

	GOLGOHAR STEEL PROJECT	
	Technical Specification For Lightning Protection System of Weighing	
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Technical Specification For Lightning Protection System of Weighing

00	ISSUED FOR APPROVAL	M.KHAVARI	F.NIKNAM	A.MONFARED	1405/04/09
Rev.	DESCRIPTION	REVISED BY	CHECKED BY	APPROVED	APP DATE

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1.0 GENERAL

1.1 Introduction

This specification is prepared to cover the minimum requirement for designing Lightning Protection System which located in loading, unloading & railway loading area project of Golgohar Mining & Industrial Co. Equipment and materials selection will be based on the utilization of modern proven technology that can be demonstrated as having operated successfully and reliably in an equally onerous environment.

1.2 Scope

This specification has been prepared to provide minimum requirement for design, erection and supply of lightning protection system regarding loading, unloading & railway loading area project of Golgohar Mining & Industrial Co.

In case of discrepancy between documents and this specification, the stringent shall be applied.

No deviation from this specification is allowed unless specificity agreed among OWNER and VENDOR.

1.3 Terms and Definitions

In construing this specification following words and expressions shall have the meanings as follows:

The **Owner / Purchaser** is **Golgohar Mining & Industrial Company**.

The **Manufacturer/Supplier/Vendor** is the organization to which the

Purchase order has been awarded.

1.4 Document Priority

In case of conflict between documents, the order of precedence shall be:

- This Specification,
- Calculation document,
- Drawings and other documents,
- Applicable laws, rules and regulations of the country,
- I.E.C. standards,
- Other standard and codes when I.E.C. publications have not yet been issued.

1.5 Conditions of Operation

All of the Electrical Equipment & Systems will be suitable for 24 hours, 7 days/week, and 365 days/year operation.

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2.0 Site Conditions

2.1 Plant Location

The Site is located at Gol-E-Gohar Iron Ore Complex, situated in Sirjan, Province of Kerman in southern part of Islamic Republic of IRAN, approximately 285 km southwest of Kerman city and 335 km north of Bandar Abbas port, in a semi-desertic high plateau terrain, 1750 m above sea level, and flanked by mountains over 2500 m high trending northwest to southwest.

2.2 Meteorological

Ambient Temperature

Max. Temperature:	+40 deg. C (Recorded)
	+50 deg. C (Design)
Min. temperature:	-12 deg. C (Recorded)
	-10 deg. C (Design)
Average temperature:	+15.9 deg. C (Design)
Wet bulb design temperature (summer):	+25 deg C
Relative Humidity:	Max. 70%

Wind Velocity

According to National Iranian Code (6th revision):

Basic speed data:	130 Km/h
Basic pressure data:	0.845 KN/m ²
Correction factor:	

0 - 10 m:	2
10 - 20 m:	2.2
20 - 100 m:	2.4

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Rainfall

Yearly 120 mm (average)

Monthly rainfall 260mm (Max)

Barometric Pressure

820 milliards

Geological Conditions

This data is belonging to the existing palletizing plant location. For the engineering the contractor shall be study geotechnical conditions for the essential location according to the project plan.

Altitude: About 1,750 m above mean sea level

Soil bearing: approx. 20t/m²

Ground water level: approx. 60 m below ground level

Earthquake Load

Equipment in plant will be dimensioned including a safety calculation against earthquake according to the "Iranian Code for Seismic Resistant Design of Buildings

– Publication No. S253-2nd edition, autumn 1999" ("Iranian Regulations 2800") and "Minimum

Design Loads for Building and Structures" (Iranian Regulations 519).

- Design base acceleration: 0.3·g

- Classification of Buildings: Group 2

- Soil classification: soil type III-b

3.0 STANDARDS AND CODES

The systems will meet, as far as applicable the latest edition of the following recommendation:

IEC 62305 Series Protection Against Lightning

BS EN 62305 Series Protection Against Lightning

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4.0 Basic

The design of the lightning protection system shall be in accordance with relevant codes and regulations, including local codes and practices, but maximum advantage shall be taken of inherent continuity and the minimum amount of copper tape or cable shall be used.

Lightning protection system shall be separate from other forms of earth but facilities should be provided for bonding of these systems. Generally speaking, lightning protection system (LPS) will consist of three main parts as follow:

- 1) Air Terminal
- 2) Down Conductor
- 3) Earth Terminal

Air terminals may be in different forms, but in this project "Air Rods" and "Mesh" can be used for air terminal. The air terminals shall be directly earthed as close as possible with down conductors, which shall consist of bare copper conductor or metallic parts of building (as natural down conductors) shall carry current from air terminals to earth terminals. At least two down conductors shall be considered for each lightning protection system. If there is any insulation between concrete foundation and soil, Steel bars of re-enforced concrete foundation shall be considered as earth terminals. Resistance of earth terminal to mass of earth should not be greater than 5 ohms.

Structures which are made of metal and which are electrically continuous do not require a separate down conductor for lightning protection. Two earth lugs or bosses at 450 mm above ground on opposite sides of the equipment shall be provided and connected to two earth rods near to the base of the equipment. The method used shall depend on the need for protection against direct lightning strikes.

Exterior metal parts of a lightning protected building such as aerials, vents, doors, staircases and drain pipes shall be bonded to the lightning protection system.

Structures which are made of a poorly conducting material, e.g. brick or concrete, and which are vulnerable to a lightning strike, shall be provided with down conductors, air terminals and earth electrodes.

All air terminals shall be made of copper, unless otherwise agreed. Corrosion resistance should be considered for air terminal/down conductor material selection.

Wherever possible, lightning conductors shall follow the most direct route to earth. The lightning earth system shall be connected directly to the plant source earth.

Where a steel structure requires direct earthing for lightning, each earth lug or boss shall be connected directly to an adjacent earth electrode(s).

5.0 Design

5.1 Structural lightning protection design considerations

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BS62305 (Protection of structures against lightning) clearly advises strict adherence to the provision of a conventional Lightning Protection System (LPS) – to the total exclusion of any other device or system for which claims of enhanced protection are made.

Principle components of a conventional structural lightning protection system, in accordance with BS62305 are:

- Air termination network
- Down conductors
- Earth termination network
- Bonding (to prevent side flashing).

5.2 Air termination network

On high risk structures such as explosive factories, no part of the roof should have distance more than 2.5m from an air termination conductor. This is generally achieved by applying a 5m x 10m mesh to the roof.

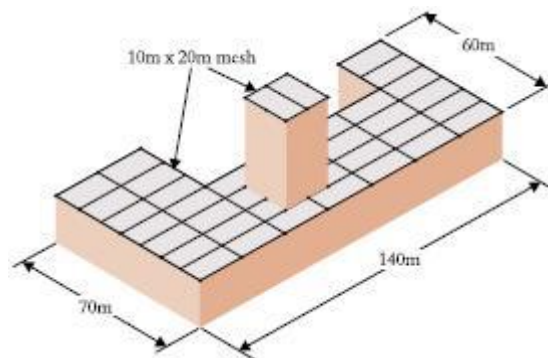


Figure 1 - Air terminations for tall conducting structures

However, for most structures, a mesh of 10m x 20m is considered sufficient, giving a maximum distance from any part of the roof to the nearest conductor of 5m.

The zone of protection does not seem to be applied because of the need to interconnect the down conductors of the tall block to the air termination of the lower block. In such cases it is necessary to connect the lower air termination up to the lower down conductors to facilitate this inter connection, even though this extension is within the zone of protection of the tower.

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The 'Zone of Protection' offered by an air termination network is considered to be 45° for heights up to 20m. Above this height, the zone of protection is determined by the 'Rolling Sphere Method'.

This involves rolling an imaginary sphere of 60m radius over a structure. The areas touched by the sphere are deemed to require protection. On tall structures, this can obviously include the sides of the building.

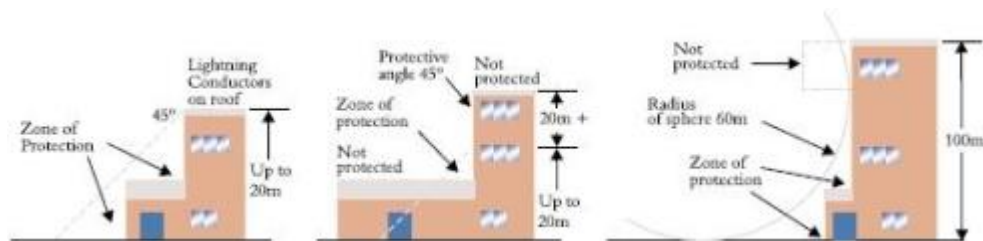


Figure 2 - Zones of protection

5.3 Down conductors

Down conductor positioning and distancing is often dictated by architectural constraints. There should be one down conductor for every 20m or part thereof of the building perimeter at roof or ground level (whichever is greater). These should be evenly spaced and distances apart of more than 20m avoided if possible.

If the building is above 20m in height or of an abnormal risk this distance should be reduced to 10m.

They should be routed as directly as possible from the air termination network to the earth termination network to avoid risks of side flashing. Re-entrant loops are also to be avoided. BS62305 & BS 6651 Recommends that the length of conductor forming the loop should not exceed eight times the width of its open side.

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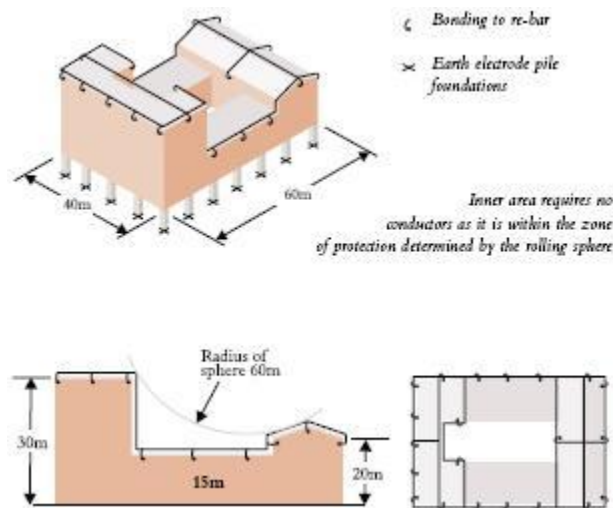


Figure 3 - Lightning Protection Scheme to BS62305 & BS 6651 using the reinforced concrete within the structure for down conductors

BS62305 Allows the use of 'natural conductors' such as rebars and structural steelwork, provided that they are electrically continuous and adequately earthed.

5.4 Earth termination networks

Each down conductor must have a separate earth termination. Moreover, provision should be made in each down conductor, for disconnection from the earth for testing purposes. This is achieved with a test clamp (see Figure 4).

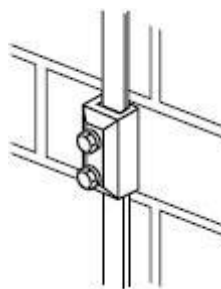


Figure 4 - Oblong test or junction clamp

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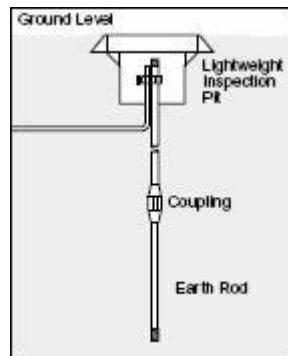


Figure 5 - Deep driven earth electrode

BS 62305 Stipulates that the resistance to earth of the lightning protection system measured at any point, should not exceed 10 ohms.

With the test clamp disconnected, the resistance of each individual earth should be no more than ten times the number of down conductors in the complete system. e.g. for a system with 15 down conductors, the individual earth readings should be no more than $10 \times 15 = 150$ ohms.

Several types of earth electrode are permissible, but by far the most commonly used are deep driven earth rods. BS 62305 states that the combined earth rod length of a system should not be less than 9m while each individual earth rod should not be less than 1.5m in length.

5.5 Earth rod electrodes

3-meter copper rod, as a vertical earth electrode will be installed for lightning protection electrode. Minimum distance between each two earth rods should be the depth of installation.

Generally, earth terminals shall be protected against corrosion.

Horizontal spacing between earth electrodes shall not be less than the combined buried length of two electrodes. At least one more than the required minimum number of electrodes shall be installed. By this means each electrode can be disconnected one at a time for testing without affecting the integrity of the earth system.

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5.6 Parallel earth rod electrodes

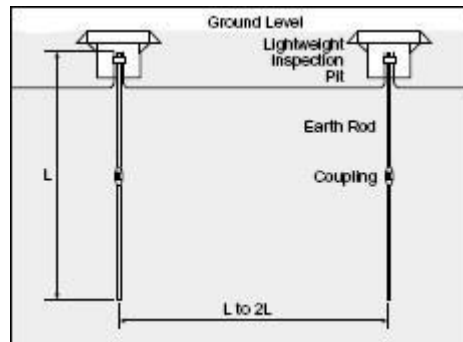


Figure 6 - Spacing of parallel earth rod electrode

Where ground conditions make deep driving of earth rods impossible, a matrix arrangement of rods coupled to one another by conductors can be used. If possible, the earth rods must be spaced at a distance at least equal to their driven depth.

If earth rods cannot be driven in a parallel line a “Crows Foot” configuration can be used, ensuring that the spacing/depth ratio is still maintained.

High resistivity soil conditions can be overcome by backfilling earth rods with a suitable medium such as Marconite conductive concrete which effectively increases the diameter of the earth rod and hence its surface area, thus lowering resistance to earth.

5.7 Bonding

All metal work, including water pipes, gas pipes, handrails, air conditioning units, metal cladding, metal roofs etc, in the vicinity of the LPS must be bonded to it, to avoid the danger of side flashing.

For the same reason, the LPS earth should be bonded to the main electrical earth, as well as any other earthing system present in the structure.

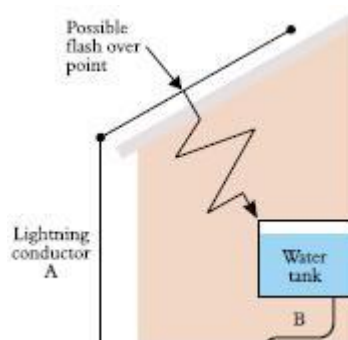


Figure 7 - Example of side flashing

If the lightning protection system on a structure is hit by lightning, then the current flowing through the system and the resistance/impedance offered by the conductor path will

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determine the magnitude of the potential difference seen by the lightning conductors with respect to true earth. The lightning conductors can, instantaneously, have a potential magnitude of megavolts (1,000,000V) with respect to true earth.

Typically, at instant of discharge:

potential difference at A = 1,500,000V

potential difference at B = 0V

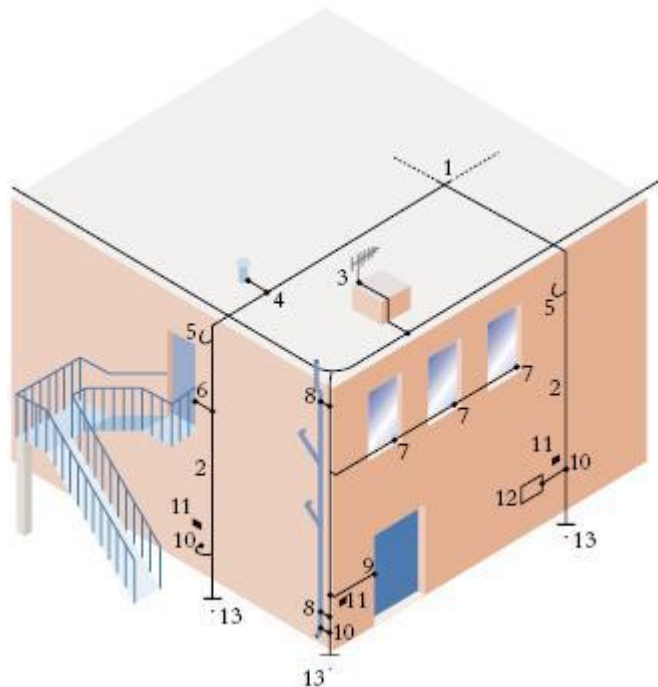


Figure 8 - Bonding to prevent side flashing

1. Air termination
2. Down conductor
3. Bond to aerial
4. Bond to vent
5. Bond to re-bar
6. Bond to metal staircase
7. Bond to metal window frame
8. Bond to vent pipe
9. Bond to steel door/frame
10. Test clamp
11. Indicating plate
12. Main earthing terminal of electrical installation
13. Earth termination point

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5.8 Corrosion

BS62305 Contains tables of materials suitable for use in Lightning Protection System (LPS) components. Adherence to these requirements is vital to avoid corrosion problems.

The correct choice of material and installation design should ensure a life span of 30 years for the earth electrode system.

6.0 Inspection, testing, records and maintenance

The code BS 62305 adequately details the requirement for inspecting an LPS, the testing required and the detailed records that should be maintained.

Observance of clauses 32 to 34 of the code BS 62305 will highlight any maintenance of the system required. Of particular importance is the regular detailed examination of the complete LPS for any evidence of corrosion. If this check is not carried out then vital components within the LPS, which may have suffered from corrosion and which could exhibit a high resistance could be missed. This will have a detrimental effect on the whole system making it an unattractive high impedance path for the lightning current to follow.

To minimize this problem, along with regular inspections, the selection of the correct materials should be made in accordance with the recommendations of BS62305.

Note:

- 1- Mesh conductor size is 50mm² in this project.
- 2- Down conductor size is 50mm² in this project.