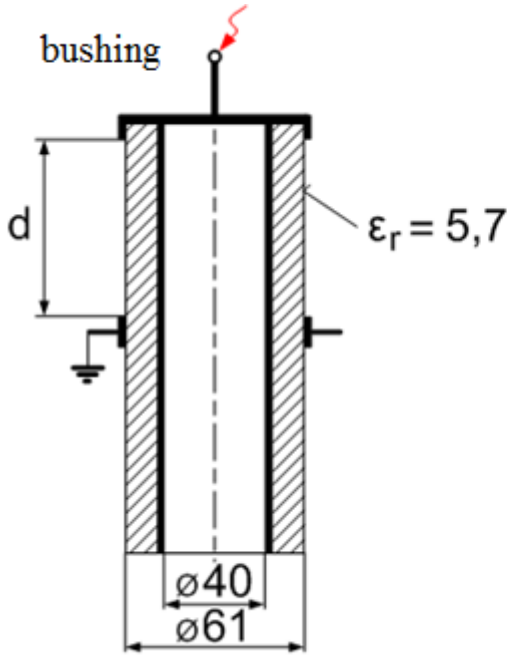
Task 7: Surface Discharges on a Bushing

(Laboratory F1-115)

A) Measurement of Flash-over Characteristics

Determine the flash-over characteristics on electrode distance (with maximal distance d = 150 mm) for models of bushing and supporting insulator. Both characteristic should be plotted to one graph. You can observe various stages of surface discharges (corona, spark discharge, …) under an eclipse.

Tested Objects:



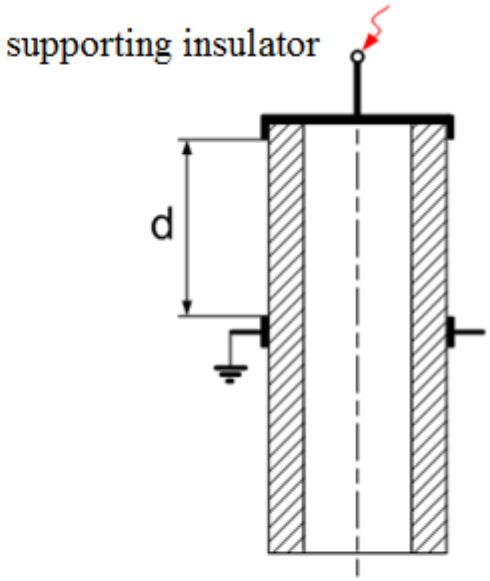
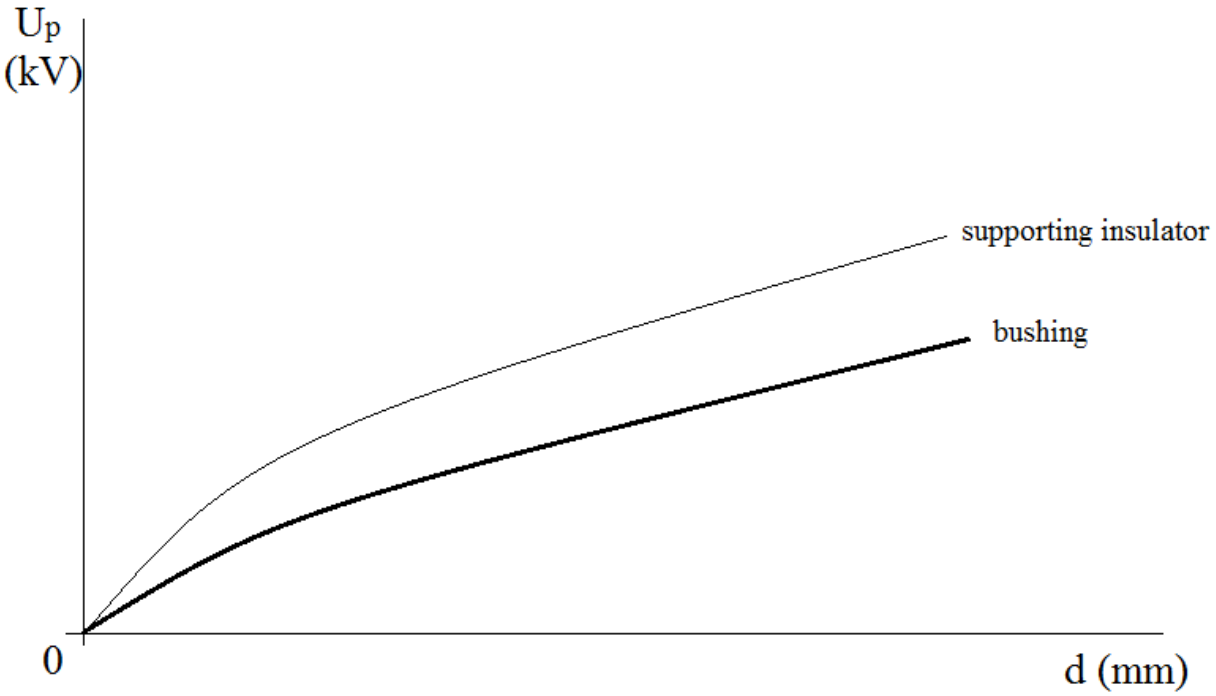


Table of Measured Values:

Bushing d_i **(mm)**	U_1 **(kV)**	U_2 **(kV)**	U_3 **(kV)**	∅**U (kV)**

Supporting insulator d_i **(mm)**	U_1 **(kV)**	U_2 **(kV)**	U_3 **(kV)**	∅**U (kV)**

Example of the Graphical Evaluation of Results:



B) Determination of Initial Partial Discharge Voltage of Bushing

Calculate the initial partial discharge voltage for bushing (constant k in the formula for U_0 can be chosen to k = 0.335 and permittivity of insulating tube ε_r = 5.4; permittivity of vacuum is $\varepsilon_0 = 8.854 \cdot 10^{-12}$ F/m). Further, estimate the initial partial discharge voltage by hearing and vision. Both results should be compared. You can observe the independence of the initial voltage on an electrode distance d.

Formulas for the Calculation:

- The capacity per unit length of the bushing:

$$C_1 = \frac{2\pi\varepsilon_r\varepsilon_0}{\ln\frac{r_2}{r_1}} \quad \left(\frac{pF}{mm}; \frac{pF}{mm}, -, mm\right)$$

- Specific surface capacity is given by dividing the capacity of the average perimeter of the tube O_s:

$$c = \frac{C_1}{O_s} \quad \left(\frac{pF}{mm^2}; \frac{pF}{mm}, mm\right)$$

- The initial partial discharge voltage is given by formula:

$$U_0 = \frac{k}{c^{0,45}} \quad \left(kV; \frac{pF}{mm^2}\right)$$