High-precision remaining life assessment services for oil-filled transformers

Winner of PM Excellent Product Award (Development Award) from Japan Institute of Plant Maintenance
Winner of Technical Achievement Award (Development Award) from Japan Electrical Manufacturers’ Association

Do you have any transformers in use for more than 25 years? The service life expectancy of a transformer is 30 years.

“The damage from accidents caused by aging deterioration is huge.”
“If it’s still usable, that’s already a sign of danger.”

At Fuji Electric
“We can very precisely predict the remaining service life using our own structured neural networks.”

Structured neural networks

Fuji Electric’s proprietary prediction and diagnosis technology was developed to be more highly precise and uses a modified neural network technique capable of learning complex multivariate relationships and automatically tuning the structure of the model.

We have a proven track record that includes forecasting electricity demand and optimizing energy plant operations.

Predicting remaining service life using structured neural networks

Conventional method (Furfural method)

Method using structured neural networks

Problem: The estimation range of the average degree of polymerization residual rate corresponding to the amount of furfural A is wide [(1) to (2)].

Conventional method
(average prediction range)

Structured neural network method
(average prediction range)

15 years
3 years

JEM1463 is the evaluation criteria for the average degree of polymerization for transformer insulation paper. (Evaluation criteria for the average degree of polymerization of the insulation paper used for the coil of an oil-filled transformer over 1,000 kVA.)
Flow of remaining service life assessment

Intended mainly for transformers with more than 15 years of operation.

1. Extraction of 1 liter of oil from transformer
2. Oil analysis
   - Analysis of gas in oil
   - Examination of oil characteristics
   - Furural analysis
3. Estimation of average degree of polymerization using structured neural networks
4. Remaining service life prediction

Inspection cycle and replacements timing

<table>
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<tr>
<th>Classification</th>
<th>Part</th>
<th>Inspection cycle and replacements timing</th>
<th>Considerations</th>
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</thead>
<tbody>
<tr>
<td>Parts in oil</td>
<td>Inside main unit</td>
<td>Consider an internal inspection depending on the result of an oil gas analysis performed once every 1 to 2 years.</td>
<td></td>
</tr>
<tr>
<td>Oil sealed units</td>
<td>Gasket seal section</td>
<td>Test replacements of gaskets about every 15 years.</td>
<td></td>
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<tr>
<td>Air access fittings</td>
<td>Protection relay type parts</td>
<td>Replace units in 15 years.</td>
<td></td>
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<tr>
<td>Mechanical wear parts</td>
<td>Coating due to overheating</td>
<td>Test replacements for bearings are critical.</td>
<td></td>
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<tr>
<td>Loaded tap changers (LTCs)</td>
<td></td>
<td>Replace at every switching frequency of 10,000 to 15,000 times.</td>
<td></td>
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</tbody>
</table>

We will respond promptly.

Typical schedule: Oil extraction, oil analysis: 5 days
Remaining service life prediction: 2 days

Our diagnosis experience

As of the end of March 2013 we have diagnosed 992 transformers (of which 30% were competitors' products). As a result, the diagnosis results helped our customers to make replacements plans or to review maintenance plans and we won a reputation for our diagnosis services that can be utilized effectively to create optimal maintenance and replacements plans.

Fuji Electric has presented on its structured neural networks and high-precision remaining service life assessment for oil-filled transformers at various academic conferences.

- "Deterioration diagnosis method for oil-filled electrical equipment" *
- "Remaining service life estimation method for oil-filled electrical equipment" *

*: Patent pending

Safety precautions

Note: Before using this product, in order to use it correctly, be sure to carefully read the Instruction Manual and Specifications, or contact our company or your dealer for information as necessary.

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