Transformer Population Management

➔The transformer all over the world is nearing the end of its lifetime. This will mean that urgent actions are required to optimize your transformer fleet performance through higher availability.

➔Ageing assets, ever rising energy demand, the need to deliver without outage are all issues facing the utilities and industries everywhere. Financial constraints will demand an increased return on investment over reduced maintenance or replacement budgets.

➔*Ing Georg P. Daemisch of DTC [Daemisch Transformer Consult] has the expertise to provide you with a wide range of services and solutions that will help you derive optimized performance levels from your entire fleet of transformers over its lifetime. We adopt sophisticated evaluation criteria, modeling techniques and advanced computer software to achieve this end. In effect, we will be able to tell you very much in advance precisely what levels of repairs or maintenance or replacements are to be done and at what time.*

Fleet Screening:

➔Large fleets of transformers will be evaluated using data that is already available with you such as years in operation, application, gas in oil, maintenance and failure history and the like. The aim of this screening is to obtain a ranking for the population based on technical and economical criteria. Transformers will be ranked as High Risk, Medium Risk, Low Risk and No Risk. Transformers that require further evaluation will be identified that will lead to the next step: Standard Evaluation.

Standard Evaluation:

➔Those transformers falling under High Risk will be selected for further detailed, elaborate analysis. This will encompass reviews of design parameters, visual inspection reports, monitoring devices, diagnostic data and other relevant parameters. The life management decision for this step will be based on both technical and non-technical issues. The technical aspects will include assessing separately thermal, mechanical and electrical properties for the transformer as well as accessories while the non-technical aspects will be economic, strategic and environmental.

➔Valuable conclusions and recommendations can be drawn based on each of the aspects above-mentioned. We will then be able to define the quantum of repair, maintenance or retrofit work that will be necessary.

Advanced Evaluation:

➔For Advanced Evaluation, the number of transformers will further be reduced. This evaluation will incorporate information gathered rom aforesaid information besides advanced calculations, simulations, root cause analysis and other techniques. Advanced diagnostics also will be performed such as Dissolved Gas Analysis [DGA], including On-Line gas monitoring, Re-saturation behavior, FURAN analysis, Frequency Response Analysis [FRA], Dielectric Spectroscopy and Partial Discharge Measurements.

➔The advanced evaluation will provide a very solid understanding of each transformer condition. The output of such an evaluation will influence your decision making as to whether the unit has to be maintained, repaired, retrofitted or completely replaced.

Maintenance Programs:

Basic Maintenance:

➔To ensure that a transformer operates reliably, it is important to do routine maintenance when the unit is in service. The basic maintenance will include visual inspections, checking silica-gel status, checking oil leakages, checking cleanliness of bushings, checking pumps, fans, motors and other accessories. This will not need an expert; only basic transformer knowledge will be sufficient.

Advanced maintenance:

➔Advanced Maintenance Program offered will include oil cleaning, active part cleaning and drying, and re-clamping of the windings.

Monitoring:

➔If a unit is found to be in a critical condition but still usable, it may be recommended to instal a suitable monitoring device. This will help to detect potential faults as well help the customer to effectively plan their maintenance for optimization of performance of the equipment. Transformer accessories such as tap changer and bushings should also be monitored. The output from the installed monitoring device will give an indication when such maintenance or repairs will have to be undertaken.

Repair and Retrofit:

➔Those transformers that are identified as High Risk will need to be repaired or retrofitted with reliable components that will increase the availability of the units. Expert advice will be helpful to achieve this end.

➔DTC is well equipped to undertake the population management of your entire transformer fleet. You will find them highly proficient and quite economical too.

Look at what it offers you:

➔It offers a clear understanding of the condition of your transformer fleet and accurate information on possible risks associated with each and every unit in the fleet.

➔It has the ability to draw alternative asset management scenarios based on your strategy and the condition of your fleet.

➔It can define actions to be taken for each specific asset and evaluate pay-back or net present value for each of the scenario in consideration with diverse technical and economical aspects.

➔It can help implement defined actions by using efficient maintenance, repair, retrofit or replacement decisions.

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Is your transformer dying

➔Transformers constitute the single largest equipment investment in the power generation system and the grid. They also are the most critical equipments because any failure to these can be catastrophic in terms of loss of asset and consequent revenue loss.

➔With the advent of the de-regulation of the power industry throughout the world, power generation has witnessed an enormous surge in capacity. However, enough consideration has not been given to a corresponding increase in both transmission and distribution infrastructure.

➔The result is that, everywhere, the transformer has ultimately been made to bear the over-load even though it was not originally been designed to do that. This phenomenon has led to a very severe strain on transformers, resulting in substantial degradation of quality and reliability of power delivery.

➔In olden days, obviously, transformers were more ruggedly built. They were over-insulated. They were built to last as much as half a century! And, they indeed were subjected to much less stress and negligence than today.

➔As competition became more severe in the market-place and as computer-based techniques became the norm in transformer design, compromises came to be accepted on otherwise very rigid specifications. This was done with a view to achieve substantial reduction in manufacturing costs as well as to advance delivery schedules.

➔The world over, a major share of the transformer population has outlived their designed life. These are almost on the verge of collapse. In transformers, problems lie dormant over very long periods of time without any visible manifestations and suddenly these pop up to the surface. By then, unfortunately, irreparable, irrevocable damage has already happened.

➔Transformers do not last forever. Transformer insurers have carried out elaborate, systematic, studies on the possibility of transformer failures, particularly relating to those that were installed in the 1970s or earlier. According to them, a minimum of 10% of these transformers would fail within the next 12 months at present levels of loading.

➔Unexpected transformer failures can be catastrophic. Think of the replacement cost of the transformer. Think of the revenue loss on account of power delivery disruption. Think of the loss of your reputation which in fact is your most important asset! Think of the time it will take before you get up and start running again!

You now will ask two questions:

➔*Is it possible to predict transformer failures?*

➔*Is it possible to prevent transformer failures?*

➔Luckily for you, the answer to both these questions is a firm “yes”. This answer is subject to your assessing precisely the ageing condition of your transformers and adopting appropriate measures to arrest further deterioration and ageing. Most kinds of failures can be reduced if detected early enough.

➔Traditional transformer assessment methods will not provide you with a true picture of the real inside condition of the equipment. The results mostly are ambiguous. Any preventive measures based on such flawed data can only lead you to disastrous results.

➔Your transformer is a very expensive equipment. It is highly complex and critical too. All the time, complex chemical processes take place inside the same. If you want to get optimum performance from this equipment, you must be armed with correct, authoritative information on what actually is happening inside it.

➔*Daemisch Transformer Consult can help your engineers as well as technicians to diagnose correctly these internal processes and arm them with necessary skills in the undertaking of appropriate diagnostic as well as treatment procedures. In effect, your people will acquire all the expertise necessary to keep your transformers running at peak levels of performance.*

Georg P. Daemisch

WorkShop Profile

This training is designed to impart a no-nonsense and very practical information and guidance essential for the effective management of transformers.

All the relevant facts needed to understand the complex processes that lead to the death of a transformer as well as measures available to counter these adverse chemical processes will be discussed in great detail.

The life of oil filled transformers is purely a matter of chemistry. This fact is little known and is generally neglected by transformer owners. On the other hand, transformer manufacturers have capitalized on their knowledge of this chemistry for many years. This training will attempt to answer and demystify these matters thread-bare.

This training will help you to:

➔Fully appreciate the processes that combine and contribute to the ageing of a transformer.
➔Appreciate new oil analysis methods, strategies and technologies in the field of transformer care.
➔Appreciate current analysis methods in terms of the quality, accuracy and relevancy of the information supplied.
➔Assess the condition of your transformer as a whole and not just the condition of the insulating oil in the transformer.
➔Develop a maintenance strategy applicable to your transformer in particular.
➔Understanding and caring for uninhibited napthenic insulating oils.
➔Understanding cellulose and how best to keep it healthy.
➔Understanding and evaluating various transformer treatment systems available. The pros and cons of these systems will be discussed in-depth.

How to read an oil analysis report?

Reading and evaluating the oil analysis report can be an overwhelming and sometimes seemingly impossible task. This training will help your people to understand the results and also to evaluate them objectively so as to enable you to plan appropriate maintenance strategies in advance.

Understanding Oxidation Products:
As the oil in your transformer ages, it oxidizes and begins to break down, producing aldehydes and peroxides. These bind together and form sludge. This sludge attacks the chemical bonds that hold the cellulose insulation together [measured by polymerization]. When the oil's neutralization number [NN] reaches a particular low level, the cellulose insulation has already become weak.

Since the cellulose insulation in any transformer can only be replaced with a rewind, it makes better sense to remove the oxidation by-products before they can do any substantial damage to the cellulose. How best to deal with such a situation will be examined.

➔*What they are?*
➔*How do they behave?*
➔*How best you can deal with them?*
➔*How to develop a maintenance strategy applicable to your transformer population in particular?*

Various Maintenance Choices available and the relevancy thereof:

Breakdown Maintenance:

Nothing is done until the transformer fails.

Scheduled Maintenance:

Inspections, Replacements, Re-Conditioning and Repairs are scheduled, hopefully much ahead of anticipated failures.

Predictive Maintenance:

This strategy is based on monitoring, where the aim is to detect and monitor incipient faults before break down occurs or expensive repairs are required.

Proactive Maintenance:

This is an advanced form of maintenance where the root causes of failure are identified and monitored.

WorkShop Agenda:

➔Transformer Design.
➔Transformer Oil Characteristics.
➔Transformer Oil Behavior.
➔Measuring Transformer Life.
➔Factory Electrical Tests.
➔Field Electrical Tests.
➔Testing of Transformer Oil.
➔Dissolved Gas Analysis vs Fault Gas Detection.
➔Water in Transformers.
➔Interpretation of Oil Analysis Data.
➔Reclaiming Oil in Energized Transformers.
➔Life Maintenance Program for Transformers.
➔Choosing the right Maintenance Strategy.
➔Evaluation of Oil Test Data of your transformers.
➔Actual Case Studies.

New Transformers:

➔Specification
➔Mechanical Design
➔Cooling Systems
➔Auxiliaries.

Tests in Transformer Workshop:

➔Fingerprints and 0-Values before transport and installation using FRA, FDS or other suitable dielectric measurements.
Tests after Installation:
➔Fingerprints and 0-Values after transport and installation using FRA, FDS or other suitable dielectric measurements for comparison with the pre-shipment workshop tests and detecting of transport and installation failures.
➔Control of design and workshop tests by using on-line gas monitoring systems for start-up fingerprints.

Evaluation of Existing transformers:

➔Transformers below design life limit [15-30 years].
➔Regular tests of Electrical, Mechanical and Thermal Soundness.
➔Using apart of classical oil tests, DGA, On-Line Gas Monitoring, FRA, FDS and or other suitable dielectric measurements.
➔Residual Life-Time Strength.
Transformers after design life limit [15-30 years] or with obvious Premature Ageing Symptoms.
➔The Ageing Procedure.
➔The Ageing Symptoms.
➔Evaluation of condition [using apart of classical oil tests, DGA, On-Line Gas Monitoring, FRA, FDS and or other suitable dielectric measurements.
➔Life management.
➔Conservation using Oil Regeneration, Gas and water conditioning.

Transformer Population Management [TPM]

➔Residual life-time strength of transformer populations.
➔Planning of TPM Procedures.
➔Implementing of TPM Procedures.
➔Control and support of TPM Procedures.
➔Application of Conservation Systems.
➔Questions and Answers.

Georg P. Daemisch

Ing. Georg P. Daemisch exclusively specializes in providing consultancy services in the areas of assessment, ageing behavior, life enhancement and substance evaluation of medium to very large transformers. In various countries, he has provided consultancy services to a large number of transformer fleet owners. He has also conducted largely attended workshops on Over Aged Transformers.

Selected Projects:

➔Lifetime conservation of a 220 KV/250MVA transformer of Eolic Generation Parc.
➔Application planning for recovering and conservation of a transformer population in an aluminum smelter of VAW - Germany - 34 Transformers.
➔Assessment planning of long term lifetime optimization of the transformer population in an aluminum smelter plant of Hydro Alu in Germany.
➔Application planning for recovering and conservation of a transformer population in an aluminum smelter of Pechiney-Greece.
➔Application planning for recovering and conservation of a transformer population in an aluminum smelter of Pechiney-France.
➔Evaluation and assessment planning of a defined transformer population in a regional network of EON-Germany.
➔Assessment consulting for 300MW power plant generator transformers of EON-Germany.
➔Assessment consulting for hydro power plant generator transformers of EON-Wasserkraft-Germany.
➔Assessment consulting for defined transformer population for aluminum smelter transformers of National Aluminum Co Ltd-India.
➔Assessment consulting for defined transformer population of a very large chemical plant-Solvay-Spain.
➔Assessment consulting for defined transformer population of a very large nickel smelting plant of PT Nickel-Indonesia. More than 50 large transformers including 4 submerged arc furnace transformers.
➔Assessment consulting for 400MVA generator transformers of TAVANIR-Iran-Ramin Power Plant.
➔Assessment consulting with conservation and reliability survey for the industrial power plant of Thyssen-Krupp-Germany consisting of 8 transformers of 10 to 225MVA in Duisberg Ruhrort.
➔Assessment consulting with conservation and reliability survey for the industrial power plant of Thyssen-Krupp-Germany consisting of 12 transformers of 10 to 225MVA in Duisburg Hamborn.
➔Assessment consulting for 350MW power plant generator transformers of Vattenfall-Germany.
➔Assessment consulting for industrial power plant transformers of TOTAL-France.
➔Regular assessment for Voest-Alpine -Austria [VA-TECH] for transformer population.
➔Regular assessment of transformer population of paper division and cellulose mill of Norske-Skog.
➔Assessment consulting for power plant generator transformers of Austrian Hydro Power-Austria.
➔Evaluation assessment of transformers of Tenga Nasional Berhard [TNB]-Malaysia.
➔Assessment consulting for 90MW arc furnace transformers of BSW-Germany.
➔Assessment of a large transformer [120MVA-220KV] failure at Delhi Transco-India.
➔Evaluation assessment of a large transformer population at Durgapur Steel Plant-India.
➔Assessment consulting for 200MW grid transformers at RWE-Germany.

Major Seminars & Workshops.

Conducted major seminars and workshops on Over-Aged Transformers in following Indian cities.
➔*New Delhi.*
➔*Hyderabad.*
➔*Kolkata.*
➔*Bangalore.*

In the recent past, conducted dedicated In-House Transformer Training courses for following:

➔National Aluminum Co Ltd-India. 3.50.000 TPY smelter.
➔Durgapur Steel Plant-India. 2 million TPY plant.
➔Dubai Electricity & Water Authority-Dubai.
➔Shuweihat Power Plant-Ruwais-Abu Dhabi. 1800MW.
➔Madras Aluminum Company Limited.

Conferences-Speaker:

➔2001-International Conference-Technical University-Ilmenau-Germany.
➔2001-17th Electrical Conference-Tehran-Iran.
➔2002-International Symposium on Over Aged Transformers-Regensburg-Germany.
➔2002-Eurotechcon-Birmingham-UK.
➔2003-International Conference-Technical University-Ilmenau-Germany.
➔2003-18th Electrical Conference-Tehran-Iran.
➔2003-Eurotechcon-Manchester.
➔2003-19th Electrical Conference-Tehran-Iran.
➔2004-TecCon Conference-San Antonio-Texas-USA.
➔2004-International Symposium on Over Aged Transformers-Regensburg-Germany-Main Speaker.
➔2004-VDE Conference-Colonia-Germany.
➔2005-EuroTechCon-Manchester-UK.

Papers-Articles:

➔Treatment of Oil Immersed Power Transformers.
➔On-Line Drying of Transformers.
➔The Aged Transformer.
➔Geriatry of Transformers.
➔The Over-Aged Transformer [Updated].
➔Geriatry of Transformers [Updated].
➔Vacuum Based Treatment of Transformer Oil.
➔Gas in Oil Analysis.
➔Drying of Transformers.
➔Prevention of Transformer Ageing.

Work Experience:

➔Maschinenfabrik Reihausen.
➔BBC Mannheim.
➔ABB.
➔TrafoUnion.
➔Siemens-AG.

Education:

➔M.Sc.Electrical Power Engineering-Karlsruhe-Germany