

**OMAN WASTEWATER  
SERVICES COMPANY S.A.O.C**



**الشركة العمانية  
لخدمات الصرف الصحي ش.م.ع.م**

**OMAN WASTEWATER SERVICE COMPANY**

**ELECTRICAL STANDARD SPECIFICATION**

**SECTION 14**

**LIGHTNING PROTECTION**

Controlled Copy

## INDEX

<b>Item</b>	<b>Description</b>	<b>Page</b>
1-0	Scope	1/6
2-0	Standards specifications	1/6
3-0	Quality Assurance	1/6
3.1	Design Criteria	1/6
3.2	Submittals	1/6
4.0	Products	2/6
4.1	Materials	2/6
5.0	Installation	5/6
6.0	Testing	6/6

## **1-0 SCOPE**

This Specification defines the requirements for the design, construction, inspection and testing of lightning protection, to be installed within Oman Wastewater Services Company projects.

## **2-0 STANDARDS SPECIFICATIONS**

The design, construction, inspection and testing of the lightning protection system shall comply with all relevant Statutory Regulations, and the latest editions (current at the time of Tender) of all relevant British and Harmonised European Standards, including:

§ Omani Electrical Standards

§ British Standard:

BS 7430: Code of practice for earthing

BS 6651: Code of practice for protection for structures against lightning.

## **3-0 QUALITY ASSURANCE**

### **3-1 Design Criteria:**

The lightning protection system shall be in accordance with OES Rules and regulations.

### **3-2 Submittals:**

Full technical details and conductor size calculations of each type of cable or wire proposed shall be provided,

Exact route of each cable or wire proposed shall be provided.

## **4-0 PRODUCTS**

### **4-1 Materials**

The system provided under this specification shall be the standard product of a manufacturer regularly engaged in the production of lightning protection systems and shall be the manufacturer's latest approved design.

- a) Materials used in connection of the installation of the lightning protection system shall be proved for lightning protection systems by UL. No combination of materials shall be used that form an electrolytic couple of such nature that corrosion is accelerated in the presence of moisture. Where unusual conditions exist which would cause corrosion of conductors, conductors with protective coatings or oversized conductors shall be used.
- b) Where a mechanical hazard is involved, conductor size shall be increased to compensate therefore, or suitable protection shall be provided. The conductors may be protected by covering them with molding or tubing made of nonmetallic material.
- c) Aluminum materials may not be used except on roofs that utilize aluminum roofing components. When aluminum materials are used, provide all materials of aluminum composition to ensure compatibility, except down conductors and grounding. Provide copper down conductors with bimetal transition at the roof assembly rated for the application.

#### Air Termination Conductors and Down Conductors:

All conductors shall be stranded copper and of the grade ordinarily required for commercial electrical work generally designated as being 98 percent conductive when annealed. Aluminum conductors may only be used on roofs that are built of aluminum roofing components. Conductor minimum size shall be in compliance with NFPA 780.

- a) Lightning air terminals and down conductors for lightning air terminals shall be provided as indicated on the drawings. Where vertical air terminations are used, they shall be min of 15 mm diameter tinned copper (air termination rod) 0.8 meter long with top spike, unless specified otherwise.

- b) Generally, roof conductors and down conductors shall be of PVC sheathed 3 x 20 mm (minimum) copper tape. PVC colour to be approved by the Engineer. However, bare copper tape may be used unless indicated otherwise.
- c) Air termination rods shall be securely anchored and welded.
- d) Down conductors shall run along the outer surface of the wall or column of the building.
- e) Down conductors shall be as short as possible, protected and directly connected to earthing system through test links.
- f) Anchoring bolts shall be used to hold roof conductors and down conductors in firm position.
- g) Lightning conductor connectors shall be provided for conductor splice connections and conductor terminal connections.
- h) The connectors shall be heavy duty, cast metal and shall have hex-head screws in the bodies and holes in the tongues for bolts.
- i) TV antenna, HVAC equipment, handrails and structures in the vicinity of the lightning protection system, if any, shall be bonded to the system by 3x20 sq. mm (minimum) PVC sheathed copper tape.

Roof penetrations:

- a) Roof penetrations shall be accomplished with through-roof fittings specially designed for this purpose. Through-roof fittings shall utilize solid rods with appropriate hardware. Fittings shall incorporate a positive means for sealing around the rod.

Main Earth Loops:

25 x 3 mm tinned copper tape, unless otherwise indicated on the Project Drawings.

Earth Electrodes:

- a) Shall be of the earth rod type
- b) Earth rod electrodes: 16 mm diameter steel core copper jacketed type, comprising a high strength steel alloy core with a molten welded copper covering, minimum 0.25 mm thick
- c) To be not less than 3.6 m long, in 1.2 m sections coupled by strong bronze coupler.

Earth Connectors:

- a) Connector fittings shall be copper or copper alloy per UL 96 and compatible with material type used for air terminals and conductors.
- b) All belowground and concealed connections shall be made with exothermic welded connections.

Removable Earth Links:

To comprise a bolted copper link fixed on porcelain insulators and complete with studs, nuts and washers to take the earth tape and a bolted lug adequately sized for the final connection of the earth electrode.

Bolts, Washers and Nuts in Bolted Connections:

Shall be of High copper alloy or silicone bronze. Ferrous hardware is not acceptable.

Earth Pit Cover:

Shall be of heavy duty construction.

## **5-0 INSTALLATION**

### Removable Earth Links:

- a) Shall be fixed in every main earth lead to enable the electrode system to be disconnected for testing
- b) Shall be installed in an accessible position, above ground as close as possible to the earth electrode.

### Bolted Connections:

Where bare copper is bolted in connections contact surfaces shall be silver electroplated.

### Brazed Connections:

Where earthing terminal connections are to be brazed to equipment, thoroughly clean metal prior to brazing and repaint impaired surfaces to prevent corrosion.

### Connections Between Dissimilar Metals:

Connections shall be protected by painting with a moisture resistant bituminous paint or compound, or wrapping with protective tape to exclude moisture.

### Earth Rod Electrodes:

- a) Drive extensible rods of the same diameter into the ground, either manually or by power driven hammer, to a suitable depth to obtain low resistivity in the particular soil
- b) Weld earth connectors to the top of the rods, in sufficient number to make connection with all incoming cables.
- c) The ground rod should be copper bonded instead of galvanized to reduce resistance and longer life. The installation will probably require multiple ground rods. The ground rods need to be permanently bonded together as a common grid, generally with large stranded copper and all

connections are generally cad-welded.  
When the soil is rocky, special fill material in the ground rod holes may be required to provide a low-resistance and non-corrosive medium. The fill material should maintain its high conductivity in wet or dry soil, not leach into the soil, and not dissolve or decompose over time.

Earth Plate Electrodes:

- (a) Use where:
  - (i) Ground resistivity is low but increases with depth;
  - (ii) It is not possible to go deep into soil.
- (b) Protect terminations against corrosion.

Earth Pit:

Provide a concrete/PVC pit complete with a heavy duty concrete, cast iron or PVC cover with recessed lifting hook to the Engineers written approval, at the head of the earth rod, to protect the rod and allow access to connections for testing.

**6-0 TESTING**

- a) Test earthing systems by the earth megger test.
- b) The resistance of any one point in the lightning protection earth continuity system to the main earth electrode shall not exceed 10 ohms, without taking account of any bonding to other services.
- c) Install additional earth electrodes in parallel, if these figures are not met.