SECTION- B 2.13

LIGHTNING PROTECTION SYSTEM

2.13.1 PREMABLE

A. The lightning protection system of Class II to IEC shall encompass all structural elements within the building to form a Faraday cage, all structural elements shall be bonded together to ensure electrical continuity in the event of a lightning strike. Metal tapes shall be provided to run along the periphery of the tower. The spacing between the tapes shall to suite the class II protection. The metal tapes will be then allowed run externally outside the building periphery to connect with mother earth through earth micro piles.
B. Testing and inspections of the Lightning Protection System shall be as per recommendations within IEC.
C. The Electrical Contractor shall record all continuity results for vertical/horizontal/transitions/etc as required to provide a fully integrated Lightning Protection system suited to protect the building complying with requirements.
D. The Electrical Contractor must visually record the installation its progresses on site. He shall take photographs taken each joint at each floor during the progress of the Lightning protection works using a digital camera. Record all images at the following locations in digital format. Provide photographic details of all Engineering Services, which are concealed within the building, before final concealment. Supply good quality digital photos to be printed at 300 dpi (or images of 4.0 Megapixels at 7"x5" print size) and submit to the Lodha Representative in the following formats:
    a. 7"x5" photographs & JPEG type electronic format and issued by e-mail (or on CD ROM)

2.13.2 SUMMARY

A. A lightning protection system will be provided to safely discharge the passage of a lightning strike to earth. This will take the air terminal, connected to the structure of the building and then terminated in piles at ground level. The lightning protection system shall encompass all structural elements within the building to form a Faraday cage, all structural elements shall be bonded together to ensure electrical continuity in the event of a lightning strike.
B. This section specifies Design, Supply, Installation, Testing, Commissioning and setting of the complete network for Lightning Protection Systems. The system and equipment shall be designed, supplied, installed, commissioned and tested in accordance with relevant code as described below. This specification shall be used in conjunction with all drawings, Schedule of requirement and BOQ attached.
C. The Scope of work also includes:-
    1 Survey: Ascertain the nature of the site and all local conditions and restrictions likely to affect the tender and the execution of the Lightning protection work. No claims for additional costs shall be accepted for lack of knowledge in this regard. Examine all available drawings of the site and site services, which may be obtained from the Lodha Representative prior to tender. Before commencing work, carry out an examination and full survey of the site, buildings, structure and services affected by the Engineering Services works. This survey shall include identification (location, depth and size) of all underground services and, with prior written agreement from the Lodha Representative, should be intrusive, if appropriate.
    2 Responsibility to complete the full detailed design.
    3 Verify the design to complete the Lightning Protection system.
    4 Undertaken design calculations to IEC latest edition.
    5 Provide any test certificate required to ensure final connections are made in accordance with the requirements of the standards.

D. The contractor shall note that the lightning protection system shall be installed in stages; reference shall be made to the main contract preliminaries for details of the project construction program.
E. The lightning protection system shall encompass all structural elements within the building to form a Faraday cage, all structural elements shall be bonded together to ensure electrical continuity in the event of a lightning strike.
F. The system shall comprise the following elements:

    1 Air Terminal strike plates
    2 Air Termination network
    3 Structural columns
    4 Structural slabs

5 Reinforced Concrete columns
6 Reinforced Concrete slabs
7 Façade
8 Roof steelwork and other equipments
9 Down conductors
10 Pile Caps
11 Earth Pits
12 Bi metallic test clamps
13 Electronic Surge Suppression Devices for power and telecommunication systems.
14 External Metal structure
15 All architectural metallic extensions from building façade

G. Code & Standards: - The lightning system shall be designed and executed in accordance with the latest applicable sections of the IEC/BS/IS codes. Since IS Standards are originated from IEC standards, technical requirements listed in the latest IEC standards supersedes IS standards requirements which do not cover them.

IEC 61024-1-2	Lightning Protection System – Latest Edition
BS EN 62305 (1 to 4)	Lightning Protection System – Latest Edition
EN 50164	Accessories for Lightning Protection Systems
IS 2309	Lightning Protection System – Latest Edition

2.13.3 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Shop Drawings: For air terminals and mounting accessories.
1 Layout of the lightning protection system, along with details of the components to be used in the installation.
2 Include indications for use of raceway, data on how concealment requirements will be met, and calculations required for bonding of grounded and isolated metal bodies.
3 Coordinated layout/sectional/details drawings with respect to the façade/ structure/ architecture/ etc as required
C. Qualification Data: For qualified Installer and manufacturer. Include certification by back ground information confirming projects undertaken in region.
D. Field quality-control reports.
E. Comply with recommendations from codes "Inspection and Maintenance of Lightning Protection Systems," for maintenance of the lightning protection system.
F. Record all continuity results for vertical/horizontal/transitions/etc as required to provide a fully integrated Lightning Protection system suited to protect the building complying to requirements of codes.
G. Photograph: Provide progress photographs taken at weekly intervals during the progress of the Lightning protection works using a digital camera. Record all images at the following locations in digital format. Provide photographic details of all Engineering Services, which are concealed within the building, before final concealment. Supply good quality digital photos to be printed at 300 dpi (or images of 3.0 Megapixels at 7”x5” print size) and submit to the Lodha Representative in the following formats:
1 7”x5” photographs & JPEG type electronic format and issued by e-mail (or on CD ROM)
H. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features, including the following:
1 Ground rods.
2 Ground loop conductor.
3 Vertical down conductor locations & lap joint locations on layout, tap off locations to facade on elevation drawings.

2.13.4 QUALITY ASSURANCE

A. Acceptable manufacturers: Firms regularly engaged in manufacture of equipment required for this installation, whose products have been in satisfactory use in similar service for not less than 10 years. Provide equipment produced by a manufacturer listed as an Acceptable Manufacturer in this Section and as approved by the Lodha Representative.

B. Standards Compliance: Comply with requirements of applicable local codes and regulations pertaining to lightning protection systems as listed above.
   a. Lightning Protection System: System shall be installed by trades specializing in lightning protection systems.
   b. In case of conflict among the referenced standards and codes, the more stringent provision will govern.

2.13.5 MANUFACTURERS

A. Approved Manufacturers: Subject to compliance with requirements provide products by one of the manufacturers in Section G.

2.13.6 TECHNICAL REQUIREMENT

2.13.6.1 COMPONENT PARTS

A. The principal components of lighting protection system shall be as follows:

1 Air terminations.
2 Down conductors.
3 Joints and bonds.
4 Structural columns
5 Structural slabs
6 Reinforcement steel
7 Reinforced Concrete columns
8 Reinforced Concrete slabs
9 Façade
10 Roof steelwork
11 Bi metallic test clamps
12 Electronic Surge Suppression Devices for power and telecommunication systems
13 Test joints.
14 Earth terminations.
15 Earth electrodes.
16 Earthing pit
17 Air Termination network

2.13.6.2 AIR TERMINATIONS

A. Air terminations shall consist of horizontal conductors in the form of networks as per codes listed above.
B. No part of the roof should be more than 5 meters from the nearest horizontal conductor; this will be achieved typically by an air termination network mesh of approximately 5 meter x 5 meter.

2.13.6.3 DOWN CONDUCTORS

A. The code covers the use of down conductors of various types including the use of strips, rod, reinforcing bars and structural steel stanchions. Any good conductor which may from part of the building structure can be included, appropriately joined to the air and earth terminations and in general the higher the number of down conductors used, the lower the risk of side-flashing and other undesirable phenomena.
B. Likewise, large conductors reduce the risk of side-flashing especially if insulated.
C. The down conductor system should, where practicable, be directly routed from the air termination to the earth termination network and be symmetrically placed around the outside walls of the structure starting from the corners.
D. Pattern and number of down conductors, joints, bonds and test joints shall be as per the recommendations of relevant code.

2.13.6.4 EARTH TERMINATION NETWORK

A. Nominated piles identified on the Electrical and structural engineers drawings shall be used as earth electrodes and shall be connected to the relevant down conductor, these generally comprise reinforcing in the building structure.
B. The whole of the earth termination network should have a combined resistance to earth not exceeding 10 (ten) ohms without taking account of any bonding to other services.

2.13.6.5 EARTH ELECTRODES

A. The earth electrodes should be driven into the ground beneath, or as close as practicable to, the structure and down conductor where ground conditions are favorable for the use of rods in parallel, the reduction in earth resistance is small when the separation between the rods becomes less than their driven length
B. Earthing electrodes shall be copper clad steel 20mm minimum diameter, 3m (meter) length.

2.13.6.6 CONNECTORS/FITTINGS/FASTENERS AND HARDWARE

A. Provide all connectors, fittings, fasteners, hardware, clamps, guards, lugs, etc., as required to connect, interconnect and install all parts of the system (maximum cable fasteners spacing - 1 meter).
B. Fabricated from copper/GI/AL metal and approved for use intended.
C. Provide connections rated and approved for application between dissimilar metals.

2.13.7 EXECUTION

2.13.7.1 INSPECTION

A. Examine conditions where lightning protection system is to be installed. Notify the Lodha Representative in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected.

2.13.7.2 INSTALLATION

A. Install lightning protection system as per approved scheme from Lodha & consultant & indicated, in accordance with manufacturer's written instructions, and in accordance with local authority requirements to ensure that installation complies with requirements and serves intended function.

B. Coordinate as necessary to interface installation of the lightning protection system with the building architecture, Façade, structure, roof equipment and earthing.

C. Install conductors with more than one direct path from air termination to earth connections avoiding sharp bends and narrow loops. Conceal all conductor drops to earth within building structure as indicated. Provide flush cable support boxes with gaskets and bolted cast covers, finish as directed by the Employer's Representative.

D. Properly guard and protect all work installed in accessible locations.

E. Install all material in a manner to prevent electrolytic action under the presence of moisture. Bond metallic projections on every roof. Route perimeter conductors on the set back roofs as required. Connect perimeter conductor/air terminal systems to steel reinforcing column system as indicated on the drawing / manufactures requirement/ site requirement.

F. Make all roofs, wall or other penetration in a manner to prevent the ingress of water or moisture.

G. Install lightning protection system so that completed work is unobtrusive and does not detract from the building's appearance.

H. Make installation in a manner to eliminate possibility of displacement and subsequent maintenance.

I. Make all connections mechanically and electrically sound and clean all bonding surfaces just prior to attachment.

J. Conductors

K. Tape on flat roof areas shall be run exposed. Fasteners shall be fixed in accordance with Standard and manufacturer's recommendations. Colour of tape sheath and fasteners to be white and agreed with the Employer's Representative.

2.13.7.3 COORDINATION

A. Coordinate installation of lightning protection with installation of other building systems and components, including electrical wiring, supporting structures and building materials, metal bodies requiring bonding to lightning protection components, and building finishes.
B. Coordinate installation of air terminals attached to roof systems with roofing manufacturer and Installer.
C. Flashings of through-roof assemblies shall comply with roofing manufacturers' specifications.
D. Attend meetings as required to ensure the co-ordination of all Lightning protection works **and implement to suit the construction of complete integrated building construction**.
E. In addition convene meetings as required to ensure the co-ordination of all Lightning protection works.
F. Incorporate details provided by others into the co-ordination / installation drawings making due allowance for all building elements, structure and other services, or provide all necessary details, drawings, schedules, etc. required to enable the co-ordination drawings to be prepared by others.
G. Identify at an early stage, and report prior to works commencing, any conflict in the positioning between the Lightning protection works, the structure and/or architectural elements. In particular co-ordinate the services and suspended ceiling supports in the ceiling and floor voids to ascertain if structural tolerances have been exceeded, and services voids reduced, and take on-site dimensions. Advise the Lodha Representative of any proposed corrective action to resolve any conflicts. Any necessary remedial works shall be carried out at no additional expense to the Lodha Representative.
H. Mock up to be arranged for installation of all types of items listed on the drawings, BOQ and elsewhere.

2.13.7.4 INSPECTION & TESTING

A. Provide all detailed drawings, etc. of the equipment to enable the insurance company to approve design before manufacture, if requested by the Lodha Representative.
B. Agree a programme for inspection and certification of specified equipment.
C. Inform the Lodha Representative when equipment is to be ready for examination.
D. Provide all necessary access and facilities for inspecting and testing as may be required by the Lodha Representative.
E. Where indicated in this specification, the installations will be inspected by a 'competent' person acting for the Lodha Representative.
F. Ensure the installations concerned satisfy the Lodha Representative requirements in all respects.

2.13.8 FIELD QUALITY CONTROL

A. Upon completion of lightning protection system, test system to demonstrate compliance with specifications. When possible, field correct defective equipment, then retest to demonstrate compliance. Replace equipment which cannot be satisfactorily corrected at no additional cost to the Lodha Representative.
B. Check continuity of entire system.
C. Inspect all connections prior to concealing same and ensure compliance with all applicable standards.
D. Perform an earth resistance test immediately after driving earthing (ground) rods and furnish test results to Lodha Representative.
E. Install equipment under direct supervision of the equipment manufacturer's factory representative.
F. Fully test the complete lightning protection system in the presence of the Lodha Representative to demonstrate continuity of all conductors. Submit a written test report in format approved by Lodha Representative.

2.13.8.1 CORROSION PROTECTION

A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.
B. Use conductors with protective coatings where conditions cause deterioration or corrosion of conductors.

2.13.8.2 CLEANING & PROTECTION

A. Upon completion of the Work, remove unused materials, debris, containers and equipment from the project site.
B. Protect the Work during the construction period so that it will be without any indication of use or damage at the time of acceptance.

END OF SECTION- B 2.13