

Section 27 05 26

Grounding and Bonding for Communications Systems

Part 1 – General

1.01 Additional Information

A. Refer to Section 27 00 00 for the following Part 1 General information

- 1) References
- 2) Definitions / Terms / Acronyms
- 3) Submittal Requirements
- 4) Contractor Qualifications
- 5) Manufacturer Qualifications
- 6) Bidder Qualifications
- 7) Testing Agency Qualifications
- 8) Delivery, Storage and Protection
- 9) Project conditions
- 10) Sequencing
- 11) Continuity of Service and Scheduling of Work
- 12) Protection of Work and Property
- 13) Warranty

1.02 Summary

A. This Section includes the following:

- 1) Conduit, fittings and bodies.
- 2) Bonding, Grounding cable and fittings.
- 3) Junction boxes, pull boxes and gutters.
- 4) Measured pull tape.

B. This Section covers only communications bonding and grounding conduit and fittings.

1.03 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 will mean the latest printed edition of each in effect at the date of contract unless the document is shown dated.

C. Conflicts:

- 1) Between referenced requirements: Comply with the one establishing the more stringent requirements.
- 2) Between referenced requirements and contract documents: Comply with the one establishing the more stringent requirements.

D. References:

- 3) American National Standards Institute (ANSI):
 - a. C80.1 Rigid Steel Conduit – Zinc Coated.
 - b. C80.4 Fittings for Rigid Metal Conduit.
- E. Federal Specifications (FS):
 - 1) W-C-58C Conduit Outlet Boxes, Bodies Aluminum and Malleable Iron.
 - 2) W-C-1094 Conduit and Conduit Fittings Plastic, Rigid.
 - 3) WW-C-566C Flexible Metal Conduit.
 - 4) WW-C-581D Coatings on Steel Conduit.
- F. National Electrical Manufacturers Association (NEMA):
 - 1) RN1 Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Electrical metallic Tubing.
 - 2) TC2 Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
 - 3) TC3 PVC Fittings for Use with Rigid PVC Conduit and Tubing.
 - 4) NEMA VE 1 – Metal Cable Tray Systems.
 - 5) NEMA VE 2 – Metal Cable Tray Installation Guidelines.
- G. American Society for Testing and Materials International (ASTM):
 - 1) ASTM A123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 2) ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 3) ASTM B633 – Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
- H. Underwriters Laboratories Inc. (UL):
 - 6) 6 Rigid Metal Electrical Conduit.
 - 7) 514 B Fittings for Conduit and Outlet Boxes.
 - 8) 651 Schedule 40 and 80 Rigid PVC Conduit.
 - 9) 651A Type EB and A Rigid PVC Conduit and HDPE Conduit.
 - 10) 1666 Standard for Riser Application for Optical Fiber Raceway.
- I. National Fire Protection Association, Inc. (NFPA) ANSI/NFPA 70 National Electrical Code (NEC).
- J. National Electrical Safety Code (NESC).
- K. Telecommunications Industry Association TIA-569-B-2004 Commercial Building Standard for Telecommunications Pathways and Spaces.
- L. American National Standards Institute ANSI J/STD-607-A-2002 Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
- M. Building Industry Consulting Service International (BICSI) Telecommunications Distribution Methods Manual (TDMM).
- N. Building Industry Consulting Service International (BICSI) Customer Owned Outside Design Manual.
- O. Local, county, state and federal regulations and codes in effect as of date of purchase.

- P. Equipment of foreign manufacture must meet U.S. Codes and standards. It will be indicated in the proposal the components that may be of foreign manufacture, if any, and the country of origin.

1.04 Submittals

- Q. The Contractor will perform no portion of the work requiring submittal and review of record drawings, shop drawings, product data, or samples until the respective submittal has been approved by the Owner. Such work will be in accordance with approved submittals.
- R. Qualifications: The Contractor will submit qualification data sheets for firms and persons as specified in the "Quality Assurance" article of this specification to demonstrate their capabilities and experience.
- S. Proposed product data sheets: The Contractor will submit catalog cut-sheets that include manufacturer, trade name, and complete model number for each product specified. Model number will be handwritten and/or highlighted to indicate exact selection. Identify applicable specification section reference for each product.
- T. Record Drawings: Furnish CAD drawings of completed work including cable ID numbers following the Owner's labeling standards. Submit in hardcopy (two full size and two half size) and electronic formats.

1.05 Project Conditions

- A. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- B. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating units without field measurements. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.

1.06 Coordination

- C. Contractor shall furnish and install telecommunications grounding busbars, telecommunications bonding backbone(s), grounding equalizer(s), and equipment bonding conductors to install a complete telecommunications grounding system.
- D. The Electrical Contractor shall furnish and install telecommunications grounding busbars, telecommunications bonding backbone(s), grounding equalizer(s), and equipment bonding conductors to install a complete telecommunications grounding system.
- E. Field coordinate installation of conduit and cable with other trades to ensure clearance requirements are met.
- F. Coordinate with all contractors providing equipment outside the scope of this contract.

Part 2 – Products

2.01 Manufacturers

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Grounding Conductors, Cables, Connectors, and Rods:
 - a. Chatsworth Products.
 - b. Approved Equal.

2.02 Materials

- A. All conduits, fittings, junction and pull boxes will be UL rated.
- B. All conduits, fittings, junction and pull boxes will comply with the NEC.
- C. PVC-Coated Rigid Steel Conduit and Fittings: Follow NEMA RN1 (Type A).
- D. Non-metallic Conduit and Fittings: Pass NEMA TC2, UL 651 and 651A and FS W-C- 1094A. EMT fittings will be formed steel compression ring type. Die cast fittings are not allowed.
- E. Rigid Steel Galvanized Conduit and Fittings Before Coating
 - 1) Follow FS WW-C-581d, ANSI C80.1, and UL 6.
 - 2) Pass bending, ductility, and thickness of zinc coating in ANSI C80.1.
- F. Electrical Metallic Tubing (EMT):
 - 1) EMT fittings will be formed steel compression ring type. Die cast fittings are not allowed.
 - 2) EMT will be UL listed and conform to NEC Article 300.22.
 - 3) Will be used inside buildings only.
 - 4) Only manufacturer's fittings, transition adapters, terminators and fixed bends will be used.
 - 5) All transition junction and pull boxes, fittings terminators and adapters will be a metallic material.
 - 6) Minimum average tensile strength will be 1250 lbs. For 1½-inch and smaller conduits and innerduct.
 - 7) Minimum average tensile strength will be 1800 lbs. For conduits larger than 1½ inch.
- G. Conduit Bodies: Follow UL 514B and FS W-C-58C. Furnish sufficient coating for touch up after installation.
- H. Conduit Fittings
 - 1) All fittings will be compression or threaded.
 - 2) Fittings will provide a secure connection for pulling communications cables.

- 3) Setscrew fittings are not permitted.
- I. Conduit "condulets" are not permitted.
- J. Flexible conduit is not permitted.
- K. Non-metallic conduits are not permitted in above ground installations. Conversion fittings are required for non-metallic (below ground) to metallic (above ground) transitions.
- L. Telecommunications Bonding Backbone (TBB):
 - 1) All Telecommunications Bonding Backbone (TBB) Cables will be insulated and installed in conduit between manholes, telecommunications closets, building steel frame and building electrical grounding system.
 - 2) TBB cables will interconnect all Telecommunications Grounding Busbars (TGB) with the Telecommunications Main Grounding Busbar (TMGB). The TBB will originate at the TMGB and extend throughout the building and connects to all the TGB's in telecommunications closets and equipment rooms.
 - 3) The TBB will be installed without splices, where practicable. If splices are necessary they will be minimum in number accessible and located in telecommunications spaces. Joined segments will be connected using irreversible compression-type connectors, exothermic welding or equivalent.
 - 4) The TBB will be No. 3/0 AWG between TMGB and TGB's. The TBB from one TGB to another TGB will be No. 6 AWG. The TBB from TGB to the panel board in the same telecommunications space will be No. 6 AWG. All TBB connections to the TGB will utilize listed 2-hole compression connectors.
 - 5) Exothermic welds will be used to connect TBB from TMGB or TGB and building steel frame. All other connections will use 2-hole compression connectors.
 - 6) UL Listed with Flame Propagation compliant with UL 2024.
- M. Maintenance Hole Bonding and Grounding.
 - 1) The Maintenance Hole will be bonded and grounded if a splice case is required for any cable pulled through the space. No bonding or grounding is required if all cables are pulled without a splices.
 - 2) Splice cases, cable rack and ground rod will be bonded together using a minimum No. 6 AWG copper cable.
- N. Pull Boxes, Junction Boxes and Gutters
 - 1) All junction boxes, gutters and pull boxes will comply with NEC Article 314.
 - 2) All junction boxes, gutters and pull boxes will meet the following minimum material requirements:
 - a. 16-gauge steel or heavier.
 - b. Seams will be continuously welded and grounded smooth.
 - c. External screws and clamps.
 - d. External mounting feet (where possible).
 - e. Oil-resistant gasket and adhesive.

- f. ANSI 61 gray polyester powder coating inside and out over phosphatized surface.
 - g. UL 50 type 12.
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- 3) All junction boxes, gutters and pull boxes will be provided with bushings for conduits and/or cabling.
 - 4) All junction boxes, gutters and pull boxes will be securely installed.
 - 5) All junction boxes, gutters and pull box sizes for single and multiple conduit runs will comply with BICSI TDMM.
 - 6) All bonding conductors and connectors will be listed for the purpose intended and approved by a Nationally Recognized Testing Laboratory (NRTL).
 - 7) All bonding conductors will be insulated and copper. The minimum bonding conductor size will be a No. 6 AWG.

Part 3 – Execution

3.01 Additional Information

A. Refer to Section 27 00 00 for the following Part 3 - Execution information

- 1) General
- 2) Cable Pathways
- 3) Work Area Outlets
- 4) Installation Practices
- 5) Labeling
- 6) Firestopping
- 7) Sealing of Penetrations and Openings
- 8) Cable Supports
- 9) Cable Protection
- 10) Grounding
- 11) Documentation
- 12) Training
- 13) Cleaning
- 14) Project Closeout

3.02 Preparation

- A. Contractor's on-site RCDD supervisor will review, approve and stamp all shop drawings, coordination drawings and record drawings.
- B. Verify conduit system is properly sized for cables (minimum one inch, unless otherwise noted in Drawings).
- C. Verify general conduit route following Drawings.
- D. Verify substrates to which work is connected and determine detail requirements for proper support.
- E. Verify proper location and type of rough-in for conduit, cable terminations and ground buss bar.

3.03 Installation

- A. Coordinate locations with other trades prior to installation.
- B. Install work following drawings, manufacturer's instructions and approved submittal data.
- C. Installation plans and requests for information (RFIs) will be reviewed by contractor's on-site RCDD.
- D. All work will be supervised and reviewed by contractor's on-site RCDD.
- E. Locations and Types:

- 1) Install PVC coated conduits in outdoor above-ground locations, inside valve vaults and wet wells, and in corrosive and wet environments.
- 2) Install PVC conduits in buried duct banks or encased in concrete. Use PVC coated rigid steel elbows for stub-outs.
- 3) Install exposed conduit parallel or perpendicular to lines of existing construction and grouped together where possible, without interfering with use of premises or working areas. Prevent safety hazards and interference with operating and maintenance procedures.
- 4) Conduit may pass through areas with temperature differential of 20 degrees F or more. Seal with proper fitting at barrier between areas of differing temperature.
- 5) Do not install conduit in interference with equipment placement or operation; piping; structural members; maintenance access; indicated future equipment.
- 6) Contractor's RCDD supervisor will coordinate with drawings of other disciplines to determine availability of space for installation.

F. Design Considerations

- 1) Conduit fill will comply with ANSI/TIA/EIA-569-B.
- 2) The minimum bend radius is six times the conduit inside diameter (ID) for a two inch conduit or less.
- 3) The minimum bend radius is ten times the conduit ID for a conduit greater than two inches.
- 4) Below grade conduit will extend three inches above finished floor (AFF) with a bushing.
- 5) Ceiling conduit or sleeves will extend six inches below finished ceiling with a bushing.
- 6) All stubbed conduit ends will be provided with a ground bushing.
- 7) All conduit penetrations will comply with all applicable fire codes. All conduit penetrations in fire-rated walls or floors will be sealed and fire proofed to at least the rating of the penetration area.
- 8) Conduits will be routed in the most direct route, with the fewest number of bends possible.
- 9) There will be no continuous conduit sections longer than 100 feet. For runs that total more than 100 feet, insert junction or pull boxes (or gutters if appropriate) so that no continuous run between pull boxes is greater than 100 feet.
- 10) There will be no more than two 90-degree bends (180 degrees total) between conduit pull boxes.
- 11) Changes in direction will be accomplished with sweeping bends observing minimum bend radius requirements above. Do not use pull boxes for direction changes unless specifically designated otherwise in the Drawings.

- 12) Unless otherwise noted in the Drawings, conduits entering pull boxes will be aligned with exiting conduits.

G. Telecommunication Bonding Backbone (TBB) Installation

- 1) Comply with ANSI/TIA/EIA-607.
- 2) TBB placed in ferrous metallic conduit that exceeds 1m(3 ft) in length, will be bonded to each end of the conduit with a conductor sized as a NO. 6AWG, minimum.
- 3) The TBB conductor for telecommunications will bond the TMGB to the service equipment (power) ground.

- H. Identification: Refer to Section 270553 Identification for Communications Systems for labeling requirements.

3.04 Acceptance

- A. Once all work has been completed, test documentation has been submitted and approved, and the Owner is satisfied that all work has been completed in accordance with contract documents, the Owner will notify Contractor in writing of formal acceptance of the system.
- B. Acceptance will be subject to completion of all work and submittal and approval of complete as-built documentation as described above, and MAA final inspection of the work for compliance with the approved as-built documentation.

End of Section