

SECTION 27-05-26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 – GENERAL

1.01 DESCRIPTION

- A. The work covered by this section of the Specifications includes all labor necessary to perform and complete such construction, all materials and equipment incorporated or to be incorporated in such construction and all services, facilities, tools and equipment necessary or used to perform and complete such construction. The work of this section shall include, but is not limited to, the following:
 - 1. Install a telecommunication's grounding and bonding infrastructure.
 - 2. Grounding shall extend from the vault system to the TMGB.
 - 3. Grounding shall extend from the main building grounding bus bar to the TMGB.
 - 4. Bonding of all ladder rack segments, conduit, pull boxes, junction boxes, equipment racks/frames for use in support of the telecommunications infrastructure. All bonding and grounding shall terminate on the ground bar in the nearest EF/TR/ER.
 - 5. Bond all metallic/armored cable sheaths and associated protectors to the ground bars in each EF/TR/ER.
 - 6. Bond all Vaults, Manholes, Pull Holes and Pull Boxes to the common grounding system.
 - 7. All ground wires shall be terminated using the proper two-hole, compression type, copper lugs.

1.02 QUALITY ASSURANCE

- A. Refer to Section 27-00-00 for general details.

1.03 CODES, STANDARDS, AND GUIDELINES

- A. Except as modified by governing codes and by the Contract Documents, comply with the applicable provisions and recommendations in Section 27-00-00.
- B. The Cal Poly ITS Telecomm group, Telecommunications Standards Document and the Labeling, Design and Syntax Standards in Appendix B.

1.04 SUBMITTALS

- A. Refer to Section 27-00-00 for general details.
- B. Shop Drawings:
 - 1. Shop drawings shall show the locations where grounding backbone conductors are to be run and where they are to be attached to ground bars (TGB and TMGB) within each EF/TR/ER.
- C. Submit the complete list of materials proposed for this work in accordance with Section 27-00-00.
- D. Submit Manufacturer's Cut Sheets for the following:
 - 1. Any products not specifically listed in the PRODUCTS section shall require a submittal of the manufacturer's cut sheets and approval by the Cal Poly ITS Telecomm group.

1.05 IDENTIFICATION

- A. Each backbone grounding conductor larger than #6 AWG shall be labeled with its far end destination at every instance where it attaches to a ground bar or ground rod. Labels shall be outdoor rated, 1" wide, nylon labels with black lettering at each endpoint and in each manhole or pull box.
- B. Refer to Section 27-05-53 for additional details.

1.06 DEFINITIONS

- A. The Bonding Conductor for Telecommunications (BCT): The BCT shall bond the TGB to TBB, and bond the TMGB to the service equipment (building main power) ground.
- B. The Telecommunications Main Grounding Busbar (TMGB): The TMGB serves as the dedicated extension of the building grounding electrode system for the telecommunications infrastructure. The TMGB also serves as the central attachment point for telecommunications bonding backbones (TBB) and equipment, and is located such that it is accessible to telecommunications personnel.
- C. The Telecommunications Grounding Busbar (TGB): The TGB is the common central point of connection for telecommunications systems and equipment in the location served by that TR/ER.
- D. The Telecommunications Bonding Backbone (TBB): A TBB is a conductor that interconnects all TGB's with the TMGB. A TBB's basic function is to reduce or equalize potential differences between telecommunications systems bonded to it. A TBB is not intended to serve as the only conductor providing a ground fault current return path.
- E. The Telecommunications Bonding Backbone Interconnecting Bonding Conductor (TBBIBC): Whenever two or more vertical TBBs are used within a multistory building, the TBB shall be bonded together with a TBB interconnecting bonding conductor (TBBIBC) at the top floor (at a minimum).

1.07 WARRANTY

- A. Refer to Section 27-00-00 for general details.

PART 2 – PRODUCTS

2.01 PRODUCT CONSISTENCY

- A. Product Consistency: Any given item of equipment or material shall be the product of one manufacturer throughout the facility. Multiple manufacturers of any one item will not be permitted.

2.02 METALLIC CABLE SPECIFICATIONS

- A. Ground Wire for Telecommunications Backbone (TBB):
 - 1. Non-Insulated grounding wire with a minimum conductor size of Number 3/0 AWG copper wire (or as indicated on drawings).
 - 2. Wire must be UL listed.
- B. Bonding Conductor for Telecommunications (Bonding the TGB to the TBB):
 - 1. Insulated grounding wire with a minimum conductor size of Number 1/0 AWG copper wire, with PVC insulation.
 - 2. Must be UL listed.
 - 3. Cable jacket marking: Must be legible and shall contain the following information:

- a. Manufacturer's name.
 - b. Copper Conductor Gauge.
 - c. UL listing.
 4. Cable jacket shall be green with black lettering.
- C. Ground Wire for connections within an EF/TR/ER:
1. Insulated grounding wire with a minimum conductor size of Number 6 AWG copper wire, with PVC insulation.
 2. Must be UL listed.
 3. Cable jacket marking: Must be legible and shall contain the following information:
 - a. Manufacturer's name.
 - b. Copper Conductor Gauge.
 - c. UL listing.
 4. Cable jacket shall be green with black lettering. **(See Fig. #140 in Appendix B)**
- D. Ground Wire for connections underground
1. Non Insulated stranded grounding wire with a minimum conductor size of Number 2 AWG copper wire.
 2. Must be UL listed.

2.03 COMPRESSION LUG CONNECTORS

- A. Compression Lug Connector (Attaching #6 AWG ground wire to TGB or TMGB):
1. Copper Two-Hole Lug, Straight Long Barrel
 2. 1/4" Bolt Size, 5/8" Hole Spacing
 3. Twin clamping elements for cable; two holes for attachment to grounding bar, etc.
 4. Approved Manufacturer: Thomas & Betts or Cal Poly ITS Telecomm group approved equal.
- B. Compression Lug Connector (Attaching #6 AWG ground wire to Conduits, Racks, Cable Runway, Cable Tray, other Grounded Telecom room elements):
1. Copper Two-Hole Lug, Straight Long Barrel
 2. 3/8" Bolt Size,
 3. Twin clamping elements for cable
 4. Approved Manufacturer: Thomas & Betts or Cal Poly ITS Telecomm group approved equal.
- C. Compression Lug Connector (Attaching #1/0 AWG or larger ground wire to TGB or TMGB):
1. Copper Two-Hole Lug, Straight Long Barrel
 2. 3/8" Bolt Size, 1" Hole Spacing
 3. Twin clamping elements for cable; two holes for attachment to grounding bar, etc.
 4. Approved Manufacturer: Thomas & Betts or Cal Poly ITS Telecomm group approved equal.
- D. Compression Lug Connector (Attaching #3/0 AWG or larger ground wire to TGB or TMGB):

1. Copper Two-Hole Lug, Straight Long Barrel
 2. 3/8" Bolt Size, 1" Hole Spacing
 3. Twin clamping elements for cable; two holes for attachment to grounding bar, etc.
 4. Approved Manufacturer: Thomas & Betts or Cal Poly ITS Telecomm group approved equal.
- E. Cable to cable connector: Heavy duty, permanent connection by exothermic weld between two or more copper conductors (#2 AWG and larger); splice "T" or cross, as indicated on the drawings and as required.
1. Exothermic Welding reusable graphite mold for Cable to Cable Connection.
 2. Approved Manufacturer: Thomas & Betts or Cal Poly ITS Telecomm group approved equal.

2.04 BUSBARS

- A. TMGB (Telecommunications Main Grounding Busbar)
1. The TMGB shall
 - a. Be a predrilled copper busbar provided with holes for use with standard sized lugs.
 - b. Have minimum dimensions of ¼ in. thick x 4 in. wide x 20 in. long.
 - c. Be UL listed or by another nationally recognized testing laboratory.
 - d. Provided with insulators to electrically isolate busbar from mounting surface.
 - e. Provided with a minimum of 2 in. clearance from wall or other mounting surfaces for access.
 - f. The hole pattern for attaching grounding lugs shall meet the requirements of ANSI-J-STD – 607-A and shall accept 27 lugs with 5/8" (15.8 mm) hole centers and 3 lugs with 1" (25.4 mm) hole centers.
 2. Approved Manufacturer: Chatsworth or Cal Poly ITS Telecomm group approved equal.
- B. TGB (Telecommunications Grounding Busbar)
1. The TGB shall
 - a. Be a predrilled copper busbar provided with holes for use with standard sized lugs.
 - b. Have minimum dimensions of ¼ in. thick x 2 in. wide x 12 in. long
 - c. Be UL listed or by another nationally recognized testing laboratory.
 - d. Provided with insulators to electrically isolate busbar from mounting surface.
 - e. Provided with a minimum of 2 in. clearance from wall or other mounting surfaces for access.
 - f. The hole pattern for attaching grounding lugs shall meet the requirements of ANSI-J-STD – 607-A and shall accept 15 lugs with 5/8" (15.8 mm) hole centers and 3 lugs with 1" (25.4 mm) hole centers.
 2. Approved Manufacturer: Chatsworth or Cal Poly ITS Telecomm group approved equal.

.2.05 GROUND RODS

- A. Ground Rod (In Underground Vaults & Manholes)
1. Solid copper clad steel

2. 3/4" diameter by 10' length
- B. Ground Rod (In Underground Pull Holes & Pull Boxes)
 1. Solid copper clad steel
 2. 5/8" diameter by 8' length
- C. Ground Rod Attachment
 1. Exothermic Welding reusable graphite mold for Cable to Ground Rod Connection.
 2. Terminate Cable to Ground Rod, #2 AWG to Rod 3/4"
 3. Approved Manufacturer: Thomas & Betts or Cal Poly ITS Telecomm group approved equal.

PART 3 – EXECUTION

3.01 GENERAL

- A. The Contractor shall install each ground conductor (wire) as an uninterrupted conductor section between the designated termination points, unless otherwise directed by the installation specifications. There shall be no splices or mechanical couplers installed between the wire points of origin and termination except as shown on the Drawings and/or specified herein.
- B. Unless otherwise noted, all ground wires shall be routed through the telecommunications cable management pathways so as to achieve a "coupled bonding conductor" effect.
- C. Do not install ground bars until after their installation location has been approved by the Cal Poly ITS Telecomm group representative.

3.02 QUANTITIES

- A. Quantities of ground wires, bonding components, etc. shown on the drawings are illustrative only and are meant to indicate the general configuration of the work. The Contractor is responsible for providing the correct quantities of materials to construct a grounding and bonding system that meets the intent of these Specifications and the relevant codes.

3.03 INSTALLATION

- A. Cable & Wire Installation
 1. Required Grounding Connections:
 - a. Provide and install one individual #6 AWG ground wire from each equipment rack/frame (installed under this work) to the TGB in the room. **Each conductor is to be "home run"; do not "daisy chain" the connections, unless specifically indicated on the drawings.**
 - b. Provide and install one individual #6 AWG ground wire from the overhead cable runway (installed under this work) to the TGB in the room.
 - c. Install one individual #6 AWG ground to each cable tray entering room.
 - d. Install one individual #6 AWG ground to each cable shielded termination. e. Install one individual #6 AWG ground to each entrance protector.
 - e. Install one individual #6 AWG ground to each metal conduit or sleeve.
- B. Busbar Installation
 1. Wall-Mount Busbars

- a. Attach busbar to the wall with appropriate hardware according to the Manufacturer's Installation Instructions.
 - b. Conductor connections to the TMGB or TGB shall be made with two-hole bolt-on compression lugs, with lock washers, sized to fit the busbar and the conductors.
 - c. The Wall mount Busbar assembly shall be mounted @ 18" AFF, on the wall perpendicular to the rack row farthest from the entry door and close to or in a corner. (See the Fig. # 148 in Appendix B)
2. Ground Terminal Block
- a. Every rack and cabinet shall be separately bonded to the MGB or TGB.
 - b. Minimum bonding connection to racks and cabinets shall be made with a rack-mount two-hole ground terminal block sized to fit the conductor and rack, installed on the rear of the rack, at the top, according to manufacturer recommendations.
 - c. Remove paint between rack/cabinet and terminal block, clean surface and use antioxidant between the rack and the terminal block to help prevent corrosion at the bond.

3.04 GROUNDING & BONDING

- A. See appropriate sections of this document for details.

3.05 TESTING

- A. The Contractor shall test all metallic wires and cables installed under these Specifications.
- B. ***Using a multimeter, test continuity of each system element to ground (TGB or TMGB) for a maximum resistance of 1Ω.***

3.06 ACCEPTANCE

- A. Upon receipt of the Contractor's documentation of testing, the Cal Poly ITS Telecomm group representative will review/observe the installation and may randomly request tests of the cables/wires installed. Once the testing has been completed and the Cal Poly ITS Telecomm group representative is satisfied that all work is in accordance with the Contract Documents, the representative will notify the Contractor and/or the Cal Poly Project Manager in writing or via email.

3.07 RECORD (AS-BUILT) DRAWINGS

- A. The Project Record Drawings shall show the types and locations of installed grounding and bonding conductors.

END OF SECTION

DOCUMENT VERSION CONTROL

REVISION	DATE	AUTHOR	REASON
1	02/20/2014	R. VOLK	INITIAL DOCUMENT DEVELOPMENT
	02/20/2014	DW & MH	PRIMARY REVIEW COMPLETE