Lightning and Static Electricity Protection Systems

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CHAPTER 1 INTRODUCTION

1-1 PURPOSE.

This course provides policy and design requirements for static electricity protection, and lightning protection systems and related grounding for facilities and other structures.

The information provided here may be utilized by electrical engineers in the development of the plans, specifications, calculations, and Design/Build Request for Proposals (RFP) and may serve as the minimum electrical design requirements. It is applicable to the traditional electrical services customary for Design-Bid-Build construction contracts and for Design-Build construction contracts. Project conditions may dictate the need for a design that exceeds these minimum requirements.

1-2 REFERENCES.

Appendix A contains a list of references used in this course. References applicable to a specific topic are also listed and described in the appropriate sections of this course.

1-3 KEY CODES AND STANDARDS.

The following codes and standards are applicable:

- IEEE 142, *IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems.*
- NFPA 70, *National Electrical Code*.
- NFPA 70B, *Recommended Practice for Electrical Equipment Maintenance*.
- NFPA 77, *Recommended Practice on Static Electricity*.
- NFPA 780, *Standard for the Installation of Lightning Protection Systems*.
- UL 96, *Lightning Protection Components.*
- UL 467, *Grounding and Bonding Equipment*.

Additional requirements associated with grounding, bonding, and shielding of communications facilities are provided in MIL-HDBK 419A, *Grounding, Bonding and Shielding for Electronic Equipment and Facilities*.

CHAPTER 2 STATIC ELECTRICITY PROTECTION

2-1 STATIC GROUNDING AND BONDING REQUIREMENTS.

Identify hazardous classified locations in accordance with NFPA 70. Provide grounding and bonding for these areas in accordance with NFPA 77 to support the intended operations.

Include a listing of hazardous materials, containers, and operating units in the design, and indicate fixed operating equipment locations on the drawings. Identify portable and movable equipment requiring static electricity grounding distinctively by location and with type of grounding method each location requires.

2-1.1 Bonding and Grounding Conductors.

Bonding and grounding conductors must be large enough to withstand mechanical damage and must not be smaller than 6 AWG copper. For added flexibility, use braided cable or flexible bonding strap for static grounds on portable or movable equipment. Install at least two separate braided cables or flexible bonding straps on portable or movable equipment such as doors, hinged shelves, or tables. Conductors are typically uninsulated. Apply bonding for other facilities in accordance with NFPA 70 and NFPA 780. Before securing any bond, ensure electrical continuity by removing any paint, oil, dirt, or rust on contact surfaces. Bonds shall have a resistance reading of one ohm or less.

2-1.2 Connections.

Do not connect static grounds above grade to

- Electrical equipment grounding systems.
- Telecommunications system grounds.
- Gas, steam, oil, hydraulic, hot water or air lines.
- Sprinkler systems.
- Any component of the lightning protection system (LPS).

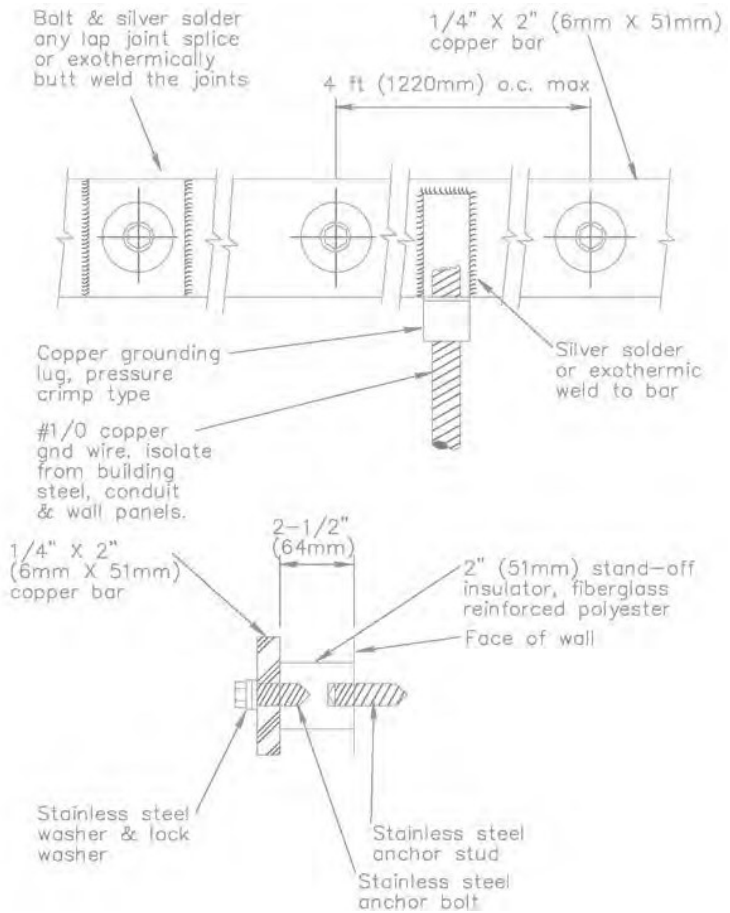
These systems shall be interconnected below grade. Connection above grade to a down conductor of the LPS is authorized if the down conductor is within the bonding distance calculated in NFPA 780. As an exception to performing the calculations required by NFPA 780, the 6-foot (1.83 m) bonding requirement allowed by UL 96A can be used. The preferred method for reducing the potential for side flash is to increase the separation distance, so that a bond is not required. The minimum size of the bonding conductor is 6 AWG copper.

Bond other interior grounding system conductors separately to static electricity bonding jumpers or other bonded metals, and connect at or below finished grade to an appropriate grounding electrode or grounding system. Steel framing members of the building and metal siding that are electrically bonded together and not used for lightning protection may be used as part of the grounding conductor system, but no penetrations into exterior steel siding or other exterior finish are allowed above ground level, whether sealed or not.

2-1.3 Static Bus Bars.

A static bus typically consists of 2-inch x ¼ inch (51 mm x 6 mm) copper bars installed on the interior wall of the facility, as shown in Figure 2-1. Static bus bars shall be used only for static grounding. Bus bars, especially those used in the telecommunications industry, come with insulators. Static bus bars shall be isolated from other grounding subsystems as much as possible and must be isolated when used for ordnance grounding and from lightning protection down conductors including steel columns used as the down conductor. The grounding system for the static bus bars is typically connected to the building grounding system below grade at a ground ring or ground rod.

Figure 2-1 Static Bus Bar.



2-1.4 Resistance to Ground.

Current caused by static electricity is typically on the order of milliamperes. A resistance to ground of 10,000 ohms is more than adequate to bleed off normal static charges. All grounds used for static protection in DoD facilities, including those for aircraft and fuel tanks, must have a maximum resistance of 10,000 ohms. Any danger of electrical shock hazard caused by the 10,000-ohm value can be eliminated by proper bonding to other grounding media.

2-1.5 Ground Grab Bars.

Ground grab bars may be installed immediately outside entrance doors to operating buildings, rooms or structures where special hazards exist. A ground grab bar consists of a length of non-corroding conductive pipe or bar which is connected to the earth electrode system (EES).

2-2 GENERAL APPLICATIONS.

2-2.1 Conditions.

This course does not identify all applications where static electricity protection should be provided. The electrical designer must analyze suspected potential static electricity charges and address the conductive paths that could reasonably exist between them, particularly in the following conditions:

- Hazardous area classifications and locations as listed in the NFPA 70. The electrical design must incorporate the requirements of the using service relative to hazardous materials, equipment, and containers to enable the construction contractor to proceed with a full understanding of static electricity protection requirements.

- Locations containing hazardous materials that will be handled or stored.

- Movable and portable equipment having static electricity generating capabilities potentially dangerous to personnel.

- Locations containing explosives or related type materials need to comply with applicable Service requirements for ordnance facilities; refer to the paragraph titled “Key Codes and Standards”.

2-2.2 Applications.

Comply with NFPA 77, including the following types of applications:

- Spray painting operations; also apply NFPA 33.

Purchase this course to see the remainder of the technical materials.