



**LCDC**  
TELECOMS

**LIGHTNING PROTECTION  
(WHITE PAPER)**

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## 1 INTRODUCTION

Lightning discharges over telecommunications systems are often subjected to Lightning discharges due to their high elevation metallic structures ( Mast, Roof mounted etc..)

LCDC SA has experience on this subject and would like to offer this document to provide information which might prove useful. Indeed, telecommunications networks often have towers or pylons conducive to the initiation of discharge currents initiating electrical current returns, the intensity of the plasma can reach several hundreds of thousands of amperes (kA).

## 2 THE PHENOMENON OF LIGHTNING

Originated from an environment of a humid and hot atmosphere. The warm air filled with humidity rises. At a certain altitude, the water turns into ice droplets and due to their weight fall to the ground.

The friction of the droplets with the air causes ionizations and a negative electrostatic charge is formed. In approaching the earth, the electric field formed between the volume of ionized air and the land becomes increasingly high. When this electric field becomes high enough, an electric arc between this volume of ionised air and the earth is formed. Due to the nature of electrical contact the arc forms easily when there is conductive material nearby (eg metal pylons).

It then establishes a corona path: the positive charges of the land are attracted to the negative charges in the ionised air in order to re-establish a neutral medium. This path takes the route of lowest resistance that depends on the soil resistivity and ground loops that are offered by our artificial telecommunications equipment (metal pylons and high installations of antennas).

Peak current is established, the intensity is even stronger due to the connection to the fact that the land is of low ohmic resistance.

These current peaks not only cause damage by the heat but also cause driver currents to be induced in all conductive loops around the area where the contact with the land is made.

## 3 PREVENTION AND PROTECTION.

Means of prevention and protection of the phenomenon described above is simple enough to propose. For example, it would constitute a volume of positive charges rather high ground, thereby minimizing the current landfill.

But this phenomenon is accompanied by complex parameters that need to be evaluated and anticipated:

- There are discharges between the different volumes of negative charges (lightning) traveling in the atmosphere. These discharges cause high winds, which mechanically deformed volumes, which make a study model very difficult to conceive.
- In 5% of cases it was found that landfills are an ideal connection from the air to the land. Any protection thus becomes catalyst damage.

## 4 PROTECTION AND PREVENTION

### 4.1 TRADITIONAL EARTHING NETWORKS.

An earth connection of electrical or electronic equipment is required to:-

- form part of the protection for men working in rural industries.
- avoid industrial noises in radio equipment

The network of industrial land is mainly composed of:

- An electrical circuit ground (Electrical Earth). It connects all the land of electric power at a single point upstream to where it should be connected to the neutral phase of the supply network.
- A ground circuit called mechanical (Dirty Earth): it ensures a short-circuit to all the connections between two dissimilar metals to prevent the creation of electrical torque (battery effect) creating corrosion of metals at the joint. Note that it is automatically on the ground radio antennas Telecom.
- An electronic circuit ground (Clean Earth), it connects all the electronic equipment to a route which provides the lowest impedance between the equipment and the earth. It must be of high quality to get rid of industrial noise (from 2 to 6 MHz).

These three "earths" are then connected to a single point (final copper bar) which is then connected directly to ground itself through a picket, bridle etc. ..

### 4.2 DEVELOPMENT OF EARTHING NETWORKS.

The study of lightning phenomena and protection has only occurred in relatively recent times (the last 40 years). Increasingly, in areas of intensive lightning activity, the trend is to no longer respect the topology of a star network of ground circuits as advocated in recent years, but to connect all the earths together to overcome the negative effects of currents induced by the peak current discharges.

## 5 RECOMMENDATIONS AND CHOICE OF PROTECTION DEVICES.

There is no effective 100% solution to the problem. There are radioactive detection systems which, when present, give a pre-alert, lightning conductors on top of high masts attract the lightning away from the main antennas, etc. .. buried capacitor

Our recommendations are based on our experience on the pylons of 240 m erected in the jungle and primary rainforest of Malaysia, humid region, sandy bottom, etc. .. that seems to resemble the good sites encountered in GABON

Our results have determined the most effective use made of three components:

- Use of earths made of hollow stakes filled with Chemicals to improve the conductive quality of the earth
- Use of semi conductive chemical powder to mix with the surrounding soil of the earth point.
- Use lightning conductors to provide an umbrella of protection to the tower and its antennas.

We attached some brochures for these products.

## 6 BUDGETARY PRICES PER SITE WITH THE VICINITY OF METALLIC MASTS

item	Description	Qty	Unit price excluding VAT	Total price
1	Chemical Earth electrode 6 feet with two pots of 20 kg of soil additives (GAF Increase Fill Ground))	1	665,00	665,00
2	25 kg bag of GAF additive	1	65,00	65,00
3	Refill kit for the electrode (for 14 feet)	1	65,00	65,00
4	Electrostatic umbrella - DAS (dissipation array system)	1	24 600,00	24 600,00
5	Adaptation of umbrellas on existing towers (pylons plan to receive)	1	4 300,00	4 300,00
<b>TOTAL per site exc VAT €</b>				<b>29 695,00</b>