

Moisture Tolerance

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MIDEL 7131 has a very high moisture tolerance. This means it can absorb far greater amounts of water than mineral oil and silicone liquid without compromising its dielectric properties. MIDEL 7131 can also trap more water which may slow down cellulose ageing. In the case of mineral oil, there is a danger that this water will be released as condensation.

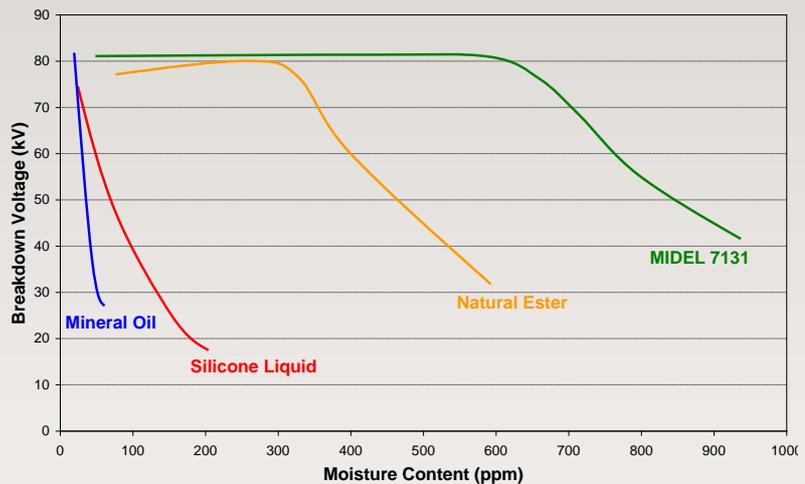
Why Moisture Tolerance Is Important in Transformers:

- ▶ Dielectric strength - reduces as moisture content increase
- ▶ Rate of paper ageing - increases with higher moisture content
- ▶ Bubble formation during overloads - bubbles form at a lower temperature when there is a high moisture content in the paper
- ▶ Condensation during cool down - risk of release of free water from mineral oil

Dielectric Strength

Figure 1 shows the breakdown voltage at ambient temperature of MIDEL 7131, natural ester, mineral oil and silicone liquid with increasing moisture levels. It clearly illustrates that even a small amount of water in mineral oil and silicone liquid cause a rapid deterioration in breakdown voltage. In contrast, MIDEL 7131 maintains a high breakdown voltage of >75kV even when moisture levels exceed 600ppm.

Figure 1 - Breakdown Voltage vs. Moisture Content at 20°C (IEC 60156 2.5mm)



Rate of Paper Ageing

The rate of paper ageing is directly related to the water content. Various studies have shown that the lifetime of the paper reduces by as much as a factor of ten for each extra 1% of water content in the cellulose. As the cellulose ages it releases water, thus accelerating the ageing process. Therefore it is vital that cellulose is kept as dry as possible.

MIDEL 7131 has the ability to trap more moisture than mineral oil, which can reduce the amount of water in the paper and hence reduce the ageing rate.

Using moisture equilibrium curves it is possible to show that for MIDEL 7131 at 60°C, water content in fluid of 200ppm would equate to water content in the cellulose of 1.1%. At the same temperature, mineral oil with a water content of 20ppm would lead to water content in the cellulose of 2.6%. The extra 1.5% of moisture would equate to at least a tenfold decrease in the life of the cellulose.

Bubble Evolution During Overloads

Bubbles in dielectric fluids are undesirable since they are electrically weak. According to IEC 60076-14, bubble evolution temperature is directly related to the moisture content of cellulose. During overload conditions the temperature of paper wrapped conductors will rise, increasing the risk of reaching critical temperatures for bubble evolution. For example, with a paper water content of 2.6% the temperature at which bubbles form will be 130°C. With a water content of 1.1% the bubble evolution temperature is 165°C. Since MIDEL 7131 has the ability to keep paper drier it gives a greater margin of safety during overloads.