OSP Bonding and Grounding

In the communications industry, bonding and grounding provides essential electrical protection and is a necessary part of any OSP cable installation. Proper bonding and grounding ensures safety and cable performance by preventing unsafe buildup of static electricity, reducing the risk of electric shock to workers, and averting damage to equipment.

Bonding and Grounding Definitions

Bonding

Bonding refers to the electrical interconnection of conductive parts designed to maintain a common electrical potential. Bonding conductors must be of sufficient gauge to carry anticipated current due to power contact.

Grounding

Grounding refers to the electrical connection of telecommunication hardware to an effective electrical ground. An effective electrical ground can be the vertical down lead (VDL) of a power system multi-ground neutral (MGN), a grounded neutral of a secondary power system, or a specially constructed grounding system.

Bonding and Grounding Benefits

- Reduce the hazard of electrical shock and damage to structures and equipment due to AC and DC voltages and lightning surges.
- De-energize the power circuit quickly in the event of an accidental contact by causing operation of power circuit breakers of fuses.
- Provide paths to ground for shield currents in metallic cable shields, thereby reducing the voltages induced in cable conductors.
- Reduce noise voltages in sensitive circuitry by providing an effective common reference point for circuit potentials to which outside induced currents can drain without disturbing circuit operation.

NESC®

The National Electrical Safety Code® (NESC®) requires cable shields, support strands, and other non-current carrying metallic hardware to be effectively grounded.

Important

Effectively ground cable shields, support strands, and other non-current carrying metallic hardware at dead-ends and junction points for noise mitigation, personnel protection, and power contact protection.

Know, understand, and comply with all applicable national, state, and local codes and ordinances. When in doubt, consult a local, licensed professional with experience in OSP telecommunication installations.

Exposed vs. Unexposed OSP

The first consideration when designing a protected system is to determine if the cable plant is "exposed" or "unexposed." The terms "exposed" and "unexposed" are used to describe a system's vulnerability to sources of current and voltage.

Exposed

If the cable plant is subject to electrical disturbances from sources of current and voltage, the system is exposed.

Examples of electrical disturbances include:

- Contact with power conductors > 300V to ground
- Ground potential rise > 300V
- Lightning
- Power Surges > 300V
- 60-Hz induction exceeding 300V rms

All exposed systems are required to be bonded and grounded.

Unexposed

Cable plant which is not subject to electrical disturbances from sources of current and voltage is considered "unexposed." Unexposed systems may require no protection. Unexposed plant connected to exposed plant is considered exposed.

Exposed vs. Unexposed

When in doubt, assume all systems are exposed. It is important to understand the requirements and practices of the applicable authorities, regulations, and codes to determine if a cable would be considered exposed or unexposed. To avoid conflict, consult the Authority Having Jurisdiction (AHJ).

Multi Ground Neutral (MGN) vs. Non-MGN

MGN Systems

MGN systems are characterized by a neutral conductor which originates at the substation and is carried continuously along the primary and secondary circuits.

In a typical MGN system the components are bonded to the MGN at prescribed locations.

This neutral conductor is grounded at intervals of approximately 1300′ (0.25 mi).

Any exposed OSP having a metallic component requires electrical protection at the building entrance.

Non-MGN (a.k.a. Delta) Systems

In a typical non-MGN (a.k.a. Delta) system, there are two primary feeds; each is attached to a primary bushing on the transformer.

The transformer's second tap is grounded to the VDL. There is no ground connection from the primary of the transformer to the secondary.

In the U.S., MGN systems are the most common.

Power systems may vary in structural design based on service needs and geographical location.

TIP! Contact the local utility company for information on the types of power systems used in the area.

Proper Grounding

- Connect all metallic components of all cables entering the building to the Telecommunications Main Grounding Busbar (TMGB).
- All grounding conductors must be connected to the TMGB.
- Bond cable shields at all splice locations and to the metallic strand of self-support aerial cables.
- Bond all buried cables to ground rods or MGN.
- Bond underground cables to apparatus cases, cable sheaths/shields and connect to maintenance hole bonding ribbon.
- Plastic sheath cables may not require bonding at pull-through maintenance holes.
- Verify that all components are tied into the grounding system.

Bonding

- Electrical bonding is a crucial part of construction activity.
- The use of protective devices in conjunction with effective grounding prevents the build-up of voltages and currents on individual pairs.
- Every splice requires shield continuity and a shield-to-strand bond.
- Bond and ground multiple cable strands and cable shields in maintenance holes and terminal housings.

Bonding and Grounding Protection Devices

Examples include:

- Station Protectors
- Central Office Protectors
- Pole-Top Arresters
- High-Voltage Protectors
- Protected Cable Terminals

OSP cable will often be routed parallel to or cross under high voltage lines. Consult the AHJ for clearance requirements between telecom and power lines.

Shield Bond Connectors

Shield bond connectors may be referred to as bonding clamps, grounding connectors, alligator clamps, and B-Bond clamps. B-Bond clamps are sized to accommodate various cable diameters. Shield bond connectors may be used for grounding aerial and underground cables. It is important to consider the shield type when selecting a shield bond connector.

Shield Types and Bond Clamp Styles

Bare (uncoated) shield tapes
This group includes metal tapes that do not bond to the jacket. The shield bond connector attaches directly to the shield without the involvement of the jacket.

Coated shield tapes that do not bond to the jacket
This group includes coated shield tapes having a layer of flooding compound applied where the shield and jacket interface. For coated tapes, choose a shield bond connector having "prongs" capable of penetrating the shield coating and making contact with the underlying metal. These shield bond connectors attach directly to the shield.

Coated shield tapes which bond to the jacket
These designs require a shield bond connector that "sandwiches" the shield and jacket. These connectors require prongs which penetrate the coating and attach securely.

There is no need to remove the jacket when using this clamp style.

Aerial Cable Checklist

- Properly bond to ensure shield continuity.
- Bond shield to support strand at each splice, terminal, and load point.
- Bond the support strand to the MGN at both ends of each cable section and every ¼ mile. If no MGN exists, use a driven ground rod or non-insulated guy to maintain ¼ mile intervals.
- Separate communication and power cables in accordance with all applicable national, state, and local codes and ordinances.

Direct Buried Cable Checklist

- Where the separation from power cable is > 3 feet, bond at each terminal and splice closure to ensure shield continuity.
- Where the cable is buried within 6 feet of the power apparatus, bond to the power neutral or power apparatus at all above ground Telco terminals, pedestals, apparatus cases, and cable closures.
- Ground every other pedestal.
- For installations where the cable plant is < 3 feet from the power supply, contact the power company.

Underground Conduit Cable Checklist

- Bond exposed cables at all maintenance holes where a splice is made.

Drop Wire Checklist

- Shields of aerial drop wires must be bonded at both ends and grounded at the building entrance.
- Metallic support strands of figure 8 designs must be bonded to the support strand but are typically not bonded/grounded at the building attachment.
- Special design considerations, such as metal buildings, may require bonding. When in doubt, consult the AHJ.
- Shields of buried service/distribution wires must be bonded at both ends and grounded at the building entrance.

Fiber Cable Considerations

- Bonding and Grounding is critical for safety of fiber cable systems.
- The NEC (US) recommends in Article 770 that non-current carrying metallic members (armor shield, metallic central member, metallic strength member) of optical fiber cables be bonded and grounded at the point of entrance into a building or residence. Note that the NEC recommends that the grounding wire on the outside plant cable at the building entrance should be bonded together with all the building grounding electrodes. This grounding scheme limits the potential differences between the outside cable plant and the building wiring system.
- The NESC (US) recommends that the messenger wire employed to support aerial optical fiber cables be grounded at four connections in each installed mile. In addition, the NESC recommends that the messenger wires be grounded at common crossing structures.
- Local and state regulations often supersede NEC and NESC recommendations. System designers should contact state and local regulatory agencies to determine if regional regulations exist that differ from the NEC and NESC recommendations.
- At a minimum, all metallic components of the optical fiber cable should be bonded and grounded at each building and cable entry point. The system designers should assess the installation environment to determine the potential of induced voltage from power lines or lightning or both. The system designer should evaluate the estimated value of the induced voltage to determine if bonding and grounding should be performed at defined frequencies that vary from the NEC, the NESC, or state and local regulatory agencies.
- Bonding hardware varies based on user preference and cable type employed.

Reference Documents

USDA Rural Utilities Service Bulletin 1751F-801 (Electrical Protection Fundamentals)

USDA Rural Utilities Service Bulletin 1751F-802 (Electrical Protection Grounding Fundamentals)

USDA Rural Utilities Service Bulletin 1751F-810 (Electrical Protection of Digital & Lightwave Telecommunications Equipment)

Can be found at

https://usdasearch.usda.gov/search?utf8=%E2%9C%93&affiliate=usda&query=1751F-801&commit=Search

For Additional Information

The National Electrical Code® (NEC®)

The National Electrical Safety Code® (NESC®)

ANSI/TIA/EIA – 607

BICSI Customer-Owned OSP Design Manual

BICSI Information Transport Systems Manual

Bonding and Grounding Practices of the Local Telco

EC&M www.ecmweb.com

Cabling Installation & Maintenance https://www.cablinginstall.com