

**PART 4 (B)**

**DETAIL SPECIFICATION : LIGHTNING PROTECTION SYSTEM**

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## **4 (B) DETAIL SPECIFICATION : LIGHTNING PROTECTION SYSTEM**

### **4.5 SPECIFICATION FOR THE WORK**

Allow to supply and install the Lightning Protection System for the NEW PSYCHIATRIC WARD building and the roof over the new building.

**All down conductors must be installed into galvanised flush conduits neatly installed in the walls of the complex.**

The work group applicable to this trade shall be No. 160.

### **4.6 SCOPE**

This specification covers the supply of materials, installation, commissioning and testing of a **Lightning Protection System** for the above service.

The installation has been measured and allowed for in the Bill of Quantities of the documentation.

### **4.7 PROGRAMME**

The installation shall be carried out in accordance with the building programme.

### **4.8 SPECIALIST WORK**

A recognised specialist shall carry out the installation work with a proven track record in the field of Earthing and Lightning Protection.

Information in respect of the Specialist Contractor must be provided as an integral part of this enquiry for consideration together with the submission of the tender. The information pages have been included in the documentation.

### **4.9 COMPLIANCE WITH REGULATIONS AND STANDARDS**

The Lightning Protection Installation shall comply with SANS Codes as per the General Specification: Lightning Protection.

### **4.10 DEFINITION OF TERMS**

“Air Terminals” - the part of a Lightning Protective System that is intended to intercept lightning charges (Air Terminals include masts, metallic roofs, roof conductors and finials).

“Down Conductor” - A conductor that connects an air terminal to the earthing terminal.

“Earthing terminal” - The above ground terminal of the earthing system.

“Earthing system” - The part of the lightning protective system that is intended to discharge lightning currents into the general mass of the earth.

“Finial” - An air terminal consisting of a metal rod with a rounded end.

#### **4.11 DRAWINGS**

The tenderers shall scrutinize the drawings issued with the tender.

On request, Elevation drawings can be made available for general tender purposes.

##### **4.11.1 WORKING DRAWINGS**

The Contractor shall submit shop drawings for the following:

- Details of Air Terminals
- Details of Down Conductors and Lightning Protection Test draw boxes
- Details of reinforcing steel bonding terminals (if required)
- Details of test joints, i.e. Lightning Protection Test draw boxes.
- Details of Earthing System
- “As built” marked up drawings on completion of the installation.

Lightning ground flash density shall be as for the inland South Coast area.

#### **4.12 LIGHTNING PROTECTION SYSTEM**

The Lightning Protection System shall consist of the Air Terminal runs, vertical risers, pipework, and equipment forming an integral part of the Installation and the earth electrodes installed into the groundwork.

##### **4.12.1 System Description And Performance**

The system shall comprise:

- a) Air terminal conductors shall be installed onto the new roofs consisting of cement tiles
- b) Down conductors shall be installed flush via 20mm galvanised conduits.
- c) Earthing electrodes shall be installed into the ground (or counter poise earth conductors)

Each earth electrode associated with a down-conductor shall have a resistance not exceeding two hundred ohms or  $nR_t$ , whichever is the lesser, where:

$R_t$  = 30 ohm for category A structures

$R_t$  = 50 ohm for category B or C structures

$n$  = the number of down conductors connected to a common air terminal system.

After the down-conductors have been bonded to their separate earth electrodes, the earth resistance of the earth electrodes system thus connected in parallel by a common air terminal system must not exceed  $R_t$ .

The resistance of the completed system shall not exceed thirty ohms.

#### **4.12.2 Air Terminal Conductors**

Metallic roof structures may be used as the main air terminal and subsequently bonded to down conductors accordingly. Air terminals shall be installed for non-metallic roof structures.

The air terminal conductors shall be 10mm diameter solid aluminium conductors. These shall be mounted in sturdy guides so as to prevent direct contact between the aluminium and the building structure, but permit longitudinal movement of the conductor.

The guides shall be installed at no greater than 600mm intervals. Guides shall also be installed immediately on either side of each bend.

The guides, if made of aluminium, shall be isolated from the concrete by a sturdy metal spacer.

Expansion loops shall be provided in the air terminals at approximately 15 metre intervals.

#### **4.12.3 Down-Conductors**

The down conductors shall preferably be of the same material and section as the air terminal conductors. The down conductors shall be contained in flush mounted galvanised steel conduits.

The conduits shall be installed flush into the brickwork and/or columns between the outlet points at roof height via test draw boxes and outlet points at 500mm below ground level.

Each outlet point i.e. at roof height and below ground level, shall consist of an off set conduit protruding from the wall, fitted with a socket (threaded coupling) and blank stopper. Openings in stoppers for conductors shall be sized to the nearest clearance diameter.

The down-conductor connections to the Main Air Terminal shall be, where possible, installed in inconspicuous positions.

#### **4.12.4 Lightning Protection “Test” Draw Boxes**

Allow to supply and install resin fibre draw boxes complete with resin fibre cover plates, fixed by means of bolts into the walls of the structures as standard Lightning Protection Test Draw Boxes.

The Draw Boxes are to be installed at low-level  $\pm 300\text{mm}$  above the ground or concrete/cement apron surrounding the building.

The vertical Lightning Protection down conductors and the Lightning Protection conductors connecting to the "Ground Earth System" are to be joined by means of suitably sized ferrules in the draw boxes.

By disconnecting the vertical conductors from the conductors connecting to the "Ground Earth System" it must be possible to measure conduct performance testing of the Ground Earth system and the Earth Terminal system.

#### **4.12.5 Earth Electrodes**

Supply and install 16mm diameter 1,2m long earth rod type electrodes vertically into the ground to a depth with the top 500mm below general ground level. The Electrodes are to be positioned on the sides of the building. The electrodes are to be installed 1 000mm from the building and as far as possible away from any adjacent cables and/or other metal components connected to the "Mains Earth System" for the general building installations.

**NOTE:** Depending on the earth continuity tests a counterpoise (horizontal ground conductor) earth system can be installed providing the cost does not exceed that of installing Electrodes and that the cost benefit is passed on to the Department of Works.

The earth electrodes shall comprise of a copper clad steel rod at least 16mm in diameter. There shall be a molecular bond between the rod and the cladding, so as to prevent peeling or chipping. The cladding shall be of a quality and thickness as to afford protection against corrosion of the steel core after installation.

All the metal components, the Main Earth Electrodes and all extraneous metal parts are to be bonded to each other by means of 50mm<sup>2</sup> PVC insulated conductors lugged on both ends and fixed with cadmium-plated bolts.

#### **4.12.6 Joints Between Dissimilar Metals**

Where copper to aluminium joints are required, these shall be by means of heavily tinned lugs, or ferrules of a design which excludes the possibility of direct contact between copper and aluminium. Lugs shall be secured by means of stainless steel nuts, the end of the conductor in contact with steel shall be tinned, and the clamp shall be of a material, which does not promote galvanic action, such as stainless steel.

#### **4.12.7 Materials**

All materials used shall be of the best quality and selected for the best resistance to corrosion.

## **4.13 TESTING**

### **4.13.1 Testing Of Lightning Protection System**

On installation of each earth electrode for the lightning protection system, its resistance shall be measured. Additional electrodes shall be installed until the specific value has been attained.

Provide permanent testing joints between each down conductor and its associated earth conductor.

**Test and submit records to the Engineer, as follows:**

- Earth resistance of earth conductor
- Continuity of any trench earth
- Continuity of overhead system by measuring between one down and each of the remaining down conductors with the earth conductors disconnected.

On completion of the lightning protection system, the resistance to earth of the system as a whole shall be measured.

### **4.13.2 Witnessing Of Tests**

Prior to commencement of any tests, the Engineer shall be notified to enable him to witness tests should he opt to do so.

### **4.13.3 Test Certificates**

On completion of the lightning protection installation, the specialist sub-contractor shall submit test certificates covering all tests, irrespective of whether any previous test results have been submitted or not, and all such tests shall comply with SANS 10313. The Engineer shall be given 48 hours notice of such tests being carried out, and shall have the right to witness and check these tests.

## **4.13 BILL OF QUANTITIES**

Prices of conductors are to allow for joints at angles and intersections for joints in the length (aluminium to aluminium), testing joints, expansion loops and for conductor guides. Joints and bonds of conductors to dissimilar metallic surfaces are measured separately.