Transformer Oil
Generator Transformer, De-gassing

CLEAN OIL
BRIGHT IDEAS

CJC™ Application Study

Application Study written by:

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CUSTOMER
Hafslund Produksjon Holding AS, Vamma Kraftstasjon, power station in Glomma Vassdraget.

THE SYSTEM
Generator transformer T08, 15 MVA-53.9/5kV, serial no./year: T-41391/1963, 5.8 t oil.

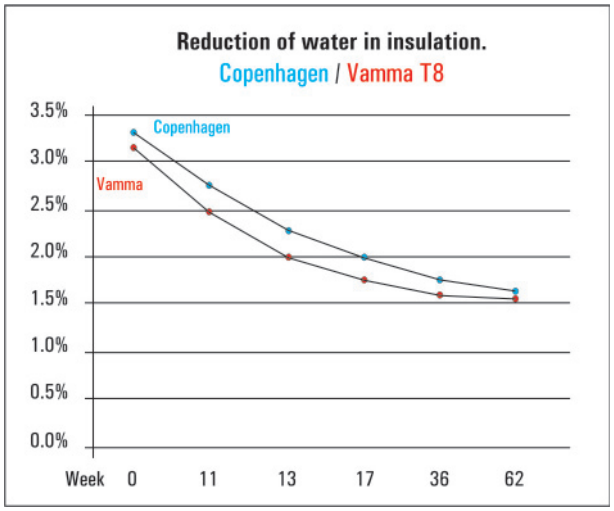
THE PROBLEM
The level of water found in the transformer oil indicated that the cellulose insulation on the windings had a water content of more than 3 per cent. When the oil was changed in 1985 it was in reasonably good condition and it became the objective to obtain this situation again.

THE SOLUTION
The first stage was the installation of a **CJC™ Mobile Off-line Fine Filter HDU 27/108 MZ** to remove contamination and particles from the transformer oil. This was followed by connecting a **CJC™ V30 Vacuum Filter** for continuous de-gassing and drying of the cellulose insulation in the transformer. These measures were undertaken as part of an agreement between Hafslund and Øwre-Johnsen for a test period of three months in which improvements in water and contamination levels had to be measured.

THE RESULT
After only 85 days of operation the water content was reduced from 3.2% to 2.5%. This meant that the CJC™ V30 Vacuum Filter unit had removed 3 litres of water from 600 kg of insulation material. Comparing this with data from similar transformers the graph (see right) shows the time required for drying to the required level. Verification was undertaken using the indirect method, IDA 200 and measurement of water in the insulation materials. The measurement of the gassing rate was carried out by E-CO Tech, GE, Cotax and Grestad Diagnostikk & Rehabilitering AS.

THE CONCLUSION
It is commonly accepted that the lifetime of the cellulose insulation is equal to the lifetime of the transformer. Heat, water, oxygen and acid oxidation residues from the oil all affect the ageing of the cellulose insulation. The main objective of continuous de-gassing and filtration is to extend the lifetime of the cellulose insulation by reducing dissolved oxygen in the oil, reducing the water content in the cellulose insulation and the oil, and removing the water-soluble acids.

In the test period the V30 vacuum filter drew oil from the bottom of the transformer and returned the oil to the reservoir. After the test period the procedure was changed, the oil was now drawn from the top of the transformer and returned to the bottom. This change has increased the efficiency of both the drying and removal of oxygen. Oxygen came well under the critical limit of 2000 µl/l. The T08 transformer can now be designated oxygen-free, see ageing graph (ASEA).



THE RESULT

Reduction of gasses in 85 days		
Gas type	**At start up µl/l**	**After 85 days µl/l**
H_2	17.0	1.9
O_2	20,301	7,252
N_2	73,150	23,427
CH_4	21.7	0.9
CO	610	2.5
CO_2	12,560	87.3
C_2H_4	31.2	0.3
C_2H_6	25.4	0.1
C_2H_2	0.1	0.06
$C_3H_8 + C_3H_6$	48.7	0.2

COMMENTS

Mr. Tore Grestad, Consultant:
"A successful project has been finished. It was successful in both the reduction of the water content in the cellulose as well as for the effectiveness of the condition monitoring".

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