SECTION 27 05 26

GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

Grounding and bonding systems are an integral part of the signal or telecommunications cabling system. In addition to helping protect personnel and equipment from hazardous voltages, a proper grounding and bonding system will improve the electromagnetic compatibility performance of the cabling system. Improper grounding and bonding can allow induced voltages and conducted noise, which can disrupt signal transmission. The telecommunications grounding and bonding system shall conform to local codes and ANSI/TIA-607-C requirements.

1.1 STIPULATIONS

A. The specifications sections “General Conditions to the Construction Contract”, “Special Conditions” and “Division 01 – General Requirements” form a part of the Section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

1.2 DESCRIPTION OF WORK

A. Furnish and install a complete and fully-functioning grounding and bonding system. All cables, terminations, support hardware, and grounding and bonding hardware shall be furnished, installed, tested, labeled, and documented by the telecommunications contractor.

B. Coordinate layout of work with other trades. Make minor adjustments in location required for coordination. Locations of structural systems, heating work and plumbing lines shall take preference over locations of conduit lines where conflict occurs. Structural systems, heating work, and plumbing lines shall not interfere with or otherwise impede the routing of communication cabling with cable tray, raceways, or other pathways dedicated to communications. All potential issues shall be brought to the attention of the General Contractor or Construction Manager immediately, before proceeding with installation.

C. Other than minor adjustments shall be submitted to the General Contractor or Construction Manager for approval before proceeding with the work.

D. Coordinate with electrical contractor including pathways, termination points, busbar locations, and connections to the main electrical service ground and electrical distribution panels.

1.3 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

B. Related Documents and Sections:

1. Division 01 – General Requirements
2. Section 26 05 26 – Grounding and Bonding for Electrical System
3. Section 27 00 00 – Communications General
4. Section 27 05 28 – Pathways for Communication Systems

C. The following codes, associations, acts and agencies, as required by law:

1. NFPA-70, 2011 (National Electric Code)
2. National Electrical Safety Code (NESC)
3. Occupational Safety and Health Administration (OSHA)

D. The current edition of the following standards:

1. ANSI/IEEE Std. 1100-2005, Recommended Practice for Powering and Grounding Electronic Equipment

E. The current edition of the following guidelines:

1. BICSI, Telecommunications Distribution Methods Manual (TDMM)
2. BICSI/NECA-607, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings

F. When a discrepancy arises between the above-mentioned codes, standards or guidelines and the standards contained in this document, it shall be brought to the attention of the Owner immediately for resolution. The more stringent of the two guidelines shall be implemented.

1.4 SYSTEM DESCRIPTION

A. Provide a communications bonding and grounding system as described in this document, documents and drawings specific to that project, and in compliance with the above cited Codes, Standards and Agencies.

B. Comply with the requirement of Code of Practice for Info-Communications Facilities in Buildings.

C. Comply with the requirement for Section 26 05 26 – Grounding and Bonding for Electrical System.

D. Bond the following items within the telecommunications grounding system.

1. All communications system active equipment.
2. All PDU and surge protection equipment.
3. Raised floor systems.
4. Underfloor grounding grids (a.k.a. “supplemental bonding grids” or SBGs) for computer or telecommunications rooms.
5. Metallic raceway systems, including metallic cable trays.
6. Communications equipment enclosures (cabinets) or cross-connect frames.
7. Broadband passive devices.
8. Metallic splice cases.
9. Metallic cable screens, armor or shields.
10. All metal cable conduit.
11. Electrical service panels in entrance facilities, telecommunications and equipment rooms.
12. Wall and rack mounted grounding busbars.
13. Exposed building steel that is within 6 feet of equipment racking systems.
14. Building steel extending to earth in outside-plant.
15. All related bonding accessories.

1.5 SUBMITTALS

A. Refer to Section 27 00 00 – Communications General

B. Shop drawings showing construction details and locations of components, and description and routing of interconnecting cabling.

C. Provide table of contents with all product names, manufacturer, and specific product number identified to accompany manufacturer's product information cut sheets or specifications sheets.

D. Provide report of field tests and observations certified by the testing organization.

1.6 QUALITY ASSURANCE

A. Grounding to conform to applicable building codes.

B. Cable and equipment to be installed in a neat and workmanlike manner.

C. Materials and Methods shall comply in every way with above cited Standards and Codes.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Burndy Corporation

B. Chatsworth Products Incorporated (CPI)

C. Panduit Corporation

D. Thomas and Betts Corporation

E. Legrand

2.2 CONDUCTORS

A. Conductors shall be copper. Bare and insulated conductors are permitted. The NEC specifies criteria for mechanical protection.

B. Conductors shall comply with UL 486A-486B.

C. Insulated Conductors

1. Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.
2. Ground wire for custom-length equipment ground jumpers shall be #6 AWG, 19- strand, UL-listed, Type THHN wire.

D. Bare Copper Conductor

1. Shall conform to the following standards.

a. Solid Conductors: ASTM B-3

b. Stranded Conductors: ASTM B-8
c. Tinned Conductors: ASTM B-33

E. Cable Tray Grounding Jumpers

1. Shall not be smaller than #6 AWG and no longer than 12 inches in length. If jumper is a wire, it shall have crimped grounding lugs with two holes and long barrels for two crimps, if jumper is a flexible braid, it shall have a one-hole ferrule. Attach with grounding screw or connector provided by cable tray manufacturer.

2.3 COMPRESSION LUGS

A. Compression Type

B. Two holes with various hole spacing's to fit the busbar.

C. Long barrel that will allow a minimum of two crimps with standard industry colors.

D. An inspection window to verify that the conductor is fully seated in the lug.

E. Crimp according to manufacturer's recommendation.

2.4 TAPS

A. Shall be able to accept #6 AWG to 1/0 AWG.

B. Shall require a minimum of two (2) crimps for C Tap and H Tap, one (1) crimp for I-Beam and busbar Taps.

C. Crimp according to manufacturer's recommendation.

2.5 GROUNDING BUSBARS

A. Telecommunications Main Grounding Busbar

1. TMGB shall be predrilled, wall-mounted, rectangular bar of hard-drawn solid copper, 1/4-inch by 4-inches in cross section and at minimum 20-inches long. Increase length as necessary to provide all connections with 25% spare capacity. The busbar shall be NRTL listed for use as TMGB and shall comply with ANSI/TIA-607-C.
2. A TMGB shall be provided at the telecommunications service entrance (or as indicated on the drawing set).
3. Predrilling shall be with holes for use with lugs specified in this section.
4. Stand-off brackets shall provide a 4-inch clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
5. Stand-off insulators for mounting shall be Lexan or PVC and comply with UL 891.

B. Telecommunications Grounding Busbar

1. TGB shall be predrilled, wall-mounted, rectangular bar of hand-drawn solid copper, 1/4-inch by 2-inches in cross section and at minimum 10-inches long. Increase length as necessary to provide all connections with 25% spare capacity. The busbar shall be NRTL listed for use as TGB and shall comply with ANSI/TIA-607-C.
2. A TGB shall be provided in each telecommunications room.

3. Predrilling shall be with holes for use with lugs specified in this section.
4. Stand-off brackets shall provide a 2-inch clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
5. Stand-off insulators for mounting shall be Lexan or PVC and comply with UL 891.

C. Rack and Cabinet Grounding Busbar

1. Rack and cabinet grounding busbars shall be rectangular bars of hard-drawn solid copper, accepting conductors ranging for #14 AWG to 2/0 AWG, NRTL listed as complying with UL 467 and complying with ANSI/TIA-607-C. Predrilling shall be with holes for use with lugs specified in this section.
2. Provide clean bond to any rack mounted equipment regardless of whether or not equipment has an integrated grounding terminal.
3. Vertical busbars shall be a minimum of 36-inches long with stainless-steel or copper plated hardware for attachment to the rack.

2.6 COMMUNICATIONS GROUNDING RODS

A. Shall be copper-clad steel, 3/4-inch in diameter by 10 feet in length minimum.

2.7 GROUNDING CLAMPS

A. Pipe Clamps

1. Used to ground copper code conductor to water pipe or copper tubing.
2. Casted from high strength, electrolytic bronze to provide reliable grounding connections.
3. Plated steel screws provide high strength and inhibit corrosion.
4. Accommodates a wide range of pipe, tube, rod, and conductor sizes
5. UL Listed for grounding and bonding with AWG conductor and suitable for direct burial or encasement in concrete.

B. Bronze Grounding Clamps for Conduit

1. Used to ground copper conductor parallel to, or at right angle to a rod, tube, or pipe.
2. Made from high strength, electrolytic cast bronze.
3. High strength silicon bronze hardware provides long term reliable assembly.
4. Accommodates a wide range of pipe, tube, rod, and conductor sizes.

C. Beam Clamps

1. For bonding structural steel (ex: I-beams) into bonding network.
2. Should fit a wide range of standard (angled) and wide flange (parallel) structural steel beams.
3. Provide a mounting pad suitable for a two-hole compression lug.
4. UL 467 Listed and CSA 22.2 Certified for grounding and bonding suitable for direct burial in earth or concrete.
5. Comply with vibration tests per MIL-STD-202G (Method 201A).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate TMGB and TGBs so that they are accessible to telecommunications personnel.

B. At a minimum, follow all manufacturer instructions. In case of discrepancy between manufacturer and contractor requirements, the more stringent shall apply. In the case of conflicting instructions, report any discrepancy to the Design Engineer in a timely fashion so as not to impact the construction timeline.

C. Telecommunications Bonding Backbone (TBB):

1. Bonding and grounding conductors may be insulated or un-insulated and shall not decrease in size as the grounding path moves closer to earth.
2. Connections (bonds) between the telecommunications grounding network and associated electrical panels shall be done by a qualified electrician in accordance with guidelines in ANSI/TIA-607-C and applicable electrical codes.
3. Bonding Conductors should be continuous and routed in the shortest possible straight line path, avoiding changes in elevation and sharp bends.
4. TBB in multi-story buildings with multiple risers (multiple TBBs) shall employ a grounding equalizer (GE) between vertical grounding backbones at the top floor of the building and minimally at every third floor in between to the lowest floor level. The GE shall be no smaller than the largest sized TBB.
5. Conductors used to bond TBB to conduit ends shall be of #6 AWG size or larger.
6. Conductor sizing shall be based upon project specification (drawings and notes) for that installation. These sizes are based on TBB length per ANSI/TIA-607-C recommendations. Contractor shall bring to the attention of Architect anywhere TBB project specified sizing appears insufficient per the Table below:

Sizing of the TBB	
TBB Linear Length (feet)	TBB Size (AWG)
Less than 13	6
14-20	4
21-26	3
27-33	2
34-41	1
42-52	1/0
53-66	2/0
67-84	3/0
Greater than 85	4/0

D. Grounding Busbars

1. Indicate locations of grounding busbars on Drawings. Install busbars horizontally, in insulated spacers 2 inches minimum from wall, 12 inches minimum above finished floor unless otherwise indicated.
2. The TMGB shall be installed at the bottom of the backboard near the building entrance conduits in the EF.
3. Each TGB shall be installed at the bottom of the backboard near where the TBB enters or passes through each TR.
4. Connectors on TBB which attach to TMGB shall be of two-hole, long-barrel compression lugs of the LCC series.
5. Building steel within six feet of the communications grounding system should be bonded into the system with appropriate hardware.
6. Connectors on backbone and rack/cabinet bonding conductors which attach to TGB shall be of two-hole, long-barrel compression lugs of the LCC series.

7. Racks and cabinets shall have individual Rack Bonding Conductors (RBC) bonding to the Telecommunications Equipment Bonding Conductor (TEBC) - DAISY CHAINING OR SERIAL CONNECTIONS OF ONE RACK OR CABINET TO ANOTHER WILL NOT BE ACCEPTED.
8. In smaller Telecommunications Rooms (3-5 racks) it is acceptable to have telecommunications equipment bonding conductors (TEBC) that go directly from each individual rack to the TGB. DAISY CHAINING OF RACKS WILL NOT BE ACCEPTED.
9. Rack Bonding Conductors (RBC) or above rack row grounds (TEBC) shall be installed to maintain a minimum of 2" separation from all other types of cable - power or communications.

E. Telecommunications Enclosures and Equipment Racks

1. Bond metallic components of enclosures to the telecommunications bonding and grounding system.
2. Install vertical rack equipment grounding busbar unless the enclosure and rack are manufactured with the busbar.
3. Bond the equipment grounding busbar to the TGB using No. 2 AWG bonding conductors.

F. Structural Steel

1. Where the structural steel of a steel frame building is readily accessible within the room or space, bond each TGB and TMGB to the vertical steel of the building frame.

G. Electrical Power Panelboards

1. Where an electrical panelboard for telecommunications equipment is located in the same room or space, bond each TGB to the ground bar of the panelboard.

H. Cable Runways and Cable Trays

1. In order to achieve the objectives of potential equalization, ensure that the all cable runway and cable tray sections are bonded together and bonded back to the TMGB/TGB using two-hole compression lugs or ground terminal blocks. Listed split bolts suitable for the application can be used for bonding sections of cable runways or trays. Cable runway/tray bonding conductors shall be installed between every splice junction of runway/tray to ensure electrical continuity. Consult cable runway/tray manufacturer’s for recommended grounding and bonding requirements.

3.2 FIELD QUALITY CONTROL

A. Perform tests and inspections. Tests shall be performed by the contractor and the designer/consultant shall perform the inspections.

B. Test and Inspections

1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer’s written instructions.
2. Test the bonding connections of the system using an AC earth ground-resistance tester, taking two-point bonding measurements in each telecommunications equipment room containing a TMGB or a TGB and using the process recommended by BICSI TDMM. Conduct tests with the facility in operation.

a. Measure the resistance between the busbar and the nearest available grounding electrode. The maximum acceptable value of this bonding resistance is 100 milliohms (0.1 ohm).
b. A copy of the test results shall be provided to Owner prior to any telecommunication services being activated.

3. Test for ground loop currents using a digital clamp-on ammeter, with a full-scale of not more than 10A, displaying current in increments of 0.01 A at an accuracy of plus/minus 2.0 percent.
    a. With the grounding infrastructure completed and the communications system electronics operating, measure the current in every conductor connected to the TMGB and in each TGB. Maximum acceptable ac current level is 1.0 A.
4. Excessive Ground Resistance
    a. If resistance to ground at the BCT exceeds 5 ohms, notify Owner promptly and include recommendations to reduce ground resistance.
5. Grounding system will be considered defective if it does not pass tests and inspections.
6. Prepare test and inspection reports and provide to Owner.

END OF SECTION