

SECTION 26 41 00
FACILITY LIGHTNING PROTECTION

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Lightning Protection Institute (LPI): 175, Standard of Practice.
2. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - b. 780, Standard for the Installation of Lightning Protection Systems.
3. UL:
 - a. 96, Standard for Lightning Protection Components.
 - b. 96A, Standard for Installation Requirements for Lightning Protection Systems.

1.02 DESIGN REQUIREMENTS

A. Provide lightning protection system design for the following structures:

1. Building 10 – Administration.
2. Building 12 – Maintenance.
3. Building 20 – Headworks.
4. Structure 22 – Odor Control.
5. Structure 25 – Process Tank.
6. Building 32 – Process Facility.
7. Structure 70 – Reclaimed Water Storage Tank.
8. Building 80 – Digester Facility.
9. Structure 88 – Exterior Storage.

B. Design lightning protection system to comply with applicable provisions of LPI 175, UL 96, UL 96A, and NFPA 780.

1.03 SUBMITTALS

A. Action Submittals:

1. Reproducible Electronic Drawings:
 - a. Lightning protection system layout.
 - b. Component locations.
 - c. Detailed plans.
2. Down conductor.
3. Connecting conductor.
4. Bond strap.

5. Air terminals.
6. Fittings.
7. Connectors.
8. Ground rods.

B. Informational Submittals:

1. Field test report.
2. UL 96 Master Label Certification.

1.04 QUALITY ASSURANCE

- A. Designer: Lightning protection system design shall be prepared by an LPI-certified master designer. Shop Drawings shall be stamped by the designer.
- B. System components shall be the product of a manufacturer regularly engaged in the manufacturing of lightning protection components in accordance with UL 96.
- C. Lightning protection system shall be installed under direct supervision of an LPI 175 Certified Master Installer.
- D. Inspection of final installation and grounding connection shall be performed by an LPI-certified inspector.
- E. Provide the Work in accordance with NFPA 70 and NFPA 780. Material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization in order to provide a basis for approval under NEC.
- F. Materials and equipment manufactured within the scope of standards published by UL shall conform to those standards and shall have an applied UL listing mark.

PART 2 PRODUCTS

2.01 GENERAL

- A. Complete system shall bear UL 96 Master Label.
- B. System Material: Copper or high copper content, heavy-duty bronze castings, or aluminum where required to meet the anti-corrosion elements of the NFPA standards, unless otherwise specified.
- C. Material shall comply in weight, size, and composition for the class of structure to be protected as established by NFPA 780.

2.02 AIR TERMINAL:

A. Physical Characteristics:

1. Material: Solid copper rods with tapered or blunt points as required for application.
2. Diameter: D: 1/2 inch.
3. Length: Sufficient to extend minimum 10 inches above object being protected.
4. UL 96 Label B applied to each terminal.

B. Functional Characteristics: None

C. Performance Characteristics: None

2.03 GROUND ROD

A. Physical Characteristics:

1. Material: Copper-clad steel.
2. Diameter: Minimum 3/4 inch.
3. Length: 10 feet.

B. Functional Characteristics: None.

C. Performance Characteristics: None.

2.04 CONDUCTORS

A. Physical Characteristics:

1. Lightning System Conductors: Bare medium hard-drawn stranded copper, or stranded aluminum as required for the application.
2. Main Down Conductor: Smooth twist stranding.
3. Connecting Conductor: Concentric stranding.
4. Bonding Conductor: Flexible strap minimum 3/4-inch wide by 1/8-inch thick or secondary bonding conductors.
5. Main down and connecting conductors shall bear the UL 96 Label A, applied every 10 feet.
6. Grounding Conductors: Stranded bare copper.

B. Functional Characteristics: As specified in Section 26 05 05, Conductors.

C. Performance Characteristics: None.

2.05 CONNECTORS

A. Physical Characteristics:

1. Compression Type:
 - a. Compress-deforming type; wrought copper extrusion material.
 - b. Single indentation for conductors 6 AWG and smaller.
 - c. Double indentation with extended barrel for conductors 4 AWG and larger.
 - d. Barrels prefilled with oxide-inhibiting and antiseizing compound and sealed.
2. Mechanical Type: Split-bolt, saddle, or cone screw type; copper alloy material.

B. Functional Characteristics:

1. Compression Type:
 - a. Outdoor: Listed as suitable for direct-buried application.

C. Performance Characteristics: None.

2.06 GROUNDING WELLS

A. Physical Characteristics: Ground rod box, complete with cast-iron riser ring and traffic-rated cover marked "GROUND ROD."

B. Functional Characteristics: None.

C. Performance Characteristics: None.

PART 3 EXECUTION

3.01 GENERAL

- A. Workmanship to comply with all applicable provisions of LPI 175, UL 96, UL 96A, and NFPA 780.
- B. Aluminum materials shall be used where required to meet the galvanic corrosion requirements of UL 96A.
- C. Provide pitchpockets or method compatible with roofing to waterproof roof penetrations.
- D. Install system in inconspicuous manner so components blend with building aesthetics.

- E. Structures that are all metal are to be bonded to grounding system as indicated in drawings. Are terminals and down conductors may be eliminated where the steel elements provided code recognized path to ground.

3.02 EXAMINATION

- A. Verify conditions prior to installation. Actual conditions may require adjustments in air terminal and ground rod locations.

3.03 INSTALLATION

A. Air Terminals:

1. Supports: Brackets or braces.
2. Parapet Bracket Attachment: Lag or expansion bolts.
3. Secure base to roof surface with adhesive or pitch compatible with roofing bond.
4. Provide terminal flashing at roof penetrations.
5. Perimeter Terminals:
 - a. Maximum Spacing: 20 feet.
 - b. Maximum Distance From Outside Edge of Building: 2 feet.
6. Roof Ridge Terminals: Maximum spacing 20 feet.
7. Mid-Roof Terminals: Maximum spacing 50 feet.
8. Provide blunt point air terminals for applications exposed to personnel.

B. Conductors:

1. Conceal whenever practical.
2. Provide 1-inch PVC conduit in building walls or columns for main downleads and roof risers.
3. Support: Maximum spacing for exposed conductors.
 - a. Vertical: 3 foot.
 - b. Horizontal: 4 foot.
4. Maintain horizontal and vertical conductor courses free from dips or pockets.
5. Bends: Maximum 90 degrees, with minimum 8-inch radius.
6. Install air terminal conductors on the structural roof surface before roofing composition is applied.

C. Bonding:

1. Bond to Main Conductor System:
 - a. Roof-mounted ventilators, fans, air handlers, masts, flues, cooling towers, handrails, and other sizeable metal objects.
 - b. Roof flashing, gravel stops, insulation vents, ridge vents, roof drains, soil pipe vents, and other small metal objects if located within 6 feet of main conductors or another grounded object.

2. Bond each steel column or major framing members to grounding system.
3. Bond each main down conductor to grounding system.

D. Grounding System:

1. Grounding Conductor:
 - a. Completely encircle building structure.
 - b. Bury minimum 1 foot below finished grade.
 - c. Minimum 2 feet from foundation walls.
2. Interconnect ground rods by direct-buried copper cables.
3. Maximum Resistance: 1 ohms when connected to ground rods.
4. Connections:
 - a. Install ground cables continuous between connections.
 - b. Exothermic welded connections to ground rods, cable trays, structural steel, handrails, and buried and nonaccessible connections.
 - c. Provide bolted clamp type mechanical connectors for all exposed secondary connections.
 - d. Use bolted offset parapet bases or through-roof concealed base assemblies for air terminal connections.
 - e. Provide interconnections with electrical and telephone systems and all underground metal pipes.
 - f. Provide electric service arrestor ground wire to building water main.

3.04 FIELD QUALITY CONTROL

A. Field Testing:

1. Isolate lightning protection system from other ground conditions while performing tests.
2. Resistance: Test ground resistance of grounding system by the fall-of-potential method.
 - a. Test Resistance to Ground: Maximum 1 ohm.
 - b. Install additional ground rods as required to obtain maximum allowable resistance.
3. Test Report:
 - a. Description of equipment tested.
 - b. Description of test.
 - c. Test results.
 - d. Conclusions and recommendations.
 - e. Appendix, including appropriate test forms.

- f. Identification of test equipment used.
- g. Signature of responsible test organization authority.

END OF SECTION

