Transmission and Distribution of Electrical Power

By

Assis. Prof. / Mohamed Ahmed Ebrahim Mohamed

E-mail: mohamedahmed_en@yahoo.com

Web site: http://bu.edu.eg/staff/mohamedmohamed033


Lecture (4)

Corona

What is Corona?

A self sustained partial discharge that develops at high concentrated electric field

Factors affecting Corona

- Atmospheric conditions (Temperature, Pressure, Humidity,…,etc.).
- Line voltage.
- Conductor surface condition.
- Ratio d/r.

Factors affecting Corona

- Impurities on conductor.
- Spacing between the electrodes.
- Radius of electrodes.
- Electrode surface factor.
- Onset voltage

Disruptive critical voltage

It is the minimum voltage at which the ionization takes place taking into account that corona is not visual (complete break down of the dielectric)

Disruptive critical voltage

$$V_d = m_0 \delta g_0 r * \ln\left(\frac{d}{r}\right) \qquad Kv(r.m.s)$$

Where

- g_o = Breakdown strength of air at 76 cm of mercury and 25 ^{0}c
- m_o = Irregularity factor of wire
- r = Radius of the conductor
- d = Distance between the wires
- δ = Reduction factor of break down strength also called air density factor

$$\delta = \frac{(3.92b)}{(273+t)}$$

Where

- b = the barometer pressure in cm of mercury,
- t = the temperature of air in ^{0}c .

Factors affecting disruptive critical corona voltage

* The condition of conductor surface.
* The atmospheric conditions.
* The conductor configuration.

Visual critical voltage

It is the minimum voltage at which corona just comes visual (the corona starts becoming visible) & Its value is higher than the disruptive one

$$V_v > V_d$$

$$V_v = V_d \left[1 + \left(\frac{0.3}{\sqrt{\delta r}} \right) \right]$$

Corona power loss

The formation of corona is associated with a loss power, which will have some effect on the efficiency of the line, but will not be a sufficient importance to have any appreciable effect on the voltage regulation.

Corona power loss

$$P_c = 244 * \frac{F + 25}{\delta} \sqrt{\frac{r}{d}} \left(V_{ph} - V_d\right)^2 * 10^{-5} \quad Kw/Km/Phase$$

*Where

V_{ph} = phase voltage

F = voltage frequency

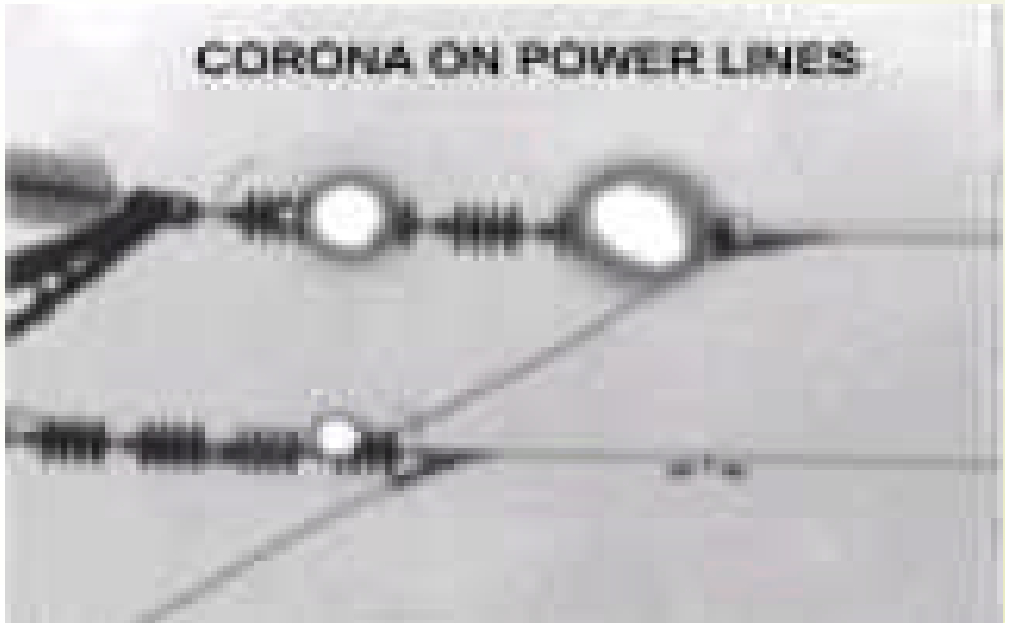
V_d = disruptive critical voltage

How to avoid Corona

* Using electrodes with high thickness dielectric coating
* Increase the spacing between the electrodes
* Using bundled conductor (best economical way)

Advantage of Corona

Reduces transient (i.e. charges includes on the line by light will be dissipated by corona, so corona acts as safety valve)



Disadvantage of Corona

* High power loss in transmission
* TV & Radio signal interference
* Hissing noise & conductor vibrate
* Luminous violet glow around T.L
* Break down may occur
* Ozone & oxide of Nitrogen are produced
* Third harmonics may be produced

Check for Corona

$$V_d = 155 Kv \ / \ Phase$$

$$\text{The working voltage} = \frac{220}{\sqrt{3}} = 127.02 \text{ Kv/phase}$$

$$\text{The working voltage} < V_d$$

No Corona under normal working conditions

Thank You
For Your Attention

Mohamed Ahmed
Ebrahim