**Exercises on High Voltage Engineering (Mar 20, 2025):**

**Exercise 3-3:** The length of China's first 1000kV AC line silicon rubber composite insulator is 9.75m, and its switching impulse withstand voltage is 1950kV. Under the atmosphere condition of *t*dry=30℃, RH=80% and *p*=99.5kPa, how many kilovolts of switching impulse voltage should be applied to test the insulator?

**Exercise 3-7:** What are the ways to improve the sliding spark discharge voltage of a bushing under the power frequency voltage? In order to increase its sliding spark discharge voltage, what is the effect of increasing the surface distance alone?

**Exercise 3-8:** Under the power frequency testing voltage, a bushing just does not occur the phenomenon of sliding spark discharge. If the test voltage amplitude is unchanged, but the standard lightning impulse voltage is applied, can the phenomenon of sliding spark discharge occur or not in the test?

**Exercise 3-10:** When the smooth porcelain bushing (*ε*r=6) with an inner diameter of 6cm and a thickness of 3cm, and a inside conductor rod with a diameter of 6cm or 3cm respectively, please try to estimate the sliding spark initiation voltage in these two cases according to the empirical formula.

**Exercise 3-11:** The thickness of a glass plate is 2mm, and its *ε*r should be measured by the power frequency sliding spark discharge voltage. The power frequency sliding spark discharge voltage measured in the test is 17kV (rms).

(1) What is the *ε*r of the glass plate?

(2) What is the specific surface capacitance of the glass plate?

**Exercise 3-15:** Please describe the requirements for electrical and mechanical performance of insulators briefly.

**Supplementary Exercise 1:** The HV soft wire with a diameter of 3mm passes through the hole of a wall show below. The high voltage generated by the indoor equipment is then guided outdoors for HV testing. The size of the hole is shown in the figure. Under the atmosphere conditions of *t*dry=32℃, *t*wet=28℃, *p*=99.8kPa in summer and *t*dry=12℃, *t*wet 6℃, *p*=104kPa in winter, what is the maximum power frequency AC or positive lightning impulse voltage that can be lead to outdoors without accidental discharge of the HV wire to the wall, or to the door frame and to the ground (the expected withstand voltage can be calculated with 90% breakdown probability)?

High-voltage wire

Wall

Ground

4m

2.25m

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High-voltage wire

2m

2m

Ground

Door frame

Door frame

Door frame

**Supplementary Exercise 2:** In the document on OHLs-1, some photos of OHL self-supporting tower, tensioning tower and guyed tower are given.

(1) As for the OHLs, how are the different conductor configurations realized?

(2) What is the sag of an OHL? What are the factors that affect the sag of conductor?