SECTION 27 05 26

GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 – GENERAL

1.1 PURPOSE

A. This guideline is intended to provide useful information to the Professional Service Provider (PSP) to establish a basis of design. PSP is to apply the principles of this section such that the University of Texas at Arlington (UTA) may achieve a level of quality and consistency in the design and construction of their facilities. Deviations from these guidelines must be approved by UTA and may require justification through Life Cycle Cost (LCC) analysis and submitted to UTA for approval.

1.2 **LESSONS LEARNED AND DESIGN CONSIDERATIONS**

A. Telecommunications Contractor shall review and adhere to all of University of Texas at Arlington Standards of Installation for Network Cabling.

1.3 SUMMARY/OVERVIEW

A. This section includes grounding and bonding products, design requirements and installation for communications systems.

B. Related Sections

1. Section 27 00 00 – Communications
2. Section 27 05 28 – Pathways for Communications
3. Section 27 05 43 – Underground Ducts and Raceways for Communications Systems
4. Section 27 11 00 – Communications Equipment Room Fittings
5. Section 27 13 00 – Communications Backbone Cabling
6. Section 27 15 00 – Communications Horizontal Cabling

1.4 REFERENCES

A. The publications listed below form a part of this specification. The publications are referred to in the text by basic designation only

B. Specific reference in specifications to codes, rules, regulations, standards, manufacturer's instructions, or requirements of regulatory agencies shall mean the latest printed edition of each in effect at the date of contract unless the document is shown dated.

C. Conflicts

1. Refer to Section 27 00 00.

D. Codes and Standards

1. American Society for Testing and Materials (ASTM):
   a. B 3 soft or annealed copper wires
   b. B 8 Concentric-Lay-Stranded copper conductors, hard, medium hard, soft
   c. B 33 tinned soft or annealed copper wire for electrical purposes
2. Institute of Electrical and Electronics Engineers (IEEE):
   a. 142-1991 recommended practice for grounding of industrial and commercial power systems
   b. 1100-1999 recommended practice for powering and grounding sensitive electronic equipment in industrial and commercial power systems.
3. Underwriters' Laboratories (UL):
   a. UL 83 thermoplastic insulated wire and cables
   b. UL 467 grounding and bonding equipment
4. National Fire Protection Association (NFPA)
   a. ANSI/NFPA 70 National Electrical Code (NEC)
   b. NEC Article # 250 – Grounding
   c. NEC Chapter 8 – Communications Systems
5. ANSI/NECA/BICSI-607 commercial building grounding and bonding requirements for telecommunications.
6. Building Industry Consulting Services International (BICSI) Telecommunications Distribution Methods

Manual. (TDMM)

7. Equipment of foreign manufacture must meet U.S. codes and standards. It shall be indicated in the proposal the components that may be of foreign manufacture, if any, and the country of origin.

1.5 SYSTEM REQUIREMENTS

A. General
   1. All conductor wire, busbars and conduit shall be UL listed.
   2. The communications ground system shall be independent from all power grounding.
   3. Power grounding and/or bonding shall not be allowed to interfere or provide any back feed or be a conductor to the separate communications ground system source or to any communications bonded materials or equipment.

B. TMGB
   1. The main ground source feed to the Telecommunications Main Grounding Busbar (TMGB) in the Equipment Room (ER) shall be an independent feed from the main building ground system.
   2. The main ground source feed shall be a green-insulated stranded copper ground wire from the building ground system to the TMGB in the ER properly sized by Electrical Engineer.
   3. The green-insulated stranded copper ground wire shall be installed in a two-inch metallic conduit.
   4. The green-insulated stranded copper ground wire connections shall be exothermically welded at connecting ends.

C. Equipment cabinets and racks.
   1. All cabinets and racks shall be provided with a separate communications ground, consisting of a minimum #6 AWG green-insulated stranded copper ground wire, from each equipment rack ground point to the aisle/row ground by as direct a route as possible. The aisle ground shall terminate on the nearest ground connection point as required in Section 27 00 00.

1.6 SUBMITTALS

A. Refer to Section 27 00 00.

1.7 QUALITY ASSURANCE

A. The Contractor shall submit written proof that the following experience requirements are being met.
   1. The Contractor shall submit references and other related evidence of installation experience for a period of three years prior to the issue date of this specification.
   2. The Contractor shall furnish products of latest proven design, new and in current production. Do not use obsolete components or out-of-production products.

B. Tests for Insulated Cable must pass a vertical tray flame test following IEEE 383-2.5.

C. Grounding system should be designed following all applicable NEC & IEEE requirements by an Electrical Engineer from a firm acceptable to owner's insurance underwriter.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Ship on manufacturer's standard reel sizes of one continuous length. Where cut lengths are specified, mark reel quantity accordingly.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with requirements, manufacturers that may be incorporated in the work, include, but are not limited to the following:

B. Cable Manufacturers:
   1. Houston Wire and Cable Company
   2. Okonite Company
   3. General Cable
   4. Pirelli Cable Corporation
   5. Triangle Wire and Cable, Inc.
   6. Acceptable alternative

C. Electrical Service Entrance Bonding Conductor and Connector Manufacturers
   1. Copperweld
   2. Thomas & Betts

3. Blackburn
4. Acceptable alternative

D. Exothermic Connector Manufacturers
1. Erico Products (Cadweld)
2. Continental Industries (Thermoweld)
3. Harger
4. Acceptable alternative

E. Crimp Connector Manufacturers
1. Thomas & Betts
2. FCI Burndy Electrical
3. O-Z/Gedney
4. Acceptable alternative

F. Telecommunication Grounding Busbars
1. Harger
2. Erico
3. Leviton
4. Acceptable alternative

G. Bonding Straps
1. Chatsworth
2. Harger
3. Brundy
4. Acceptable alternative

H. C-Type Compression Taps
1. Brundy
2. Harger
3. Acceptable alternative

I. Antioxidant Joint Compound
1. Chatsworth
2. Acceptable alternative

J. Labeling
1. Refer to section 27 00 00.

K. Firestopping
1. Refer to section 27 00 00.

2.2 MATERIALS

A. Communications Grounding Conductors: Insulated copper American Wire Gauge (AWG) wire following ASTM-B3, ASTM-B8 and ASTM-B33, of following sizes:
1. Telecommunications Bonding Backbone (TBB), from the TMGB to the Telecommunications Ground Busbars (TGB): # 3/0 AWG green-insulated stranded copper ground wire.
2. TGB to equipment cabinets and racks, conduits, cable raceways, etc.: Minimum # 6 AWG green-insulated stranded copper ground wire.

B. Grounding Connectors: Connectors shall be a copper alloy material and two-hole, double- crimp compression lug type at all connecting ends.

C. Telecommunications Main Ground Busbar (TMGB): The TMGB, located in the main equipment room (ER), shall comply with the following:
1. Pre-drilled copper busbar with standard NEMA bolt hole sizing and spacing for the type of connectors to be used.
2. Sized for the immediate requirements and allow for growth. The minimum dimensions shall be .25 inch thick by 4 inches wide by 20 inches long.
3. Contain pre-drilled holes, which shall support a minimum of two tiers of eight # 6 AWG copper two-hole compression lugs.
4. ASTM-B187-C11000 Copper bar suitable for use with two-hole compression-type copper lugs.

D. Equipment Cabinet and Rack Ground Busbar:
1. Provide and install a ground busbar in all racks and equipment cabinets to be used as an equipment grounding bus.
2. The busbar shall be for equal-flange (channel) 19-inch rack width and shall include ground bar, splice plate and #12-24 mounting hardware.

3. The minimum dimensions shall be .75 inch in width by .1875 inch in thickness.
4. The busbar shall have pre-drilled holes and shall be suitable for use with two-hole compression-type copper lugs.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Refer to section 27 00 00.

3.2 PREPARATION:

A. Contractor's on-site RCDD supervisor shall review, approve and stamp all shop drawings, coordination drawings and record drawings.
B. Copper and copper alloy connections should be cleaned prior to connection.

3.3 INSTALLATION

A. Contractor shall install work following specifications, drawings, manufacturer's instructions and approved submittal data.
B. All work shall be supervised and reviewed by the Contractor's on-site RCDD.
   1. Installation plans and requests for information (RFIs) shall be reviewed by Contractor's on-site RCDD.
C. General:
   1. Bonding and grounding procedures and components shall comply with ANSI-J-STD-607- A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, and be installed to comply with ANSI/NECA/BICSI-607 Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings.
   2. Bonding should be accomplished such that the bonding system is integrated and compliant with NEC specifications.
   3. Bonding conductors shall be routed with minimum bends or changes in direction and should be made directly to the points being bonded.
   4. Bonding connections should be made by using compression copper lugs or, within the ground electrode system, exothermic welding (see NEC Article 250) for parts of a grounding system that are subject to corrosion, that must carry high currents reliably or for locations that require minimum maintenance.
   5. Make connections to dry surfaces only. Remove paint, rust, oxides, scales, grease and dirt from surfaces before making connection. Burnish clean a one square inch area, drill, tap, apply an adequate amount of antioxidant joint compound mixed for the metal surface types affected, and bolt conductor and connector to burnished and compounded area. Ensure proper conductivity.
   6. Route bonding conductor(s) the shortest distance between bonding contact points.
   7. The insulated ground-wire connecting ends shall have a minimum amount of insulation removed at ground lug.
   8. Do not connect ground wire in power cable assemblies to the telecommunications ground system.
   9. If bare-bonding conductors are used, isolate bonding conductors from one another and do not allow them to touch one another.
   10. A conductive material shall be installed to separate dissimilar metals apt to corrode through electrolysis under the environmental operating conditions specified.
   11. If multiple systems are involved (lightning protection systems, communications, radio and TV, CATV, etc.), those systems shall be bonded together to minimize potential differences between the systems, per NEC 250.94.
D. Telecommunication Bonding Backbone
   1. The Contractor shall:
      a. Provide one (1) #4/0, based on building size green-insulated ground cable from the Building Electrical Service Entrance Grounding Electrode System to the Telecommunication Main Grounding Busbar (TMGB) in the Telecommunications Entrance Facility and bond to the Building Electrical Service Entrance equipment Grounding Electrode.
      b. Provide one (1) AWG size smaller than the #4/0 Electrical Service Entrance Main Ground green-insulated ground cable from the TMGB to the TGB located in each Telecommunication Room. Bond from the TMGB to each respective TGB.
      c. Provide one (1) #2/0 stranded insulated copper ground cable from the TMGB/TGB along the entire row of racks and bond each rack to the #2 TBB with a #6 conductor using a C-type compression lug.

d. Provide #3/0 Grounding Equalizer (GE) conductor(s) whenever two or more TBBs are used within a multi-story building at the top floor and at a minimum of every third floor in between.
e. This conductor shall be labeled at each end as to its function and the room number of its opposite end with the warning of "Telecommunications Ground -DO NOT REMOVE".
f. Furnish and install all required bonding material and hardware and utilize tools manufactured for this purpose from the ladder rack ladder rack closest to standing racks.
g. Refer to previously listed documents, publications and standards for additional codes, standards and requirements for system grounding installations.

2. The connections of the bonding conductor for telecommunications, the Grounding Equalizer, between busbars, and the TBB to the TMGB, shall connected using exothermic welding.
   a. All exothermic welding shall be by Division 26.
   b. The Contractor shall:
      1) Coordinate with the building services personnel in occupied spaces to prevent the smoke from the exothermic weld process from potentially setting off smoke/fire alarms.
      2) Determine and coordinate on-site fire safety personnel requirements with local fire code officials.
3. The TBB green-insulated stranded copper ground wire connections from the grounding busbar to the equipment racks and ground straps shall be exothermically welded or hydraulically crimped with double crimp connector at connecting ends. Two-hole grounding lugs are preferred.
4. The TBB conductors should be installed without splices. Where splices are necessary, the number of splices should be a minimum and they shall be located in telecommunications spaces.
5. Joined segments of a TBB shall be connected using exothermic welding, irreversible compression-type connectors, or equivalent. All joints shall be adequately supported and protected from damage.

E. Equipment Cabinets and Racks
1. To provide electrical continuity between rack elements, paint-piercing grounding washers shall be used where rack sections bolt together, on both sides, under the head of the bolt and between the nut and rack.
2. A horizontal busbar shall be installed at the base and back of each cabinet and rack for floor fed cabinets/racks.
3. A vertical busbar shall be installed to the rear of the right-hand side rail with thread- forming screws to ensure metal-to-metal contact.
4. Each cabinet and rack shall be provided with a minimum # 6 AWG insulated ground wire.
5. Do not bond racks or cabinets serially (loop from cabinet/rack to cabinet/rack).
6. Each cabinet or rack bay against a wall shall be bottom/side ground feeds from the wall.
   a. Wall ground feeds/raceways to racks shall not be exposed on the walls.
   b. Exception: Some cabinet or rack bays will require the ground to be fed from the ceiling raceway. Refer to drawings for details.
7. The Contractor shall provide a ground strap for each equipment rack and bond to the TBB, Furnish all required bonding materials and hardware manufactured for this purpose. Follow NEC bonding procedures/specifications.
8. All ground raceways within each cabinet (or on each rack, where applicable) or cabinet base and adjacent-ganged cabinet base shall be an insulated metallic flex type raceway and shall not interfere with equipment mounting frames or equipment mounting brackets.
9. Each ground feed shall provide proper installation allowances and penetration depths to provide conversion fittings from solid metallic to insulated metallic flex conduit raceways.
10. To bond each cabinet and rack to ground, burnish clean a one square inch area, drill, tap, apply an adequate amount of antioxidant joint compound mixed for the metal surface types affected, and bolt connectorized conductor to burnished and compounded area. Ensure proper conductivity.

F. Cable Runway, Cable Raceway And Support System Grounding
1. The Contractor shall provide communications cable tray and cable runway systems with a communications isolated ground from the TBB.
2. All cable tray needs to be electrically continuous per NEC 250.96.
   a. Metal raceways, wire-mesh cable trays, cable armor, cable sheath, enclosures, frames, fittings, and other metal non-current-carrying parts that are to serve as an alternate grounding path, with or without the use of supplementary equipment grounding conductors, shall be effectively bonded where necessary to ensure electrical continuity and the capacity to conduct safely any fault current likely to be imposed on them. Any nonconductive paint, enamel, or similar coating shall be removed at threads, contact points, and contact surfaces, and be connected by means of fittings designed so as to make good bonding points.

3. The Contractor shall provide and install #6 AWG insulated ground wire to bond one end of each cable tray/runway system to the #2/0 TBB.
4. For electrically non-continuous conduits that contain only grounding conductor, the Contractor shall bond the conduit and conductor together at both ends to ground to nearest TGB with grounding bushings or ground clamps.

G. Shielded Backbone Cabling:
1. The Contractor shall terminate and bond shield to the nearest TGB or TMGB at both ends, following manufacturer's guidelines.

H. Unshielded Backbone Cabling:
1. The Contractor shall bond each end at the nearest TGB or TMGB in the area that the associated cables are terminated.

3.4 FIELD QUALITY CONTROL

A. Testing
1. Upon completion of the electrical system, including all grounding, the Electrical Contractor shall test the system for stray currents, ground shorts, etc. Approved instruments, apparatus, services, and qualified personnel shall be utilized. If stray currents, shorts, etc., are detected, eliminate or correct as required.

END OF SECTION