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MEASUREMENT OF THE DIELECTRIC LOSS TANGENT IN THE INSULATING MATERIAL

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The ability of a dielectric to dissipate energy in an electric field is usually characterized by the angle of dielectric loss, as well as the tangent of the angle of dielectric loss.

At alternating voltage, in insulation, a current flows, which is ahead in phase of the applied voltage by an angle φ (Fig. 1), a small angle δ caused by the presence of active resistance. The ratio of the active component of the current I_a to the capacitive component I_c is called the dielectric loss tangent and is expressed as a percentage. In an ideal lossless dielectric, the angle is δ=0 and, accordingly, tgδ=0. Humidification and other insulation defects cause an increase in the active component of the dielectric loss current and tgδ. Since at the same time the active component grows much faster than the capacitive component, the tgδ indicator reflects a change in the state of isolation and loss in it. With a small amount of insulation, it is possible to detect developed local and concentrated defects.

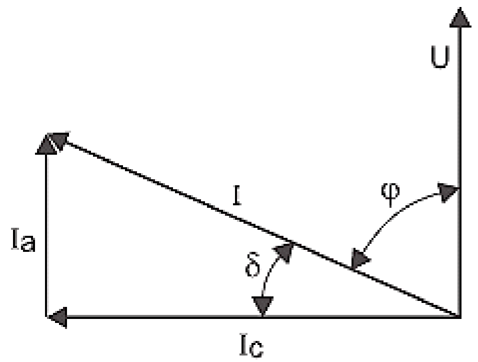

Figure 1. Vector diagram of currents through a dielectric with losses: *U*-voltage on the dielectric; *I* - is the total current through the dielectric; I_a, I_c are, respectively, the active and capacitive components of the total current; φ - is the phase shift angle between the applied voltage and the total current; δ - the angle between the total current and its capacitive component

In Ukraine, the value of the dielectric loss tangent (tgδ) is normalized for a temperature of 363 K, so the measurement should be made at temperatures close to the normalized one. Measurement tgδ is produced by alternating current bridges of types P5026M or P595, which are essentially capacitance meters (Schering bridge). The scheme defines the parameters of the insulation design, corresponding to the equivalent circuit with a series connection of a capacitor without loss *C* and a resistor *R*, for which tgδ, %=0.01 πRC. The measurement process consists in balancing the bridge circuit by alternately adjusting the resistance of the resistor and the capacitor.

There are electrostatic and electromagnetic effects of the electric field on the measurements tgδ. Electromagnetic effects are eliminated by complete shielding of devices. Electrostatic effects are reduced by disconnecting the voltage creating the influencing field. This method is most effective, but not always applicable in terms of power supply to consumers.