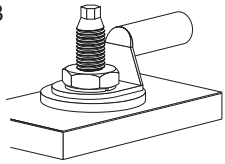
Note:

- 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.

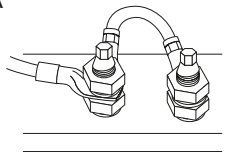
Single point connection

		Recommended electrical connectors:	Max. short circuit current according to IEC and UL
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_{cw} = 1.20 kA (IEC) I_{cw} = 0.75 kA (UL)
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_{cw} = 14.40 kA (IEC) I_{cw} = 10.10 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:	Max. short circuit current according to IEC
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_{cw} = 1.92 kA (IEC)

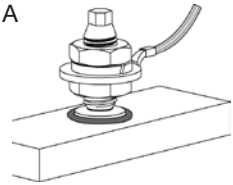
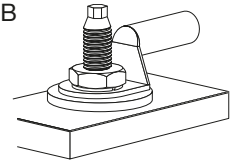
Note:

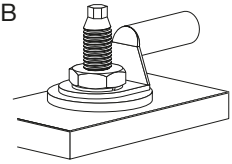
- Recommended maximal cross section of connected cable according IEC 60947-7-2 and IEC 60947-7-1: 16 mm² (6 AWG) copper (tested short circuit current I_{cw} = 1.92 kA for 1 s)
- Fastening of thicker cable is acceptable, if the maximum short circuit current I_{cw} and the exposure time is not exceeded 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)
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	

Classification H (acc. IEC 62561-1)	Recommended electrical connectors:	Maximum lightning current
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_{imp} = 100 kA for ≤ 5 ms (according to IEC 62561-1)

Note:

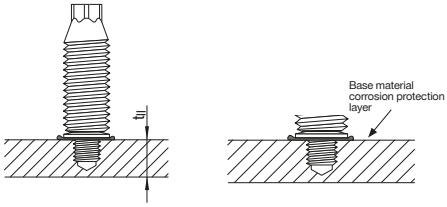
- When S-BT-ER/-EF is used in class H applications only type B cable connection is allowed.
- Tightening torque of 8 Nm must be observed accurately for type B cable connection.

Application Requirements

Base material thickness t_{II} ≥ 6 mm *)

Thickness of base material corrosion protection layer ≤ 0.8 mm [0.0315"].

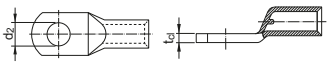
For single point connection type B conductivity disc must be in direct contact with non-coated base material.



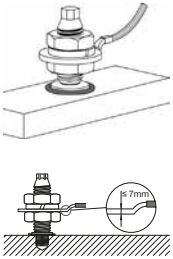
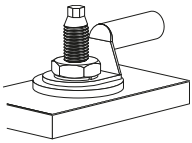
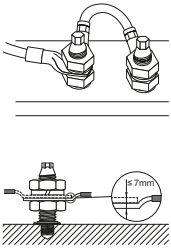
*) for the applications “Functional bonding and terminal connection in a circuit” and “Protective bonding circuit” the minimum base material thicknees can be reduced to t_{II} = 3 mm. Applicable only for Type A, single point connections.
In case of a drill through hole or a pilot hole in thin base material, 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 d_2



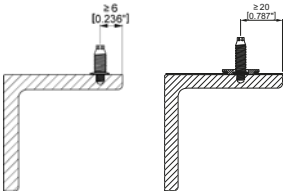
Fastener	Single point connector				Double point connector	
	Type A		Type B		Type A	
	t_{cl} [mm]	d_2 [mm]	t_{cl} [mm]	d_2 [mm]	t_{cl} [mm]	d_2 [mm]
S-BT-ER M10/15 SN 6	≤ 7	10.5			≤ 7	10.5
S-BT-ER W10/15 SN 6	≤ 7	10.5			≤ 7	10.5
S-BT-EF M10/15 AN 6	≤ 7	10.5			≤ 7	10.5
S-BT-EF W10/15 AN 6	≤ 7	10.5			≤ 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		

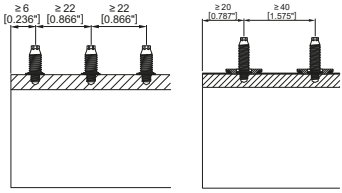
Single point connector		Double point connector
Type A	Type B	Type A
		

Spacing & edge distances

Edge distance:
Type A connector: ≥ 6 mm [0.236"]
Type B connector: ≥ 20 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	
	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 µm. 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.

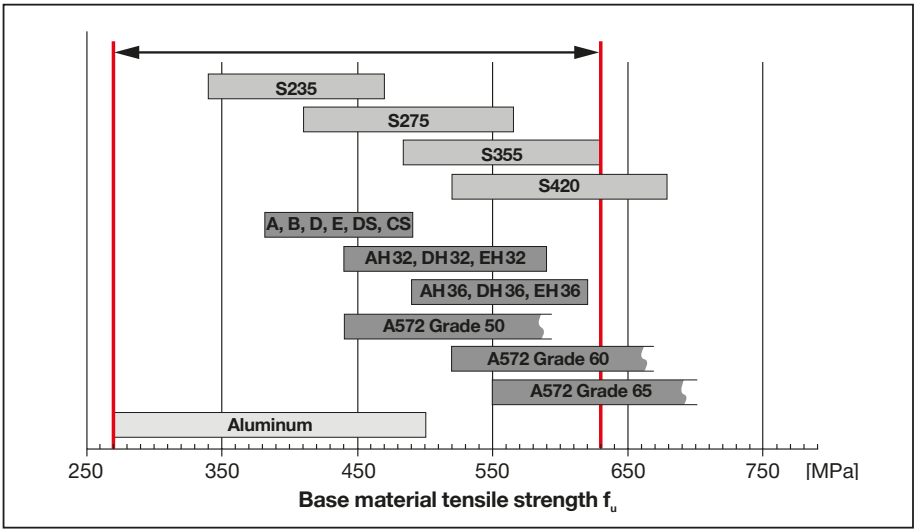
To prevent corrosion of the base material due to the drilling process the following base material thickness tIl has to be given.

	Fastener	
	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_{II} [1]		
3 mm [0.12"] ≤ t_{II} < 6 mm [0.24"] Pilot drill may cause damage to backside coating	✗ [2]	✗ [2]
6 mm [0.24"] ≤ t_{II} < 7 mm [0.28"] Pilot drill may cause damage to backside coating	✓	✓ [3]
t_{II} ≥ 7 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 ≥ 340 MPa [49 ksi].
Minimum thickness of base material t_{II}: refer to section "Application Requirements".
Maximum thickness of base material t_{II}: no limits.



Fastener selection and system recommendation

Fasteners	Drilling tool	Stepped drill bit	Setting tool	Depth gauge
S-BT-ER M8/15 SN 6	SBT 4-A22 or SF BT 18-A or SF BT 22-A	TS-BT 5.5-74 S	SBT 4-A22 or SFC 18-A or SFC 22-A	S-DG BT M8/15 Long 6
S-BT-EF M8/15 AN 6				
S-BT-ER M10/15 SN 6				S-DG BT M10-W10/15 Long 6
S-BT-ER W10/15 SN 6				
S-BT-EF M10/15 AN 6				
S-BT-EF W10/15 AN 6				

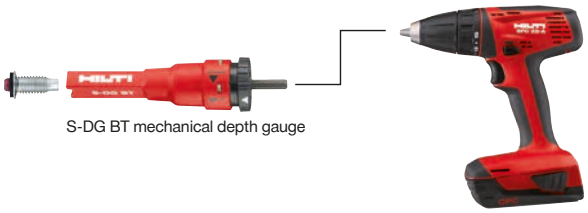
Fasteners	Drilling tool	Stepped drill bit + coating removal drill bit	Setting tool	Depth gauge
S-BT-ER M10 HC 120	SBT 4-A22 or SF BT 18-A or SF BT 22-A	TS-BT 5.5-74 S TS-BT HC120/ AWG4/0	SBT 4-A22 or SFC 18-A or SFC 22-A	S-DG BT M10-W10 HC 6
S-BT-ER W10 HC AWG4/0				
S-BT-EF M10 HC 120				
S-BT-EF W10 HC AWG4/0				

Fastener quality assurance

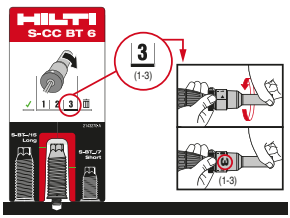
In order to ensure the exact screw-in depth and a proper compressed sealing washer, the S-BT-ER/-EF studs have to be installed with the appropriate depth gauge. With this tool the screw-in depth can be adjusted in a range of 0 – 1.5 mm (3 steps, 0.5mm per step).
The S-CC BT calibration card is needed 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 ≥ 1000 settings.



S-DG BT mechanical depth gauge



Design and functionality of the mechanical calibration card S-CC BT

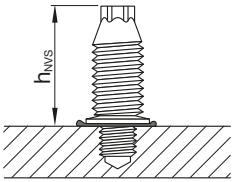
Fastening inspection

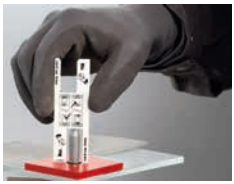
The installer is responsible for the correct setting of the S-BT-ER / -EF studs.
For the periodical verification of the correct stud stand-off the S-CG BT check gauge can be used.

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

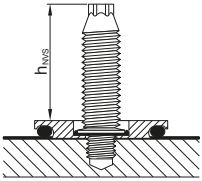




Design and functionality of the check gauge S-CG BT

h_{NVS} = 26.10 mm to 26.60 mm [1.028" to 1.047"]

S-BT-ER M10 HC ___
S-BT-ER W10 HC ___
S-BT-EF M10 HC ___
S-BT-EF W10 HC ___

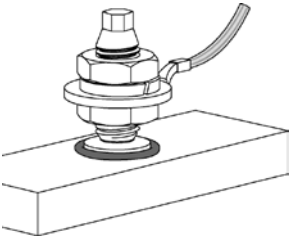


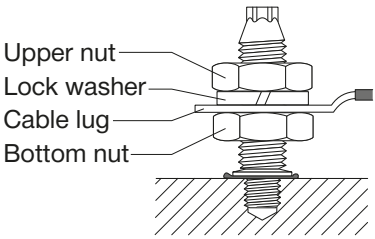
Designation	Product name	Comment
S-DG BT M8/15 Long 6	Depth gauge	for exact setting of S-BT-ER M8/15 SN 6, S-BT-EF M8/15 AN 6
S-DG BT M10-W10/15 Long 6	Depth gauge	for exact setting of S-BT-ER M10/15 SN 6, S-BT-ER W10/15 SN 6, S-BT-EF M10/15 AN 6, S-BT-EF W10/15 AN 6
S-DG BT M10-W10 HC 6	Depth gauge	for exact setting of 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 for S-BT-ER and S-BT-EF
S-CC BT HC 6	Calibration card	for calibration of the depth gauge for 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 S-BT-ER and S-BT-EF
S-CG BT HC	Check gauge	for verification of the stand-off for S-BT-ER M10 HC ___, S-BT-ER W10 HC ___ S-BT-EF M10 HC ___, S-BT-EF W10 HC ___

Installation

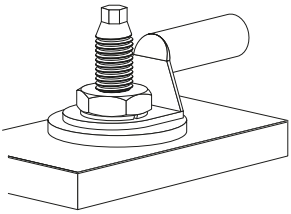
Single point connection

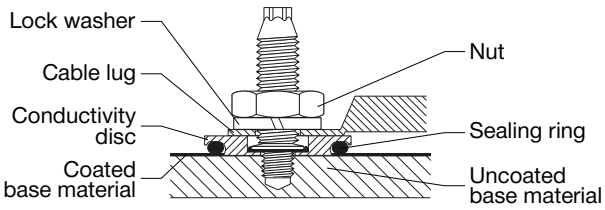
Single point connection type A:





Single point connection type B:

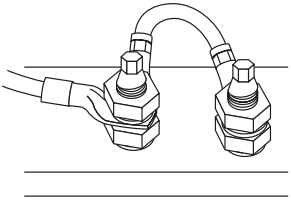


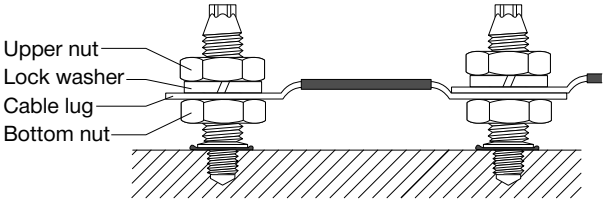


For Type B cable connection the following requirements have to be observed:
- The conductivity disc must be in direct contact with the non-coated base material. Coating has to be removed with the coating removal drill bit.
- Tightening torque of 8 Nm must be observed accurately.

Double point connection

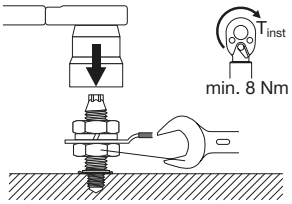
Double point connection type A:





Torque recommendation for all S-BT-ER and S-BT-EF

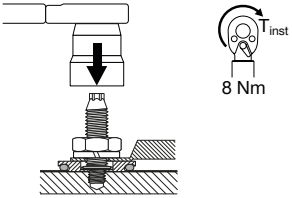
Single point connection type A and double point connection type A:



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 ¼" (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	package includes nuts and lock washers	Electrical connection
S-BT-EF M10/15 AN 6	2186204	Threaded stud		
S-BT-EF W10/15 AN 6	2186206	Threaded stud		
S-BT-ER M8/15 SN 6	2186207	Threaded stud	package includes nuts and lock washers	Electrical connection
S-BT-ER M10/15 SN 6	2186203	Threaded stud		
S-BT-ER W10/15 SN 6	2186205	Threaded stud		
S-BT-ER M10 HC 120	2204739	Threaded stud	package includes nuts, lock washers and conductor discs	Electrical connection
S-BT-ER W10 HC AWG4/0	2206611	Threaded stud		
S-BT-EF M10 HC 120	2204932	Threaded stud	package includes nuts, lock washers and conductor discs	
S-BT-EF W10 HC AWG4/0	2206612	Threaded stud		
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 ¼" – 8 Nm	2119272	Torque tool	manual torque tool (8 Nm)	