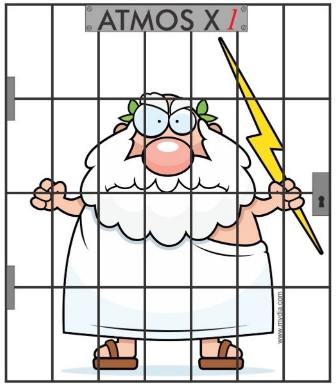
Atmos Plus X1.1

Officina de Mydia / Volts and Bolts



Models and Verificaçtions for LPS design

Software **Atmos Plus X1.1**, update 11.1.0, March 2016

Contents:

1. Introduction

On this document we’ll show the options available for calculating the Lightning Protection System (LPS) of Edifications - structures like Industrial, commercial and residential Buildings and Houses; Areas - Open ones and also Parking lots and sporting courts, and also Isolated structures, like Tanks, Chimneys, Water reservoirs, Towers, Antennas, Posts and some volume one needs to protect with external posts.

Atmos uses a concept of approximating the actual structure to an already defined Model - that is, a building can have several decorative or architectural details that will be too slow and cumbersome to describe to a software, either entering data or through a CAD drawing, so we opted to contain the volume to protect under a more generic shape or form that, if correctly protected, will guarantees the protection of any volume under it.

Please note that the names used for the Models are only for illustration, an “Industrial building” can be also a shopping center or a hospital.

This document shows the available calculations for the current version of Atmos Plus X1.1; the smaller versions - Atmos Pro X1 and Atmos LE X1 - have fewer calculations available and (for LE version) dimensions can be limited, please check our site or sales contact - see item 4 for internet addresses.

2. Models

2.1. Edifications

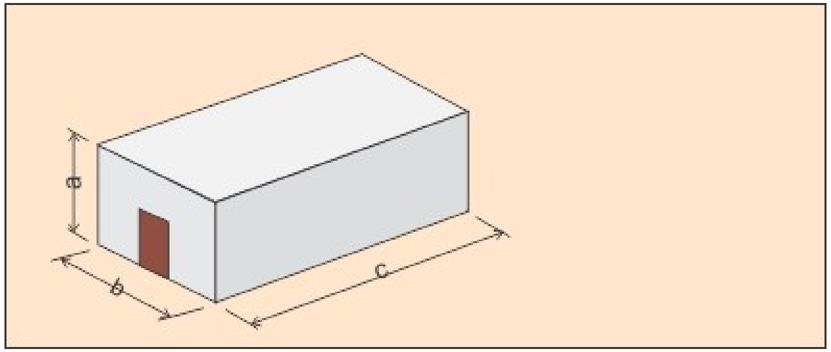
2.1.1. Industrial buildings

Rectangular blocks with several options of roofing.

2.1.1.1. Simple Industrial Building

This is the most complete model of Atmos; for the air terminals, 5 alternatives are calculated: 3 different vertica air terminals height, then the Faraday cage positioned in both directions - for current IEC 62305-3 standard, both Faraday results will be the same, but for NFPA 780 they are different, as this standard (as IEC on the past) allows for rectangular meshes instead of square ones. The typical construction is a slab, with or without roof, but metallic structures are also very common - in this case, the structure is already a Faraday cage, you only need air terminals if you wish to protect the roof against perforation and fractures.

Model:

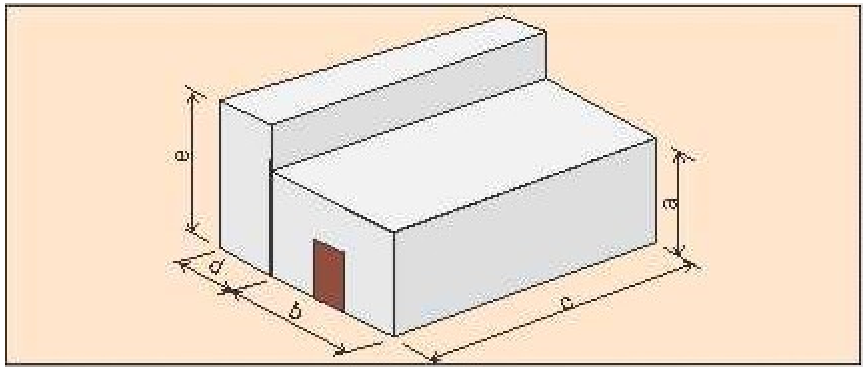


Data needed: height (a), width (b) and length (c).

2.1.1.2. Conjugated Industrial building

One of the blocks is higher than the other, and the LPS is calculated with a Faraday cage.

Model:

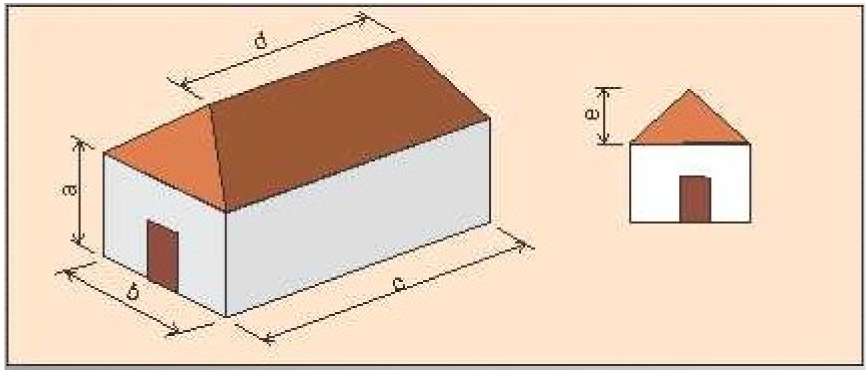


Data needed: same as the simple Industrial building, plus the higher block height (e) and width (d).

2.1.1.3. Industrial building with two-sloped roof

In this model, we have a two-sloped roof, used mainly in old industrial buildings and some residential ones; this model is intended for big structures, for a House, use the appropriate model - see item 2.1.3.2.

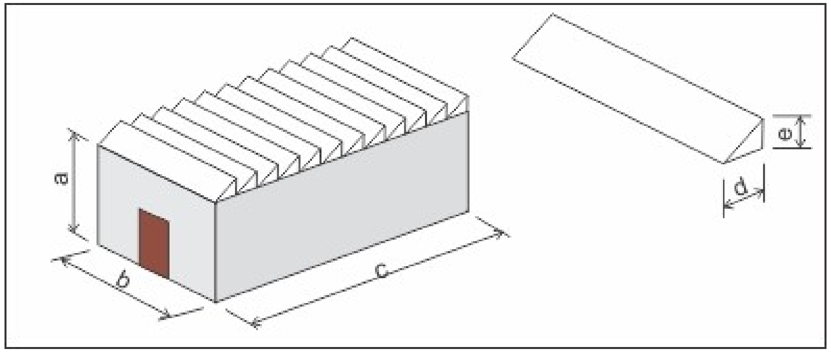
Model:



Data needed: height (a), width (b) and length (c), then the length of the ridge (d) and the height of the roof (e).

2.1.1.4. Industrial building with shed roof (sawtooth)

Model:



Data needed: height (a), width (b), length(c), and width (d) and height (e) of the shed.

2.1.2. Buildings with a significant elevation at the roof

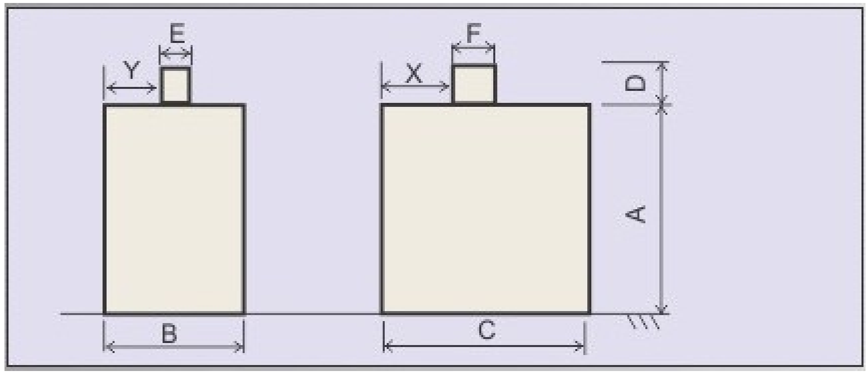
This model assumes there's an elevation at the roof, typically a water reservoir or machine house for elevators, helipad or other.

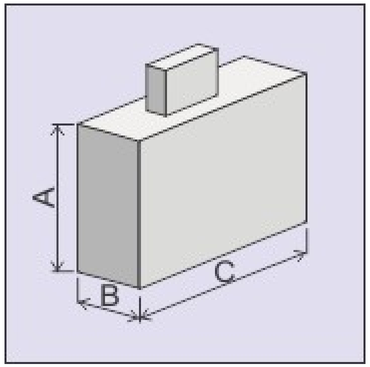
Atmos will make use of this elevation to calculate a mixed model: a Faraday cage at the elevation and a conductor at the building roof overhang and then position the EGM sphere on them to check if it touches the roof - if that happens, the program then uses a Faraday cage to protect the open area..

This mixed model calculation is more economical for typical residential buildings - and some offices building also. If the elevation is too small or the building is too big, it can be more economic if you use the model "Industrial building" (see above) to use vertical rods as air terminals instead of the Faraday cage, then manually add the conductor at the eaves of the elevation and ground it to the main LPS..

2.1.2.1. Rectangular Plan

Model:



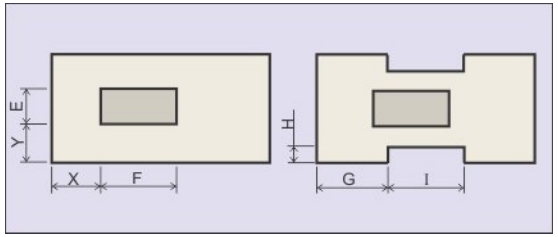


Data needed: height (a), width (b) and length (c) of both the building and the elevation (d, e, f), and the coordinates (x, y) positioning the elevation.

2.1.2.2. “H” shaped Plan

Same as previous Model, but additional data: position of the retreat (“H”) center relative to the corner of the building (g), width (i) and length (h) of the retreat.

Detail:

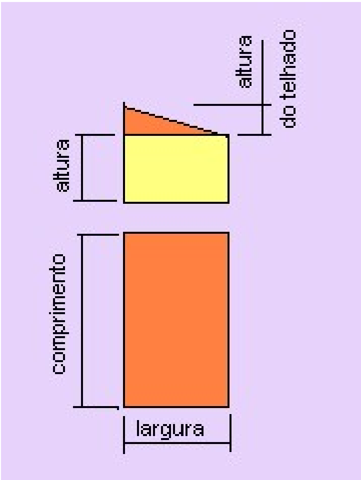


2.1.3. Houses

Relatively small structures for residences, offices, garage, etc., usually with two-slope roof, although the roof with one slope is also used in smaller houses.

2.1.3.1 House with rectangular plan and roof with one slopes

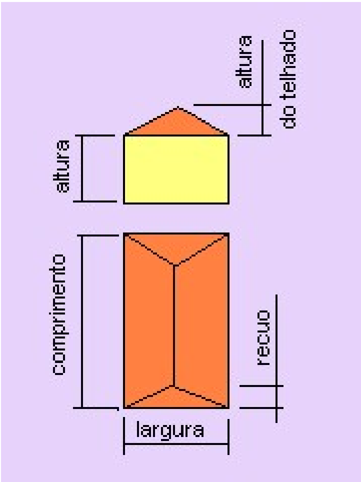
Model:



Data needed: wall height, width, length and the roof height.

2.1.3.2. House with rectangular plan and roof with two slopes

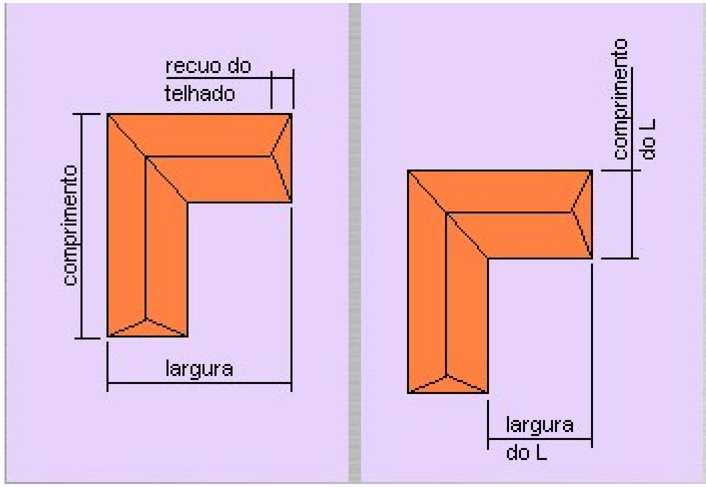
Model:



Data needed: height of the walls, width, length, retreat and height of the roof.

2.1.3.3. House with “L” shaped plan

Model:

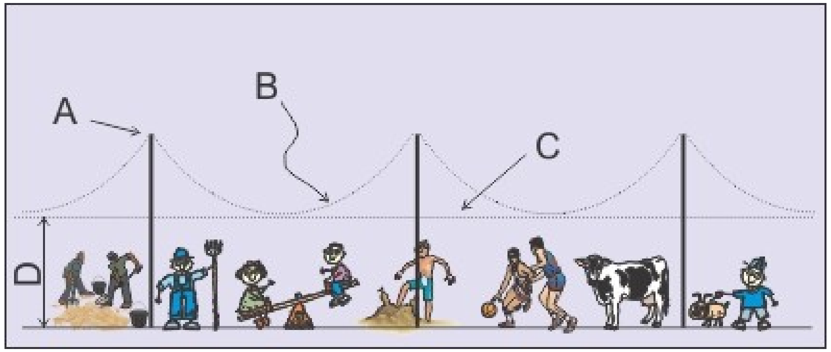


Data needed: besides the data from the rectangular House, you need to enter also the width and length of the second wing of the House.

2.2. Areas

Open areas where people and vehicles circulate, or where there are equipments, or swimming pools, a camping area and others.

As we don't have here a building to protect, Atmos will use the concept of an "imaginary plane" : suppose there's a plane, parallel to the soil surface, above a given height:

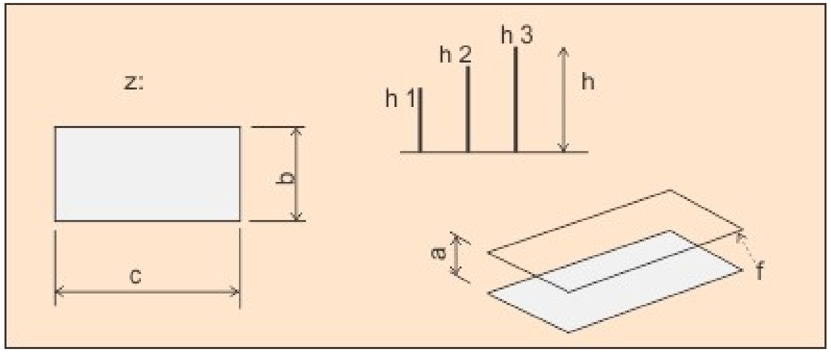


If we block the EGM sphere to touch the plane, we'll also blocking any flash to reach the volume under the plane. Please note that, on this version, the program assumes that there is a wall - more or less of the same height of the plane - surrounding the area, where the sphere can be supported; this is an usual but optimistic situation comparing with the case where the sphere touches the soil around the posts area - we're studying to add support for this other situation on a future version of Atmos, check with us in case of need (see contact info on item 4, bellow).

2.2.1. Open (and free) area

It's any open area that will be protected by posts, and Atmos can position them freely in a matrix form (parallel lines and columns) at the most economical way, that is, the minimum number of posts for each post height, then Atmos will find three answers that you'll later compare and chose..

Model:

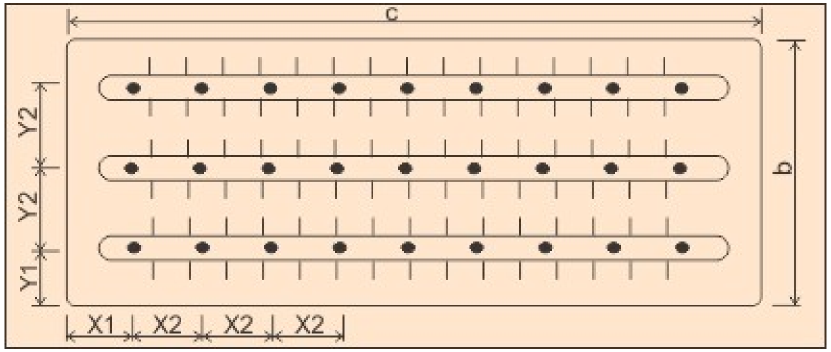


Data needed: height of the imaginary plane (a), width (b), length (c), three post heights - necessarily higher than (a).

2.2.2. Parking lot

This Model could be considered a Verification (see item 3, bellow) because, instead of freely positioning the posts at the most economic places, Atmos will verify if the existing (or planned) lighting posts of the Parking lot are sufficient to protect the whole area.

Model:

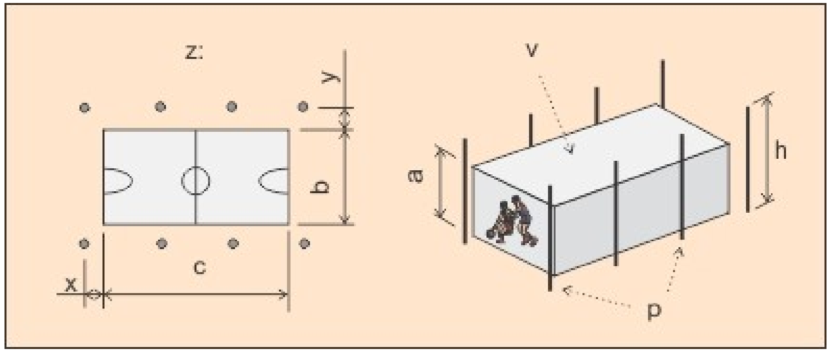


Data needed: height of the imaginary plane (a), width (b), length (c), position of first post (x1, y1), typical (constant) spacing of the posts in both directions (x2 and y2).

2.2.3. Sports court

The basic idea is a basketball court with lighting posts preferably metallic that will be used as air terminals, like in the former case of the Parking lot but, here, the posts are external to the volume. As a consequence, there's a limit for the width: if it's near or bigger than the EGM sphere, the solution will be impossible and a lightning could reach the center region.

Model:



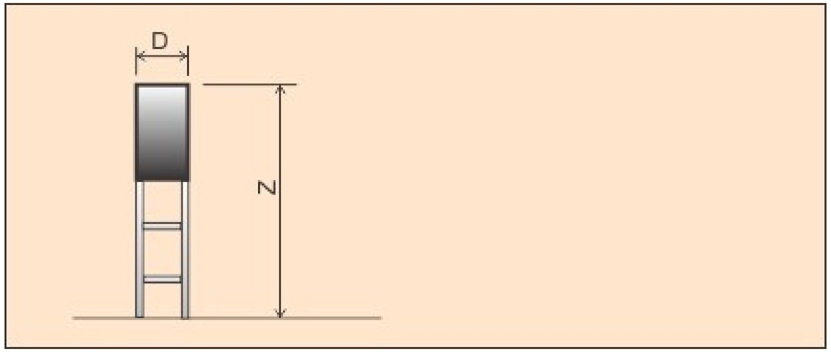
Data needed: height of the imaginary plane (a), width (b), length (c), position of the first post (x, y) and posts height (h).

2.3. Isolated Structures

2.3.1. Water reservoir

Structure with small dimensions but positioned well above the surface; usually cylindrical and made of concrete - if it's metallic, probably will be self-protected, in this case the LPS can be omitted.

Model:

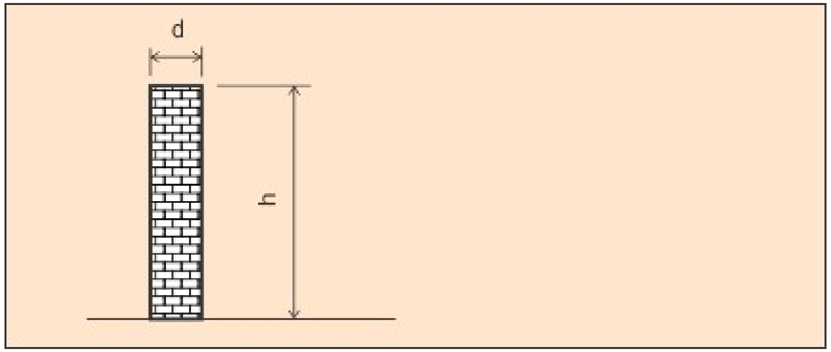


Data needed: diameter (d) and height (z).

2.3.2. Chimney

Metallic ones are normally self-protected, but the concrete or brick ones will need a LPS.

Model:

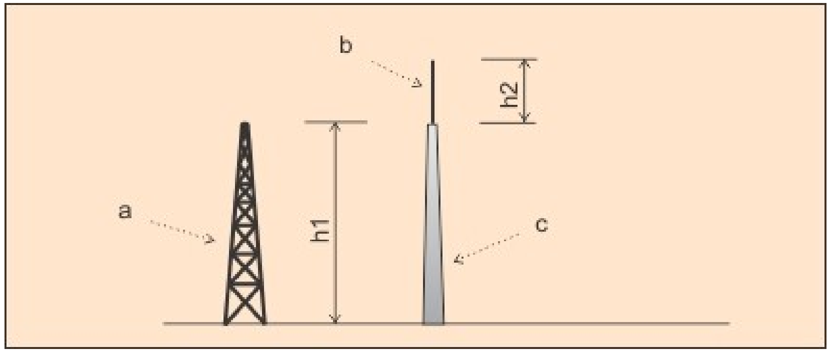


Data needed: diameter (d), height (h), construction material and if the gases are flammable.

2.3.3. Antenna or Post

If it's metallic, normally is already self-protected; for concrete posts, you an use the rebars as ground conductor or install two external conductors.

Model:

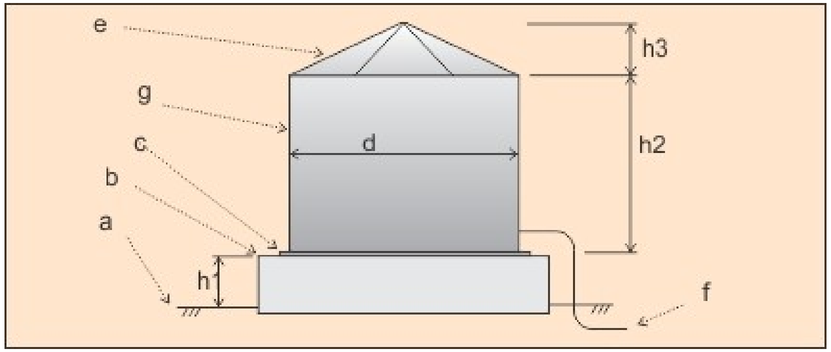


Data needed: height (h1) and, if exists, the height of the additional rod (h2).

2.3.4. Tank

Metallic tanks are considered self-protected if they have a minimal wall thickness (for lightning impact) and diameter (for grounding) also above a minimal size (also function of the soil or base material); according to the standard, the number of ground connections will vary.

Model:

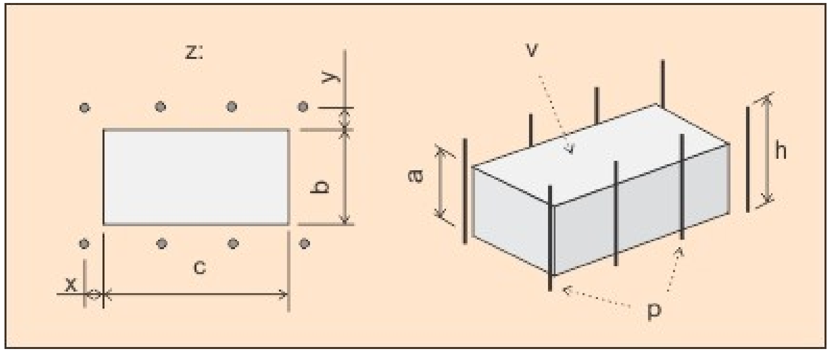


Data needed: heights of the base (h1), tank side (h2) and the roof (h3), and the diameter (d).

2.3.5. Isolated

Any (generally small) structure that needs protection by external posts without contact with the structure - that is, the lightning current doesn’t flow inside the protection volume; useful for a sculpture, a gas tank, explosives deposit and others.

Model:



Data needed: height of plane (a), width (b), leght (c), position of first post (x, y) and posts height (h).

3. Verifications

Atmos Verifications will check if some structure or people are protected by a higher structure nearby. The Safety Distances apply several methods to check if some metallic structure or equipment is sufficiently spaced from a down conductor, be it an external cable, a concrete rebar or some metallic column or post.

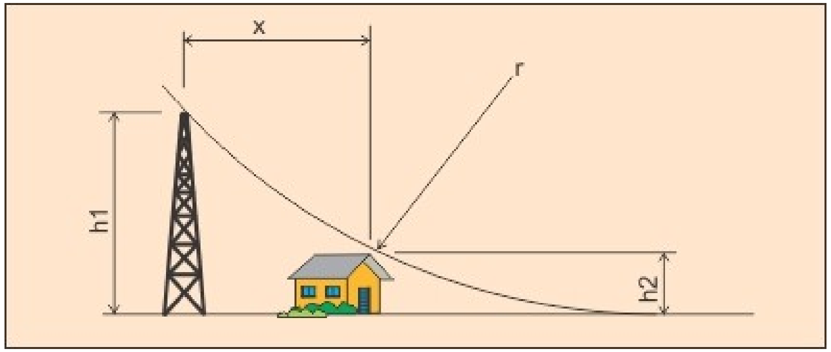
3.1. Protection Verifications

Atmos has, currently three Verifications of protection - we're considering add some others, so we're accepting suggestions (see Contacts at the end of this document). The reports generated comprises a scaled draft and a descriptive text.

3.1.1. Profile

It's the simple situation: we have a smaller structure besides a bigger one, metallic or with LPS installed, and we want to know if it's necessary to install a LPS also on the smaller structure or if it's already protected by the higher one - that is, it's inside the protection volume.

Model:



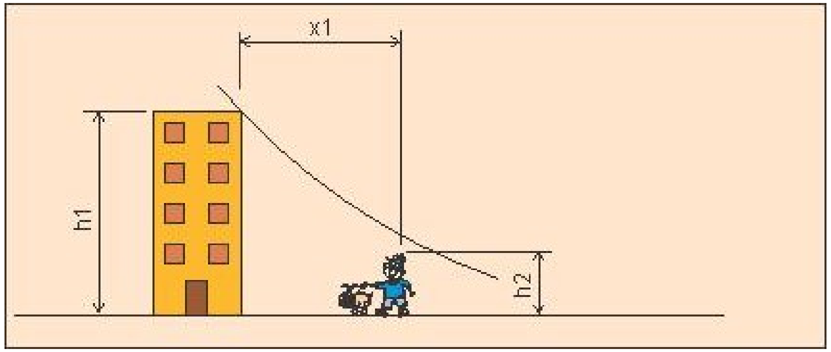
Data needed: heights h1 and h2, spacing (x).

3.1.2. Sidewalk

This Verification is somewhat the inverse of the Profile: here we set an imaginary plane (see definition on item 2.2 above) besides a structure protected by a LPS, then we check the maximum distance that is protected at the plane height.

The typical case is the sidewalk besides a building, but can also be applied to a backyard, frontal area or, in an industry, some area with equipments installed outside (but near) the building.

Model:

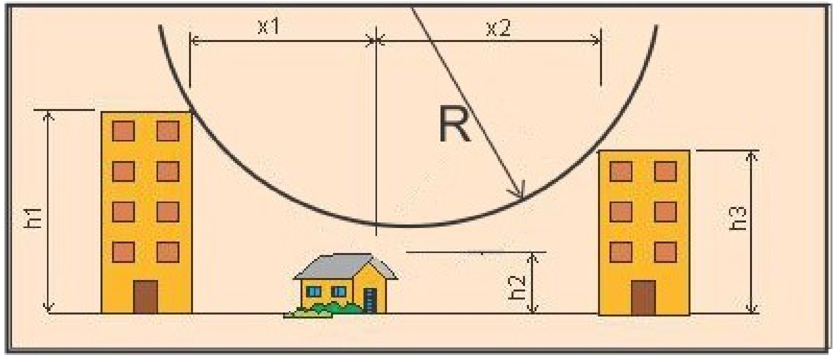


Data needed: heights h1 and h2 and the spacing x1.

3.1.3. Sandwich

Is the most complex Verification Model: we have a small structure (or an open area with equipments, etc) between two others; note that, depending on the heights and spacings, the central structure can be protected even if one of the others are of the same or even smaller height.

Model:



Data needed: heights h1, h2 and h3, and spacings x1 and x2.

3.2. Safety distances

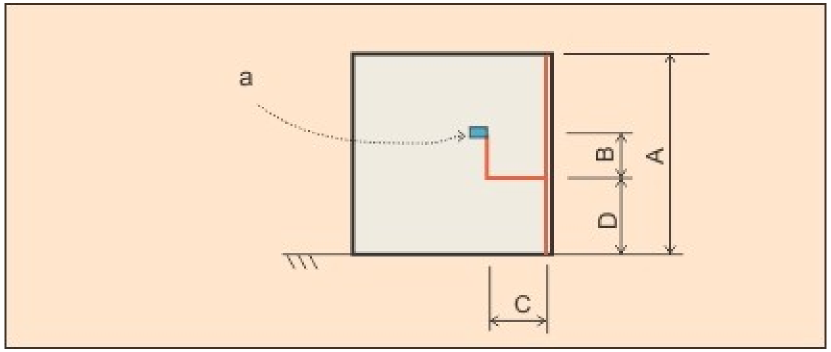
Find the minimum distance that a grounded metallic equipment or mass should keep from the nearest down conductor - or, looking from the other side, verifies if the equipment located at a given distance is in danger of receive a side flash.

The international standards present variations on the formulas, both in precision - “basic” x “detailed” - and significant differences between standards; Atmos, on the current version, has available both the basic calculations from the standards and a general case, calculated with a given flash current and the conductor inductance.

We are developing, for the next Atmos version, the calculation according to the detailed (or complete) method from IEC 62305-3 with some bonuses, like locating the nearest down conductor and allowing to several verifications on the same Location (building).

3.2.1. Basic

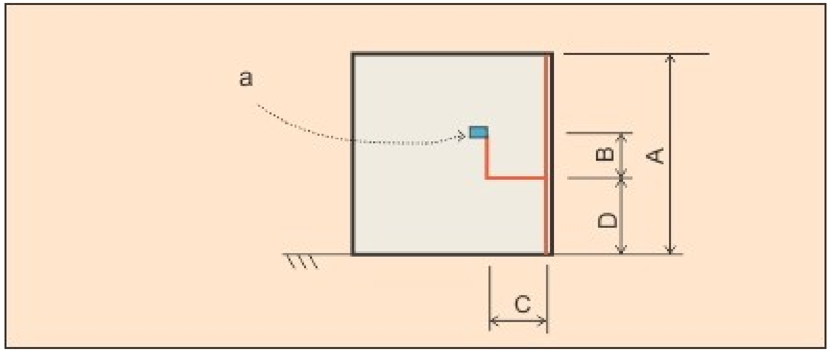
Model:



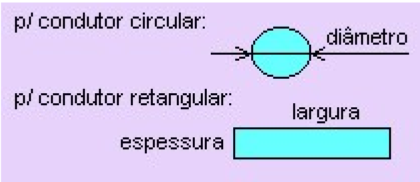
Data needed: height of the building (a), heights of the connection (d) and the metallic mass relative to the connection (b) and the spacing (c).

3.2.2. Inductance

Model:



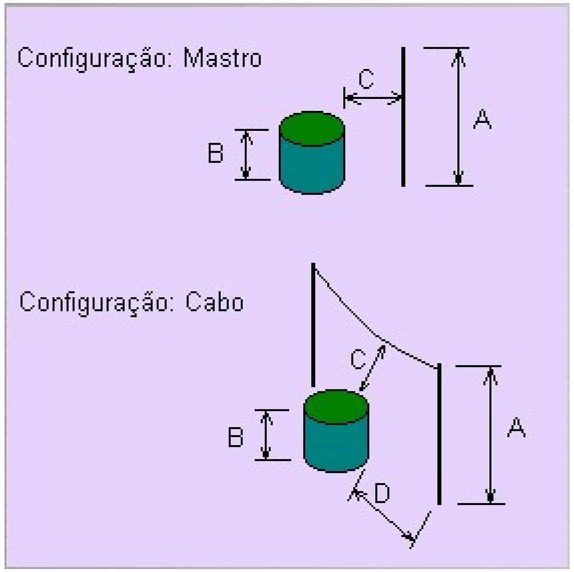
Data needed: same as in the Basic arrangement, plus the diameter (or width and thickness) of the conductor and the percentage of the flash current:



3.2.3. Dangerous area

Particular case where the metallic equipments or small tanks are already at the soil surface, probably grounded, but located near a metallic post or down conductor - depending on the dimensions and spacings, a side flash can occur.

Model:

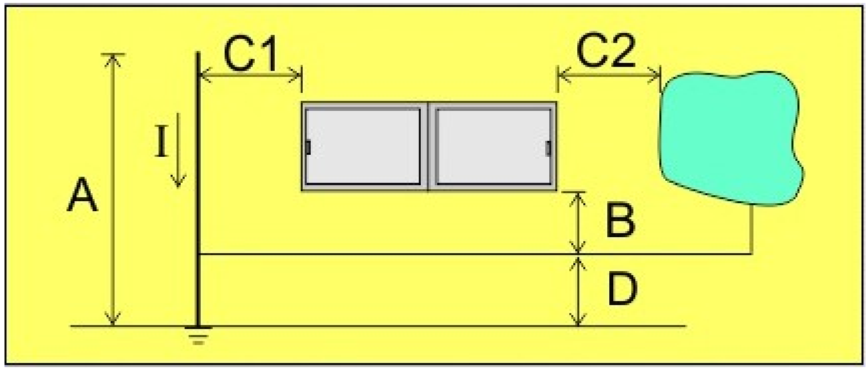


Data needed: post height (a), equipment or tank height (b) and spacings (c) and (d).

3.2.4. Window

It's a particular case, where we have a metallic structure - typically, but not necessarily, a windows with metallic frame - between the down conductor and the equipment or a metallic structure; in Atmos, you can set two gaps - C1 e C2 - that can be either air or brick.

Model:



Data needed: besides the data from the Basic arrangement (a), (b) and (d), you need the dimensions C1 and C2 and the gaps medium (air or bricks).

4. Contact

For purchasing user licenses or consult any doubt about Atmos or our other software, please contact us through the following channels:

4.1. International

Volts and Bolts OÜ:

Internet: www.voltsandbolts.com

Facebook: www.facebook.com/voltsbolts

E-mails: sales@voltsandbolts.com and support@voltsandbolts.com

4.2. Brazil

Officina de Mydia:

Internet: www.mydia.com

E-mails: vendas@mydia.com and suporte@mydia.com

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