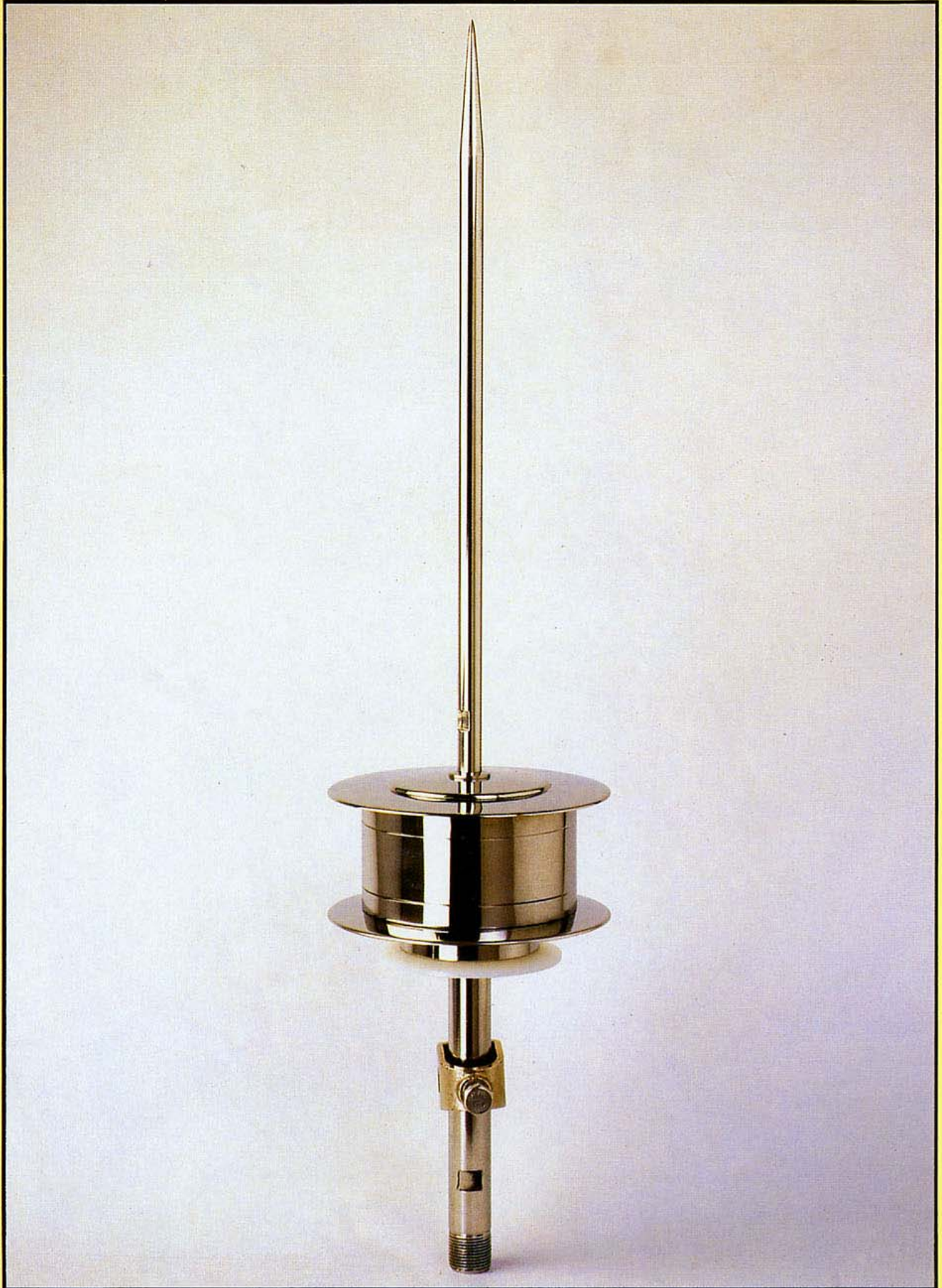


⚡ APOLLO ⚡

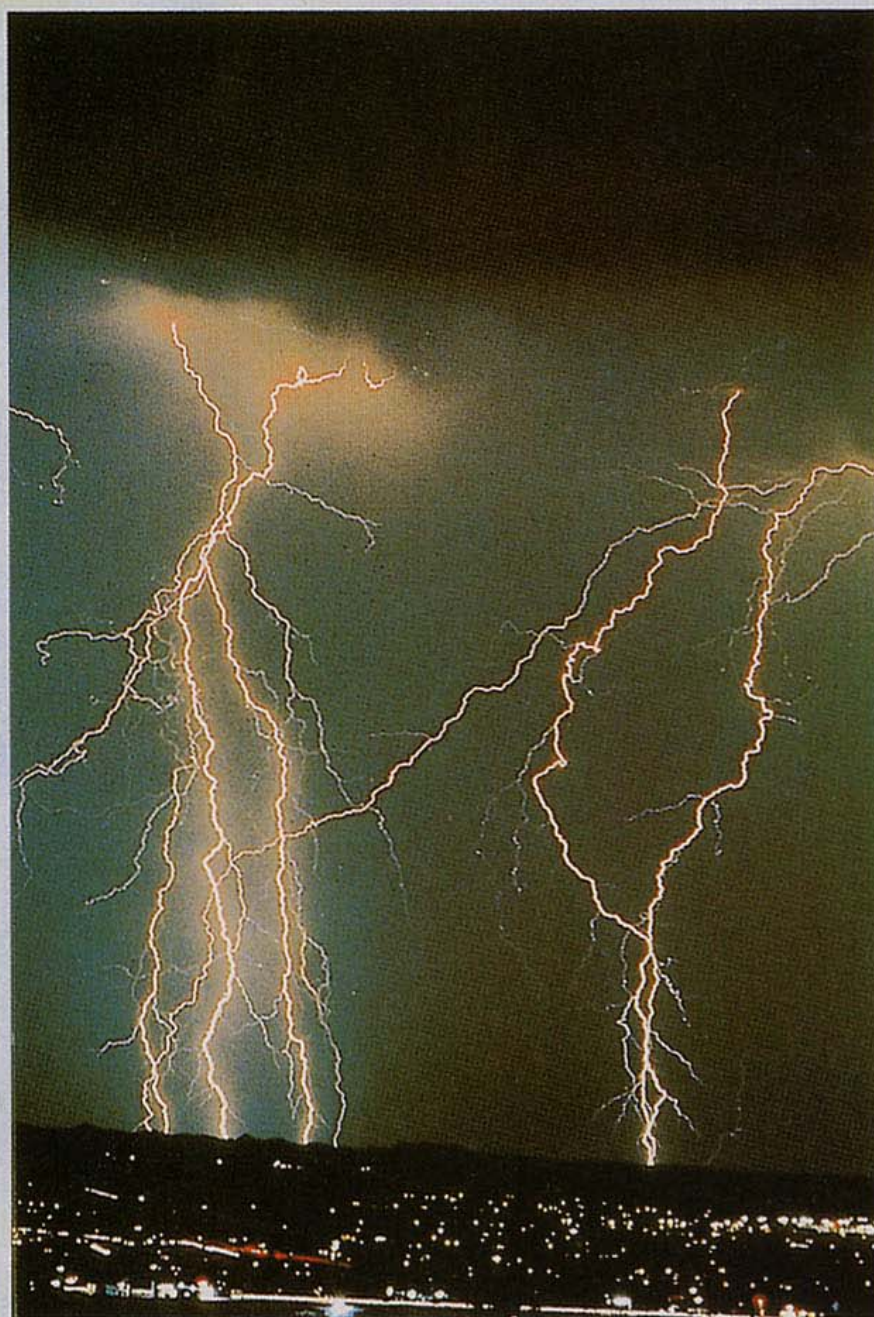
LIGHTNING CONDUCTOR SERIES



APOLLO

LIGHTNING CONDUCTOR SERIES

ACCORDING TO FRENCH STANDARD NFC 17-102



- ✘ "Apollo" Generator is placed inside a double waterproof insulation box to protect the system against the worst atmospheric and climatic conditions.
- ✘ A discontinuous synchronous emission is created by "Apollo" generator in the same time as leader steps.
- ✘ "Apollo" is a non-radioactive lightning conductor.
- ✘ This lightning conductor is self-powered and doesn't need any maintenance.

APOLLO

LIGHTNING CONDUCTOR SERIES

APOLLO ACTIVE SYSTEM WITH STARTING DEVICE

COLLECTOR: It is formed by triple protective system (electro-atmospheric condensator, starting device and earth leakage current), with double insulation appliance and spark way.

ELECTROATMOSPHERIC CONDENSATOR: The APOLLO is provided with an isolated external armature, at floating potential with regard to its earth-connected central axle, forming a natural condensator in terms of its surrounding electric field with two spark channels, one in controlled atmosphere and the other in ambient atmosphere.

STARTING SYSTEM: the APOLLO is equipped with a high-voltage electrical pulses transformer-generator with alternating operation, depending on the surrounding electric field.

When the electric fields are very high (over 50 Kv/m), the APOLLO external armature at floating potential receives and accumulates this energy and by certain process, its transformer-generator releases high-voltage pulses which are scattered at short intervals into the atmosphere in leader or tracer form. These impulses created by the ascending leader or tracer are conveyed to the atmosphere taking the form of intermittent discharges, reaching an average speed of 1 m/microsec. This process is called advance time.

In order to be better understood the previous terms are further explained:
BEGGINING POINT: It is the place where meet the descending tensions from the thunderclouds and the tensions produced from the earth due to the difference of potential.

ASCENDING TRACER: They are the electrical effluvia emitted by propitious spots from earth to the stormy clouds.

DESCENDIG TRACER: In the same way, they are the electrical effluvia heading to earth from the thunderclouds.

ATMOSPHERIC GRADIENT: It is the generating tension in the discriminative space.

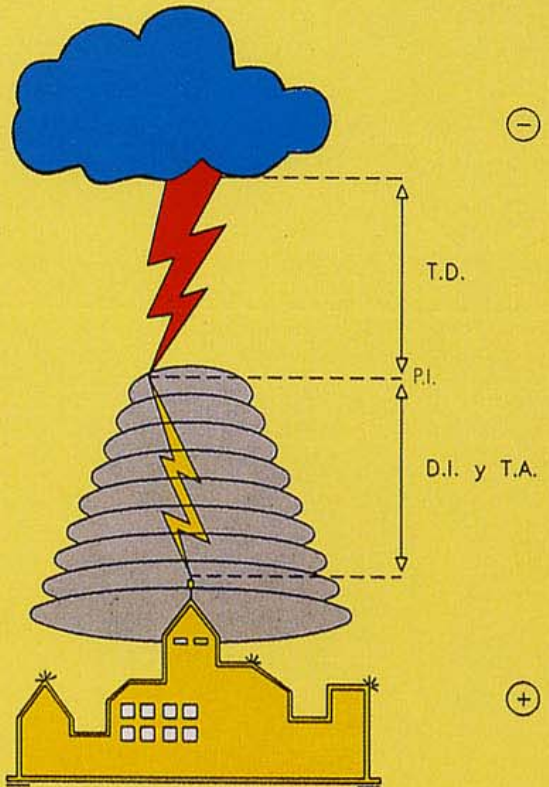
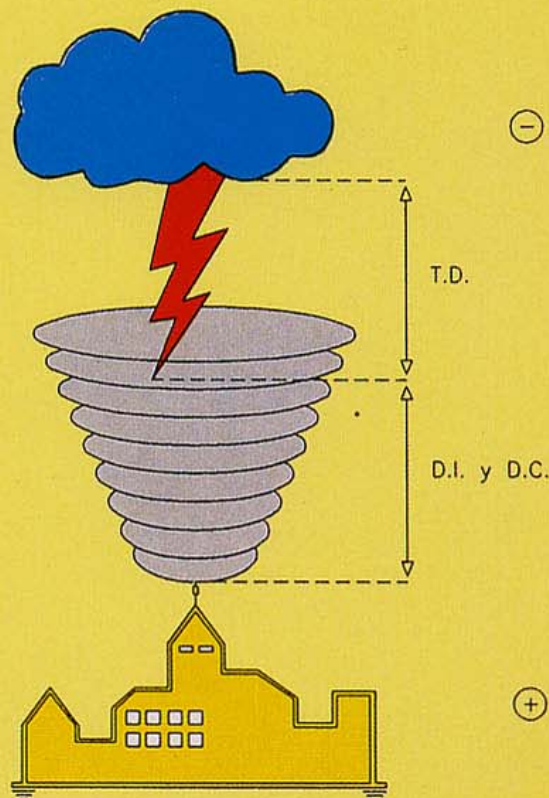
POINT OF IMPACT: It is the one produced on the ground by a lightning or spark falling (strength).

ADVANCE TIME: It is the anticipation of electrical effluvia forming an ascending leader or tracer in relation to the surrounding critical points.

DISCRIMINATIVE SPACE: It is the area between the thunderclouds and the earth.

PROPIOUS POINTS: They are those otstanding spots on earth, the highest and usually sharp-shaped ones, which are more likely to collect electrical effluvia and lightning falling due to their features.

SPACE TO PROTECT: It is the volume requiring a protection against lightning effects because of its high occupational density and the importance of its



APOLLO

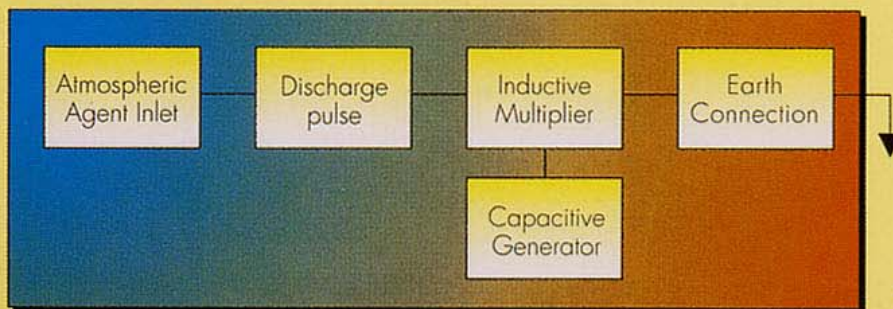
LIGHTNING CONDUCTOR SERIES

ENERGY BLOCK AND OPERATION PRINCIPLES

DISCHARGE PULSE: It is which the lightning tracing and collecting pulse is created with, using the electrical gradient existing between cloud and earth; through the inductive multiplier and using a buffer in controlled atmosphere, a high-speed of breakdown pulse is created and therefore the lightning disruption point is displaced to a great height, which will be greater the more electric field exists.

CAPACITIVE GENERATOR: It is in charge of the direct earth-cloud joining when the tracer has been sent. In order to get the direct joining, after the condensator has been charged, the dielectric is opened by joining the lightning conductor frame (which have the same voltage as the atmosphere at this moment) to the earth so that it is obtained a total discharge of the lightning stroke whith no need for this same lightning stroke to pass through the energy block. In other words, the energy block remains undamaged with regards to a possible breakdown, during the discharge. Once this operation is finished, the dielectric comes back to its former position (closed) and therefore the lightning is ready again to start a new cycle.

DIAGRAM OF THE ENERGY BLOCK



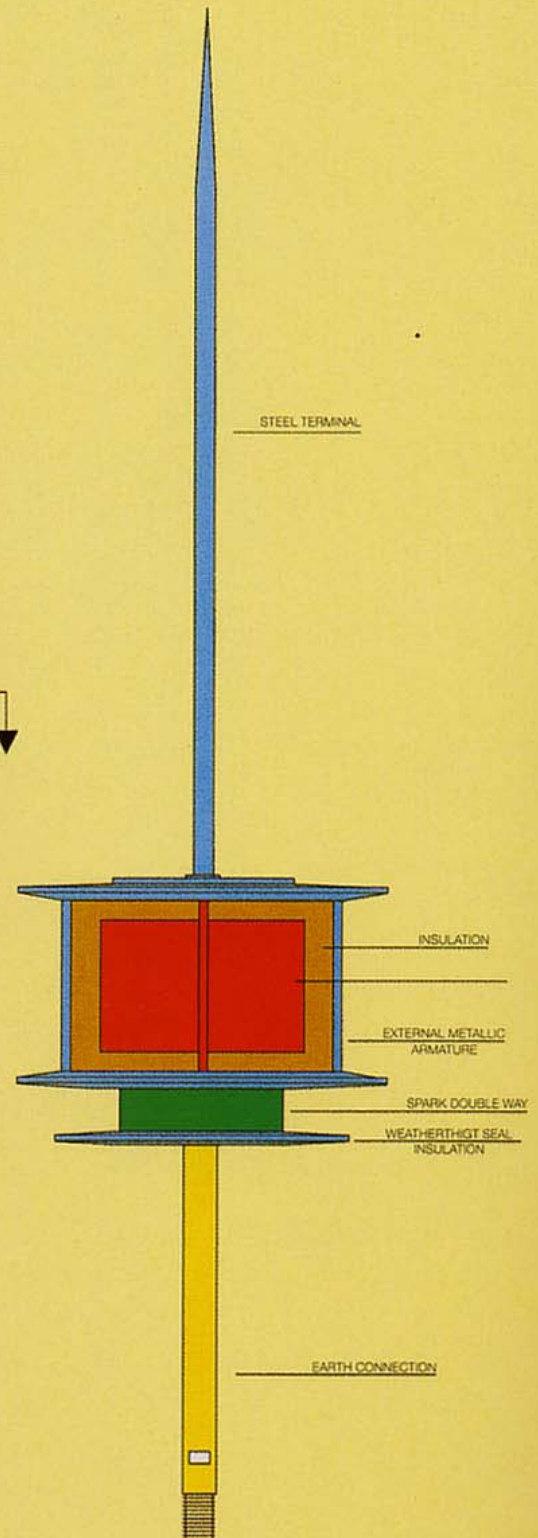
SYSTEM INSULATION

The insulation and the weathertightness of the different parts of the APOLLO system are very important. The set is provided with an insulation when suffering the atmospheric incidences such as rain, ice, snow winds, etc. and it is also free from possible alterations of the received electrical discharges.

There is a second insulation preventing even possible pollution that might affect the system.

SPARK DOUBLE WAY BY VERTICAL SLIDING

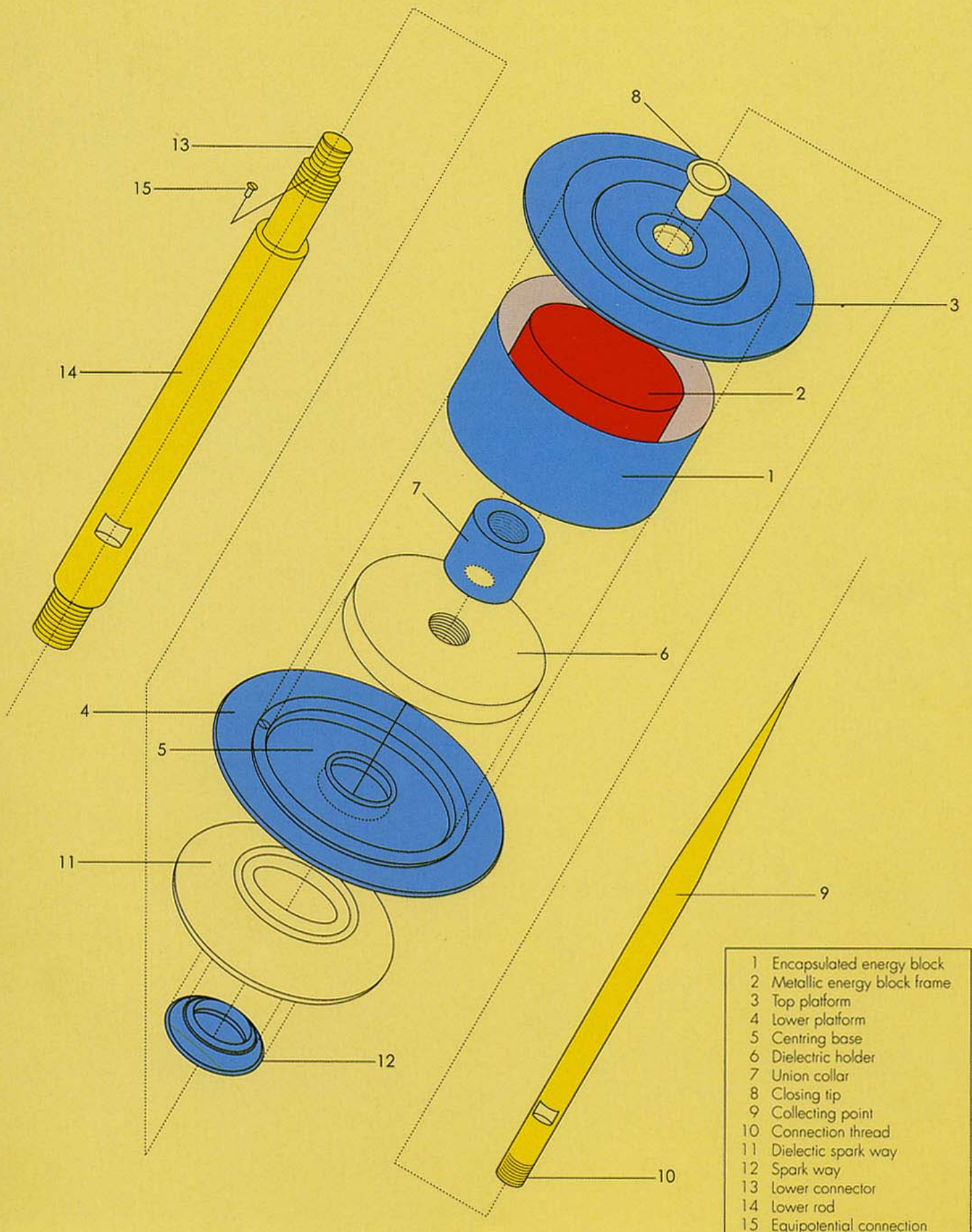
The APOLLO is provided with a set of spark double way with different performance, being the principal one the vertical-sliding spark way. It is formed by very thin circular curbs, which get their maximum performance speed at the moment of starting between the insulated part of the system and the one at earth voltage. Likewise, this vertical way position avoids the possibility of altering the field by directional changes that may affect the system speed and effectiveness.



⚡ APOLLO ⚡

LIGHTNING CONDUCTOR SERIES

EXPLODED VIEW OF THE APOLLO DEVICE



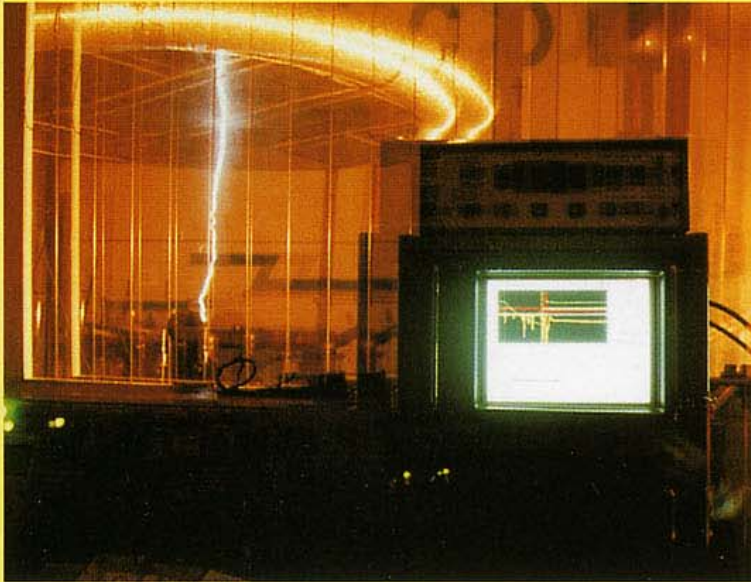
- 1 Encapsulated energy block
- 2 Metallic energy block frame
- 3 Top platform
- 4 Lower platform
- 5 Centring base
- 6 Dielectric holder
- 7 Union collar
- 8 Closing tip
- 9 Collecting point
- 10 Connection thread
- 11 Dielectric spark way
- 12 Spark way
- 13 Lower connector
- 14 Lower rod
- 15 Equipotential connection

⚡ APOLLO ⚡

LIGHTNING CONDUCTOR SERIES

ACTIVE SYSTEM WITH TRIGGERING DEVICE

SENSOR: Formed by triple protection system. With double triggering device of environmental watertight insulation.



ELECTROATMOSPHERIC CONDENSER: The Apollo has an external housing isolated with regard to its central shaft connected to the earth. Forming a natural condenser in function of the surrounding electric field, with two spark gap, one in controlled atmosphere and another in environmental atmosphere.

SYSTEM OF HAVING FEB: The Apollo has a generating transformer of electric impulses of high tension, with alternating operation,

depending on the surrounding electric field.

For a bigger understanding we will explain the exposed points previously.

INITIATION POINT: It is where the descending tensions meet with the clouds and the tensions taken place from the earth by difference of electric potential.

UPWARD TRACER: They are the electric effluvium emitted by favourable points from earth toward the stormy clouds.

DESCENDING TRACER: They are equally the electric effluvium that go toward the earth from the stormy clouds.

ATMOSPHERIC GRADIENT: It is the generating tension in the discriminatory space.

IMPACT POINT: Taken place in earth by the fall of a lightning or spark gap.

TIME OF ADVANCE: It is the anticipation of electric effluvium forming a tracer or upward leader with regard to the other surrounding critical points.

DISCRIMINATORY SPACE: It is the area understood between the stormy clouds and the earth.

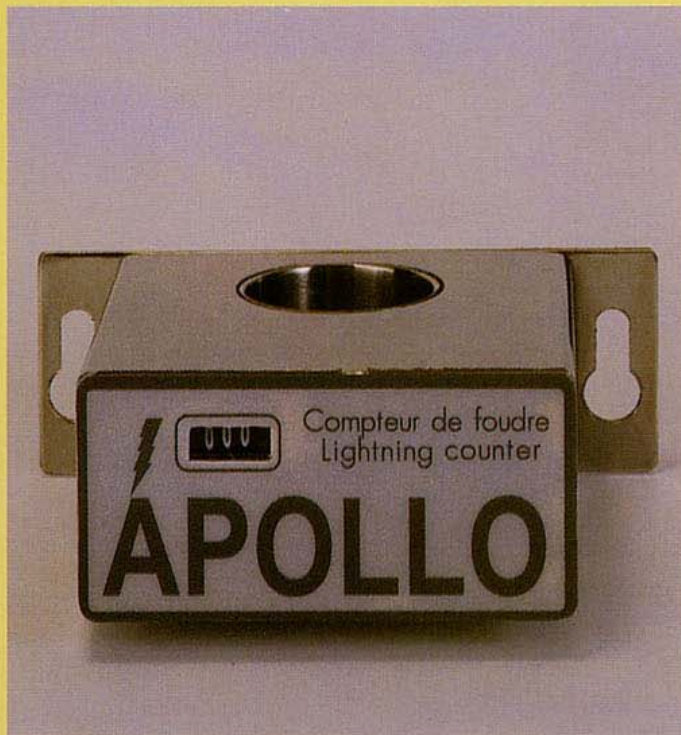
FAVOURABLE POINTS: They are those dominant points in earth but high and generally sharp that have a bigger probability of emissions of electric effluvium and lightning fall for their characteristics.

SPACE TO PROTECT: It is the volume that demands a protection against the effects of the lightning, for their high occupational density and importance of their content.

⚡ APOLLO ⚡

LIGHTNING CONDUCTOR SERIES

LIGHTNING COUNTER:



DESCRIPTION

- Capable of detecting and registering discharges between 1'5 and 100 kA.
- Increase automatically the register of the counting when the lightningrod captures and derives to protection earth any discharge, obtaining thus a very long life.
- The frontal has a window in the one which is visualized the registered current value.
- Possibility of reset (set to zero) through accessory equipment 21012-PC, destined control of yield of your installation.
- Quick and easy installation, serially to protection earth conductor of the lightningrod.
- Presented in stainless steel box totally insulated for its placement to the outdoors in all ambient type.
- Permit entry of cable section of to 30mm of diameter

SPECIFICATION

MINIMUM REGISTER CURRENT	1'5 kA
MAXIMUM REGISTER CURRENT	100kA
MAXIMUM CONDUCTOR DIAMETER	30mm
MAXIMUM CONDUCTOR SECTION	500mm ²
DISPLAY RANGE COUNTING	0-999
INSULATIONS	IP-65
NOMINAL TEMPERATURE	-20°C/85°C
BOX DIMENSIONS (h x w x l in mm)	80 x 40 x 80
MANUFACTURING RAW MATERIAL (Inter. norm)	AISI-316
WHEIGHT (Kg)	400 gr.
PROCEDURES AND CERTIFICATIONS	UNE-21.186 NF-C 17.102

PROTECTION PERFORMANCE

Protection radius (m)							
TYPES OF APOLLO	h=height of conductor (m)						ΔL
	2	4	5	7	10	15	

LEVEL 1 *

TA 1	17	34	42	43	44	45	25
TA 2	24	46	58	59	59	60	40
TA 3	32	64	79	79	79	80	60
TA 5	38	70	85	85	85	86	66

LEVEL 2 *

TA 1	23	45	57	59	61	63	25
TA 2	30	60	75	76	77	80	40
TA 3	40	78	97	98	99	101	60
TA 5	46	84	103	104	105	107	66

LEVEL 3 *

TA 1	26	52	65	66	69	72	25
TA 2	33	66	84	85	87	89	40
TA 3	44	87	107	108	109	111	60
TA 5	50	93	113	114	116	118	66

* The advantage of installation height is 5meter.

Protection radius are calculated according to the following formula NFC 17-102.

$$R_p = \sqrt{h(2D-h) + \Delta L(2D+\Delta L)} \text{ for } h \geq 5m$$

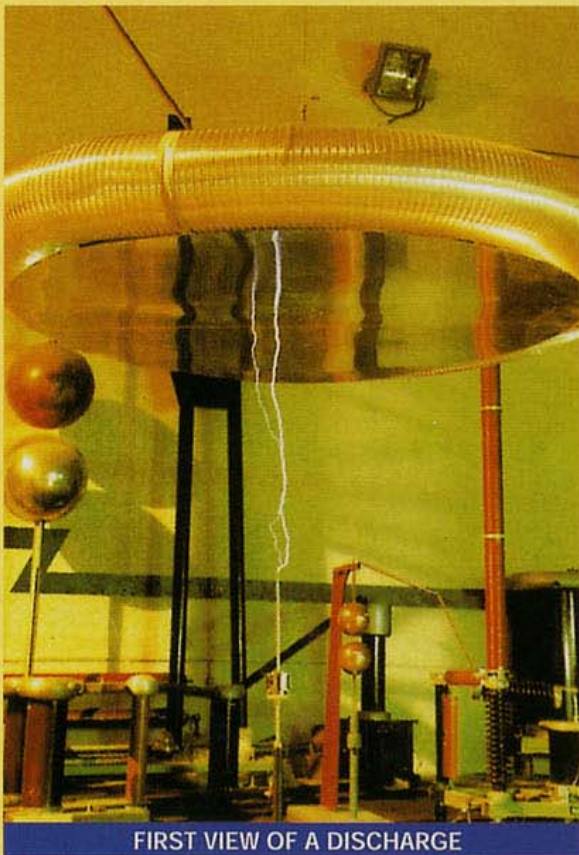
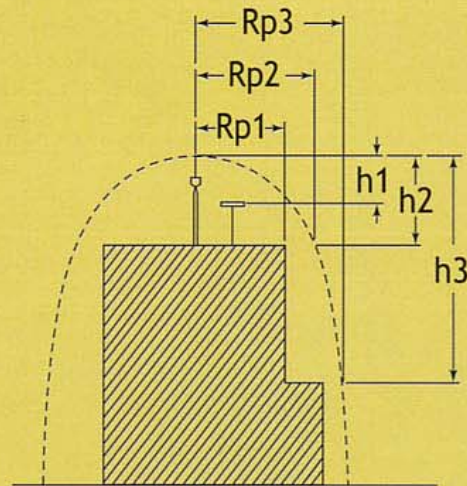
h=height of Apollo tip above the area to be protected.

D=20m for protection level I, ($0.95 \leq E \leq 0.98$)

D=45m for protection level II, ($0.80 \leq E \leq 0.95$)

D=60m for protection level III, ($E \leq 0.80$)

ΔT =triggering advance time



FIRST VIEW OF A DISCHARGE



GENERATOR OF CONTINUOUS CURRENT

阿波羅避雷產品系列

阿波羅避雷針具有主動起動及放送高壓脈衝的裝置

集結能源器及高壓脈衝放送器：該集結能源器及放送高壓脈衝器由三種系統組成（大氣電力電容器，啟動系統，及洩放雷流到大地系統）其所有的電子另件被兩種瞬間放電裝置及絕緣材料所保護。

大氣電力電容器：阿波羅放電式避雷針其外殼與接地中心軸之間以絕緣材料及兩組瞬間放電裝置隔離（一組由大氣電位所控制，另一組由避雷針四周的環繞電位所控制）其自然型成一個電容器。在大氣電位與環繞電位之間的浮動電位差就像外部的電樞一樣供應能源。

啟動系統：阿波羅放電避雷針被裝置著一組依靠環繞電場變化的能量而產生高壓脈衝的變壓器式發送器。

當環繞電場非常高時（高於 50kv/m ），阿波羅放電式避雷針的能量集結器會吸收累積由浮動電位差經由外在電柵轉換而形成的能量。然後變壓器式的高壓發送器會在瞬間放射高壓脈衝在大氣層中，增強及放大避雷針四周的電場強度，將雷的放電電位向上提高。該高壓脈衝發射的時間必需在雷前導（TRACER）到達地面上放電的時間以前，發射其雷前導的平均速度是 1米/微秒 ，該整個作業程序的提前時間差稱為提前引發時間。

為了對以上的說明做更清楚的瞭解，我們更進一步的解釋：

接觸點：雷前導的高壓與地面因電暈作用，而產生的向上前導的接觸點。

向上前導：在地面上因雷前導高壓電暈作用，而產生的地面向上的前導。

向下前導：如上述由雷雲產生高壓向下放電的前導。

大氣電位梯度：在雷雲與地面區間所產生的每一米高壓電位不同。

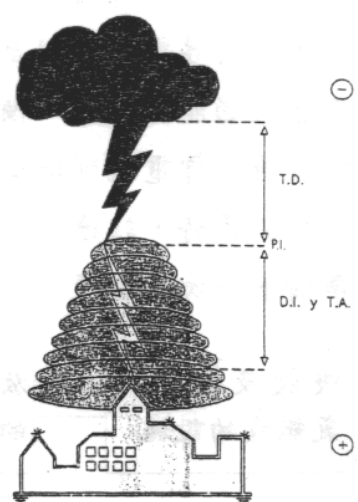
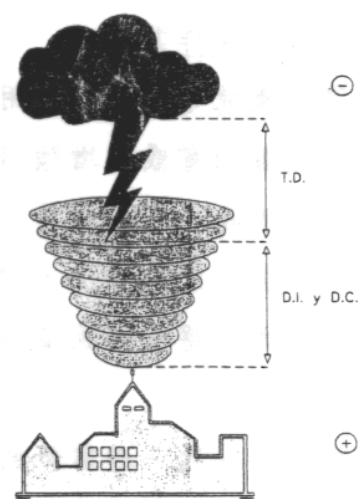
雷擊點：在地面上被雷前導放電點。

提前放電時間：放電式避雷針能夠吸收雷前導所造成地面上環繞電場變化，轉換成高壓脈衝。該高壓脈衝產生時間與雷前導到地面上放電（或傳統避雷端子）的提前時間差。

識別區間：在雷雲與地面之間的空間區域。

易被雷擊點：在地面上的最高點，突出點或尖端，一般這些點會被雷前導感應而產生電暈放電的現象，因此容易被雷擊。

保護區域：在避雷端子所涵蓋的有效保護區域。

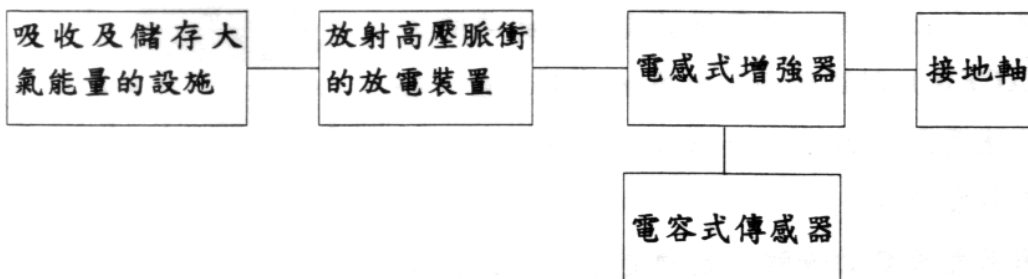
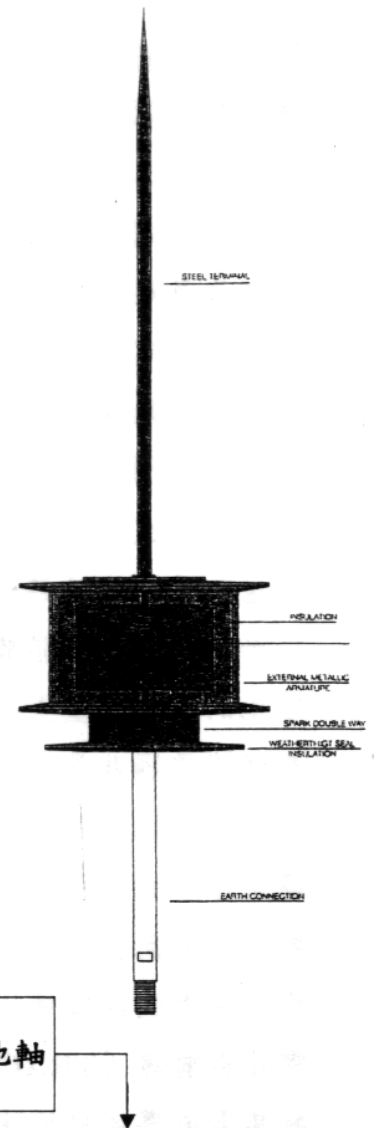


阿波羅避雷產品系列

能源模組及作業原理

高壓脈衝放電裝置：利用雷雲與地面之間所存在的電位梯度能量，經過電感式增強器以及被大氣電位所控制的緩衝器寄存器，吸收及累積能量，在瞬間產生高速可擊穿空氣的高壓脈衝，將空氣離子化，它可以放大及加強避雷針四周圍的電場強度因而將雷的放電位置提高，就好像將傳統避雷針架高一樣。

電容式傳感器：避雷針的外殼與接地中心軸隔離因此形成一個自然的電容器，當雷前導產生時該電容器自然會被充滿電而形成避雷針外殼與接地軸之間的連通介質（由於接地軸與外殼之間同等電壓）以至於電流可經該通路獲得充分的放電而不會流過能源模組。換言之，能源模組在雷電流經過放電避雷針洩放雷電流到地面時不會被其雷電流所損壞，當雷電流洩放完畢時，該連通介質又回覆到正常狀況，該避雷設備又準備下一次的循環。



絕緣系統

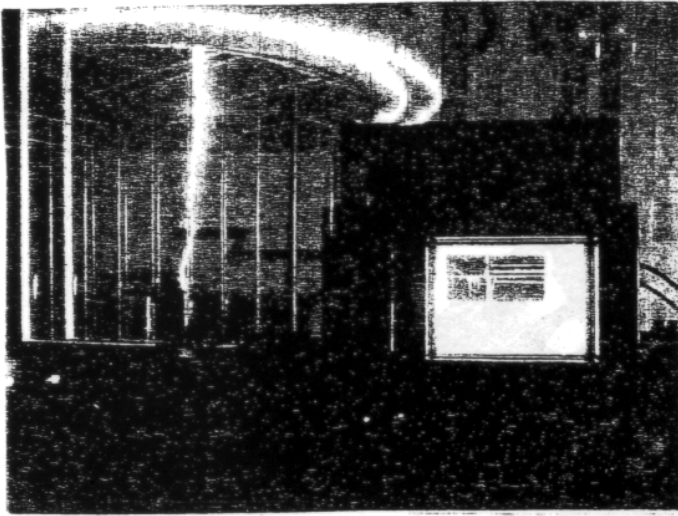
阿波羅避雷針的絕緣保護層可耐惡劣氣候，如下雨、下雪、大風、等破壞、以及雷電流放電時所造成的影響。

其第二層絕緣可預防空氣污染的酸、鹼物質的破壞。

垂直下滑的雙重瞬間放電裝置

阿波羅被裝置著一套具備不同性能的雙重瞬間放電裝置，其主要的一組是由很薄的抑制電流環所組成的垂直下滑瞬間放電裝置。該瞬間放電裝置具有讓該系統與地電壓隔離的部分在起始動作的瞬間可獲得及快速動作的性能（極短時間放電）。同樣的，該垂直放電裝置的位置，非常重要可避免電場變化而干擾該系統的動作速度與效果。

阿波羅放電式避雷針



具有連鎖反應裝置的主動避雷系統
主要原件：由三種系統(大氣電力電容器，高壓脈衝發送系統，洩放電流致大地系統)所形成，並具有雙重瞬間放電裝置被多層的具有隔絕惡劣環境及水密性的材料保護者。

大氣電力電容器：阿波羅避雷針的外殼

與避雷針中心的接地軸是隔離的，形成一個可由避雷針四週外圍環繞電場的變化而感應的自然電容器，並具有兩組瞬間放電的裝置，一個是被大氣壓電場所控制，另一個則是被避雷針四周環繞壓電場所控制。

轉換系統：阿波羅有一個可依靠避雷針四周環繞電場變化而產生高壓脈衝的變壓器型發送器。

接觸點：雷前導的高壓與地面因電暈作用，而產生的向上前導的接觸點。

向上前導：在地面上因雷前導高壓電暈作用，而產生的地面向上得前導。

向下前導：如上述由雷雲產生高壓向下放電的前導。

大氣電位梯度：在雷雲與地面間區間所產生的高壓電位差。

雷擊點：在地面上被雷前導放電的點。

提前放電時間：放電式避雷針能夠吸收雷前導所造成地面環繞電場變化，轉換成高壓脈衝。該高壓脈衝產生時間與雷前導到地面上放電（或傳統避雷端子）

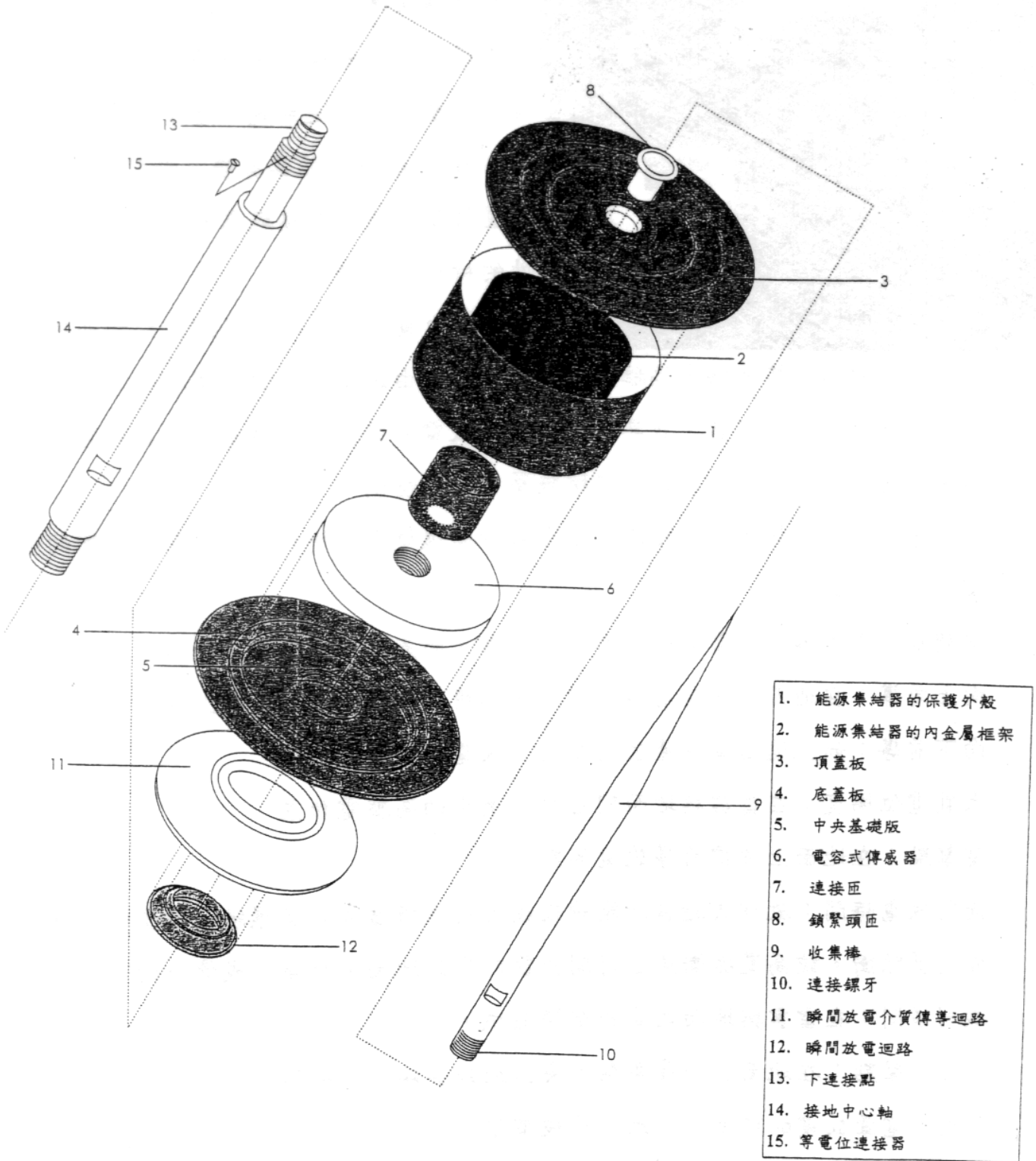
識別區間：在雷雲與地面之間的空間區域。

易被雷擊點：在地面上的最高點，突出點或尖端，一航這些點會被雷前導感應而產生電暈放電的現象，因此容易被雷擊。

保護區域：在避雷端子所涵蓋的有效保護區域。

APOLLO 放電式避雷針其構成元件如下：

EXPLODED VIEW OF THE APOLLO DEVICE



1. 能源集結器的保護外殼
2. 能源集結器的內金屬框架
3. 頂蓋板
4. 底蓋板
5. 中央基礎版
6. 電容式傳感器
7. 連接匝
8. 鎖緊頭匝
9. 收集棒
10. 連接螺牙
11. 瞬間放電介質傳導迴路
12. 瞬間放電迴路
13. 下連接點
14. 接地中心軸
15. 等電位連接器

保護範圍表及計算方式

保護半徑 (米)							
型號	按裝高度 (米)						ΔL
	2	4	5	7	10	15	
第一層級 *							
TA 1	17	34	42	43	44	45	25
TA 2	24	46	58	59	59	60	40
TA 3	32	64	79	79	79	80	60
TA 5	38	70	85	85	85	86	66
第二層級 *							
TA 1	23	45	57	59	61	63	25
TA 2	30	60	75	76	77	80	40
TA 3	40	78	97	98	99	101	60
TA 5	46	84	103	104	105	107	66
第三層級 *							
TA 1	26	52	65	66	69	72	25
TA 2	33	66	84	85	87	89	40
TA 3	44	87	107	108	109	111	60
TA 5	50	93	113	114	116	118	66

* 按裝高度以 5 米最有利。

依照下列 NFC 17-102 公式計算保護半徑。

$$R_p = \sqrt{h(2D - h) + \Delta L(2D + \Delta L)} \quad \text{for } h \geq 5m$$

$D = 20m$ 第一層及保護 ($0.95 \leq E \leq 0.98$)

$D = 45m$ 第二層及保護 ($0.80 \leq E \leq 0.95$)

$D = 60m$ 第三層及保護 ($E \leq 0.80$)

ΔT : 放電式避雷針提前放電時間

