Hands-On

Outside Plant Bonding, Grounding & Power

Course Description

This Hands-On course addresses telecommunications Outside Plant construction, routine maintenance and trouble isolation related to Bonding, Grounding and Power. We provide students with an understanding of electrical sources that could injure people or damage equipment, proper bonding & grounding procedures to minimize the effects and the proper test procedures to determine the integrity of the Outside Plant bonding & grounding system.

This course covers proper bonding, grounding and power of Outside Plant equipment for the protection of people from injury and equipment from damage due to foreign voltage and current originating from lightning and commercial AC power.

References for this training class are the National Electrical Code (NEC) and Rural Utility Service (RUS) documents.

Students Will Learn

- **This course provides students with an understanding of electrical sources that could injure people or damage equipment, proper bonding & grounding procedures to minimize the effects and the proper test procedures to determine the integrity of the Outside Plant bonding & grounding system.**
- **After completing this training course the student will be able to**
- **Causes and effects of lightning and commercial AC power on the telephone plant.**
- **Proper Outside Plant bonding & grounding and noise mitigation techniques.**
- **Testing Outside Plant facility bonding & grounding systems for proper**
- **installation and operation.**
- **And much more...**

Target Audience

Vendors and telecommunications personnel (engineers, planners, supervisors and technicians) responsible for ensuring that proper grounding requirements have been employed for buildings, power, switches and transport systems. Personnel responsible

for maintaining and accepting new or rearranged equipment from an Outside Plant perspective.

Prerequisites

An understanding of basic electrical concepts and telecommunications equipment terminology is required. This knowledge can be obtained by attending the Basic Electricity course.

Course Outline

Lesson 1 - Basic Electrical Principles

This lesson covers a general knowledge of basic electricity as it applies to the protection of personnel and equipment in Outside Plant facilities.

Objective:
After this lesson the student will understand the terms and principle concepts of basic electricity related to Outside Plant bonding & grounding. The student will be able to define Voltage, Current, Resistance, Ohms Law and Impedance as they relate to cable pairs and shields.

Lesson 2 Lightning

One of the critical potential sources of personnel danger and equipment damage in the telephone plant is extremely high levels of voltage and current resulting from a nearby lightning strike or a far off strike that enters the telephone plant and travels along telephone cables. A clear understanding of what lightning is and the dangerously high surge potentials that follow a lightning strike is necessary in knowing the importance of effective bonding & grounding.

Objective: After this lesson, the student will be able to describe the source of lightning, the magnitude of lightning strikes, how lightning enters the outside telephone plant, and the dangers related to personnel and equipment.

Lesson 3 - Commercial AC Power Distribution

Another potential source of personnel danger and equipment damage in the telephone plant is high levels of voltage and current resulting from a nearby AC power line fault or a far off power fault that enters the telephone plant and travels along telephone cables. A clear understanding of commercial AC power distribution systems and the potential faults that could occur is necessary in knowing the importance of effective bonding & grounding.

Objective:

After completing this lesson, the student will be able to describe the common commercial AC power distribution schemes and the hazardous fault conditions that can occur.

Lesson 4 Telephone Outside Plant Facilities

Understanding the physical makeup and construction of outside plant facilities will help the student understand how proper bonding & grounding and noise mitigation is achieved.

Objective: After completing this lesson, the student will be able to describe the makeup and construction of Outside Plant cable facilities, and effectively describe how the different facility elements are bonded and grounded to provide proper protection.

Lesson 5 - Lightning and AC Power Effects on Telephone Plant

The effects of high voltage and current on the OSP facilities from lightning and power faults can be harmful to people and damaging to equipment in the Outside Plant facilities. This lesson provides the students with an awareness of these effects to developing a clear understanding of Outside Plant bonding & grounding systems.

Objective: After completing this lesson, the student will be able to describe the effects that lightning and power faults have on telephone facilities.

Lesson 6 - General Bonding & Grounding

There are basic concepts, guidelines and rules required to effectively protect personnel and equipment from hazardous lightning and power fault voltage and current that may come in contact with the telephone facilities. This lesson covers the requirements set forth in NEC and RUS documentation and is essential in understanding how the Outside Plant facility is bonded & grounded.

Objective: After completing this lesson, the student will be able to describe the general concepts, guidelines and rules required in effective bonding & grounding.

Lesson 7 - Bonding & Grounding Outside Plant Facilities

Knowing how and why the telephone facilities are bonded & grounded will aid the student in understanding that bonding equalizes potentials and grounding diverts surge currents to ground.

Objective: After completing this lesson, the student will be able to describe how proper bonding & grounding of Outside Plant facilities reduces dangerous electrical potentials to personnel and equipment, and how transmission noise is greatly reduced by proper cable shield bonding & grounding.

Lesson 8 - Bonding & Grounding Customer Premises

People are protected from injury and equipment from damage inside customer premises with proper bonded & grounded in compliance with local and national codes: NEC and RUS requirements. This lesson covers code requirements for telephone facilities entering Customer Premises.

Objective: After completing this lesson, the student will be able to describe how proper bonding & grounding of customer premises protects people and equipment from harm.

Lesson 9 Central Office Ground System

This lesson covers bonding and grounding of the Central Office building and equipment, which is complicated by the use of sensitive electronic equipment and the variation of equipment types typically found in the Central Office.

Objective: After completing this lesson, the student will be able to describe the concept, theory and practical application of the Central Office grounding system and how it will protect people and equipment located inside the Central Office building.

Lesson 10 - Testing Ground Fields

This lesson covers the testing of ground fields, either a single ground rod or a ground grid system. The basic three-point-method for testing ground fields using an approved Earth Megger is discussed.

Objective: After completing this lesson, the student will be able to describe the concept, theory and practical application of the three-point-method ground field test to determine if the ground system under test meets NEC and RUS requirements.

Lesson 11 - Testing Cable Shield Bonds & Grounds

This lesson covers the testing of Outside Plant cable shield bonds and grounds for continuous connections and frequent grounds. Use of a basic AC clamp-on ammeter is discussed.

Objective: After completing this lesson, the student will be able to describe the concept, theory and practical application of testing cable shield bonds and grounds, and know the requirements for performing current reading tests with an AC clamp-on ammeter.

Lesson 12 - Hands-On Field Trip to a Local Outside Plant Cable Facility

This lesson covers actual hands-on testing of Outside Plant cable shield bonds and grounds at a local field location. Students will test real shield bonds and grounds to determine the quality of the bonding and grounding at that location.

Objective: After completing this lesson, the student will be able to effectively test Outside Plant cable shield bonds and grounds with an AC clamp-on ammeter and earth megger,

determine the quality of the ground facilities and make recommendations to correct discrepancies.

Notes

NFPA 70, National Electrical Code (NEC), 2002 Edition, National Fire Protection Association Batterymarch Park, Quincy, MA 1996.

Electrical Protection Fundamentals, RUS bulletin 1751F-801 Rural Utilities Services, United States Department of Agriculture, Washington D.C. 1995.

Electrical Protection Grounding Fundamentals, RUS bulletin 1751F-802 Rural Utilities Services, United States Department of Agriculture, Washington D.C. 1994.

Electrical Protection at Customer Locations, RUS bulletin 1751F-805 Rural Utilities Services, United States Department of Agriculture, Washington D.C. 1995.

Electrical Protection of Outside Plant, RUS bulletin 1751F-815 Rural Utilities Services, United States Department of Agriculture, Washington D.C. 1995.

Delivery Method

Instructor led with numerous Hands-On labs and exercises.

Equipment Requirements

(This apply's to our hands-on courses only)

A classroom with appropriate seating, writing surface and enough space for the class and the lab activities. A data projector with screen and a whiteboard with markers provided by the client.

BTS always provides equipment to have a very successful Hands-On course. BTS also encourages all attendees to bring their own equipment to the course. This will provide attendees the opportunity to incorporate their own gear into the labs and gain valuable training using their specific equipment.

Course Length

2 Days