
Assalamu'alaikum Wr. Wb.
PROTEKSI TEGANGAN LEBIH (*ARRESTER*)
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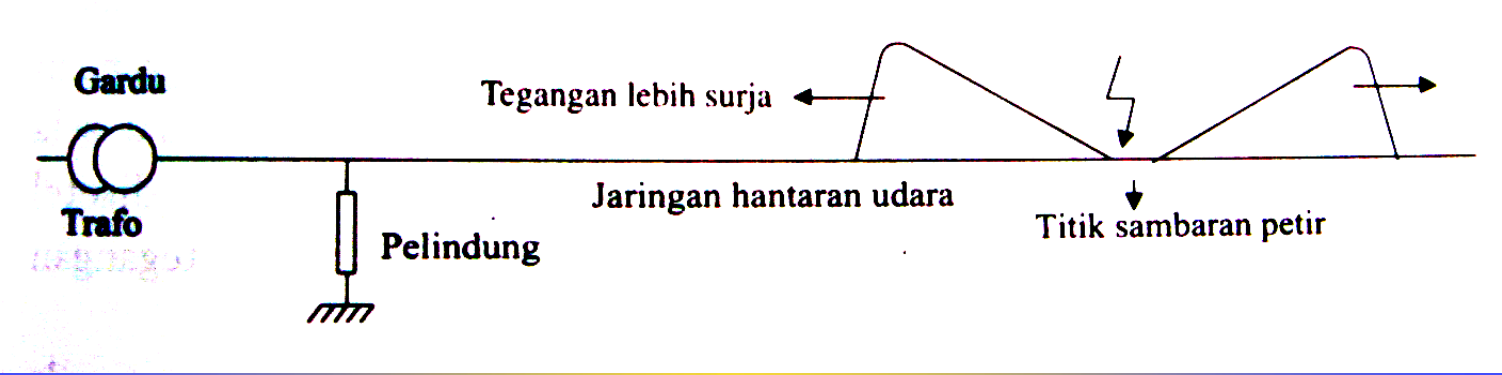
PENDAHULUAN



Sambaran petir merupakan suntikan muatan listrik yang mengakibatkan timbulnya kenaikan tegangan.

Oleh karena itu, perlu dibuat pelindung agar tegangan lebih tersebut tidak menimbulkan kerusakan pada peralatan maupun isolasi gardu.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Lightning Protection

Facts about Lightning

- A strike can average 100 million volts of electricity
- Current of up to 100,000 amperes
- Can generate 54,000 ^{o}F
- Lightning strikes somewhere on the Earth every second
- Kills 100 US residents per year

Lightning Doesn't Go Straight Down

What Does This Mean?

- Lightning can strike ground up to ten miles from a storm (Lightning out of the blue)
- There is an average of 2-3 miles between strikes

- So how can we tell how far away lightning has struck?

Use The Five Second Rule

- Light travels at about 186,291 ***miles***/second
- Sound travels at only 1,088 ***feet***/second

- You will see the flash of lightning almost immediately
  - 5280/1088= 4.9
- About 5 seconds for sound to travel 1 mile

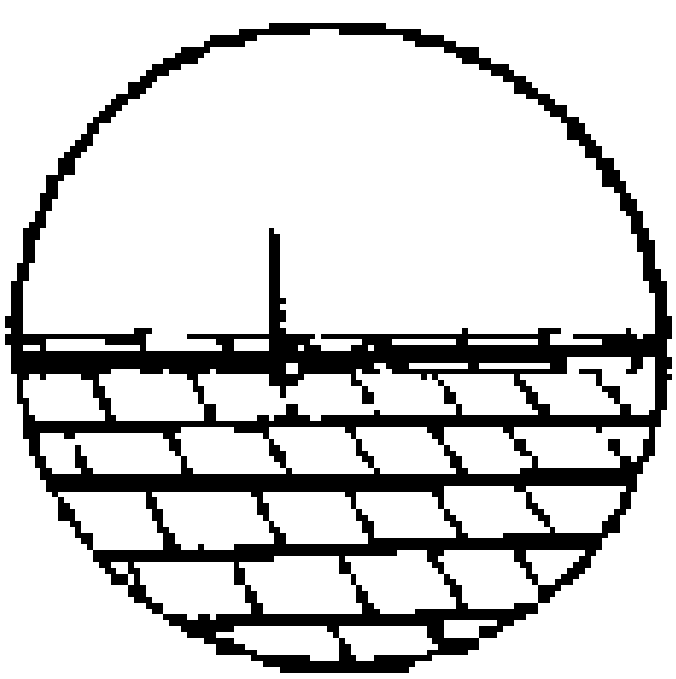
Stepped Leader

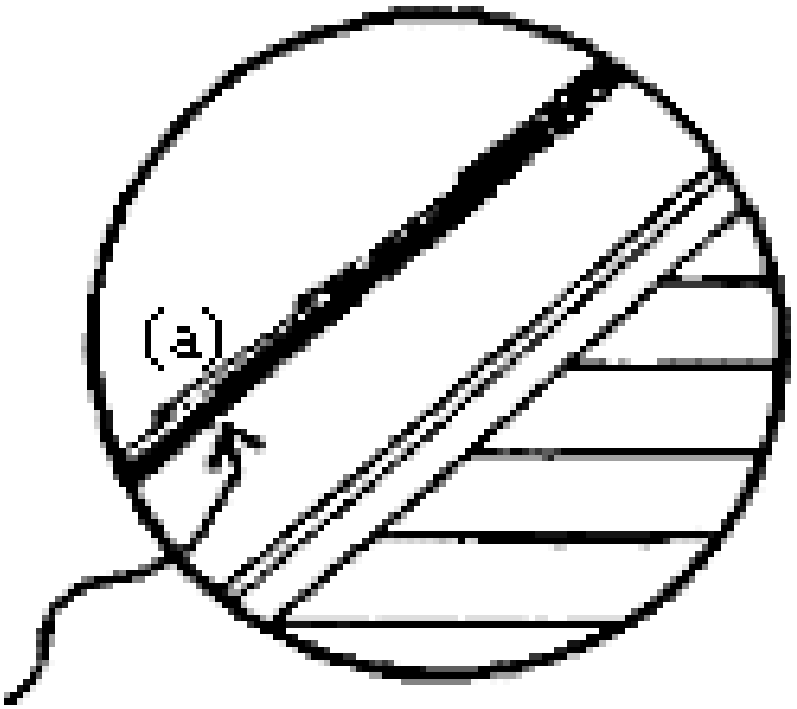
Streamers

Four Main Features of Lightning Protection

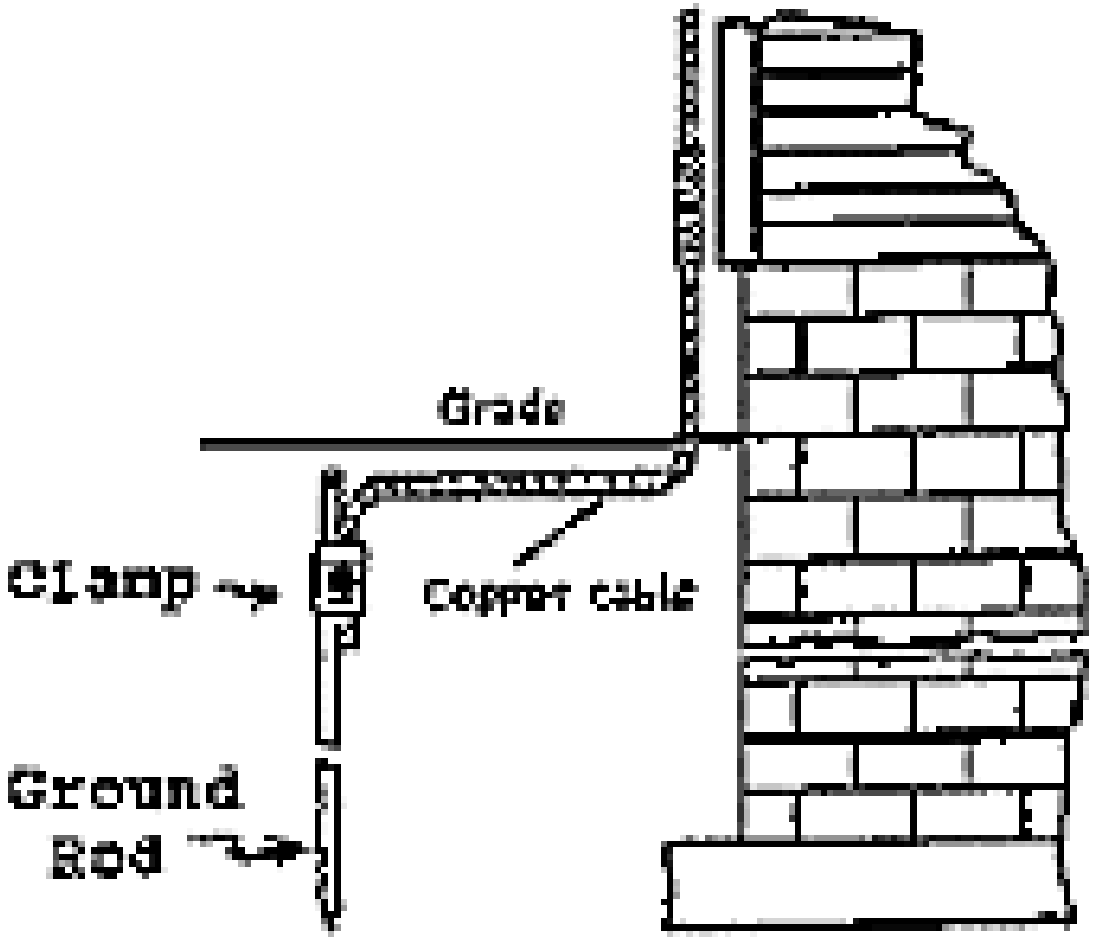
- 1) Air terminal
- 2) Conductors
- 3) Ground termination
- 4) Surge protection

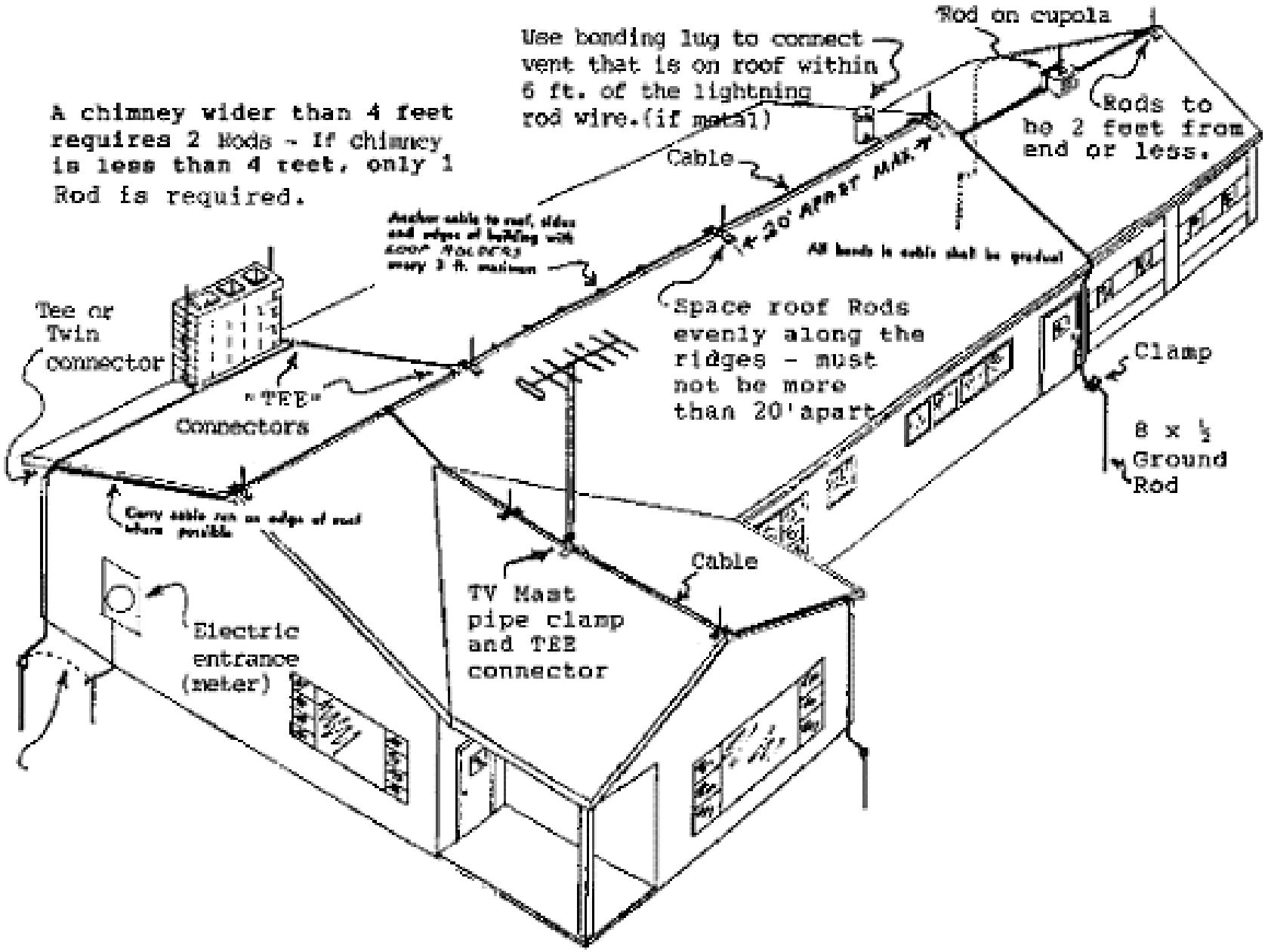
Air Terminal and Conductors



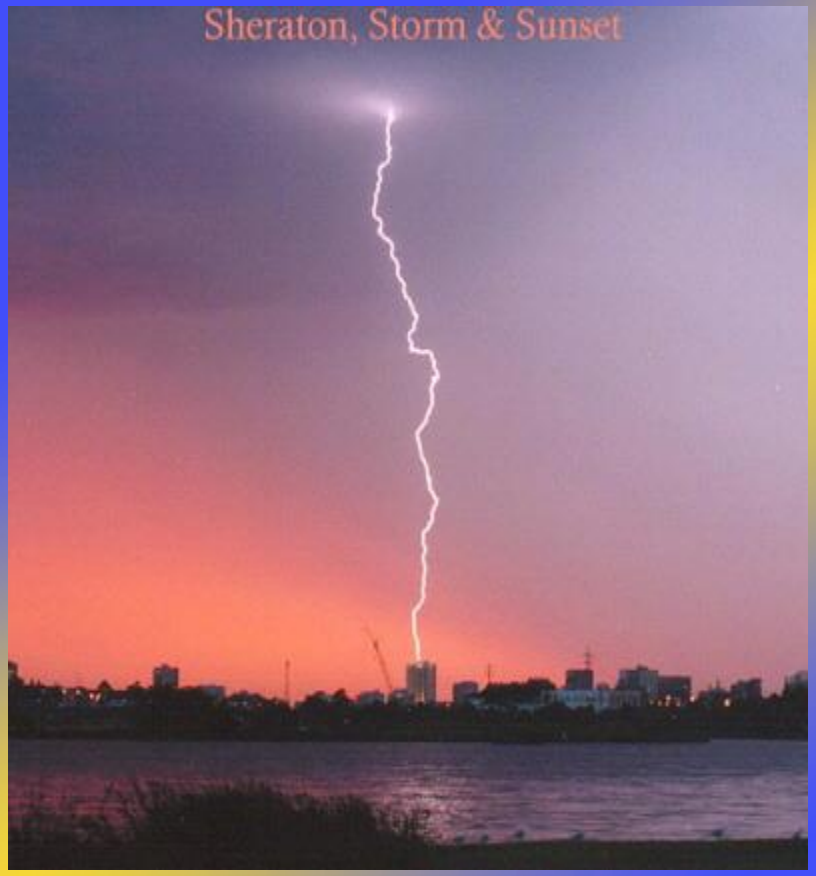


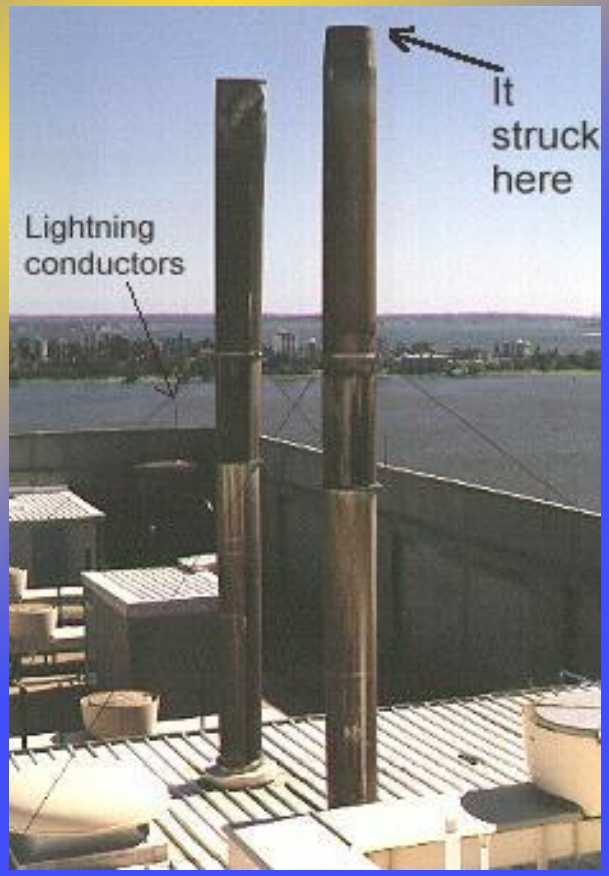
Grounding Rod




A chimney wider than 4 feet requires 2 Rods - If chimney is less than 4 feet, only 1 Rod is required.
Use bonding lug to connect vent that is on roof within 6 ft. of the lightning rod wire.(if metal)
Rod on cupola
Rods to be 2 feet from end or less.
Cable
Anchor cable to roof, ridge and edges at lighting with roof fasteners every 3 ft. maximum
20' APART MAX.
All bends in cable shall be gradual
Space roof Rods evenly along the ridges - must not be more than 20' apart
Tee or Twin connector
"TEE" Connectors
Carry cable run on edge of roof where possible
Clamp
8 x ½ Ground Rod
Cable
TV Mast pipe clamp and TEE connector
Electric entrance (meter)

Surge Protection Is A Must





Lightning Rod

ARRESTER

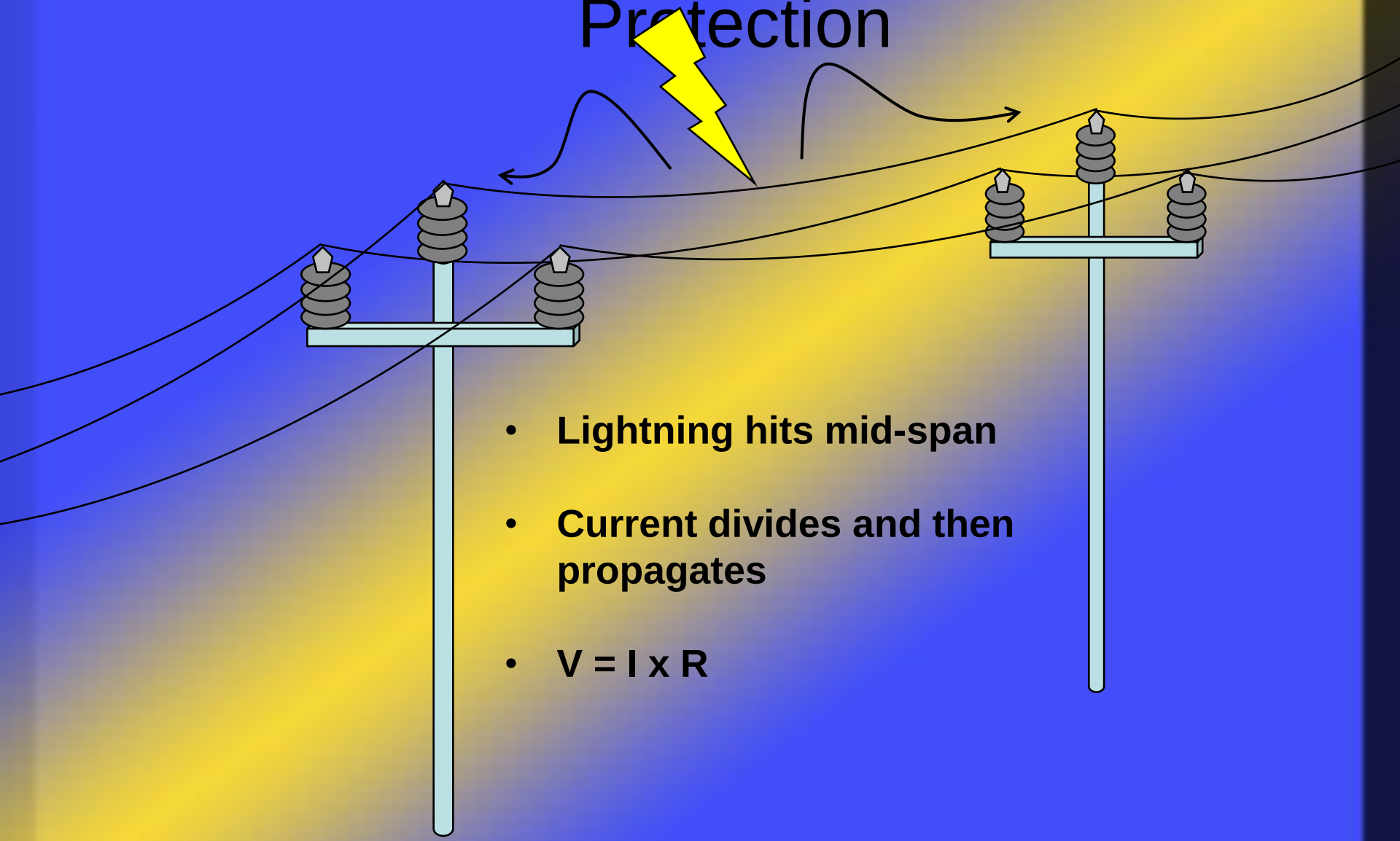
Arrester yaitu salah satu jenis pelindung sistem transmisi dan distribusi sistem tenaga listrik dari sambaran petir.

Arrester terdiri atas dua jenis, yaitu :

1. **Jenis tabung pelindung (Arrester ekspulsi)**
2. **Jenis katub**

The Enemy

Traveling Wave/ Overvoltage Protection



- **Lightning hits mid-span**
- **Current divides and then propagates**
- **V = I x R**

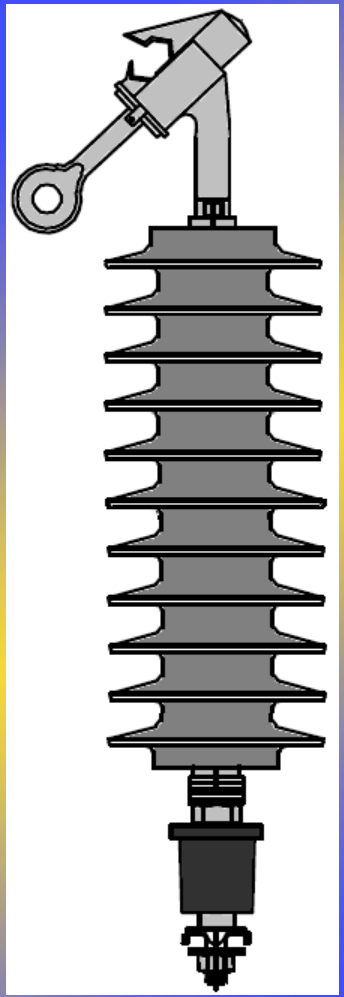
Surge Arresters - Concept

- Surge causes traveling voltage wave
- Voltage would be enough to flash-over insulation
- Surge arrester high resistance at L-G voltage
- Surge arrester low resistance at surge voltage
- Surge is diverted to ground
- Surge arrester high resistance again after surge
- Conduction time is too short for breakers to react

National Grid 115 kV Line without Surge Arresters

National Grid 115 kV Line with Surge Arresters

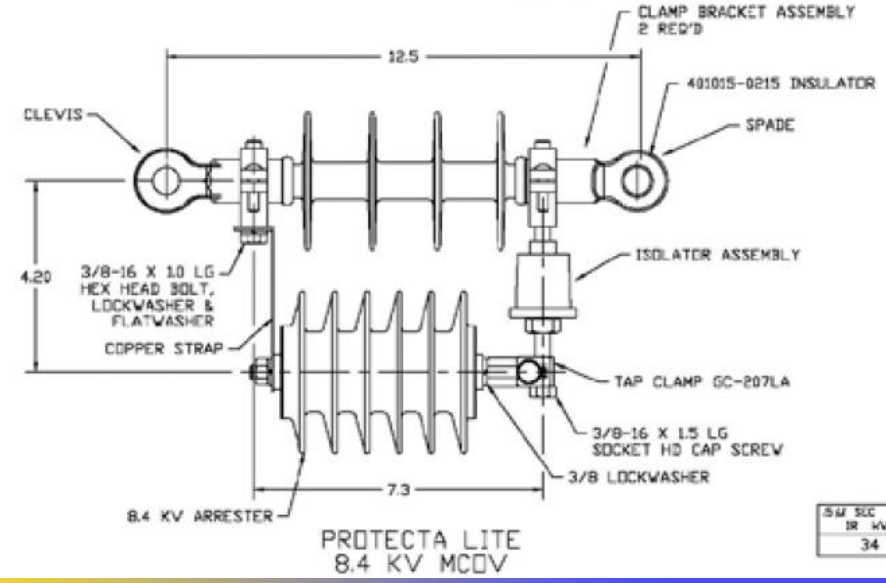
Suspended Line Arrester Configuration



Typical Dead-End Line Arrester Configuration

15 kV Class

Part No.
612009-G1-G0-001



PROTECTA LITE
8.4 KV MCOV

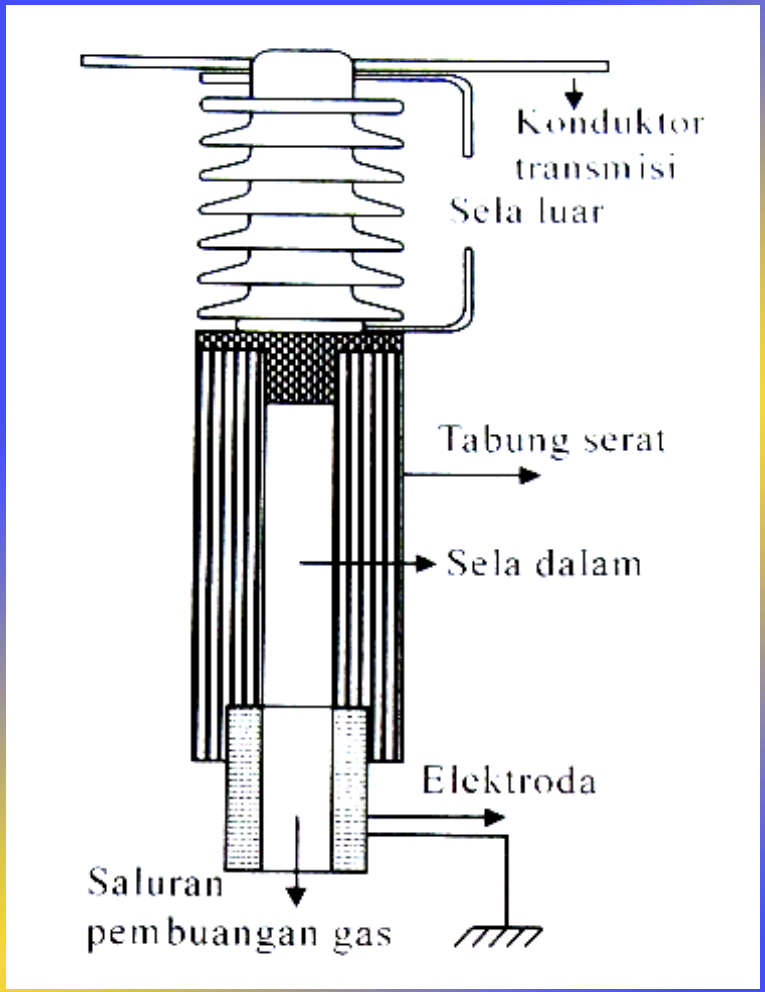
INSULATOR CHARACTERISTICS ONLY

LEAKAGE DISTANCE	16 IN
60 Hz DRY FLASHOVER	110 KV
60 Hz DRY WITHSTAND	100 KV
60 Hz WET FLASHOVER	75 KV
60 Hz WET WITHSTAND	65 KV
IMPULSE CRITICAL POSITIVE	140 KV
IMPULSE CRITICAL NEGATIVE	160 KV
NET WEIGHT	2.4 LB
TENSION PROOF TEST	10000 LB
ULTIMATE TENSION STRENGTH	15000 LB
NO. OF WEATHERSHEDS	4

NOTES:
1. ARRESTER LEAKAGE DISTANCE - 14.4 IN
2. ARRESTER WITHOUT HARDWARE - 3.25 LB
3. AS SHOWN, THE ISOLATOR ASSEMBLY IS INSTALLED ON THE SPADE END OF THE INSULATOR. THIS IS NORMALLY THE ENERGIZED END IN DEADEND APPLICATIONS. THIS ASSEMBLY CAN BE MODIFIED FOR OTHER APPLICATIONS BUT PROPER ARRESTER AND ISOLATOR ORIENTATION MUST BE MAINTAINED.
4. TO OBTAIN ASSEMBLY WITHOUT INSULATOR ORDER CATALOG NUMBER 612009-G1-G0-001.
5. TO OBTAIN HARDWARE ONLY ORDER CATALOG NUMBER 712009-G1-G0-001.

8/20 SEC 10kA IR kV	500 A SWITCHING SURGE IR kV	MAXIMUM 8/20 DISCHARGE VOLTAGE - kV AT					
		1.5 kA	3.0 kA	5 kA	10 kA	20 kA	40 kA
34	24.4	25.4	27.1	28.8	31.6	35.6	42.3

ARRESTER JENIS TABUNG PELINDUNG (ARRESTER EKSPULSI)



Arrester ini mempunyai 2 jenis sela (tanduk Api) yaitu :

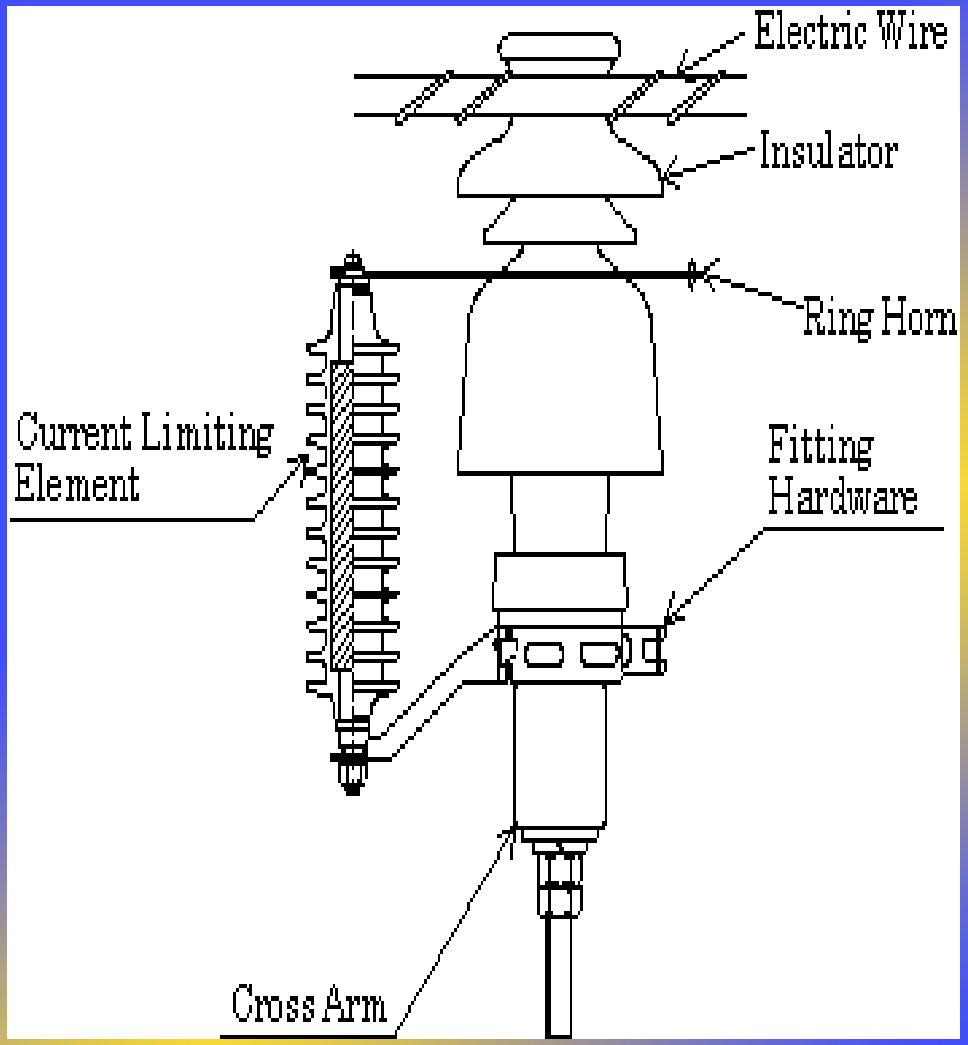
1. Sela luar

2. Sela Dalam

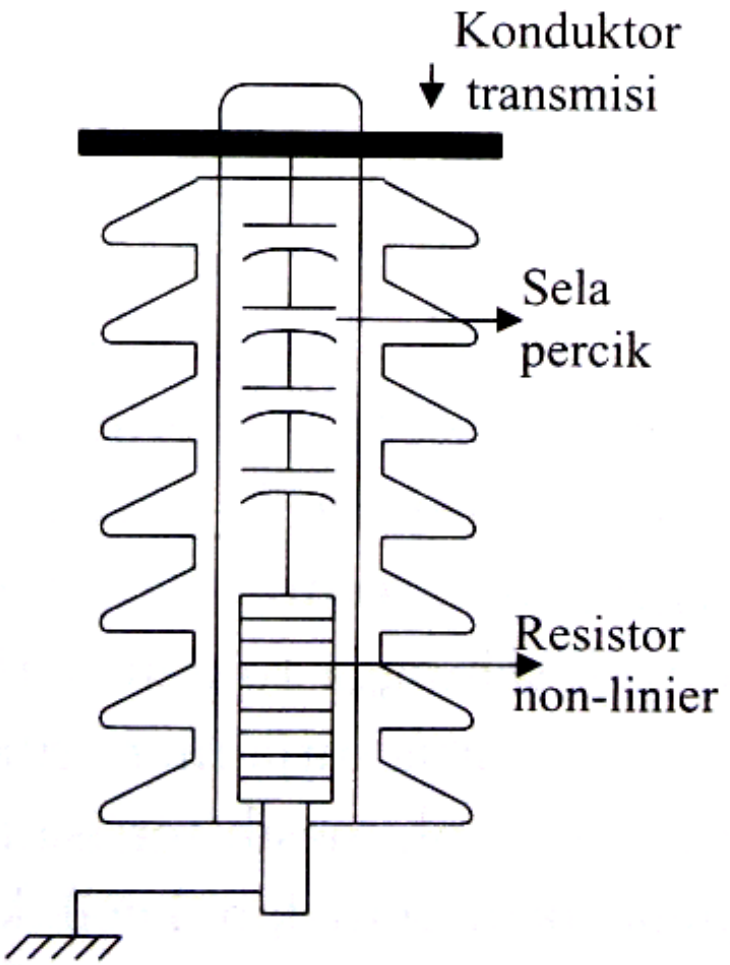
Bila di terminal Arrester tersambar petir, maka kedua sela terpercik, sehingga muatan listrik dari petir tersebut dapat dibumikan.

Arrester ini dapat melindungi trafo distribusi yang bertegangan 3 – 15 kV, tetapi belum memadai untuk melindungi trafo daya.

Arrester ini masih dipengaruhi oleh keadaan udara di sekitar arrester, seperti cuaca dan kelembaban.


Electric Wire
Insulator
Ring Horn
Current Limiting Element
Fitting Hardware
Cross Arm

ARESTER JENIS KATUB



Yaitu arrester yang terdiri atas beberapa sela percik (tanduk api) yang dihubungkan seri dengan resistor tak linier.

Sela percik dan resistor tak linier keduanya ditempatkan dalam tabung isolasi tertutup, sehingga kerja arrester ini tidak dipengaruhi udara sekitar.

Resistor tak linier disebut juga resistor kran, yang dibuat dari bahan silikon karbid.

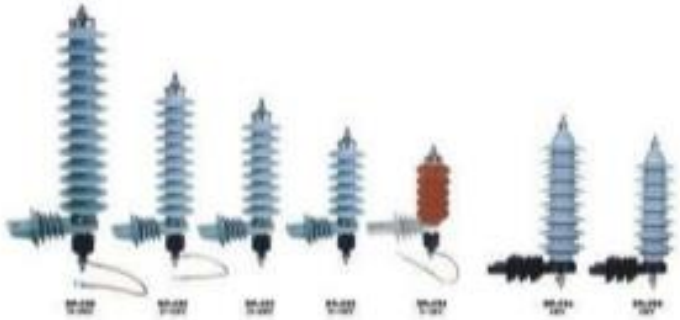
Arester jenis katup terdiri atas empat jenis yaitu :

a. Jenis Gardu
b. Jenis Saluran (15-69 kV)
c. Jenis gardu untuk mesin-mesin (2,4-15 kV)
d. Jenis distribusi untuk mesin-mesin(120-750 V)

HY5W、HY10W Serise Polymer type Lightining Arrester

Lightning Arrester

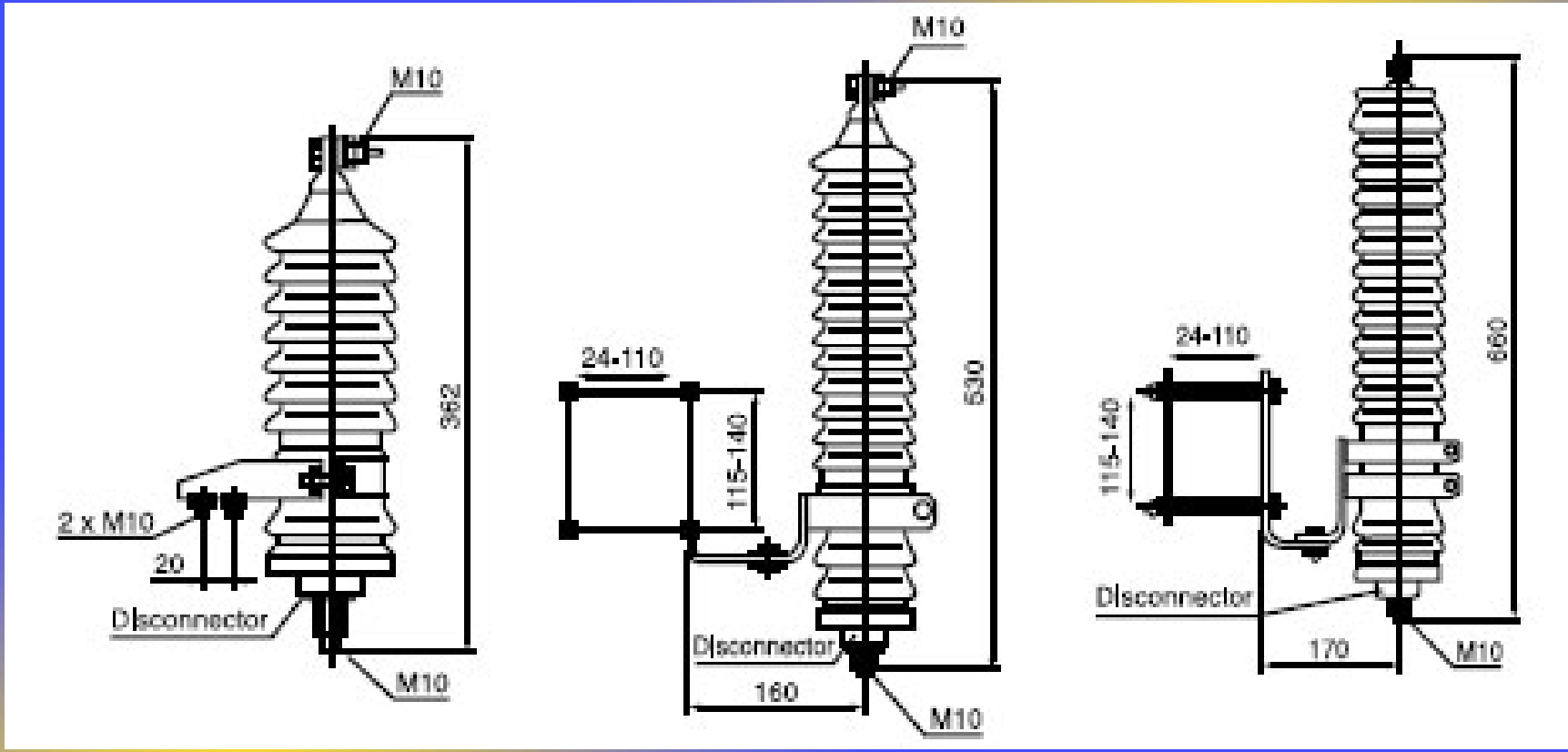
HY10W, HY5W Polymer Type Lightning Arrester



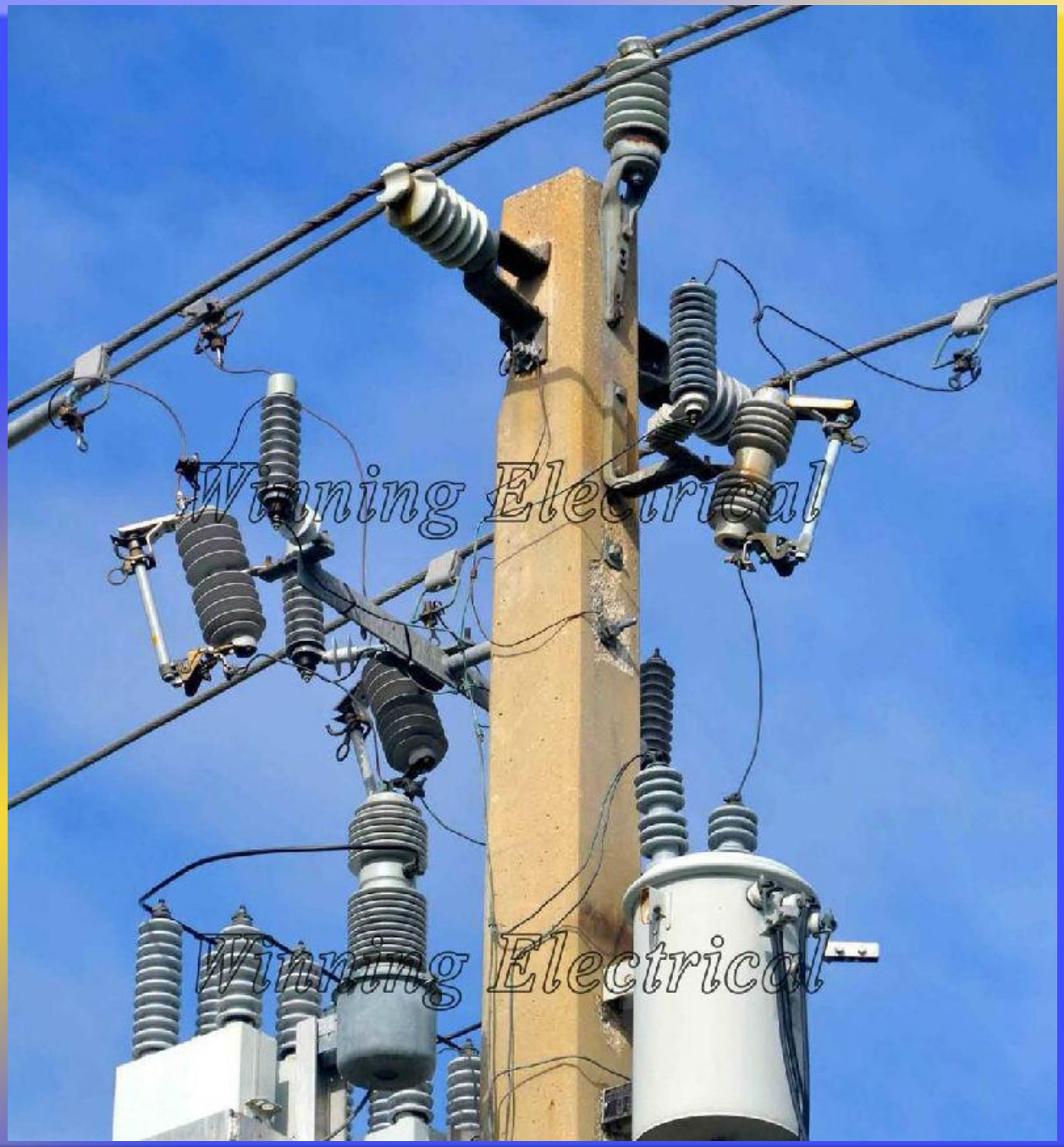
Y5W,Y5C,Y10W,Y10C Porcelain Lighting Arrester

YW,HYW Zinc Oxide Arrester

Dimensi LA


M10
362
2 x M10
20
Disconnector
M10
M10
24-110
115-140
530
Disconnector
160
M10
24-110
660
115-140
Disconnector
170
M10

LA di Saluran Distriusi



TRANSFORMER COMBI UNIT

Pekerjaan Dalam Keadaan Bertegangan (PDKB)

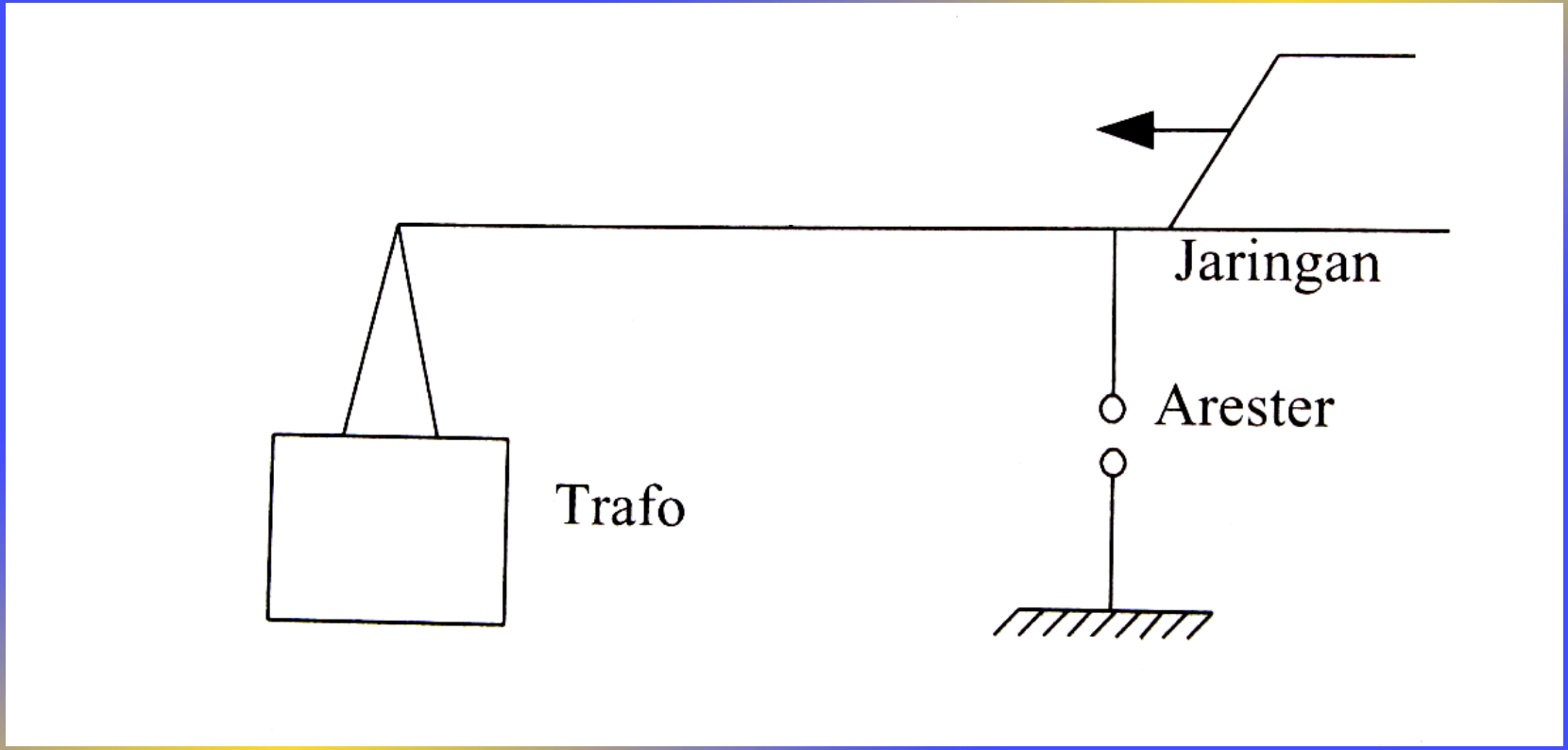
DATA PENGENAL ARRESTER

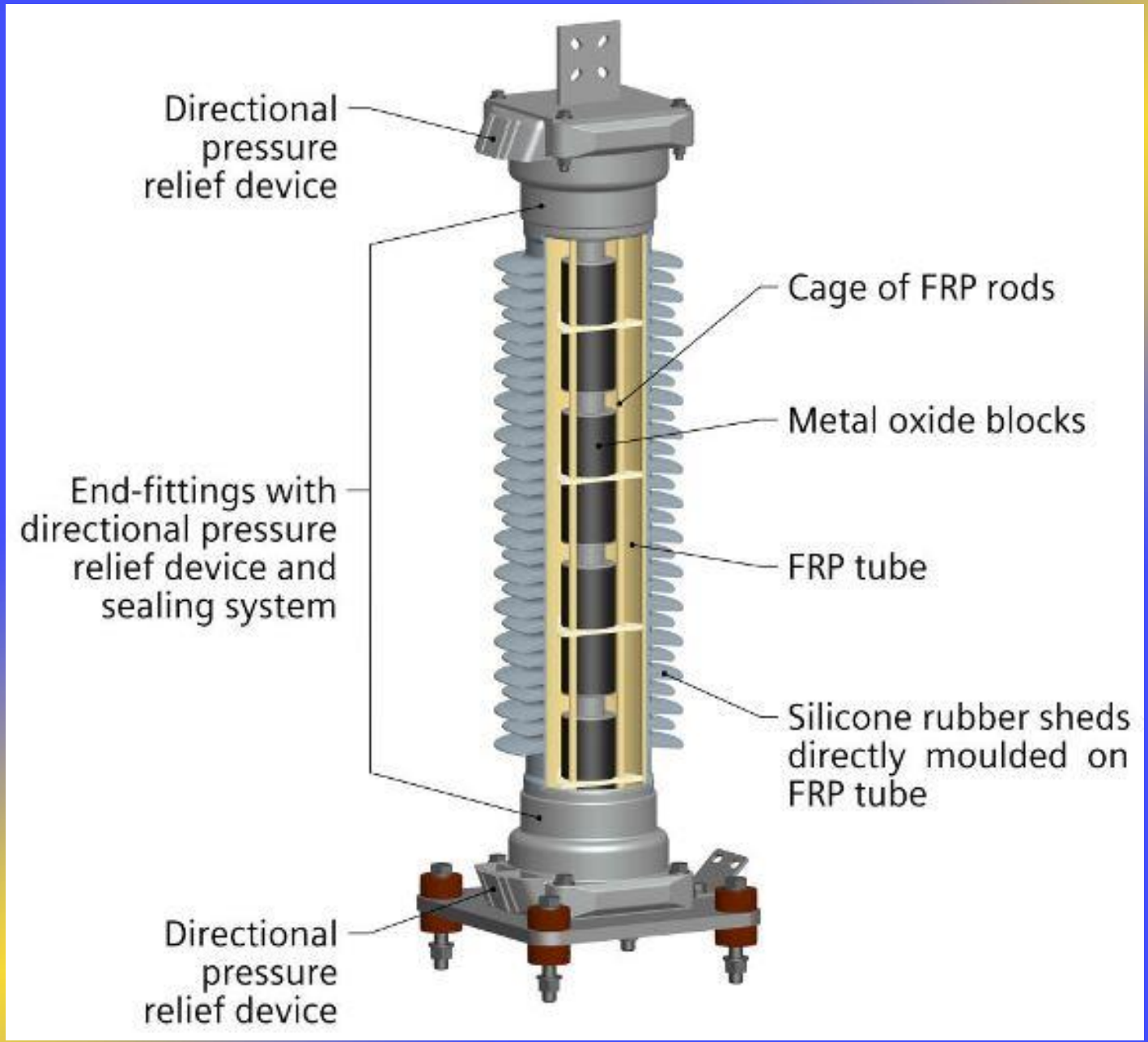
a. Tegangan pengenal
b. Arus peluahan nominal
c. Frekuensi pengenal
d. Tegangan percik frekuensi daya
e. Tegangan percik impuls maksimal
f. Tegangan peluahan atau tegangan sisa
g. Tegangan dasar (cut off votage)
h. Tegangan gagal sela
i. Karakteristik volt-waktu (V-t)
j. Margin
k. Tingkat perlindungan
l. Arus peluahan maksimal

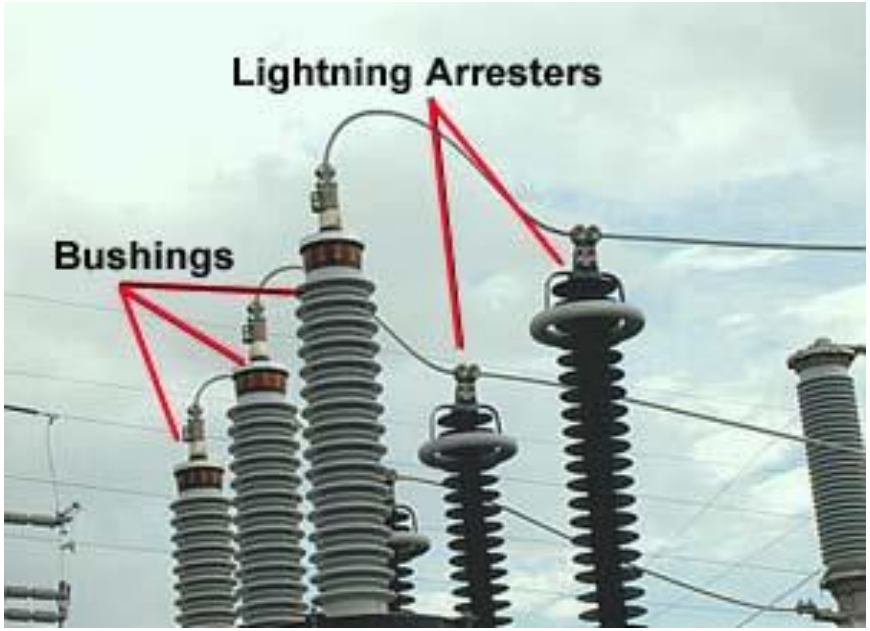
LOKASI PENEMPATAN ARRESTER

Arrester ditempatkan sedekat mungkin dengan peralatan yang dilindungi karena jarak arrester ini berpengaruh pada besarnya tegangan yang tiba pada peralatan. Jika jarak arrester terlalu jauh, maka tegangan yang tiba pada peralatan dapat melebihi tegangan yang dapat dipikulnya.

Untuk memperoleh kawasan perlindungan yang lebih baik, maka ada kalanya arrester ini ditempatkan dengan jarak tertentu dari peralatan yang dilindungi.


Jaringan
Arester
Trafo

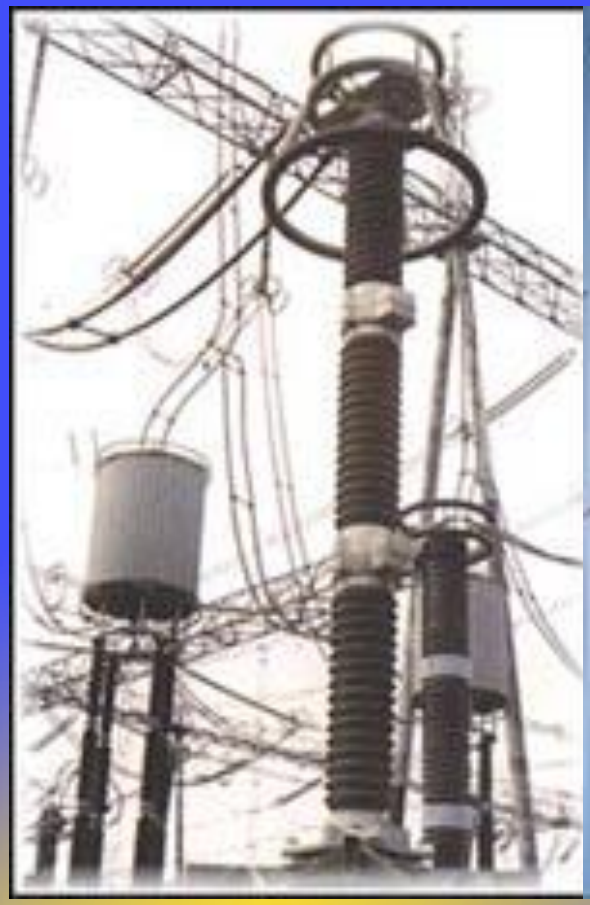

Directional pressure relief device
Cage of FRP rods
Metal oxide blocks
End-fittings with directional pressure relief device and sealing system
FRP tube
Silicone rubber sheds directly moulded on FRP tube
Directional pressure relief device


Lightning Arresters
Bushings

LIGHTNING ARRESTER

DEFINATION

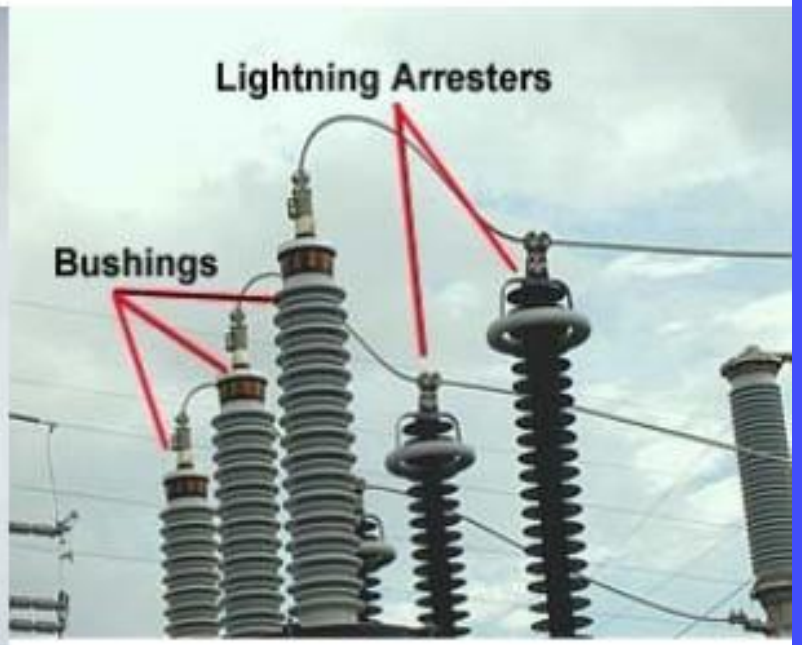
A lightning arrester is a device used on electrical power systems to protect the insulation on the system from the damaging effect of lightning.




Lightning Arresters

Lightning arrester

- Protective device
- Equipment use power poles and towers, power transformers, circuit breakers, bus structures, and steel superstructures in substations




Wassalamu'alaikum Wr. Wb.