

## **SECTION 27 05 26 – GROUNDING AND BONDING FOR COMMUNICATIONS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Provide all labor, materials, and equipment for the complete installation of Work called for in the Contract Documents.
- B. This section includes the minimum requirements for the installation of telecommunications grounding systems in Telecommunications Rooms.
- C. Included in this section are the minimum composition requirements and installation methods for the following:
  - 1. Busbars
  - 2. Ground Blocks
  - 3. Compression Lugs

#### **1.2 DEFINITIONS AND TERMS**

- A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this Section:
  - 1. AA American Airlines
  - 2. ANSI American National Standards Institute
  - 3. AWG American Wire Gauge
  - 4. BICSI Building Industry Consulting Service International
  - 5. DFW Dallas/Fort Worth International Airport
  - 6. NECA National Electrical Contractors Association
  - 7. NEMA National Electric Manufacturers Association
  - 8. NFPA National Fire Protection Association
  - 9. OAR Owner's Authorized Representative
  - 10. RCDD Registered Communications Distribution Designer
  - 11. STD Standard
  - 12. TDMM Telecommunications Distribution Methods Manual
  - 13. TGB Telecommunications Grounding Busbar
  - 14. TIA Telecommunications Industry Association
  - 15. TMGB Telecommunications Main Ground Bus Bar
  - 16. UL Underwriters Laboratories

#### **1.3 QUALITY ASSURANCE**

- A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the OAR.
- B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated,

or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the OAR.

- C. Strictly adhere to all BICSI and TIA recommended installation practices when installing telecommunications grounding systems.
- D. Contractor's Qualifications:
  - 1. Firms regularly engaged in the installation of Electrical Systems or Data Communications cabling and that have five (5) years of installation experience with systems similar to that required for this project.
  - 2. Provide references to include client names, phone numbers and a summary of project details. These references will be checked, and the clients will be asked questions relative to the performance of your company.
  - 3. Provide verification that installation personnel responsible have been properly trained to install the products described in this Section.
  - 4. Provide a BICSI RCDD certified professional and, if necessary, a master electrician, for oversight on this project. This person does not have to be working on-site but must be accessible to answer questions and provide weekly status reports. The RCDD and master electrician shall be a full time employee of the contractor.
  - 5. Provide full time project manager with a minimum of ten (10) years field experience in installation of communications systems and infrastructures. Project manager shall be assigned for the duration of the project and shall not be replaced without written consent from the OAR.
- E. Manufacturer's Qualifications:
  - 1. Firms regularly engaged in manufacture of products of the types, ratings and capacities required for this project; whose products have been in satisfactory use in similar service for not less than five (5) years, with production capabilities per applicable NEMA standards.
- F. Material and Work specified herein shall comply with the applicable requirements of:
  - 1. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2010
  - 2. ANSI/NECA/BICSI-568 – Standard for Installing Commercial building Telecommunications Cabling, 2006
  - 3. ANSI/TIA-568.0-E – Generic Telecommunications Cabling for Customer Premises, 2020
  - 4. ANSI/TIA-568.1-E – Commercial Building Telecommunications Infrastructure Standard, 2020
  - 5. ANSI/TIA-569-E – Telecommunications Pathways and Spaces, 2019
  - 6. ANSI/TIA-606-C – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 2017
  - 7. ANSI/TIA-607-D – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises, 2019
  - 8. ANSI/TIA-942-B – Telecommunications Infrastructure Standard for Data Centers, 2017
  - 9. NFPA 70 – National Electric Code, 2017
  - 10. BICSI – Telecommunications Distribution Methods Manual, 14th Edition
  - 11. NEMA – VE 1 – Metal Cable Tray Systems, 2009
  - 12. NEMA – VE 2 – Metal Cable Tray Installation Guidelines, 2006
  - 13. DFW Airport Design Criteria Manual
  - 14. US Customs and Border protection Airport Technical Design Standard, 2017
  - 15. Applicable codes and directives of authorities having jurisdiction
- G. Work:

1. The Work shall be performed in compliance with the applicable manufacturer's installation instructions, Standards, and certifications listed herein, the Contract Documents, and governing codes and regulations of the authorities having jurisdiction.
2. The drawing and specification requirements govern where they exceed Code and Regulation requirements.
3. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
4. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.

#### **1.4 CONFLICTS**

- A. This installation shall be made in strict accordance with the Specifications, Drawings, any applicable codes, referenced publications and standards. In case of conflicts between the aforementioned, notify the OAR in writing prior to commencement of affected work.

#### **1.5 SCHEDULING**

- A. The Contractor shall comply with all scheduling requests established by OAR, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed.

#### **1.6 REQUIREMENTS**

- A. All references to manufacturers, model numbers and other pertinent information herein are intended to establish standards of performance and quality of construction. The OAR must approve material submittal and substitutions in writing.
- B. Verification that all the components specified and installed meet the criteria specified by the respective component manufacturer, supplier and designer is the responsibility of the Contractor.
- C. All installation tools, special equipment and testing apparatus required to accomplish field connections and related work as described herein shall be furnished by the Contractor at no additional cost.
- D. The requirements as given in this document are to be adhered to unless revised by the OAR in writing.
- E. The Owner reserves the right to waive these requirements at any time.

#### **1.7 SUBMITTALS**

- A. Comply with provisions of Division 01.
- B. Comply with provisions of Section 27 05 00.
- C. Provide all submittal requirements under this section as a single package.
- D. Provide product data for the following:

1. Product data consisting of manufacturers specifications for each type of product to be installed, all applicable certifications and elevation/plan documents supporting compliance with stated Specifications.
2. Proposed format of as-built documentation.

#### **1.8 CONTRACTOR CLOSE OUT SUBMITTALS**

- A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 01 of the Project Manual, or a minimum of four (4) sets.
  1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.
  2. Provide above closeout documentation as an electronic file in PDF format.
- B. Warranty and Maintenance:
  1. Record Drawings

#### **1.9 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials factory-packaged in containers or reels and handle in accordance with manufacturer's recommendations. Store in a clean, dry space and protect products from damaging fumes and traffic. Handle materials carefully to avoid damage.
- B. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the OAR.
- C. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.
- D. Provide protective covering during construction to prevent damage or entrance of foreign matter.
- E. Contractor is responsible for on-site security of tools, test equipment and materials.
- F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

#### **1.10 PROJECT CONDITIONS**

- A. Verify conditions on the job site are applicable to this Work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.
- B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install Work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the Work may be installed.

## **1.11 WARRANTY**

- A. Warrant labor and product to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics, following Contractor Warranty requirements defined in Division 01. Repair or replace defects occurring in labor or product within the Warranty period without charge.
- B. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- A. The products specified in this document do not necessarily constitute the exhaustive list of products required to complete the statement of work. Except where described in the SUMMARY subpart of this document, the contractor is responsible for providing any other parts and materials needed to deliver a complete and working system.

### **2.2 Outdoor Grounding Products**

- A. Ground Rod
  - 1. Provide a ground rod for each outdoor network equipment enclosure.
  - 2. Ground rod shall have the following properties:
    - a. Solid stainless-steel construction made of high conductive drawn bare copper.
    - b. 3/4-inch diameter and 10 feet in length.
  - 3. Acceptable products:
    - a. nVent ERICO 683400
    - b. Approved equivalent.
- B. Exothermic Weld Kit
  - 1. Provide an exothermic weld between each ground rod and its bonding conductor.
  - 2. Weld shall have the following properties:
    - a. Provides a permanent, low resistance connection and molecular bond.
    - b. Connection shall be rated with the same current capacity as the conductor.
    - c. Connection shall have the ability to be visually inspected.
  - 3. Acceptable products
    - a. ERICO Cadweld System
    - b. Approved equivalent.

### **2.3 WALL-MOUNT BUSBARS**

- A. Telecommunications Grounding Busbar (TGB)
  - 1. Telecommunications Grounding Busbar (TGB) shall be constructed of .25" (6.4 mm) thick solid copper bar.

2. The busbar shall be 4" (100 mm) high and minimum 12" (300 mm) long and shall have minimum of 12 attachment points for two-hole #6 grounding lugs and 3 two-hole grounding lugs for larger gauge cable.
3. Each busbar shall have available capacity for 25% future connections.
4. No more than one attachment of a grounding lug to an attachment point of the Busbar.
5. The hole pattern for attaching grounding lugs shall meet the requirements of the latest release of the ANSI/TIA-607 standard and shall accept a minimum of 6 lugs with 5/8" (15.8 mm) hole centers and a minimum of 3 lugs with 1" (25.4 mm) hole centers.
6. No attaching of grounding lugs to the backside of the Busbar.
7. The busbar shall include wall-mount stand-off brackets, assembly screws and insulators creating a 2" (50 mm) standoff from the wall.
8. The busbar shall be UL Listed as grounding and bonding equipment.
9. Acceptable Manufacturers:
  - a. Panduit GB4B0612TPI-1
  - b. Chatsworth Products 40153-012
  - c. Owner Approved Equivalent.

## 2.4 BONDING ACCESSORIES

### A. Lay-In Ground Terminal Block

1. Ground terminal block shall be made of electroplated tin aluminum extrusion.
2. Ground terminal block shall accept conductors ranging from #14 AWG through 1/0.
3. The conductors shall be held in place by two stainless steel set screws.
4. Ground terminal block shall have two 1/4-inch (6.4 mm) holes spaced on 5/8-inch (15.8 mm) centers to allow secure two-bolt attachment to the rack or cabinet.
5. Ground terminal block shall be UL Listed as a wire connector.
6. Acceptable Manufacturers:
  - a. Chatsworth Products 40167-001
  - b. Owner approved equivalent.

### B. Compression Lugs

1. Compression lugs shall be manufactured from electroplated tinned copper.
2. Compression lugs shall have two holes spaced on 5/8-inch (15.8 mm) or 1-inch (25.4 mm) centers, as stated below, to allow secure two bolt connections to busbars.
3. Compression lugs shall be sized to fit a specific size conductor, sizes #6 to 4/0, as stated below.
4. Compression lugs shall be UL Listed as wire connectors.
5. Acceptable Manufacturers:
  - a. Panduit LCC Series
  - b. Chatsworth Products 40162
  - c. Owner approved equivalent.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

#### A. Wall-Mount Busbars

1. Attach busbars to the wall with appropriate hardware according to the manufacturer's installation instructions.
2. Conductor connections to the TMGB or TGB shall be made with 2-Hole Bolt-On Compression Lugs sized to fit the busbar and the conductors.
3. Each lug shall be attached with stainless steel hardware after preparing the bond according to manufacturer recommendations and treating the bonding surface on the busbar with antioxidant to help prevent corrosion at the bond.
4. The wall-mount busbar shall be bonded to the main building ground, in the nearest electrical room, as part of the overall Telecommunications Bonding and Grounding System.

B. Ground Terminal Block

1. Every rack and cabinet shall be bonded to the TMGB or TGB.
2. Minimum bonding connection to racks and cabinets shall be made with a rack-mount 2-hole ground terminal block sized to fit the conductor and rack and installed according to manufacturer recommendations.
3. 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.

C. Grounding Voice and Data Systems

1. Provide an approved ground at all newly installed distribution frames and protector locations using proper bonding to any existing facility. Ensure ground continuity by properly bonding to any existing facility. Ensure ground continuity by properly bonding all appropriate cabling, closures, cabinets, service boxes, and framework. All grounds shall consist of minimum #6 AWG copper wire and shall be supplied from the Telecommunications Main grounding Busbar or a Telecommunications Grounding Busbar.
2. Bond metallic conduits at one end to proper ground.
3. Provide maximum 0.5 Ohm resistance at 0.05 volts at each ground bar.
4. Ground electronic components, equipment cabinets and racks, cable trays and cable racks.
5. Provide ground lead for copper cable in multiples of 25 or more.
6. For overall-shielded cable, bond shield to proper grounding sources at one end. Do not loop ground leads or share with conduit ground leads.

D. Telecommunications Grounding System Testing

1. Two Point Bonding Measurements – This test is intended to verify that the communication room bus bar is satisfactorily grounded to the ground loop conductor which surrounds the garage structure. The resistance of this loop to remote ground has already been tested separately. Note that the power system grounds and the communication system grounds are intended to be kept separate except where they are connected together via the ground loop conductor. Since the power system grounding system is connected to the grounding loop, any nearby power system grounding component is a point that can be used for testing. The closest point is the ground (not neutral) bus bar in the power panel that is located in the communication room. In order to perform this test, first visually verify that there is no direct grounding connection between the communication grounding bus bar and the power panel ground bus. Using an earth ground resistance tester, measure the resistance between the communication ground bus bar and the ground bus in the power panel. From the BICSI TDMM, the recommended maximum resistance from the communication ground bus bar to the ground loop is 0.1 ohms. (note that this test will include the resistance of the power system grounding riser, but the total is anticipated to be less than 0.1 ohms)
2. Spurious Ground Test – This test is intended to evaluate the degree to which the communication grounding bus bar is isolated from paths to ground other than the intended ground. To perform this test, disconnect the ground conductor which connects “downward”

toward the grounding loop from the communication grounding bus bar. Using an earth ground resistance tester, measure the resistance between the communication ground bus bar and the ground bus in the power panel. The resistance should be 1000 Ohms or greater.

3. Root Mean Square Current Testing – These tests are to reveal the presence of unwanted AC or DC current flow on the bonding conductor. To perform this test, disconnect the ground conductor which connects “downward” toward the grounding loop from the communication grounding bus bar. Then connect the “downward” conductor in series through an ammeter to the communication bus bar. Measure both AC RMS and DC current. Per the BICSI TDMM, the DC current should be less than 0.5 amps and the AC current should be less than 1.0 amp

**END OF SECTION 27 05 26**