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IsoTec SE 300

Fluid Maintenance Guide – Distribution Transformers

General

IsoTec SE 300 is an extremely stable fluid with a long service life—even under the most demanding operating conditions. Similar to mineral oils, various fluid parameters of IsoTec SE 300 can be monitored throughout the transformer's lifetime to ensure consistently high performance. Regular fluid analysis also offers the advantage of detecting potential transformer issues early, before any equipment failure occurs.

In general, it is recommended to take fluid samples from distribution transformers initially before commissioning, then after the first year of operation, and subsequently at five-year intervals. For larger network transformers, heavily loaded, or particularly critical units, more frequent sampling may be appropriate.

When performing fluid tests during maintenance, it is important to consider the fundamental differences between IsoTec SE 300 and mineral oils. Many laboratories now have extensive experience analyzing IsoTec SE 300. However, applying incorrect mineral oil limits can sometimes incorrectly indicate a problem in a sample.

Table 1 provides an overview of the typical fluid test parameters according to IEC 61203 "Synthetic organic esters for electrical purposes – Guide for maintenance of transformer esters in equipment." However, this guide and the IEC 61203 standards do not apply to refilled transformers, i.e., transformers that were previously filled with a different fluid.

Tabelle 1 - General Test Parameters and Guidance Limits

Parameter	***Test Method***	***IEC 61203***
Appearance	IEC 61203 3.1	Clear, no visible contamination
Water Content*	IEC 60814	max. 400 ppm
Neutralization Value	IEC 61099 9.11	max. 2,0 mg KOH/g
Breakdown Voltage	IEC 60156	min. 30 kV
Flash Point	ISO 2592	min. 300 °C

*At room temperature

Breakdown Voltage Testing

The breakdown voltage of new IsoTec SE 300 typically exceeds 75 kV, measured using the 2.5 mm gap method according to IEC 60156. Studies show that even after prolonged aging, only minor reductions in breakdown voltage occur. Even under high moisture conditions (up to 1000 ppm at ambient temperature), the breakdown voltage during operation remains above the lower limit of 30 kV.

Certain factors can reduce breakdown voltage, such as fine particulate matter in the fluid. These particles can float between the test electrodes and create local weaknesses during breakdown testing. Signs of particulate contamination usually appear as inconsistent results across multiple system failures. If fine particles are suspected to have caused the failure, the fluid can be filtered through fine paper and retested.

Another potential issue arises if the fluid does not settle sufficiently between individual breakdown tests. In this case, gas bubbles generated by the arc do not have enough time to disperse, creating a weak spot between the electrodes. Typically, six breakdown tests are performed. It is recommended to wait at least ten minutes before the first test to allow the fluid to settle. Between subsequent tests, a five-minute interval should be observed to ensure even distribution of gas bubbles.

Flash Point Testing

Flash Point Testing can be used to determine whether IsoTec SE 300 has been contaminated with a lower flash point fluid, such as mineral oil. However, the flash point provides less information about the condition of the fluid compared to other tests, such as the neutralization value. If cross-contamination is not possible, routine flash point tests are not necessary.

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DGA and Furan Analysis

The diagnosis of transformer performance using conventional Dissolved Gas Analysis (DGA) and Furan Analysis remains applicable for transformers filled with IsoTec SE 300. DGA methods originally developed for mineral oil can generally also be used for IsoTec SE 300, but they require minor adjustments to the limits in the Duval Triangle and to the tabular ratios. For further information, please contact the technical department of IsoTec SE 300 at: info@isotec.bio