POWER LINE EARTHING

OBJECTIVE of SITE EARTHING

- TO AVOID PHYSICAL DAMAGE TO BUILDINGS AND EQUIPMENTS DUE TO DIRECT (OR) INDIRECT LIGHTNING STRIKE
- TO PROVIDE A SAFE WORKING ENVIRONMENT FOR PERSONNELS DURING LIGHTNING STRIKE
- TO PROVIDE SHIELDING AND ALTERNATIVE PATH FOR INDUCED CURRENT
- TO PROVIDE EQUIPOTENTIAL PLATFORM FOR ELECTRONIC EQUIPMENTS.

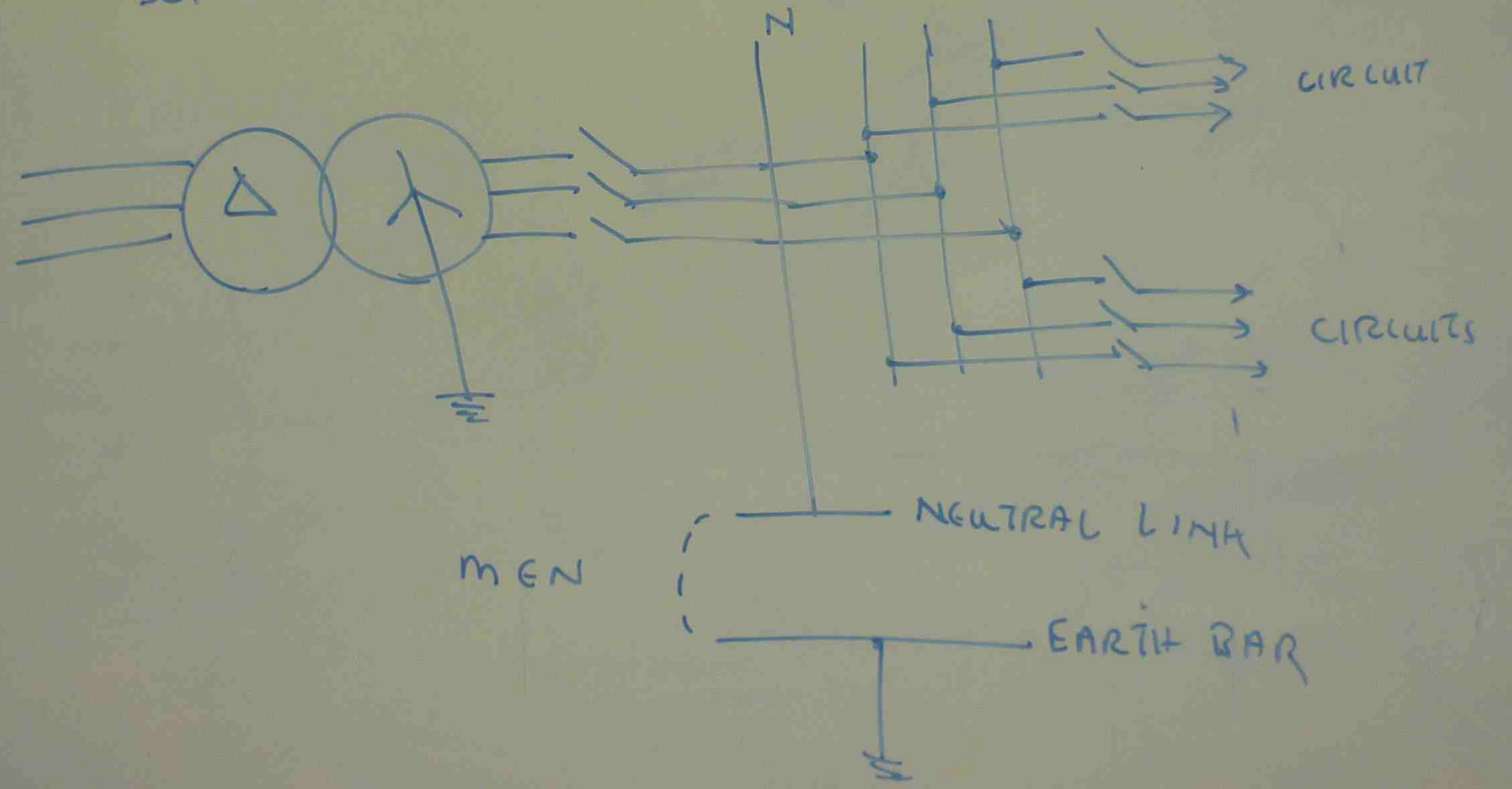
TNING

FOR

R ELECTRONIC

CATEGORIES of EARTHING

- NEUTRAL EARTHING
- SAFETY EARTHING
- SIGNAL REFERENCE CONDUCTOR EARTHING
- SCREEN REFERENCE EARTHING.

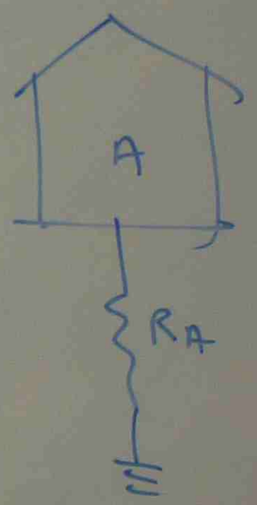


CONC

OUTER

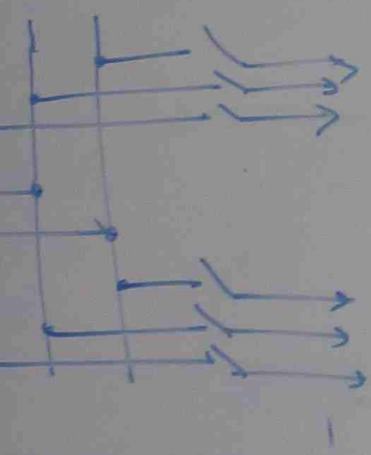
EARTH

SIGNAL RE



TWO

THING



CIRCUIT

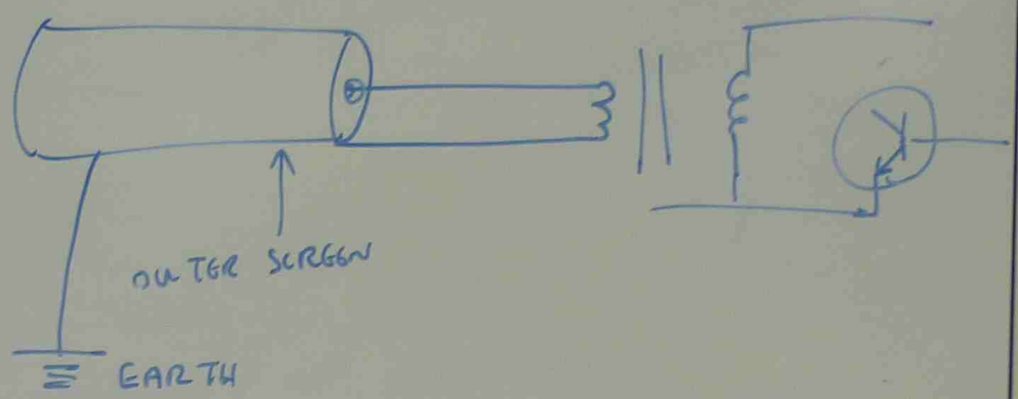
CIRCUITS

NEUTRAL LINE

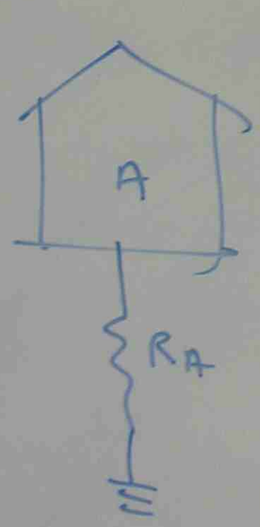
EARTH BAR

CONCENTRIC CABLE

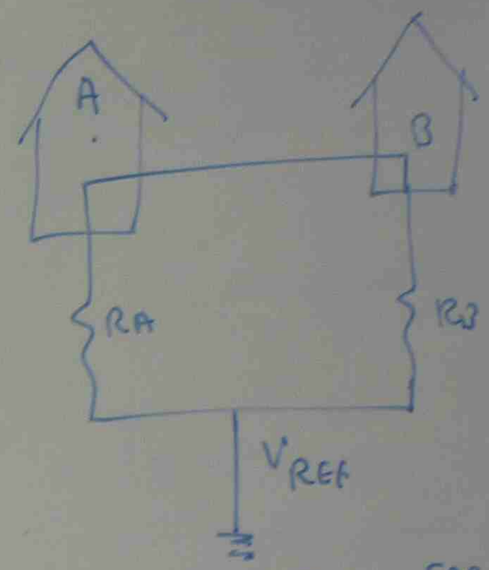
COAXIAL CABLE



SIGNAL REFERENCE CONDUCTOR EARTHING



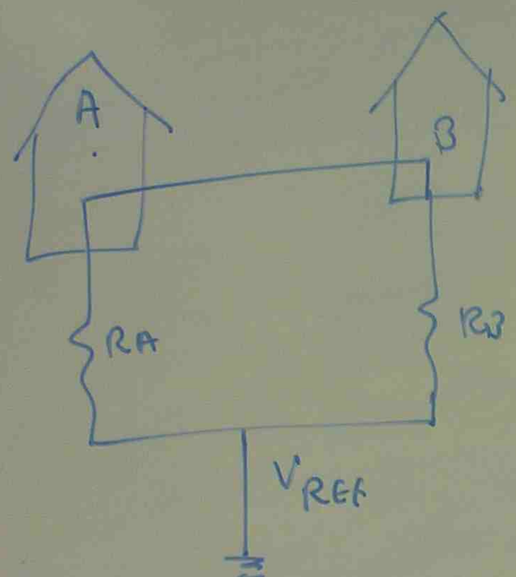
TWO SEPARATELY EARTHING



TWO SEPARATELY EARTHED BUILDINGS A & B WITH CABLE CONNECTION.

EARTH RESISTANCE MUST BE LOW ENOUGH TO CARRY THE LEAKAGE CURRENT

R EARTHING



TWO SEPARATELY EARTHED BUILDINGS A & B WITH CABLE CONNECTION.

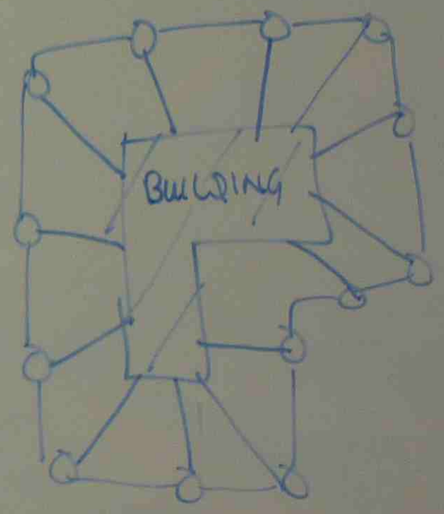
EARTH RESISTANCE MUST BE LOW ENOUGH TO CARRY THE LEAKAGE CURRENT

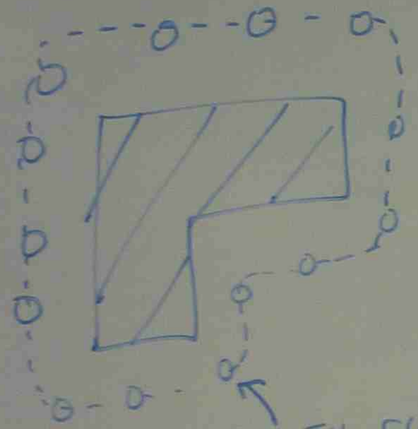
- EARTH IN ROAD MATERIAL
- SOIL RESISTIVITY
- TYPE OF SOIL
- MOISTURE CONTENT.

ARTIFICAL EARTHING → TO REDUCE EARTH RESISTANCE
EARTHING MESH

DRIVE EARTH ELECTRODES

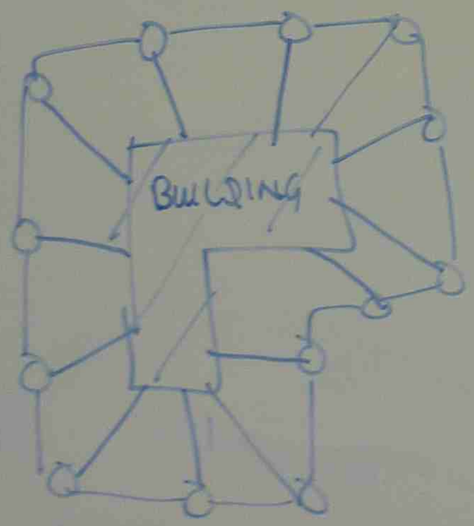
BONDING OF EARTH ELECT
TO OTHER COMPONENTS



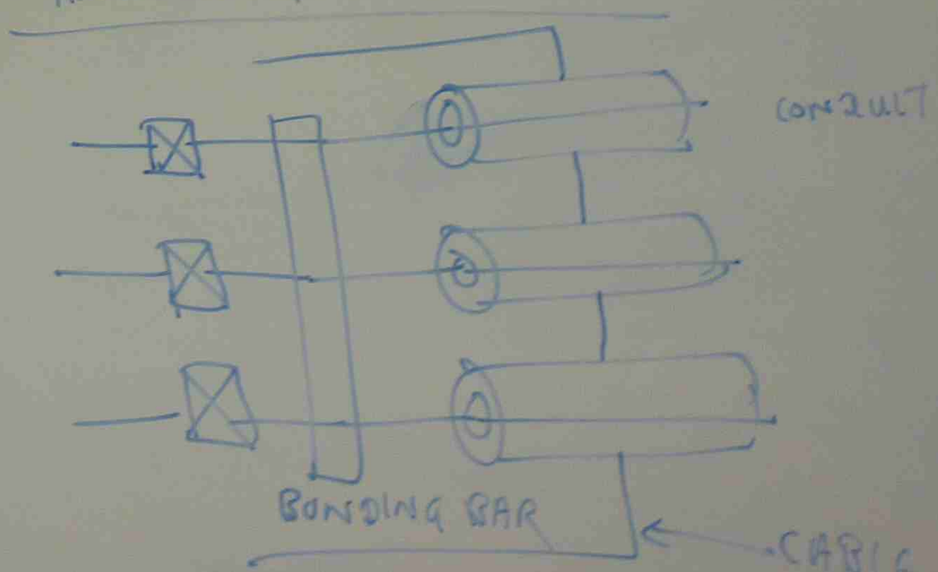


DRIVE EARTH ELECTRODES

BONDING of EARTH ELECTRODES TO OTHER COMPONENTS



BONDING OF CONDUIT CABLE & CABLE ARMOURING



→ TO REDUCE EARTH RESISTANCE

IC STRENTH of 30 KV/cm

BREAK DOWN WILL OCCUR.

$Z_c = \sqrt{\frac{200}{5\times10^{-6}}}$

$= \sqrt{40\times10^6}$

$= 6.32\times10^3$

$\times \frac{200 - 6.32\times10^3}{200 + 6.32\times10^3}$

$\frac{3\times(-6120)}{6520} = |-30.9|$

$= 30.9$

$+30.9 = 613.9$ kV

OOH

5 μf

200Ω

33 kV

TRAY

ELECTRICAL INSULATION

Types of INSULATIONS

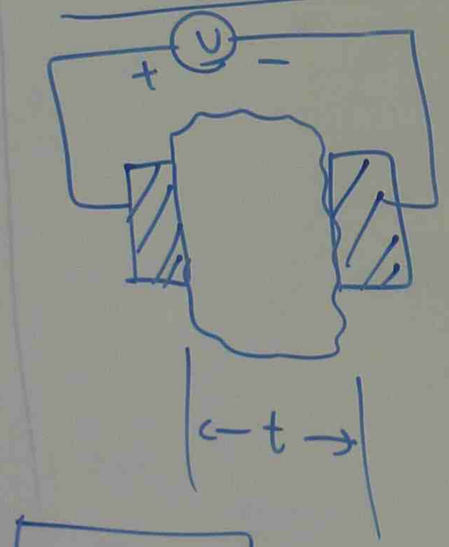
OIL IMPREGNATED PAPER, VARNISHED CABRIC,

POLYETHYLENE.

THE TRANSMISSION SYSTEM INSULATORS SUFFER

(1) ELECTRICAL STRESS (2) MECHANICAL STRESS.

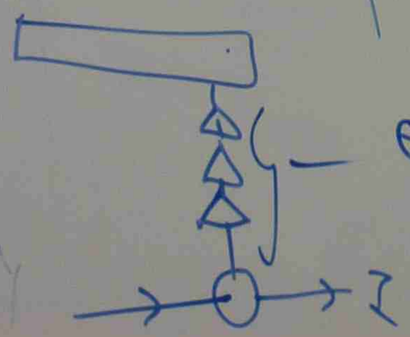
INSULATOR DIELECTRIC BEHAVIOUR



$E = \frac{V}{t}$ V/cm ELECTRIC STRESS

V = VOLTAGE

t = THICKNESS of INSULATION



ELECTRICAL STRESS

- CAPACITANCE EFFECT
- LEAKAGE CURRENT
- ELECTRIC FIELD
- SURFACE LEAKAGE CURRENT

THE INSULATOR MUST HAVE CAPABILITY TO WITHSTAND THE PUNCTURE STRENGTH.

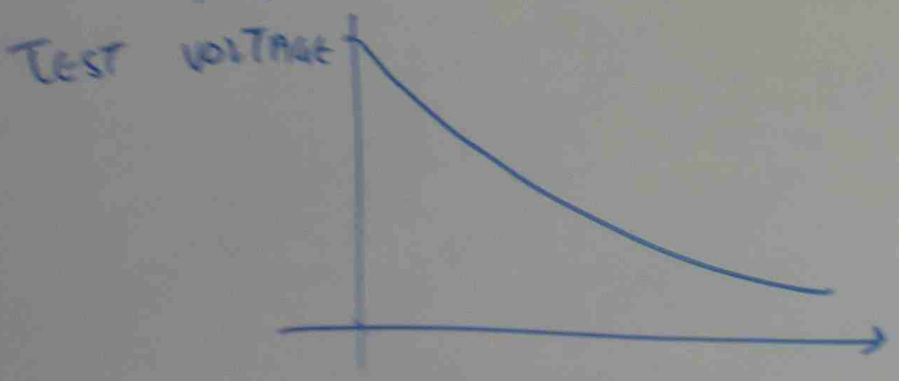
TESTING INSULATOR

INSULATION BREAK DOWN REQUIRES THE ENERGY TO BE DELIVERED FROM THE VOLTAGE SOURCE TO INSULATION VOLUME.

IT NEEDS TO NOTE THE FOLLOWINGS:-

- TIME REQUIRED FOR BREAK DOWN

(IN THIS CASE, THE LOWER THE APPLIED VOLTAGE, THE MORE SLOWLY DOES THE BREAKDOWN PROCESS PROCEEDS AND THE LONGER THE TIME TO REACH THE BREAKDOWN POINT)

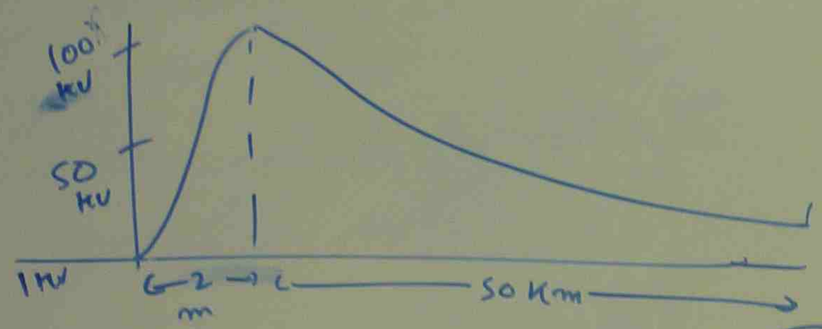


CHARACTERISTICS OF INSULATING MATERIALS

MATERIAL	RESISTIVITY	PUNCTURE STRENGTH V/cm	RELATIVE PERMITTIVITY
GLASS	2×10^{17}	$(0.5 \rightarrow 3) \times 10^{6}$	5.4 → 9.9
MICA	2×10^{17}	$(3.5 \rightarrow 7) \times 10^{6}$	2.5 → 4.5

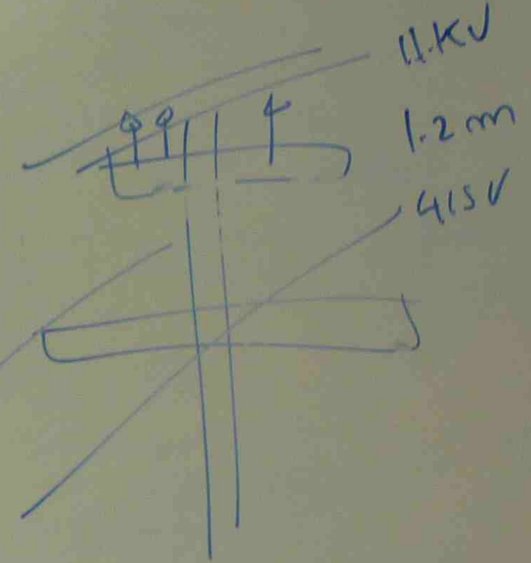
SOURCE OF OVER VOLTAGE

(I) LIGHTNING

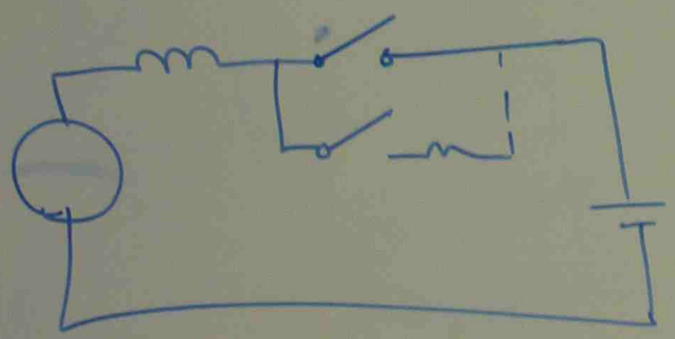


BIL – BASIC INSULATION LEVEL

– CAPABILITY TO WITHSTAND THE TRANSIENT OVER VOLTAGE

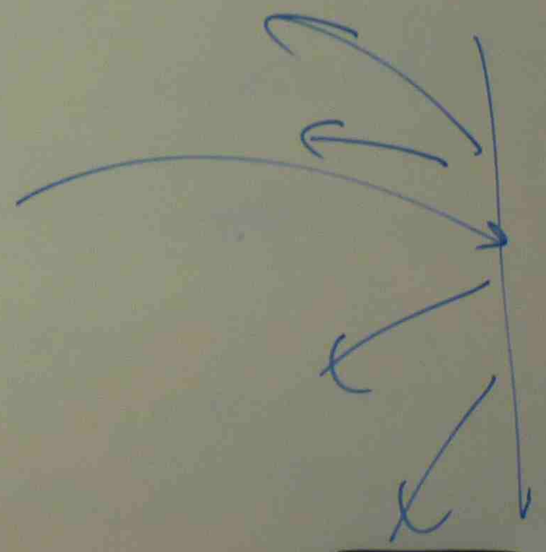


(II) SWITCHING TRANSIENT

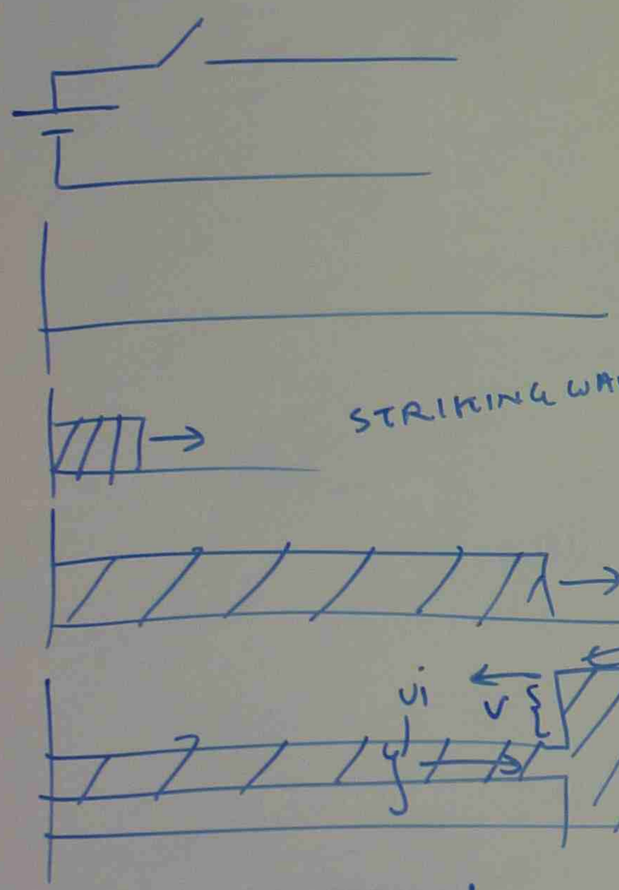


(III)

CONTACT WITH THE CIRCUIT WITH HIGHER VOLTAGE



TRAVELLING WAVE



THE RETURN | REFLECTION COMPONENT OF THE STRIKING TRAVELLING WAVE CAN BE HIGHER THAN THE ORIGINAL STRIKING WAVE MAGNITUDE.

TRANSMISSION LINE NEEDS TO WITHSTAND TRANSIENT OVER VOLTAGE

V_i = ORIGINAL WAVE

V = REFLECTED WAVE

R = LINE RESISTANCE

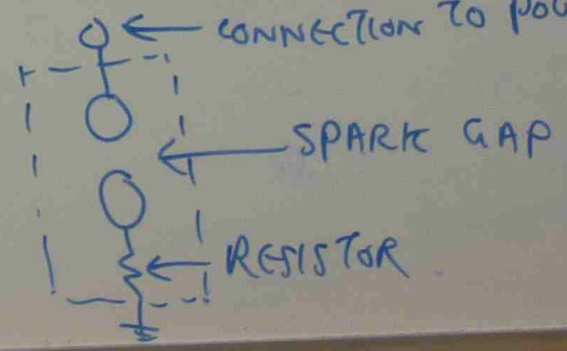
Z_c = CHARACTERISTICS IMPEDANCE

$$= \sqrt{\frac{L}{C}}$$

$$V = V_i \frac{R - Z_c}{R + Z_c}$$

WHEN THE EXCEEDS,

LIGHTING ARRESTER IS UTILIZED TO ABSORB THE TRANSIENT OVER VOLTAGE



$\therefore V_T = V +$

TRANSMISSION LINE NEEDS TO WITHSTAND TRANSIENT OVER VOLTAGE

V_i = ORIGINAL WAVE

V = REFLECTED WAVE

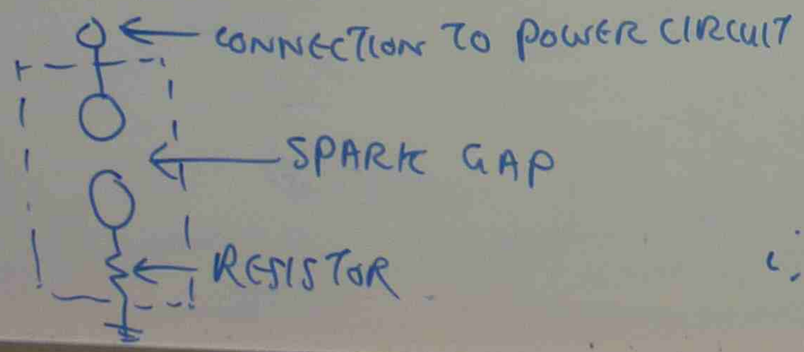
R = LINE RESISTANCE

Z_c = CHARACTERISTICS IMPEDANCE

$$= \sqrt{\frac{L}{C}}$$

$$V = V_i \frac{R - Z_c}{R + Z_c}$$

LIGHTING ARRESTER IS UTILIZED TO ABSORB THE TRANSIENT OVER VOLTAGE



WHEN THE ELECTRIC STRENTH of 30 KV/cm EXCEEDS, THE BREAK DOWN WILL OCCUR.

$L = 200H$

$C = 5\,\mu f$

$R = 200\Omega$

$V_i = 33\,kV$

$$Z_c = \sqrt{\frac{200}{5\times10^{-6}}} = \sqrt{40\times10^6} = 6.32\times10^3$$

$$V = 33 \times \frac{200 - 6.32\times10^3}{200 + 6.32\times10^3}$$

$$= 33 \times \frac{(-6120)}{6520} = |-30.9| = 30.9$$

$\therefore V_T = V + V_i = 33 + 30.9 = 63.9\,kV$

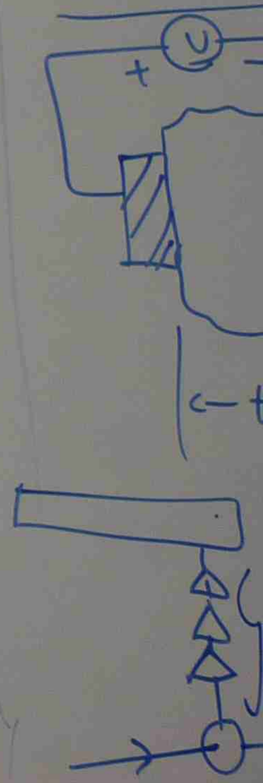
Types o

OIL IM

POLY E

THE TRANS

INSULATOR



TRAY