



# SIEMENS

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*Ingenuity for life*

Customer Services for Transformers

## SITRAM DIAG

 On-site condition assessment

### Introduction

In most countries over 70% of transformers have been in service more 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. In addition, the corresponding high replacement value and long delivery time are important considerations for the end customer.

### Features

SITRAM DIAG provides diagnostic modules for individual transformers and for the assessment of complete installed fleets and transformer populations. Siemens SITRAM DIAG for transformers suits to electricity companies as well as industrial companies, independent from the manufacturer of the equipment or the age.

The SITRAM DIAG program consists of three layers:

- Level 1: ESSENTIAL
- Level 2: ADVANCED
- Level 3: HIGH VOLTAGE TESTING
- CAM: Condition Assessment Manager with fleet assessments and relevance check.

Each program consists of the following steps:

- Execution of the on-site investigations
- Evaluation of the historical data by experienced engineers and Siemens proprietary tool, the Condition Assessment Manager (CAM)
- Provision of a comprehensive test report with recommended actions for each unit
- Ranking of the tested transformers in respect of operative risks and priority of recommended actions with a graphical "fleet health" versus "relevance" presentation.

### Benefits

Siemens condition assessments provide the basis for a targeted maintenance strategy of critical transformers prior to any corrective or preventive maintenance:

- Objective assessment for transparent decision-making
- Comparable condition assessments
- Avoidance of unplanned failures, outages and significant damages
- Improved safety and security of operation
- Optimized utilization of the transformer

### Scope of work /deliverable

The results of our assessments are properly documented in reports:

- Standardized structure of reports and information, powered by the Condition Assessment Manager
- Online information availability



- Comprehensive audit information considering the condition assessment results (electrical, chemical and mechanical condition) and economic considerations per component
- Action plan for each transformer with individually adapted maintenance, refurbishment or replacement recommendations, considering the relevance and contingency plan for the unit.

#### Technical Details

A SITRAM DIAG assessment with our Condition Assessment Manager can include the following activities:

#### 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, complemented by visual inspection and thermographic scans. 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
- Visual inspection
- Evaluation of events, load history for the recent period and maintenance activities
- Additional stand alone modules:
  - PD (UHF, acoustic sensors, corona camera)
  - Noise measurement
  - Fan and Pumps vibration measurement
  - Thermograph scans

#### 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):

- Core de-magnetization
- Ratio and phase angle
- Winding resistance and impedance
- C-tan delta (windings and bushings)
- Insulation resistance and Polarization Index (PI)
- FDS/PDC
- FRA
- Additional stand alone modules
  - All modules of Level 1 apply

#### 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 provide solutions for all kind of HV testing and loss (no load and/or short circuit losses) measurement. Heat runs or long duration tests are feasible depending on size and voltage level of the transformer under test. Level 3 assessments can be combined with all modules out of level 1 and level 2.

#### Content of Level 3 (HIGH VOLTAGE TESTING):

- Load losses, no-load losses and currents
- Applied and 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

#### CONDITION ASSESSMENT MANAGER – CAM

All SITRAM DIAG levels are supported and powered by CAM - Condition Assessment Manager - tool developed by Siemens Transformers experts in order to collect the global experience for better transformers evaluation. These also consider the equipment relevance at the fleet for any customer application.

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Subject to change without prior notice. The information in this document contains general descriptions of the technical options available, which may not apply in all cases.

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