THE CAPACITOR

The dashed drawn units C_{DA} and R_{DA} stand for the dielectric absorption, a less known effect in capacitors. Dielectric Absorption designates the charge storage in the dielectric, whereby a delayed release of the charge can occur. Dielectric absorption affects the sound characteristics of a capacitor especially strong.

In (Fig. 2) the impedance process of a capacitor, the change of his complex resistance with frequency, is seen. With increasing frequency the impedance continuously decreases until the resonance point **f** is reached.

This frequency is determined by **C** and L_s ($f_r = 1/2 \cdot \pi \cdot \sqrt{(L_s \bullet C)}$). After that the impedance - because of L_s-again increases.

The impedance minimum corresponds in its size roughly R_s. It has to be remarked at this that most "units" in the equivalent circuit diagram are quite frequency dependent.

Specifications of a capacitor

- Loss factor **D** or **tan** δ. It specifies the losses that occur in the capacitor because of R_s . Sometimes a Q-Factor is specified for this. ($D = 1/Q = 2 \cdot \pi \cdot f \cdot R_s = \tan \delta$)

- Insulation resistance (R_p), usually very big.

- Power factor:
  ($PF \text{-}= \sin \delta \text{-}= R_s/Z$). It is connected to the serial resistance R_s.

- Temperature coefficient-•-Capacitance, sometimes measured at 1 kHz (for HF-capacitors measured at higher frequencies, of course)

- For large capacitors sometimes the equivalent series resistance R_s is specified.

Capacitor Design

A modern capacitor is set up from a row of layers that have been wound on top of each other. In the foil capacitors the electrodes consist usually of a thin metal foil or a conducting layer that is vaporised directly onto the dielectric (Hence also the name metallised foil-capacitor). When the electrodes are moved against each other during the coiling on each side a surmounting piece of electrode emerges, where the lead can be fastened.

Relating to the volume unit the capacitance is highest for electrolyte capacitors. They consist of two electrodes that surround a liquid or rather gel like electrolyte. One of the electrodes is coated with a layer of aluminium oxide that takes on the function of the dielectric. The oxide layer can be manufactured in different ways.

In Elkos with a so called rough foil the oxide layer has a chemically manufactured irregular rough top side. The surface is considerably larger than with a smooth layer, correspondingly a larger capacity is obtained than in an Elko with a smooth foil and equal dimensions.

Polypropylene-**Cs** are concerning dielectric absorption and **tan** δ even better than the two aforementioned types, but because of the lower dielectric constant the dimensions are a bit bigger.

One, in addition to the standard Elkos (with a plus- and a minus connection), less common Elko-version is the bipolar specification. It can be again divided into two types, the ones with rough and the ones with smooth electrode foil. For both the level of tolerance is symmetrical (normal are +/- 10%), the characteristics are a bit better than for normal Elkos. Both **tan** δ and the dielectric absorption of all Elko-types is pretty big.