

SECTION 27 05 26

GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section and the other sections of Division 27.
- B. Drawings and general provisions including Division 1, apply to this Section.

1.02 SUMMARY

- A. This Section includes:
  - 1. Commercial building grounding and bonding requirements for telecommunication infrastructure.
  - 2. Requirements for bonding and communications cabling, equipment, pathways, spaces, and mounting equipment.
  - 3. Basic requirements for grounding for protection of life, equipment circuits and systems. Grounding requirements specified in this Section may be supplemented in other sections of these Specifications.
- B. Comply with the ANSI/TIA Standard 607-C, “Grounding and Bonding Requirements” and the NEC.

1.03 RELATED SECTIONS:

- A. Section 013300 – Submittal Procedures.
- B. Section 260526 – Grounding and Bonding for Electrical System.
- C. Section 270100 – Operation and Maintenance of Communications Systems

1.04 REFERENCES

- A. ANSI/NFPA-70, 2011 National Electrical Code (NEC)
- B. ANSI/IEEE Std. 1100-2005, Recommended Practice for Powering and Grounding Electronic Equipment
- C. ANSI/IEEE Std. C2, 2007 National Electrical Safety Code (NESC)
- D. TIA-607-C Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises
- E. ANSI/TIA-606-B Administration Standard for Telecommunications Infrastructure
- F. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
- G. OSHA Standards and Regulations - all applicable

- H. Local Codes and Standards - all applicable
- I. Anywhere low-voltage cabling Standards conflict with electrical or safety Codes, Contractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either. Knowledge and execution of applicable codes is the sole responsibility of the Contractor. Any code violations committed at the time of installation shall be remedied at the Contractor's expense. Contractor is responsible to bring any perceived conflicts between project documents and referenced Standards or Codes to the attention of the Architect and Technology Consultant for resolution.

#### 1.05 SYSTEM DESCRIPTION

- A. Provide a communications bonding and grounding system as described in this document and project drawings 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 260526 - 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.

#### 1.06 SUBMITTALS

- A. Submit the following:
  - 1. The contractor shall provide product submittals for all system components as defined in Part 2 of this specification section and all associated project specifications. These components shall include all grounding and bonding products required for a complete grounding and bonding system.
  - 2. Shop drawings showing construction details and locations of components, and description and routing of interconnecting cabling.
  - 3. Field-testing organization certificates, signed by the contractor, certifying that the organization performing the tests complies with the requirements specified in Quality Assurance below.

- B. The selected contractor will allow sufficient time in project scheduling for client and review by the Architect and Technology Consultant.

#### 1.07 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of electrical connectors, terminals and fittings of types and rating required, and ancillary grounding materials, including stranded cable, copper braid and bus, ground rods and plate electrodes, whose products have been in satisfactory use in similar service for not less than 3-years.
- B. Installer: Qualified with at least 3-years of successful installation experience on projects with technology ground work similar to that required for this project.
- C. Listing and labeling: Provide products specified in this Section that are listed and labeled. The terms “listed” and “labeled” shall be defined as they are in the National Electric Code, Article 100.
- D. Listing and Labeling Agency Qualifications: A “Nationally Recognized Testing Laboratory” (NRTL) as defined in OSHA Regulation 1910.7.
- E. Field-testing Organization Qualifications: To qualify for acceptance, the independent testing organization must demonstrate, based on evaluation of organization-submitted criteria conforming to ASTM699, that it has the experience and capability to satisfactorily conduct the testing indicated.
- F. Component Standard: Components and installation shall comply with NFPA 70, “National Electric Code” (NEC).
- G. UL Compliance: Comply with applicable requirements of UL Standards Nos. 467 and 869 pertaining to electrical and electronic grounding.
- H. IEEE Compliance: Comply with applicable requirements of IEEE Standard 142 and 241 pertaining to electrical and electronic grounding.

## PART 2 PRODUCTS

### 2.01 GROUNDING AND BONDING PRODUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
  1. B-Line Systems, Inc.
  2. Burndy Corp.
  3. Crouse-Hinds Co.
  4. Electrical Components Division; Gould Inc.
  5. General Electric Supply Co.
  6. Ideal Industries, Inc.
  7. Panduit.
  8. Thomas & Betts Corp.

### 2.02 PRODUCTS

- A. Supply types indicated and of sizes and rating to comply with NEC. Where types, sizes, ratings, and quantities indicated are in excess of NEC requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

2.03 CONDUCTOR MATERIALS

- A. Copper with minimum 98% conductivity.

2.04 WIRE AND CABLE CONDUCTORS

- A. Coordinate with Division 26 Sections.
- B. Equipment Grounding Conductor: Green insulated.
- C. Grounding Electrode Conductor: Stranded cable.
- D. Bare Copper Conductors:
  - 1. Conform to the following:
    - a. Solid Conductors: ASTM B-3.
    - b. Assembly of Stranded Conductors: ASTM B-8.
    - c. Tinned Conductors: ASTM B-33.

2.05 MISCELLANEOUS CONDUCTORS

- A. Ground Bus: Bare annealed copper bars of rectangular cross section. All bus bars shall be two-hole lug type.
- B. Bonding Strap Conductor/Connectors: Soft copper, 0.05-inch-thick and 2 inches wide, except as indicated.
- C. Flexible Jumper Strap: Flexible flat conductor, 480 strands of 30-gauge bare copper wire, 3/4" wide, 9-1/2" long; 48.250cm. Protect braid with copper bolt-hole ends with holes sized for 3/8" diameter bolts.

2.06 CONNECTOR PRODUCTS

- A. Listed and labeled as grounding connectors for materials used and approved by a nationally recognized testing laboratory.
- B. Pressure Connectors:
- C. High-conductivity-plated units.
  - 1. All lugs shall be two-hole type.
- D. Bolted Clamps: Heavy-duty units listed for the application.

2.07 GROUNDING ELECTRODES

- A. For technology systems, provide a #2 AWG minimum insulated stranded copper conductor from the grounding electrode system to each telecommunication room, terminal cabinet and central location.
- B. Bonding Plates, Connectors, Terminals and Clamps: Provide electrical bonding plates, connectors, terminals, lugs and clamps as recommended by manufacturers for indicated applications.
- C. Connectors, Terminals and Clamps will be compression type.

- D. Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials and bonding straps, as recommended accessories by manufacturers.

2.08 PIPE CLAMPS

- A. Used to ground copper code conductor to water pipe or copper tubing.
- B. Cast from high strength, electrolytic bronze to provide reliable grounding connections.
- C. Plated steel screws provide high strength and inhibit corrosion.
- D. Accommodates a wide range of pipe, tube, rod and conductor sizes - minimizes inventory.
- E. cULus 467 Listed for grounding and bonding with AWG conductor.
- F. Approved bronze grounding pipe clamps are as follows:

Part Number	Description
GPC2-1-Q	For pipe range 1/2 – 1" and conductor size range #10 SOL - #2 STR
GPC2-2-L	For pipe range 1 1/4 – 2 and conductor size range #10 SOL - #2 STR
GPC2-4-X	For pipe range 2 1/2 – 4 and conductor size range #10 SOL - #2 STR
GPC2-6-X	For pipe range 4 1/2 – 6 and conductor size range #10 SOL - #2 STR

2.09 BRONZE GROUNDING CLAMPS FOR CONDUIT

- A. Used to ground copper conductor parallel to, or at a right angle to a rod, tube, or pipe.
- B. Made from high strength, electrolytic cast bronze.
- C. High strength silicon bronze hardware provides long term reliable assembly.
- D. Accommodates a wide range of pipe, tube, rod and conductor sizes - minimizes inventory.
- E. cULus 467 Listed for grounding and bonding with AWG conductor and suitable for direct burial in earth or concrete.
- F. Approved bronze grounding conduit clamps are as follows:

Part Number	Description
GPL-8-Q	For pipe size inches 1/2 or 3/4 and conductor size range AWG #8 SOL - #4 STRL
GPL-14-X	For pipe size inches 1 and conductor size range AWG #8 SOL - #4 STR
GPL-22-X	For pipe size inches 1 1/4 and conductor size range AWG 2/0 SOL – 250 kcmil
GPL-28-X	For pipe size inches 1 1/2 and conductor size range AWG 2/0 SOL – 250 kcmil
GPL-34-3	For pipe size inches 2 and conductor size range AWG 2/0 SOL – 250

	kemil
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2.10 BRONZE GROUNDING CLAMPS FOR LAY-IN FEATURE

- A. Bonds water pipe to continuous copper grounding conductors.
- B. High strength, electrolytic cast bronze.
- C. Phos bronze hardware provides long term reliable assembly.
- D. cULus 467 Listed for grounding and bonding and suitable for direct burial in earth or concrete.

Part Number	Description
<b>GPLAC2-1-C</b>	For conductor run parallel to pipe. Pipe size inches 1/2 or 3/4 and conductor size range AWG #10 SOL - #2 STR
<b>GPLBC2-1-C</b>	For conductor run perpendicular to pipe. Pipe size inches 1/2 or 3/4 and conductor size range AWG #10 SOL - #2 STR

2.11 ZINC GROUND CLAMP

- A. Bonds steel and aluminum pipe to aluminum conductors
- B. Made from die cast zinc
- C. Zinc plated steel hardware
- D. cULus 467 Listed for grounding and bonding

Part Number	Description
<b>GPCZ2-1-C</b>	Pipe size inches 1/2 or 3/4 and conductor size range AWG #10 SOL - #2 STR

2.12 COMPRESSION-TYPE ALUMINUM-TO-COPPER REDUCING SPLICE

- A. Dual rated for use with aluminum or copper conductors.
- B. Factory pre-filled with joint compound and sealed with easy pull-out end plug to inhibit corrosion.
- C. Color-coded end plug and Panduit die index numbers marked on barrel for proper crimp die selection
- D. Tin-plated to inhibit corrosion
- E. For use up to 35 KV and temperature rated 90°C when crimped with Panduit crimping tools and dies

Part Number	Description
<b>SAR2-4-X</b>	Bonds aluminum conductor size #2 AWG to Aluminum or copper conductor size #4 AWG

2.13 COPPER AND ALUMINUM ONE-HOLE GROUNDING LAY-IN LUG FOR BONDING LADDER RACK

- A. Used for quick installation of a continuous grounding conductor
- B. cULus 467 Listed for grounding and bonding, copper lugs. UL Listed for direct burial in earth or concrete
- C. cULus Listed for use up to 600 V and temperature rated 90°C

Part Number	Description
LICC4-22-C	Copper body, 0.22-inch stud hole, conductor size range AWG #14 SOL - #4 STR
LICC4-22TP-C	Tin plated copper body, 0.22-inch stud hole, conductor size range AWG #14 SOL - #4 STR
LIAC4-22-C	Tin plated aluminum body, 0.22-inch stud hole, conductor size range AWG #14 SOL - #4 STR
LIAS1/0-14-L	Tin plated aluminum body, 0.27-inch stud hole, conductor size range AWG #14 SOL - #1/0 STR
LIAS250-56-Q	Tin plated aluminum body, 0.33-inch stud hole, conductor size range AWG #6 SOL – 250 kcmil STR

2.14 COMMUNICATIONS GROUNDING RODS

- A. Material: Copper-clad steel.
- B. Size: 3/4-inch by 8 feet long.
- C. Standards: Meet requirements of ANSI®/UL 467-1984, CSA, and ANSI/NEMA GR-1.
- D. Approved manufacturers:
  - 1. Erico

2.15 ELECTROLYTIC GROUND RODS

- A. Where standard ground rods do not have acceptable levels of conductivity (typically greater than 5 ohms resistance) to earth due to local soil conditions, electrolytic systems may be considered.
- B. Such systems shall meet the following:
  - 1. Be comprised of a hollow stainless steel or copper tube 10 feet or longer and filled with a mixture of hygroscopic electrolytic salts.
  - 2. Function as an active grounding system by absorbing moisture out of the air and constantly leaching and electrolytic solution into the surrounding soil to maintain high conductivity.
  - 3. Rod shall be encased in a conductive, non-corrosive carbon based back fill material.
  - 4. Provide low resistance to ground.
  - 5. Provide season to season stability.
  - 6. Be maintenance-free for 30 years.
  - 7. Contain no hazardous materials or chemicals.

2.16 TELECOMMUNICATIONS BONDING BACKBONE (TBB) GROUNDING CONDUCTORS

- A. To be bare or insulated copper, of minimum conductor size #6 AWG and sized at 2 kcmil per linear foot up to a maximum size of 750 kcmil.
- B. Where un-insulated, to be identified with green tape at termination location.
- C. Labeled in accordance with recommendations set forth in ANSI/TIA-606-B Administration Standard for Telecommunications Infrastructure.
- D. Approved manufacturers:
  - 1. General Cable
  - 2. Southwire

2.17 TWO-HOLE, LONG-BARREL COPPER COMPRESSION LUGS FOR GROUNDING CONDUCTORS

- A. Meets TIA-607-C requirements for network systems grounding applications.
- B. Tested by Telcordia - meets NEBS Level 3 with AWG conductor.
- C. UL Listed and CSA Certified with AWG conductor for use up to 35 KV\*\* and temperature rated 90°C when crimped with Panduit crimping tools and dies.
- D. Color-coded barrels marked with Panduit die index numbers for proper crimp die selection.
- E. Have long barrel to maximize number of crimps and provides premium wire pull-out strength and electrical performance.
- F. Have "inspection window" over tongue to visually assure full conductor insertion.
- G. Be tin-plated to inhibit corrosion.
- H. Available with NEMA and BICSI hole-sizes and spacing.
- I. Approved Manufacturers for lugs:
  - 1. Panduit

Part Number	Description
LCC-W series	Panduit two-hole compressing lugs for code conductors in BICSI hole spacing

2.18 IEEE UNIVERSAL BEAM GROUNDING CLAMP

- A. For bonding structural steel (ex: I-beams) into bonding network.
- B. Universal, fits on a wide range of standard (angled) and wide flange (parallel) structural steel beams.
- C. Provide a mounting pad suitable for a two-hole compression lug.
- D. Installs quickly and easily with standard 1/4" key hex wrench tooling.
- E. UL 467 Listed and CSA 22.2 Certified for grounding and bonding suitable for direct burial in earth or concrete.
- F. Comply with vibration tests per MIL-STD-202G (METHOD 201A).



- G. Approved Manufacturers for beam grounding clamps:  
1. Panduit

H. Approved parts for beam grounding clamps are as follows:

Part Number	Description
<b>GUBC500-6</b>	Panduit Universal Beam Grounding Clamp for copper conductor sizes ranging from #6 AWG to 500 kcmil and flange thickness from .25" to .675". Stud size is 1/2" with hole spacing for two-hole lug being 1.75" and thread size from 1/2 to 13.

2.19 WALL-MOUNT BUSBARS (TGB AND TMGB AND LABELING)

- A. Meet BICSI and TIA-607-C requirements for network systems grounding applications.  
B. Employ BICSI hole spacing to fit LCC-W series 2-hole lugs.  
C. Be made of high conductivity copper and tin-plated to inhibit corrosion.  
D. Come pre-assembled with brackets and insulators attached for quick installation.  
E. Use Panduit component labels, sold separately, to identify busbars to meet TIA-606-B.  
F. Approved Manufacturers:  
1. Panduit

G. Approved wall-mount grounding busbars are as follows:

Part Number	Description
<b>GB2B0306TPI-1</b>	Telecommunications grounding busbar (TGB) with 6 number of mounting positions with 1/4" stud hole and with 5/8" hole spacing, and 3 number of positions with 3/8" stud hole with 1" hole spacing
<b>GB2B0312TPI-1</b>	Telecommunications grounding busbar (TGB) with 12 number of mounting positions with 1/4" stud hole with 5/8" hole spacing, and 3 number of positions with 3/8" stud hole with 1" hole spacing
<b>GB4B0624TPI-1</b>	Telecommunications main grounding busbar (TMGB) with 24 number of mounting positions with 1/4" stud hole with 5/8" hole spacing, and 6 number of positions with 3/8" stud hole with 1" hole spacing
<b>GB4B1028TPI-1</b>	Telecommunications main grounding busbar (TMGB) with 28 number of mounting positions with 1/4" stud hole with 5/8" hole spacing, and 10 number of positions with 3/8" stud hole with 1" hole spacing
<b>LTYK</b>	Busbar label kit includes one printed tag and one flame retardant cable tie.

2.20 VERTICAL GROUNDING STRIP BUSBARS FOR NEW INSTALL RACKS AND CABINETS

- A. Provides clean bond to any rack mounted equipment regardless of whether or not equipment has an integrated grounding terminal.
- B. Bonds up to 45 RU per rack.
- C. Comes in EIA Universal mounting hole pattern.
- D. Complies with US and International grounding requirements.
- E. Comes in threaded rail and cage nut versions.
- F. Approved Manufacturers:
  - 1. Panduit

G. Approved rack and cabinet mount vertical busbars for new installs:

Part Number	Description
<b>RGS134-1Y</b>	Grounding strip for use with threaded rails; 78.65" (2m) length; .67" (17mm) width; .05" (1.27mm) thickness; provided with .16 oz. (5cc) of antioxidant, one grounding sticker and three each #12-24 x 1/2" and M6 x 12mm thread-forming screws.
<b>RGS134B-1</b>	Grounding strip for use with cage nut rails; 78.70" (2m) length; .67" (17mm) width; .05" (1.27mm) thickness; provided with .16 oz. (5cc) of antioxidant, one grounding sticker, three cage nut bonding studs, eight #12-24 bonding nuts and three strip clips
<b>RGS13442-1</b>	Grounding strip for use with threaded rails; 73.70" (1.9m) length; .67" (17mm) width; .05" (1.27mm) thickness; provided with .16 oz. (5cc) of antioxidant, one grounding sticker, three each, #12-24 x 1/2" and M6 x 12mm thread-forming screws.
<b>RGS13448-1</b>	Grounding strip for use with threaded rails; 83.90" (2.1m) length; .67" (17mm) width; .05" (1.27mm) thickness; provided with .16 oz. (5cc) of antioxidant, one grounding sticker and three each #12-24 x 1/2" and M6 x 12mm thread-forming screws.
<b>RGS13451-1</b>	Grounding strip for use with threaded rails; 89.15" (2.3m) length; .67" (17mm) width; .05" (1.27mm) thickness; provided with .16 oz. (5cc) of antioxidant, one grounding sticker and three each #12-24 x 1/2" and M6 x 12mm thread-forming screws.
<b>RGS13452-1</b>	Grounding strip for use with threaded rails; 90.90" (2.3m) length; .67" (17mm) width; .05" (1.27mm) thickness; provided with .16 oz. (5cc) of antioxidant, one grounding sticker and three each #12-24 x 1/2" and M6 x 12mm thread-forming screws.

<b>RGS134B42-1</b>	Grounding strip for use with cage nut rails; 73.40" (1.9m) length; .67" (17mm) width; .03" (.76mm) thickness; provided with .16 oz. (5cc) of antioxidant, one grounding sticker, three cage nut bonding studs, eight #12-24 bonding nuts and three strip clips.
<b>RGS134B48-1</b>	Grounding strip for use with cage nut rails; 83.90" (2.1m) length; .67" (17mm) width; .03" (.76mm) thickness; provided with .16 oz. (5cc) of antioxidant, one grounding sticker, three cage nut bonding studs, eight #12-24 bonding nuts and three strip clips.
<b>RGS134B51-1</b>	Grounding strip for use with cage nut rails; 89.15" (2.3m) length; .67" (17mm) width; .03" (.76mm) thickness; provided with .16 oz. (5cc) of antioxidant, one grounding sticker, three cage nut bonding studs, eight #12-24 bonding nuts and three strip clips.
<b>RGS134B52-1</b>	Grounding strip for use with cage nut rails; 90.90" (2.3m) length; .67" (17mm) width; .03" (.76mm) thickness; provided with .16 oz. (5cc) of antioxidant, one grounding sticker, three cage nut bonding studs, eight #12-24 bonding nuts and three strip clips.

2.21 ARMORED CABLE GROUNDING KIT

- A. Provides a secure bond to the armor sheath on indoor and indoor/outdoor fiber optic cables at both cassette and enclosure ends.
- B. Worm-gear design evenly distributes forces across the armor.
- C. Made from steel and aluminum material is compatible with common armor for long term reliability.
- D. Black insulating cover protects and hides the connection for an aesthetically pleasing work area.
- E. Complies with industry requirements ensuring a high level of reliability and safety.
- F. Approved Manufacturers:
  - 1. Panduit
- G. Approved armored cable grounding kits:

<b>Part Number</b>	<b>Description</b>
<b>ACG24K</b>	#6 AWG (16mm <sup>2</sup> ) jumper for armored cable diameter up to 0.84" (21.3mm); 24" (609.6mm) length; factory terminated on one end with LCC6 two-hole copper compression lug and the other end with grounding terminal; provided with two each #12-24 and M6 thread-forming screws and a black polypropylene terminal cover

<b>ACG24K-500</b>	#6 AWG (16mm <sup>2</sup> ) jumper for armored cable diameter 0.85" (21.3mm) to 1.03" (26.2mm); 24" (609.6mm) length; factory terminated on one end with LCC6 two-hole copper compression lug and the other end with grounding terminal; provided with two each #12-24 and M6 thread-forming screws and a black polypropylene terminal cover
<b>ACGK</b>	Armored cable grounding kit. Contains one grounding terminal for #6 AWG grounding conductor, and one #10 mechanical clamp for cable diameters in 9/16" – 1 1/16" diameter range.

2.22 MISCELLANEOUS BONDING ACCESSORIES:

- A. Anti-oxidation Paste (contact aid) For Copper to Copper and Copper to Steel Connections.
- B. Anti-oxidation Paste (contact aid) For Aluminum Pad-to-Pad or Thread-to-Thread Aluminum Connections.
- C. Green thread-forming bonding screws for bonding smaller equipment on threaded rack rails through the equipment mounting flange.
- D. Green bonding cage nuts from bonding smaller equipment on cage nut rails through the equipment mounting flange.
- E. Thread forming screws for bonding two-hole lugs to vertical busbars on threaded rack rails.
- F. Green paint piercing grounding washers for assuring electrical continuity between painted parts of equipment racks as described in TIA 607-C Standard.
- G. Bonding hardware kits (studs) for forming low-resistance bond between the rack or cabinet and painted rack mounted appliances and equipment.
- H. Approved Manufacturers:
  - 1. Panduit
- I. Approved miscellaneous bonding/grounding components and accessories:

<b>Part Number</b>	<b>Description</b>
<b>CMP-300-1</b>	Contact aid (anti-oxidant pastes) for copper-to-copper and copper-to-steel connections in 8 oz container. Operating temperature range -40°F (-40°C) to 350°F (177°C). Good for all voltages and suitable for grounding. Also, may be used for anti-seizing thread lubricant
<b>CMP-100-1</b>	Contact aid (anti-oxidant pastes) for pad-to-pad or thread-to-thread aluminum connections made on aluminum conductor in 8 oz container. Operating temperature range -40°F (-40°C) to 400°F (204°C).
<b>RGTBSG-C</b>	Green thread-forming bonding screw, #12-24 x 1/2" for mounting smaller equipment and bonding to rack/cabinet racks through equipment mounting flange
<b>RGTBS1032G-C</b>	Green thread-forming bonding screw, #10-32 x 1/2" for mounting smaller equipment and bonding to rack/cabinet racks through

	equipment mounting flange
<b>CNB4K</b>	Green bonding cage nut, includes 4 #12-24 bonding cage nuts (.06 – .11 thick panel) and 4 #12-24 x 1/2" bonding screws with #2 Phillips/slotted combo hex head (use 5/16" or 8mm socket). Ideal for patch panel applications
<b>CNBK</b>	Green bonding cage nut, includes 50 #12-24 bonding cage nuts (.06 – .11 thick panel) and 50 #12-24 x 1/2" bonding screws with #2 Phillips/slotted combo hex head (use 5/16" or 8mm socket)
<b>RGTS-CY</b>	Thread-forming grounding screw, #12-24 x 1/2" for bonding two-hole grounding lugs to rack/cabinet vertical busbars
<b>RGTS1032-C</b>	Thread-forming grounding screw, #10-32 x 1/2" for bonding two-hole grounding lugs to rack/cabinet vertical busbars
<b>RGW-100-1Y</b>	100 paint piercing bonding washers for 3/8" (M8) stud size; .875" (22.2mm) O.D.; provided with .16 oz. (5cc) of antioxidant.
<b>TRBSK</b>	Bonding stud kit for threaded #12-24 rail fasteners; includes 25 bonding studs and 50 bonding nuts for bonding painted equipment and appliances to rack/cabinet rails and vertical busbars
<b>CGNBSK</b>	Bonding stud kit for cage nut rail fasteners; includes 25 bonding studs and 50 bonding nuts for bonding painted equipment and appliances to rack/cabinet rails and vertical busbars

PART 3 EXECUTION

3.01 INSTALLATION

A. General:

1. This Specification document describes a generic enterprise communications bonding and grounding system for the construction of a complete and functioning grounding system. It is the responsibility of the installing contractor to adapt these general guidelines and principles to the requirements of the actual environments where the systems are to be implemented.
2. System shall provide equipment ground connections (bonds) from the premises entrance facility and outside-plant earthing system to each telecommunication room telecommunication ground busbar, through the racking systems to bond the network equipment.
3. Entire grounding link from equipment to earth should be visually verifiable except where hidden by walls, conduit or pathways.
4. Installing contractor shall label all elements of the communications bonding network according to guidelines defined in TIA-607-C and ANSI/TIA 606-B.
5. It is the responsibility of the installer to be knowledgeable of all previously cited Standards and Codes and to bring to the attention of Architect and Technology

Consultant any conflicts or discrepancies to achieve a fully functioning, standards-compliant earthing system.

6. Contractors working around or adding to existing legacy systems shall bring to the attention of Architect and Technology Consultant previously installed network elements that may not comply with modern grounding requirements for possible remediation.

**B. 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 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 conductors shall be protected from mechanical damage and built so as to minimize splicing. Where splicing is unavoidable they shall be done using irreversible compression splices (C-TAPS) built to that purpose. See the "Materials" section of this document for appropriate compression splices.
5. 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.
6. Routing grounding conductors through ferrous metal conduit should be avoided, but if it is necessary due to building constraints, any grounding conductor running through ferrous conduit longer than 3 feet shall be bonded at the end using appropriately sized HTAP and Conduit grounding clamps as described TIA 607-C using appliances described for that purpose in the "Materials" section of this document.
7. Conductors used to bond TBB to conduit ends shall be of #6 AWG size or larger.
8. Conductor sizing shall be based upon project specification (drawings and notes) for that installation. These sizes are based on TBB length per TIA 607-C recommendations. Contractor shall bring to the attention of Architect and Technology Consultant anywhere TBB project specified sizing appears insufficient per the Table below:

<b>Sizing of the TBB</b>	
TBB Length in Linear meters (feet)	TBB Size (AWG)
Less than 4 (13)	6
4-6 (14-20)	4
6-8 (21-26)	3
8-10 (27-33)	2
10-13 (34-41)	1
13-16 (42-52)	1/0
16-20 (53-66)	2/0
20-26 (67-84)	3/0
26-32 (85-105)	4/0

32-38 (106-125)	250 kcmil
38-46 (126-150)	300 kcmil
46-53 (151-175)	350 kcmil
53-76 (176-250)	500 kcmil
76-91 (251-300)	600 kcmil
Greater than 91 (301)	750 kcmil

C. Entrance Facilities and Telecommunications Main Grounding Busbar (TMGB):

1. TMGB shall be located in the entrance facility, near the electrical panel to which it will be bonded but installed to maintain clearances required by applicable electrical codes.
2. TMGB shall be sized according to the anticipated number of bonded connections needed.
3. TMGB shall have tinned surface to restrain oxidation and be cleaned and antioxidant paste applied prior to fastening conductors.
4. Connectors on TBB which attach to TMGB shall be of two-hole, long-barrel compression lugs of the LCC series as specified in the "Materials" section of this document.
5. Building steel within six feet of the communications grounding system should be bonded into the system with appropriate hardware listed in "Materials" section of this document.
6. All cables containing a metallic shield or armor shall have that shield properly bonded into the communications grounding system using the appropriately sized Armored Cable Grounding Kit listed in the "Materials" section of this document.

D. Telecommunications Rooms and Telecommunications Grounding Busbar (TGB):

1. Each telecommunications room shall have its own TGB to which equipment and dead steel (building steel and support structures) in that room are bonded.
2. The TGBs shall have a tinned surface to inhibit oxidation and be sized according to the anticipated number of bonded connections that will be needed.
3. TGBs shall be sized according to the anticipated number of bonded connections needed.
4. TGBs shall have tinned surfaces to restrain oxidation and shall be cleaned and have an antioxidant paste applied to both bonding surfaces prior to fastening conductors.
5. 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 as specified in the "Materials" section of this document.
6. Building steel within six feet of the communications grounding system should be bonded into the system with beam clamps and other hardware appropriate to that purpose listed in "Materials" section of this document.
7. Racks and cabinets shall have individual Rack Bonding Conductors (RBC) bonding to the Telecommunications Equipment Bonding Conductor (TEBC) or underfloor "Supplemental Bonding Grid - DAISY CHAINING OR SERIAL CONNECTIONS OF ONE RACK OR CABINET TO ANOTHER WILL NOT BE ACCEPTED.
8. 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.
9. To maintain this segregation of cables some telecommunications rooms may lend themselves to the installation of Auxiliary Conductor Brackets for routing bonding conductors outside of, yet parallel to ladder rack or basket tray. See "Auxiliary Brackets" in "Materials" section of this document.

10. Bonding conductor support systems like auxiliary brackets shall be spaced no further apart than three-foot intervals.
  11. All cables containing metallic shielding or armor shall be properly bonded into the communications grounding system using the appropriately sized Armored Cable Grounding Kit listed in the "Materials" section of this document.
- E. Bonding within Racks and Cabinets:
1. Racks and Cabinets shall be bonded into the communications bonding network with conductors of #6 AWG or larger.
  2. Racks, cabinets and similar enclosures shall not be attached serially (daisy-chained) but must have individual RBC into the grounding system.
  3. Newly installed racks and cabinets shall have vertical grounding busbars installed along one rail to provide clean bonding landing point for all rack mount equipment. For part numbers vertical busbars see "Materials" section of this document. Grounding busbars shall not be isolated from the rack or cabinet.
  4. All painted components of racks/cabinets shall be assembled using serrated grounding washers and thread-forming screws to ensure electrical continuity between the different structural components of the rack/cabinet.
  5. Larger equipment (chassis switches) with integral grounding terminals or pads shall be bonded to the vertical busbar with equipment grounding kits attached to those terminals and bonding them to the rack-mounted busbars. For kit part numbers see the "Materials" section of this document.
  6. Anywhere two metallic surfaces are to be bonded, contractor shall clean the contact areas of paint or oxidation using abrasive pads and apply film of anti-oxidation compound between surfaces prior to bonding.
  7. All cable fittings shall be of two-hole (LCC series) compression-type. Mechanical screw-lugs on racking systems will not be accepted and must be removed and replaced at contractor's expense.
  8. All screws used to affix compression lugs to rack-mounted vertical busbars shall be of the thread forming type made specifically for electrical bonding.
  9. Smaller equipment (servers, TOR switches) not having integral grounding pads must be bonded to the rack through the equipment mounting flanges using green thread-forming grounding screws with serrations under the head to cut through paint, coatings and oxidation that may be present on the equipment flange. Such equipment shall have minimally one grounding screw per piece of equipment.
  10. Existing (installed) racking systems containing live active equipment may be retrofitted for Standards-compliant bonding using rack retrofitting kits listed in the "Materials" section of this document.
  11. ESD (electro-static discharge) ports and wrist straps shall be provided minimally every other rack or bay to be within reach of any active equipment. On larger 4-post racks or cabinets - ESD ports and wrist straps shall be installed on the front and back to be accessible when servicing any active equipment.
  12. As a condition of employment, any internal or contracting technicians servicing active equipment must be wearing a properly grounded wrist strap to dissipate ESD charges prior to touching any active equipment.
- F. FIELD QUALITY CONTROL
1. Contractor shall verify the use of all appropriate bonding accessories in the racking systems such as grounding washers, thread-forming grounding screws and the presence of electro-static discharge ports and wrist straps within reach of all equipment to be maintained.



2. Contractor is responsible for visually verifying sizing and sound installation of the telecommunications bonding backbone including presence of properly sized and installed grounding equalizer conductors between backbones contained in separate risers.
3. Inspecting Contractor shall verify that any conduit longer than 3 feet through which a grounding conductor passes is properly bonded to the grounding conductor as described in this document.
4. During inspections contractor shall verify compliance with all stipulations specified in this document and compliance with all regulatory references (Standards and Codes) cited.
5. All opens or gaps in the bonding system during final inspections will be recorded in the inspection report and remedied.
6. During inspections, contractor shall check all grounding and bonding system conductors and connections for tightness and proper installation, including checking proper dies were used on compression taps and fittings by checking embossed die numbers on those connections.
7. Architect and Technology Consultant may request a test of 10% of bonded connections within the grounding system with a volt-ohm meter. Resistance tests taken on either side of a compression or exothermic bond shall be less than .2 (2/10) of one ohm in resistance.
8. Bonded joints to be tested may be random or individually tagged by a representative of Architect or Technology Consultant.
9. Contractor shall Test system at bonded points indicated and provide results in report form.
10. Based upon test results, Architect and Technology Consultant reserves the right to request testing on 100% of exothermic and compression bonds within the installed grounding system.
11. All bonded connections failing the test described above shall be remedied and retested by the installation contractor at contractor's expense.

END OF SECTION