

Guide Specification

Specifier Notes: This guide specification is written in Construction Specifications Institute (CSI) 3-Part Format in accordance with *The CSI Construction Specifications Practice Guide*, including *MasterFormat*, *SectionFormat*, and *PageFormat*.

This Section must be carefully reviewed and edited by the Architect or Engineer to meet the requirements of the Project and applicable building code. Coordinate this Section with Division 01, other specification sections, and the Drawings. Delete all Specifier Notes after editing this Section.

Section numbers and titles are based on *MasterFormat 2014 Update*.

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

Specifier Notes: This Section covers Hilti "X-BT-ER" threaded fasteners for use in grounding and bonding for electrical systems. Consult Hilti, Inc. for assistance in editing this Section for the specific application.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Threaded Fasteners for Use in Grounding and Bonding for Electrical Systems:

Specifier Notes: Edit the following list as required for the Project.

1. Electrical grounding of instrumentation.
2. Electrical bonding of pipe flanges.

1.2 RELATED REQUIREMENTS

Specifier Notes: Edit the following list of related sections as required for the Project. Limit the list to sections with specific information that the reader might expect to find in this Section, but is specified elsewhere.

- A. Section 26 41 00 – Facility Lightning Protection: Grounding of lightning protection system.
- B. Section 33 79 00 – Site Grounding: Site-related grounding components for buildings and facilities.

1.3 REFERENCE STANDARDS

Specifier Notes: List reference standards used elsewhere in this Section, complete with designations and titles.

- A. ANSI/NETA ATS – Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems.
- B. EN 50164-1 – Lightning Protection Components (LPC) - Part 1: Requirements for Connection Components.
- C. IEC 60204-1 – Safety of Machinery – Electrical Equipment of Machines - Part 1: General Requirements.
- D. IEC 60947-7-2 – Low-Voltage Switchgear and Controlgear - Part 7-2: Ancillary Equipment - Protective Conductor Terminal Blocks for Copper Conductors.
- E. IEEE 142 – Recommended Practice for Grounding of Industrial and Commercial Power Systems.
- F. IEEE 1100 – Recommended Practice for Powering and Grounding Electronic Equipment.
- G. NFPA 70 – National Electrical Code (NEC).
- H. UL 467 – Grounding and Bonding Equipment.

1.4 PREINSTALLATION MEETINGS

Specifier Notes: Edit preinstallation meetings as required for the Project. Delete if not required.

- A. Convene preinstallation meeting [1 week] [2 weeks] before start of Work of this Section.
- B. Require attendance of parties directly affecting Work of this Section, including Contractor, Engineer, installer, and manufacturer's representative.

- C. Review the Following:
 - 1. Materials.
 - 2. Installation.
 - 3. Protection.
 - 4. Coordination with other Work.

1.5 SUBMITTALS

Specifier Notes: Edit submittal requirements as required for the Project. Delete submittals not required.

- A. Comply with Division 01.
- B. Product Data: Submit manufacturer's product data, including installation instructions.
- C. Warranty Documentation: Submit manufacturer's standard warranty.

1.6 QUALITY ASSURANCE

- A. Grounding Materials:
 - 1. NFPA 70, Chapter 2, Articles 200 and 250.
 - 2. IEEE 142.
 - 3. UL labeled.
- B. Manufacturer's Qualifications: Manufacturer regularly engaged, for a minimum of 5 years, in the manufacturing of threaded fasteners used in grounding and bonding for electrical systems.
- C. Installer's Qualifications:
 - 1. Installer regularly engaged, for a minimum of 5 years, in installation of products specified in this Section.
 - 2. Employ persons trained by manufacturer for installation of products specified in this Section.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage and Handling Requirements:
 - 1. Store and handle materials in accordance with manufacturer's instructions.
 - 2. Keep materials in manufacturer's original, unopened containers and packaging until installation.
 - 3. Store materials in clean, dry area indoors.
 - 4. Protect materials during storage, handling, and installation to prevent damage.

1.8 AMBIENT CONDITIONS

- A. Do not install threaded fasteners under ambient conditions outside manufacturer's limits.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Hilti, Inc., 7250 Dallas Parkway, Suite 1000, Plano, Texas 75024. Toll Free 800-879-8000. Website www.us.hilti.com.

Specifier Notes: Specify if substitutions will be permitted.

- B. Substitutions: [Not permitted] [Comply with Division 01].

Specifier Notes: The electrical engineer must select, design, and evaluate the electrical wire, threaded fasteners, hardware, and grounding connectors for the specific application.

2.2 FASTENING SYSTEM

- A. Fastening System: Hilti "X-BT-ER".

Specifier Notes: Specify Hilti threaded fasteners required for the Project. Delete fasteners not required.

1. Threaded Fasteners: ["X-BT-ER M10/3 SN 4"] ["X-BT-ER W10/3 SN 4"] ["X-BT-ER M8/7 SN 4"] ["X-BT-ER M6/7 SN 4"] ["X-BT-ER W6/7 SN 4"].
 - a. UL Listed: Listing number E257069.

B. Materials:

1. Shank: CR 500 (CrNiMo alloy) S31803 (1.4462); equivalent to A4/AISI grade 316.
2. Threaded Sleeve: X5CrNiMo 17-12-2+2H, 1.4401.
3. Washer "SN": S 31635 (X2CrNiMo 17-12-2, 1.4404).
4. Sealing Washer: Elastomer; black; resistant to UV, salt water, water, ozone, oils.

C. Dimensions:

1. Thread Diameter:
 - a. Threaded Fastener "X-BT-ER M10/3 SN 4": M10.
 - b. Threaded Fastener "X-BT-ER W10/3 SN 4": UNC 3/8 inch.
 - c. Threaded Fastener "X-BT-ER M8/7 SN 4": M8.
 - d. Threaded Fastener "X-BT-ER M6/7 SN 4": M6.
 - e. Threaded Fastener "X-BT-ER W6/7 SN 4": UNC 1/4 inch.
2. Thread Length:
 - a. Threaded Fastener "X-BT-ER M10/3 SN 4": 0.945 inch (24 mm).
 - b. Threaded Fastener "X-BT-ER W10/3 SN 4": 0.945 inch (24 mm).
 - c. Threaded Fastener "X-BT-ER M8/7 SN 4": 0.945 inch (24 mm).
 - d. Threaded Fastener "X-BT-ER M6/7 SN 4": 0.787 inch (20 mm).
 - e. Threaded Fastener "X-BT-ER W6/7 SN 4": 0.787 inch (20 mm).
3. Shank Diameter: 0.177 inch (4.5 mm).
4. Washer "SN" Diameter: 0.472 inch (12 mm).

5. Overall Length:
 - a. Threaded Fastener "X-BT-ER M10/3 SN 4": 1.232 inches (31.3 mm).
 - b. Threaded Fastener "X-BT-ER W10/3 SN 4": 1.232 inches (31.3 mm).
 - c. Threaded Fastener "X-BT-ER M8/7 SN 4": 1.232 inch (31.3 mm).
 - d. Threaded Fastener "X-BT-ER M6/7 SN 4": 1.232 inches (31.3 mm).
 - e. Threaded Fastener "X-BT-ER W6/7 SN 4": 1.232 inches (31.3 mm).

- D. 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 electrical circuit.
 1. Single-Point Connection:

Specifier Notes: Specify Hilti threaded fasteners required for the Project. Delete fasteners not required.

- a. Threaded Fasteners: ["X-BT-ER M10/3 SN 4"] ["X-BT-ER W10/3 SN 4"] ["X-BT-ER M8/7 SN 4"] ["X-BT-ER M6/7 SN 4"] ["X-BT-ER W6/7 SN 4"].
- b. Maximum Allowable Permanent Current: 40 A.
- c. Connected Cable Size (tested to 40 A), IEC 60204-1: Less than or equal to 10 mm² copper (size smaller than or equal to 8 AWG).
 - 1) Fastening of cables of larger diameters than 10mm² is acceptable, provided maximum permanent current of 40 A is not exceeded and provisions on cable lug thickness are observed.

- E. Protective Bonding Circuit: For discharging short circuit current while protecting electrical equipment or earth/ground or bonded cable trays and ladders.
 1. Single-Point Connection:

Specifier Notes: Specify Hilti threaded fasteners required for the Project. Delete fasteners not required.

- a. Threaded Fasteners: ["X-BT-ER M10/3 SN 4"] ["X-BT-ER W10/3 SN 4"] ["X-BT-ER M8/7 SN 4"] ["X-BT-ER M6/7 SN 4"] ["X-BT-ER W6/7 SN 4"].
 - b. Maximum Short Circuit Current for Period of 1 s: 1,250 A.
 - c. Connected Cable Size (tested to 1,250 A for 1 s), IEC 60947-7-2: Less than or equal to 10 mm² copper (size smaller than or equal to 8 AWG).
 - 1) Fastening of cables of larger diameter than 10 mm² is acceptable provided maximum current of 1,250 A for a period of 1 second is not exceeded and provisions on cable lug thickness are observed.
 - d. Connected Cable Size (tested to 750 A for 4 s), UL 467: Size smaller than or equal to 10 AWG.
2. Double-Point Connection:

Specifier Notes: Specify Hilti threaded fasteners required for the Project. Delete fasteners not required.

- a. Threaded Fasteners: ["X-BT-ER M8/7 SN 4"] ["X-BT-ER M6/7 SN 4"] ["X-BT-ER W6/7 SN 4"].
- b. Maximum Short Circuit Current for Period of 1 s: 1,800 A.
- c. Connected Cable Size (tested to 1,800 A for 1 s), IEC 60947-7-2: Less than or equal to 16 mm² copper (size smaller than or equal to 6 AWG).
 - 1) Fastening of cables of larger diameter than 10 mm² is acceptable provided maximum current of 1,800 A for a period of 1 second is not exceeded and provisions on cable lug thickness are observed.

- F. Lightning Protection: For high temporary current due to lightning.
1. Single-Point Connection:

Specifier Notes: Specify Hilti threaded fasteners required for the Project. Delete fasteners not required.

- a. Threaded Fasteners: ["X-BT-ER M10/3 SN 4"] ["X-BT-ER W10/3 SN 4"] ["X-BT-ER M8/7 SN 4"] ["X-BT-ER M6/7 SN 4"] ["X-BT-ER W6/7 SN 4"].
- b. Maximum Current, EN 50164-1 and EN 50164-1/prA: 50 kA for 2 ms.
2. When 1 Nut is Used and Cable Lug is in Contact with Base Material:
 - a. Cable Lug: Direct contact with non-coated base material.
 - b. Extra M10/W10 Stainless Steel Washer: Install between lock washer and cable lug.
 - c. Base Material: Do not contact "X-BT-ER SN" washer, lock washer, and nut.
 - d. Cable Lug Thickness: 2 mm to 12 mm.
 - e. Minimum Cable Lug Hole Diameter: 13 mm.
 - f. Maximum Tightening Torque: 8 Nm.

Specifier Notes: Specify Hilti threaded fasteners required for the Project. Delete fasteners not required.

- g. Threaded Fasteners: ["X-BT-ER M10/3 SN 4"] ["X-BT-ER W10/3 SN 4"] ["X-BT-ER M8/7 SN 4"].
- h. Maximum Tested Current: 100 kA for 2 ms.

- G. Application Requirements:

1. Base Material:
 - a. Minimum Thickness: 5/16 inch (8 mm).
 - b. No through penetration.
 - c. Steel Strength: No limits.
2. Maximum Thickness of Cable Lugs:
 - a. Threaded Fasteners "X-BT-ER M10/3 SN 4" and "X-BT-ER W10/3 SN 4": 0.12 inch (3 mm), single cable lug.
 - b. Threaded Fasteners "X-BT-ER M8/7 SN 4", "X-BT-ER M6/7 SN 4", and "X-BT-ER W6/7 SN 4": 0.28 inch (7 mm), total of 2 cable lugs.

3. Detailing:
 - a. Spacing: Minimum 0.591 inch (15 mm) center-to-center.
 - b. Edge Distance: Minimum 0.236 inch (6 mm) center-to-edge.
4. Corrosion Resistance of Hilti CR500 and S31803 Stainless Steel Material: Equivalent to AISI 316 (A4) steel grade.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive grounding and bonding for electrical systems.
- B. Notify Architect of conditions that would adversely affect installation or subsequent use.
- C. Do not begin installation until unacceptable conditions are corrected.

3.2 INSTALLATION

- A. Install grounding and bonding for electrical systems in accordance with IEEE 142, IEEE 1100, and NFPA 70.
- B. Install threaded fasteners for use in grounding and bonding for electrical systems in accordance with manufacturer's Instructions for Use supplied with fasteners at locations indicated on the Drawings.
- C. Pre-drill holes in base steel to proper depth using manufacturer's step-shank drill bit.
 1. Ensure holes are perpendicular to surface.
- D. Ensure drilled holes and areas around drilled holes are free of liquids and debris before installation of threaded fasteners.
- E. Drive threaded fasteners into drilled holes in base steel using manufacturer's powder-actuated tool and cartridges.
 1. Fastener Stand-Off: 1.012 inches to 1.055 inches (25.7 mm to 26.8 mm) for proper compression of sealing washers.
- F. Permanently attach equipment and grounding conductors before energizing equipment.
- G. Connect to site grounding system as specified in Section 33 79 00.
- H. Bond to lightning protection system as specified in Section 26 41 00.

3.3 FIELD QUALITY CONTROL

ANSI/NETA ATS refers to specific ANSI standards and includes procedures and acceptable values for acceptance testing electrical equipment in accordance with those standards.

Section 4 of ANSI/NETA ATS stipulates division of responsibility, possibly conflicting with conditions of the contract or general requirements.

- A. Inspect and test in accordance with ANSI/NETA ATS, except Section 4.
- B. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13.
- C. Perform ground resistance testing in accordance with IEEE 142.
- D. Perform continuity testing in accordance with IEEE 142.
- E. When improper grounding is found on receptacles, check receptacles in entire project and correct. Perform retest.

3.4 PROTECTION

- A. Protect Work of this Section from damage during construction.

END OF SECTION