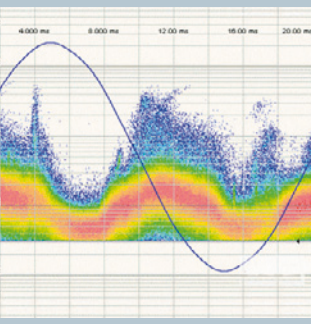

SITRAM® DIAG

Evaluating the condition of individual transformers and complete installed populations

Siemens Transformer Lifecycle Management™
A unique set of solutions, combined with the experience and expertise of the leading transformer manufacturer helps maintain the operation of your transformers at its maximum level.
Power Transformers are long lasting capital investment goods. Purchasing and replacement require long periods of engineering planning, resource and procurement. Each individual conception is specifically adapted to the individual requirements. The corresponding high replacement value and long delivery time are important considerations for the end customer.

The Solutions
Maintaining your individual power transformers or your entire transformer fleet at maximum operational level, is the prime objective of the Siemens TLM™ set of solutions. For that the most effective SITRAM® Lifecycle set of solutions apply independently of the original manufacturer, and the age of the equipment.

The Situation
In most countries over 70 % of transformers have been in service greater than 25 years. The average life of power transformers in operation is exceeding the design-life in an increasing number of cases. The majority of redundancies have been utilized for normal operation, and spare units are often unavailable. More often than not, transformers are being loaded up to, if not beyond their nameplate rating for longer periods.

Prior to any corrective or preventive maintenance the knowledge about the actual condition of each transformer in a fleet is a most evident necessity. A comprehensive knowledge of the electrical, chemical and mechanical condition is recommended.
Based on the results of the condition assessment program SITRAM DIAG, and based on economic considerations a carefully studied action-plan is being elaborated by the transformer experts. This action plan is suggesting the for each transformer individually adapted maintenance, refurbishment or replacement recommendation, if needed. Ultimately, any decision made avoids unplanned failures, outages and significant damages, and also fully optimizes the capability of the transformer.

SITRAM® DIAG Diagnostics and Condition Assessment
The SITRAM DIAG program consists of three layers:
Level 1: ESSENTIAL
Level 2: ADVANCED
Level 3: HIGH VOLTAGE TESTING

SITRAM DIAG provides diagnostic modules for individual transformers and for the assessment of complete installed fleets and transformer populations. After performing the measurements on site experienced engineers will evaluate the data and will provide a comprehensive test report, with recommended actions for each unit. There will also be a ranking of the tested transformers in respect of operative risks and priority of recommended actions.

TLM™ – Transformer Lifecycle Management™
SITRAM® DIAG – Diagnostics

Answers for energy.

SIEMENS

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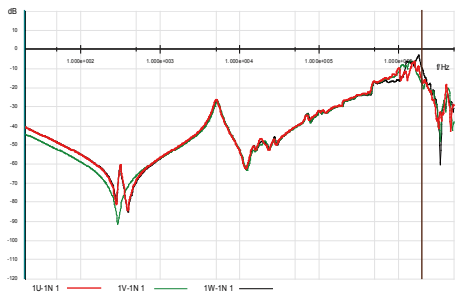
Oil testing, most powerful tool for the level 1 diagnosis



FRA measurement on a 840 MVA, GSU transformer

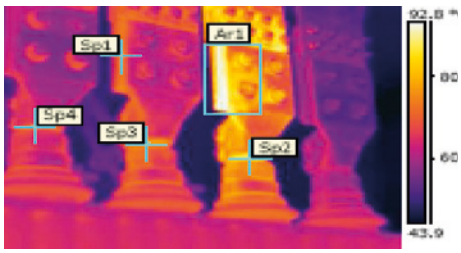
High-Voltage-Tests on-site in a nuclear power plant

SITRAM® DIAG – the Condition Asessment and Diagnistics Solution from Siemens TLM™

SITRAM® DIAG ESSENTIAL (Level 1)
All modules in the diagnosis Level 1 "ESSENTIAL" are to be applied on energized transformers. The most powerful toolbox for this application is the diagnosis of the insulating liquid. Standard oil tests, dissolved gas analysis and furanic components analysis are well developed and reliable to detect ageing and severe faults. Moisture measurement applied during the sample taking will provide reliable detection of the moisture content inside the transformer insulation.
Additional stand alone modules are available to be applied when the oil tests and/or the operating personnel gave indication for deficiencies or changes.

Content of Level 1 (ESSENTIAL):
- Standard oil test (8 –12 parameters)
- DGA
- Furanic components
- Moisture

Additional stand alone modules:
- PD (UHF-, acoustic sensors, corona camera)
- Noise measurement
- Vibration measurement
- Thermograph scans

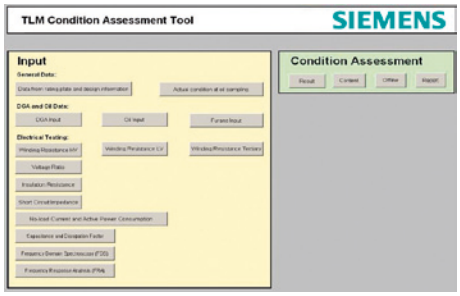


Additional module: thermograph scan

SITRAM® DIAG ADVANCED (Level 2)
The extended modules are applied on de-energized and disconnected transformers. Most measurements repeat the measurements as shown in the manufacturers test report and by comparing the results any differences will be highlighted. Modern methods such as Frequency Domain Spectroscopy (FDS) and Frequency Response Analysis (FRA) are part of a Level 2 assessment and provide information about the insulation (dielectric) condition as well as the mechanical condition (displacements) of the active part of a transformer.

Content of Level 2 (ADVANCED):
- Ratio and phase angle
- Winding resistance
- C-tan delta (windings and bushings)
- Insulation resistance and Polarization Index (PI)
- Impedance
- No load current and losses at low voltage
- FDS/PDC
- FRA

Additional stand alone modules:
- All modules of Level 1 apply



SITRAM® DIAG results from our expert system

SITRAM® DIAG HIGH VOLTAGE TESTING (Level 3)
High-Voltage-Tests on-site is usually required following on-site repairs, factory repairs, refurbishment or relocation and also performed to assure the results from the level 1 and level 2 assessments. The SITRAM DIAG mobile test fields provides solutions for all kind of HV testing and loss (no load and/or short circuit losses) measurement. Heat runs or long duration tests are feasable depending on size and voltage level of the transformer under test. Level 3 assessment can be combined with all modules out of level 1 and level 2.
For more detailed information please see the product information "High Voltage Test System".

Content of Level 3 (HIGH VOLTAGE TESTING):
- Load losses
- No load losses and currents
- Applied overvoltage tests
- Induced overvoltage tests
- Partial discharge testing
- DC testing
- Heat runs
- Long duration tests

Additional stand alone modules:
- All modules of Level 1 and 2 apply

All Siemens TLM™ solutions are designed to add value to the operation of your equipment. With this, you are also improving the security for your operational staff, providing your asset- and maintenance managers with more safety and peace of mind.

The SITRAM® set of solutions
- SITRAM® DRY
- SITRAM® HVT
- SITRAM® Monitoring
- SITRAM® REG Oil Regeneration
- SITRAM® COOL Transviso Cooling

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The required technical options should therefore be specified in the contract.