

SECTION 16450

GROUNDING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes general requirements, products and methods of execution relating to the furnishing and installation of grounding systems at ANC.

1.2 MINIMUM REQUIREMENTS

- A. The minimum requirements for the system shall conform to Article 250 of the NEC.

1.3 SPECIAL REQUIREMENTS

- A. Unless specified elsewhere, the ohmic values for grounds and grounding systems shall be as follows:
1. For grounding metal enclosures and frames for electrical and electronically operated equipment--5 ohms maximum.
 2. For grounding systems to which electrical utilization equipment and appliances are connected--5 ohms maximum.
 3. For grounding secondary distribution systems, neutrals, noncurrent carrying metal parts associated with distribution systems, and enclosures of electrical equipment not normally within reach of other than authorized and qualified electrical operating and maintenance personnel -- 10 ohms maximum.

1.4 TELECOMMUNICATIONS GROUNDING SYSTEM

- A. ANC Telecommunications ground systems include the following items, which shall be utilized in the execution of Tenant Improvement projects.
1. Telecommunication Bonding Backbone (TBB) - A copper conductor that extends from the telecommunications main grounding busbar (TMGB) to each telecommunications grounding busbar (TGB).
 2. Telecommunications Main Grounding Busbar (TMGB) - The TMGB serves as a dedicated extension of the building grounding electrode system for telecommunications infrastructure. The TMGB is located in the main telecommunications room (MDF).
 3. Telecommunications Grounding Busbar (TGB) - A busbar placed in an accessible location in each telecommunications room (TR) (formerly referred to as Intermediate Distribution Frame Room (IDF)) that is connected back to the TMGB. All equipment served from the TR shall be connected to the local TGB.
 4. Site grounding system - connects the TMGB in each structure to the low resistance earth grounding system.

1.5 REFERENCE CODES AND STANDARDS

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

NUMBER	TITLE
ANSI/IEEE C2	National Electrical Safety Code
ANSI/NFPA 70	National Electrical Code
ANSI/TIA/EIA 606	Administration Standard for Telecommunications
ANSI/TIA/EIA-607	Commercial Building Grounding and Bonding Requirements for Telecommunications
NFPA 70	National Electric Code (NEC) - Codebook and Handbook

PART 2 - PRODUCTS

2.1 EQUIPMENT

- A. All grounding conductors and equipment required for ground systems shall be listed for the purpose intended and approved by a Nationally Recognized Testing Laboratory (NRTL), and be in accordance with UL 467 and as follows:
1. Grounding conductors shall be copper.
 2. Grounding conductor for telephone/data panels shall be minimum #6 insulated copper. Comply with inter-system bonding requirements of NEC.
 3. Grounding conductor for television and radio distribution systems shall be #6 AWG insulated copper. Comply with intersystem bonding requirements of NEC.

2.2 CONNECTIONS

- A. Joints in grounding conductors below grade shall be made with exothermic welding process or hydraulically-crimped fittings listed for direct burial. Terminations above grade shall be made with solderless lugs, securely bolted in place.
- B. Clamps, lugs, connectors, bonding bushings, and all other such grounding and bonding items shall be:
1. Labeled or listed for the purpose.
 2. Shall be made (both body and hardware) of hot-dip galvanized steel, bronze, or other corrosion-resistant alloy (except bushing throats shall be plastic).
 3. Shall be the products of O-Z/Gedney, T & B, Raco, or accepted equals.
 4. In outdoor, damp, or corrosive environments, metals for these items shall be copper (with or without tin-plating), bronze, or other corrosion-resistant alloys only; O-Z/Gedney or accepted equal.

2.3 TELECOMMUNICATIONS SYSTEM BONDING

- A. Bond all telecommunication equipment chassis, ladder racks, cable trays, conduits, equipment frames, cabinets, and all other *telecommunications room and equipment room* metallic components to a local TGB with #6 AWG, 600 volt, insulated copper conductor.
- B. Bonding of grounding conductors shall be with the following methods as specified herein:

1. Connections to grounding busses: Cool Amp Plating, field applied to both surfaces for all bolted and compression connections.
 - a. Approved gas tight two hole copper grounding compression lugs T&B 54205 series two hole, crimp Cool Amp plated compression type for connection to grounding busses.
 - b. Fasteners shall be nickel plated steel nuts, bolts and lockwashers.
2. Conductor splices and connection to ground rods:
 - a. Cadweld exothermic welds. All bonds below grade shall be exothermic.
 - b. Burndy type "YG" extruded wrought copper prefilled with Pentrox heavy duty compression connectors with probe holes (Type YGA and YGS not acceptable).
 - c. High frequency copper tape shall be bonded by spot welding, or exothermic welding or brazed with silver alloy rod.

2.4 IDENTIFICATION AND LABELING

- A. Grounding conductors shall be marked with tie wrap style cable markers.

PART 3 - EXECUTION

3.1 SERVICE GROUND

- A. An equipotential plane for the grounding system at service entrance equipment has been created by connecting the following to the service entrance ground bus:
 1. The commercial system's grounded neutral conductor.
 2. All metallic water services to the building.
 3. The service entrance equipment and all conduits entering and leaving the equipment.
 4. The metallic piping systems in the building.
 5. The metallic gas piping system upstream from the equipment shutoff valve.
 6. "Ufer" ground in accordance with NEC 250-50.
 7. Structural steel columns. All columns in or adjacent to (within 50 feet) of existing electrical rooms with separately derived systems.
- B. Current carrying capacity of the grounding and bonding conductors shall be in conformity with Table 250-66 of the NEC. Exception: The bonding conductor for metallic gas piping shall be sized in accordance with Table 250-122 based on the largest overcurrent device protecting feeder conductors exiting the main distribution switchboard serving that area.

3.2 EQUIPMENT GROUND

- A. The raceway system shall be bonded in conformity with NEC requirements to provide a continuous ground path.
- B. Provide separate grounding conductor securely bonded and effectively grounded to the enclosures at both ends of all non-metallic raceways and all flexible conduit.

- C. Provide an equipment grounding conductor sized in conformity with Table 250-122 of the NEC, unless larger size noted, for all feeder and branch circuit conduits. Where conductors are adjusted in size to compensate for voltage drop, equipment grounding conductors shall be adjusted proportionately according to circular mil area.
- D. Refeeding existing feeder/branch circuits that do not have an existing equipment grounding conductor: Bond equipment grounding conductor of new feeder or branch circuit to junction box and new and existing conduits.

3.3 CONCEALED CONNECTIONS

- A. Permanent grounding connections, where permitted by the NEC to be concealed, shall not be so concealed until inspected and accepted by the local Authority Having Jurisdiction.

3.4 CORDS AND NONMETALLIC CABLES

- A. Unless specifically permitted otherwise, all cords and nonmetallic cables shall be furnished with integral Code-sized grounding conductor. Securely bond all metal components and effectively ground the entire electrical system.

3.5 TELECOMMUNICATIONS GROUNDING SYSTEM

- A. Telecommunications Bonding Backbone (TBB)
 - 1. The TBB between each TGB and the TMGB is connected in a star configuration to minimize ground loops.
- B. Telecommunications Main Grounding Busbar (TMGB)
 - 1. Equipment and metallic raceways located in the same room as the TMGB shall be bonded to the TMGB.
 - 2. TBB connections to the TMGB shall be made with listed two hole compression connectors or exothermic type welded connections.
- C. Telecommunications Grounding Busbar (TGB)
 - 1. Equipment and metallic raceways located in the same room as the TGB shall be bonded to the TGB.
 - 2. TBB connections to the TGB shall be made with listed two hole compression connectors or exothermic type welded connections.
- D. Bonding and Connections
 - 1. General
 - a. Cadweld or braze all concealed or below grade connections.
 - b. All compression connections shall be made using a hydraulic 4 way compression die.
 - c. All compression connections shall be exposed.
 - d. All insulated wire splices shall be insulated with preformed wire covers.
 - 2. To Building Steel
 - a. Cadweld all connections to building steel.

E. Identification and Marking

1. Show all conductors on neatly marked record drawings.
2. Grounding conductors shall be marked per ANSI/TIA/EIA 606. Mark each cable end using tie wrap style cable markers.

3.6 EXTERNAL BONDING JUMPERS

- A. Not permitted; all bonding jumpers shall be run inside the raceways for the circuits they serve.

3.7 SEPARATELY DERIVED SYSTEMS

- A. Separately derived systems shall be grounded in accordance with NEC Article 250-30.

1. Bonding jumper

- a. The bonding jumper shall be sized in accordance with NEC Table 250-66. Where the derived phase conductors are larger than 1100 kCMIL copper, the bonding jumper shall have an area that is not less than 12-1/2% percent of the area of the largest phase conductor.
- b. The bonding jumper shall be used to connect the equipment grounding conductors of the separately derived system to the grounded conductor.
- c. The bonding jumper shall be located within the enclosure of the source of the separately-derived system, unless specifically noted otherwise.

2. Provide termination lugs for the co-located grounded conductor, grounding electrode conductor and bonding jumper terminations, using Listed compression-type connectors suitable for all conductors landed at each location.

3. The grounded conductor of the separately derived system shall be bonded to the nearest available point of the interior metal water piping system in the area served by the separately derived system. The bonding jumper shall be sized in accordance with NEC Table 250-66.

4. Grounding electrode

- a. The grounding electrode shall be as near as practical to and preferably in the same area as the grounding electrode conductor connection to the system.
- b. The grounding electrode conductor, sized in accordance with NEC Table 250-66, shall be used to connect the grounded conductor of the derived system to the grounding electrode.
- c. The grounding electrode shall be the nearest one of the following:
 - 1) Effectively grounded structural metal member of the structure.
 - 2) Effectively grounded metal water pipe within 5 feet from the point of entrance into the building.

END OF SECTION