METHOD STATEMENT FOR INSTALLATION OF LIGHTNING PROTECTION SYSTEM

RED LINE NORTH ELEVATED AND AT GRADE

Revision and Issue Records

Review History

1	27/12/2016	For SONO	SHA	MAG	PSE
Rev. No	**Date**	**Description**	**Prepared**	**Reviewed**	**Approved**

Document Review and Approval

Signed :_____ P.Serra	Signed :_____ M.Agrimakis	Signed :_____ M. Ali	Signed :_____ R.Neri
☒ Originator	**☒ Construction**	**☐ Stakeholder**	**☒ Quality**
Signed :_____ J. Brink	Signed :_____ E. Ndarake	Signed :_____ M. Thompson	Signed :_____ D. Bernasconi
☒ Health and Safety	**☒ Environment**	**☐ Commercial**	**☒ Cont. Rep.**

Document Control

Controlled Copy Issue Log:

This document control list is only applicable for hard copies that may be required outside EDMS.

The hard copy document has been assigned as below and will be reissued automatically upon any future revision

Copy	Company Name	Representative	Date

Contents

1 Definitions and Abbreviations

Table 1: Definitions and Abbreviations

Abbreviation	Definition
BS	British Standard
PPE	Personal Protective Equipment
HS	Health, and Safety
ITP	Inspection and Test Plan

Abbreviation	Definition
PMC	Project Management Consultant
QA/QC	Quality Assurance / Quality Control
QCS	Qatar Construction Specification
SONO	Statement of No Objection
PPE	Personal Protective Equipment
RLN-EAG	Red Line North Elevated and At Grade
RLR JV	Rizzani de Eccher, Lotte and Redco - Joint Venture
MS	Method Statement
SWA	Steel Wire Armoured
LV	Low Voltage
LSOH	Low smoke zero Halogen
XLPE	Cross-linked polyethylene
OSHA	Occupational Safety and Health Administration
SLD	Single Line Diagram
QCS-2014	Qatar Construction Specification
BOH	Back of House
NEC	National Electrical Code ®

2 Purpose:

The purpose of the method statement is to describe the procedure for material delivery inspection, installation and inspection of Lightning Protection System at Stations. The Intent of this report is to explain, the methods to be adopted to ensure works conducted on site are in compliance with approved design, material approvals and as per project requirement.

3 Scope of Method Statement:

The scope of application of this method statement is the Installation and inspection of Lightning Protection System for Red Line North Elevated & At Grade. (Chainage: 25+285 to Chainage: 31+950, Section of the RLN-EAG Project.

4 Work Execution:

4.1 General Supplied Items:

4.1.1 Personnel:

Ref.	Trade & Despines	Responsibility

1	MEP Construction Manager	• Delivering the overall works in a safe and timely manner, ensuring conformance with the approved design. • Leading the team of engineers and surveyors, guiding them in the delivery of the works. • Verifying that work done is in accordance with requirements of contract. • Ensuring the quality standards set for the work are achieved and the work team adhere to the QA/QC and HS requirements of the contract.
2	Systems Assurance Engineer	• Establish the system assurance process. • Manage the RAMS team and EMC team in delivering the system assurance submissions. Liaise with the System Assurance Manager for all safety and RAM related activities respectively.
3	Project/Site Engineer	• Ensuring that the works are being carried out in accordance with contract requirements and this Method Statement. • Management onsite to ensure that the team carries out the works in time with the delivery schedule. • Implementation of and adherence of the team to the QA/QC and H&S policies and procedure.
3	QA/QC Manager	• The preparation of the company's QA manual control and supervision of all amendments and revisions • Monitor all quality related activities on the project • Perform all internal and external audits on behalf of the company's management • Preparation, monitoring, training of project staff on method statements, and control of material on site.
4	QA/QC Engineer	• The QA/QC Engineer is the overall responsible for the implementations of this procedure and will carry out the material inspection to ensure that materials received on site are approved materials. • He will be conducting surveillance and inspection duties at various stages of the project delivery to ensure compliance to contract requirements and to QA / QC requirements. • He will monitor the installation works according to the approved drawing & method statement. • He will coordinate with the Supervisory Consultant to carry out inspection/testing of the completed works. • The QA/QC Engineer is responsible for the detail application of this procedure for the inspection and testing, to coordinate with the Construction Manager and Site Engineer for the inspection of on-going work.

5	Surveyor	• Setting out all planned works. • Monitoring the works being carried out to ensure they are at the correct levels and measurements. • Maintaining documents relevant to alignment and height control.
6	Document Controller	• Documenting, distributing and maintaining data in the prescribed format. • Making the necessary data available as requested by the team or the client.
7	HS Inspector	• **Identify** HS requirements, non-compliance or otherwise by conducting both formal and informal audits and communicate said to relevant site management • **Advise** site management on HS substandard acts and HS substandard conditions on a continuous basis and record said. • **Coordinate** and record action by site management as identified and advised. • **Verify** actions taken by site management , record and report accordingly • **Conduct** relevant HS administrative functions and additional tasks as directed by HS Management.
8	Supervision Engineer	• Checking the compliance of works to the design. • Carrying out comprehensive supervision of all construction works. • Confirming that the work executed complies with the approved design and be responsible for checking the construction works.

All of the above will individually be responsible for a safe and healthy operational environment consideration of all the workers in their team related to the execution of their duties and any other personnel.

Workers

One group of workers is planned for execution of Installation of Lightning Protection System. This group will provide all activities. The group will have following labour profile:

Sr. No.	Description
1	Electrical Supervisor
2	Electrical Foreman
3	Electrician
4	Labour (skilled and unskilled)

4.1.2 Equipment and tools :

The typical construction equipment requirements is as listed below, and will be used for Installation activities at site.

Plants

No.	Type	Use
1	Man Lift	For Installation of Tags and Markers
1	Scaffolding	For the Installation
2	Lights	For use during night operations
3	Generator	For Power Generation for Lights

Small Tools and Equipment

- PPE for all staff and labour
- Measuring tapes and setting out markers
- Electrician Tool Box with all tools
- Earth Resistance Tester
- Torque wrench
- Fire Extinguisher
- Fire Blanket
- Thermo weld fixing tools
- Fitter Tool Box with all tools.
- Cad Weld accessories.
- Extension Ladder
- Hand Torch, First aid Box, Step ladder, Barrier warning tape.

Note: All the powered tools shall be suitable for use of 220V - 240V power Supply.
The above tools and equipment shall be checked for operational suitability before each shift of commencement of works including, but not limited, to safety and operational compliance. The same shall be executed for all small tools and miscellaneous items.

4.1.3 Material

1. Air terminal rod
2. Copper Earth tape
3. Copper bar
4. Removable Earth Links
5. Earth Pit cover
6. Concrete Inspection Pit
7. Copper Clamps
8. Copper Clips
9. Copper couplings

All the materials should be as per Material Submittal and to be inspected before installation.

4.1.4 Handling and Storing of Materials

1. All materials shall be stored and handled as per manufacturer's recommendations.
2. When materials arrives at site shall be inspected randomly and ensure that the materials are as per approved material submittals.
3. Any discrepancies, damage, and etc. found to the materials shall be notified and reported to QA/QC Engineer and Project Engineer for further action.
4. Materials found not suitable for site use shall be removed from site immediately.
5. While unloading, shifting and storage, it should be ensured that there are no damages.

6. Material Inspection need to be carried out while material delivered at site.
7. QA/QC Engineer will be responsible on checking and receiving all the materials delivered at site prior to stock on storage area.
8. Rejected and damaged materials shall be stored at a suitable quarantine area with proper identification label to prevent unintended use and to be returned for replacement.
9. The means by which the cable, rods and fittings are unloaded and handled at the job site shall be assessed prior to unloading.
10. Where manual handling is to be utilized it is imperative that a proper load assessment is undertaken and correct manual handling techniques are used to avoid injury. Safety and careful handling should be top priorities when handling materials.
11. For mechanical lifting, support each unit with nylon / canvas slings during all phases of handling. When off-loading, materials shall be lowered and not dropped to the ground.
12. Store all fittings and loose shipped materials indoors in a dry area.
13. Keep the materials in their original shipping containers where possible and store correctly in warehouse facility.

4.2 Site Execution

4.2.1 Program

Installation of Lighting Protection System is expected to be performed starting Dec - 2017. Detail schedule of Installation activity will be provided in the weekly update of the 3-weeks look ahead construction schedule.

4.2.2 Pre-Requisites

Before commencing the installation of the Lightning protection system the following checks shall be carried out.

1. Confirm material submittal got approved.
2. Confirm all approved materials are available for installation.
3. Confirm that the drawings are approved for construction and latest revision.
4. Ensure necessary handover release from other trades as applicable.
5. Ensure that work area is clean and safe for work with adequate lighting provided.
6. Ensure all site personnel have undergone site safety induction.
7. Ensure that installation work is undertaken by trained and experienced personnel.

4.2.3 Installation Procedures

1. Only approved materials shall be used in the lightning protection system.
2. Lightning Air Terminals and Down Conductors shall be installed as per the approved shop drawings.
3. Marking of location / routing as per approved shop drawing.
4. Air Terminals rods shall be securely anchored to the structure.
5. Down conductors shall be installed and fixed as per the approved shop drawings, normally on the outer surface of the wall or column of the structure.
6. Slope / angle roof conductors and down conductors shall be securely anchored to the structure or re-bar with suitable clamps.
7. Metallic components of the station such as roof mounted plant and equipment shall be bonded to Lightning Protection system.

8. Lightning Conductor shall be 25mmx 3mm conductor tape with PVC insulation.
9. Care should be taken while installing earth conductor on the sloped roof.
10. Lightning Air Terminals and Down Conductors connectors shall be provided for conductor splice connections and terminal connections.
11. The connectors shall be heavy duty copper alloy cast metal and shall have hex-head screws in the bodies and holes in the tongues for bolts.
12. All main earth leads will be fixed to enable the electrode system to be disconnected for testing.
13. Each earth link shall be located in an accessible position above ground and as close as possible to the earth electrode.
14. Approved earth connectors shall be connected to earth rod to connect to cables.
15. Where connections are welded to equipment a cad welding process shall be employed.
16. All bolted connections shall be tightened.
17. Contact resistance and continuity of bolted connections shall be done before concreting of column.
18. Earthing terminal connections are to be brazed to equipment, thoroughly clean metal prior to brazing and repaint impaired surfaces to prevent corrosion.
19. Connections between dissimilar metals protected by painting with a moisture resistant bituminous paint or compound, or wrapping with protective tape to exclude moisture.
20. Cross jointing, clamping & bonding will be inspected for tightness & electrical continuity.
21. Extensible rods of the same diameter shall be installed in holes drilled into the ground. If ground conditions permit, rods may be driven into the ground either manually or mechanically. The earth electrode shall be installed at such a depth that it penetrates the summer water table by a minimum of 2 metres. Under no circumstances shall lightning protection electrodes be connected to any QGEWC earthing electrode. A minimum distance of 7 metres shall be provided between any lightning earth electrode and a QGEWC earth electrode.
22. Weld earth connectors to the top of the rods, in sufficient number to make connection with all incoming cables.
23. The down copper conductor tape shall be securely clamped in the earth rod.
24. Identification labels, warning labels, etc., shall be provided / fixed wherever applicable as per project specification and approved shop drawings.

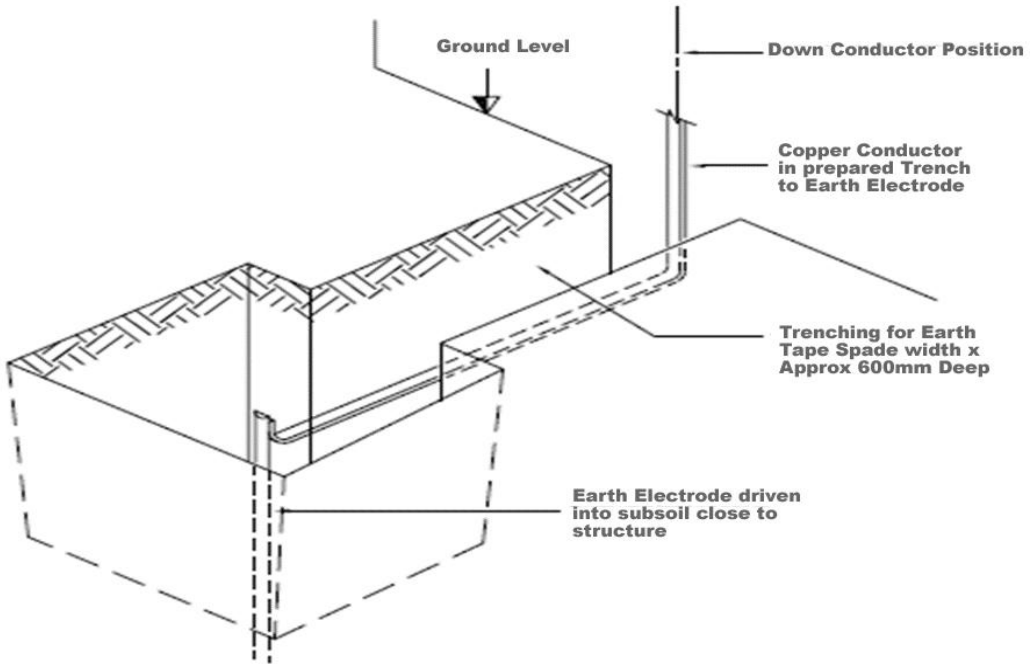

Figure -1 (Sample Picture) **Earth tape and Pit Detail**

4.2.4 Earthing

1. Each Earth Rod shall be 20mm nominal diameter rods connected together to achieve minimum overall length indicated in the specifications and materials.
2. Earth Rods shall be manually driven and driving heads shall be as per the manufacturers recommendations.
3. Depth of earth rod shall be as required to achieve a maximum earth resistance of 10Ω at any one point in the lightning protection earth continuity system to earth electrode.
4. Rods shall be connected by approved screwed coupling joints as supplied by the rod manufacturer. The ends of the rod shall be threaded, couplers shall be as per rod manufacturers.
5. The copper/earthing conductor shall be protected against damage where the conductor emerges from below grade until such time as the permanent earth pit is installed.
6. The copper/earthing conductor shall be installed/routed/sized in accordance with the approved IFC drawings, Specification and Code.
7. The copper/earth conductor installation shall not conflict with other installations.
8. All copper/earthing joints and connections to equipment shall be as per manufacturer's recommendation, approved drawings, specification and code.
9. Earth links shall be located in accessible locations and fixed using removable earth links to allow for removal during testing.
10. All lightning protection installations shall be left exposed until inspections have been completed to ensure installations are properly secured and fastened.
11. Onsite changes/modifications shall be advised to engineer for approval and "REDLINED" in approved shop drawing and changes shall be reflected in "AS BUILT".

4.2.5 Inspection Pits

1. Concrete/PVC earth pit complete with heavy duty concrete, cast iron or PVC cover with recessed lifting hook shall be provided at the top of the earth rod to protect the rod and exposed earth cable.
2. Earth pit shall be provided with identification label and warning sign.
3. The earth rod connection is below the lid of the inspection pit with adequate access for testing purposes. The earth pit shall be installed flush to grade elevation as per approved shop drawing. Reference bench mark shall be utilized to establish installation elevation.

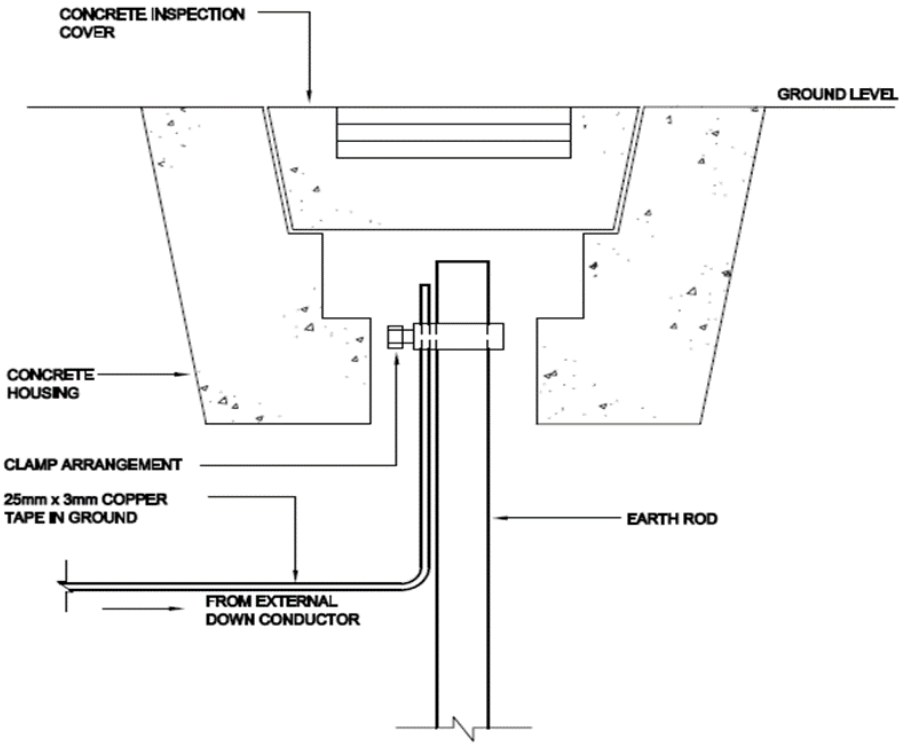

Figure – 2 (Sample Picture) **Earth Pit Detail**

4.2.6 Testing

1. Testing earthing systems by the Earth MEGGER test.
2. The resistance of any one point in the lightning protection earth continuity system to the main earth electrode shall not exceed 10 ohms.

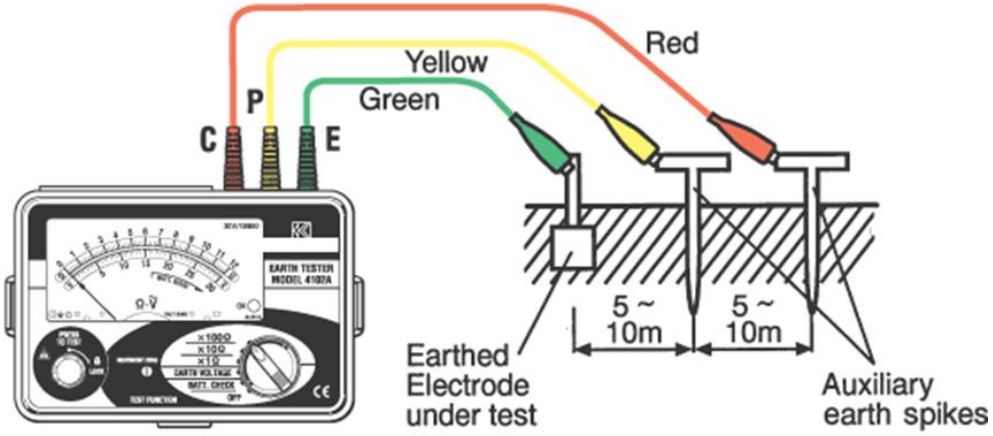

Figure – 3 (Sample Picture) **Earthing Tester**

5 Quality

The Inspection and Test Plan (ITP) for this Method Statement summarizes various characteristics to be checked. The concerned Site Engineer or Site Supervisor will be responsible to ensure compliance for these operations and the site QA/QC Engineer will carry out quality control checks and report the inspection results.

5.1 Quality Records:

ITP reference No: M002-RLR-ELE-ITP-00007.
Quality records shall be provided as identified in the ITP and maintained as per ISO 9001/QCS 2014 part section 2 QR Quality Guidelines.
Required form of records and reports are defined in the Inspection and Test Plans. Refer to Doc. No: M002-RLR-ELE-ITP-00007.

6 Health and Safety Plan:

a) The Health and Safety Plan: M002-RLR-HMS-PLN-00001 will be strictly adhered to at all times.

b) Compulsory RLR HSE induction is required before access to workplace is permitted. PPE relevant to the scope of work risks as identified must be utilized.

c) Compliance with the HS Summer working plan is compulsory Ref: M002-RLR-HMS-00003.

d) Expose to direct sunlight; including Installation of Lightning Protection System shall be avoided 11.30 AM to 3.00PM hours during Hot seasons. Prcaustion shall be taken on heat strokes, dusty winds and other unsuitable weather conditions.

e) Workplace HS communication ie Toolbox talks, task briefings and HS non compliant notices / closeouts are compulsory.

f) The health and safety Department shall create and approve tool box talks which the safety office shall conduct such meetings shall cover, at various times and before use of equipment, the respective matters consisting of, but not limited, to:

i. Use of tools including specialised equipment;
ii. Personal protective equipment;
iii. Smoking;
iv. Handling of waste material;
v. Use of ablution facilities;
vi. Barricades, signs and warning tape;

Rev 0012: July: 2016

RLR **EMERGENCY CONTACT NUMBERS** In case of emergency, accident, sickness	

HS Deputy Manager :	
Water Team	**74798184**
Environmental Assistant:	**74795948**
Management Office: _____	44719853

Contacts for Traffic issues:

Security Manager		
Traffic Manager		

6.1 Specific Measures:

Specific measures related to span erection are as follow:

1. Working at height: all measures described in M002-RLR-HMS-PRO-00005 shall be in place during erection activities.
2. Load shifting Machinery
   i. Do not operate any load shifting machinery without training and approval.
   ii. Operators of forklift trucks, bulldozers, loaders, excavators, trucks should possess appropriate certificates/ Passes.
3. Manual Handling
   Avoid manual handling operations as far as possible to minimize the risk of injury. Estimate the weight of the load. Lift an object with a correct posture. Wear suitable protective equipment. Put on gloves as far as possible to protect your hands from any cut, scratch or puncture, and wear safety boots or shoes to prevent injury to toes by heavy falling objects .Seek assistance from someone in lifting a load if necessary.
4. Portable Power Tool
   i. Do not use a portable power tool (such as saw, grinder and drill) unless its dangerous parts have been effectively guarded.
   ii. Place the electric cable and hose of a tool at an appropriate position to avoid tripping hazards.
   iii. Do not operate a cartridge operated fixing tool unless you have possessed a valid
   iv. certificate.
   v. Wear suitable eye and ear protectors while operating a cartridge-operated fixing tool.
   vi. Use a cartridge-operated fixing tool with great care.
5. Scaffold (Mobile)
   i. Do not use scaffolds unless they have been erected by trained workmen and under the supervision of a Supervisor.
   ii. Do not use a scaffold unless it has been inspected and certified safe (A Green Tag to visibly hoist on the scaffolds) by a Certified Supervisor before use.
   iii. Strictly follow the instructions of a Supervisor. Do not alter the scaffold unless authorized to do so.
   iv. Do not work on an unfinished scaffold.
   v. When it is necessary to work on a mobile scaffold, lock the wheels of the scaffold before you start working.
   vi. Do not work on a scaffold unless it has been provided with a suitable working platform.

vii. Ladders shall be used where no other means of access is possible.

6. Safety Requirements.

i. First Aid Kit to be provided at Station working areas in consultation with HSE officer.

ii. Clean up work area immediately after each task; never leave an area that is cluttered

iii. with tools or supplies that could present tripping hazard.

iv. Barriers as required shall be in place wherever necessary.

v. Visible “Safety sign” shall be provided where necessary as per HSE requirements.

vi. Good quality gloves are to be worn to protect your hands when using the equipment or handling materials.

vii. The basic Personal Protective Equipment for this particular job are:

a. Hard Hats (Hat Colours as specified by HS Department)
b. Gloves (Must Be Task Specific)
c. Goggles (Clear Shades/Glass for underground areas and Black shades/Glass for work in Sun Light)
d. Reflective Vest
e. Safety Boots (High Ankle as Qatar Rail)

7. Electricity

Before using an electric tool, check the tool and its plug and connecting cable.

1. Do not use a damaged tool.
2. Do not use an electric tool unless its connecting cable is well protected.
3. Do not use an electric tool unless its metal casing is earthed and its power supply is provided with an earth leakage circuit breaker.
4. Regular monthly inspection and regular inspection (prior to commence work) of equipment and tools shall be conducted as required. Tag must be put to tools and equipment that have damaged to prevent using.
5. Ensure that it has the correct inspection report for the month and report immediately any defects or damage to your supervisor. If faulty DO NOT USE!
6. Do not repair or alter any electrical installation unless competent to do so.
7. If you meet any fault or problem, report it to your supervisor immediately.
8. Make sure that the power cables have good insulation and properly connected not causing a tripping hazard and that they are not laid in water, working area of moving equipment, materials and areas where they are walked on.
9. Keep cables off the ground suspend from structures where possible. It must be ensured that live cables are not in contact with metallic surfaces.
10. Do not stand in water while using the equipment and do not allow the equipment to get wet.
11. Check the power supply connections and make sure that the equipment is properly earthed.
12. Only Trained technicians who have full knowledge on how to operate the equipment are allowed to use.
13. Only qualified electrician must install and maintain the live electrical equipment.
14. Make sure that all equipment (If any used), cutting machine, bending machine and all other appliances (As Specified in MS Tool & Equipment Section) brought to the Site have relevant Test Certificates I Training.

8. Fire Risk

There is always a fire risk. However, the chances of fire can be reduced, and you will know what to do when a fire breaks out if you:

1. Always keep the workplace clean and tidy.
2. Handle machinery and tools that may generate sparks or heat carefully .
3. Do not smoke or use naked flames in any area where flammable and explosive substances are stored.
4. Know where fire extinguishers are
5. Located and how they are used.
6. Know the place of assembly for fire evacuation.
7. Provide portable fire extinguishers nearby the working area and all persons involved must be familiar how to operate the fire extinguisher (If Necessary or Advised by the HS officer)

Note: Always wear safety spectacles when using the equipment.
Other specific risks & measures are addressed in the Risk assessment attached in Appendix B.

7 Environmental:

The site team including subcontractors shall implement the following environmental controls measures:

a) The waste material from the installation of Lightning Protection System are to be placed in waste skips provided at site.

b) Unused materials shall be returned to the stores for appropriate storage according to manufactures' instructions for potential reuse;

c) Colour coded skips with signage shall be provided for waste segregation (general waste, metals, and plastics). Separate colour coded storage skips to be used for hazardous material.

d) Good housekeeping shall be maintained regularly at job site.

8 Interfaces and Permits

8.1 Interfaces

- Not Applicable

8.2 Permits

- Not Applicable

9 Appendices / References:

9.1 Appendices:

- Appendix A – Inspection and Test plan;
- Appendix B – Risk Assessment;
- Appendix C – Test Report;

9.2 References:

This Method Statement shall be read in conjunction with the following documents:

Material Submittal:

Material submittal for Lighting Protection System.
Material submittal for Lighting Fixture & Accessories - BOH.
Material submittal for Lighting Fixture & Accessories - FOH.
Material submittal for Tags & Markers.
Material submittal for Fire Resistance Multicore Armoured Cables
Material submittal for Low voltage LSOH Cables & Wires
Material submittal for Cable lugs.
Material Submittal for Cable Tray, Trunking ladder & Accessories.
Material submittal for GI Conduit, Flexible Metallic Conduit & Fittings, GI Back boxes.
Material submittal for Cable Glands.

Method Statement For:

Document No.	Document Title
M002-RLR-ELE-MES-00001	Installation of Cable Containment System
M002-RLR-ELE-MES-00002	Installation of GI Conduit, Flexible Metallic Conduits & Accessories
M002-RLR-ELE-MES-00006	Installation of Earthing & Bonding System
M002-RLR-ELE-MES-00005	Installation of Fire Alarm Cables
M002-RLR-ELE-MES-00007	Installation of Lightning Protection System
M002-RLR-ELE-MES-00008	Installation of Light Fixtures & Accessories-Back of House
M002-RLR-ELE-MES-00009	Installation of Light Fixtures & Accessories - Front of House Area
M002-RLR-ELE-MES-00010	Installation of Wiring Accessories & General Power
M002-RLR-ELE-MES-00011	Installation of LV Cables & Wires
M002-RLR-ELE-MES-00012	Installation of Automatic Transfer Switches (ATS)
M002-RLR-ELE-MES-00013	Installation of Isolating Switches
M002-RLR-ELE-MES-00014	Installation of MCC Panels & Accessories
M002-RLR-ELE-MES-00015	Installation of Distribution Boards & Accessories
M002-RLR-ELE-MES-00016	Installation of Sub main Distribution Boards (SDB)
M002-RLR-ELE-MES-00017	Installation of Control Cables
M002-RLR-ELE-MES-00021	Installation of PVC Conduits & Accessories

Specifications:

Document No.	Document Title
M002-RLR-MEP-TEN-00008	Material and Workshop Specifications Volume 7
M002-RLR-MEP-SPE-27005	DD2 –Qatar University Station-WP11.2 MEP Specifications
M002-RLR-ELE-SPE-36013	Lusail Station - WP18.2 - DD2 - Earthing and Bonding. Specifications
QCS 2014	QCS 2014 Section 21 Part 21
M002-RLR-MEP-SPE-36303	Lusail Station - WP18.2 - DD2 – MEP Specifications
KAHRAMAA	Electrical and Water Design and Installation Regulations
BS 6651	Code of practice for protection of structures against lightning
BS 7430	Code of practice for earthing.
NEC	National Electrical Code ®

Reports:

Document No.	Document Title

M002-RLR-MEP-RPT-27003	DD2- Qatar University Station Earthling & Bonding Report
M002-RLR-ELE-RPT-26000	DD2- Qatar University Station WP11.2 – MEP Design Report