



High Temperature Power Transformer Models

Powertech Labs is offering a new thermal aging testing service for Power Transformer materials and components. The experimental results will provide insight concerning the expected service life of insulating fluids, paper, and other components designed to operate at high in-service temperatures. The thermal aging system is designed to be fully compatible with all types of insulating fluids and solid insulations. Custom transformer cores can be built upon request.

Degradation of Transformer Components

Components and materials present in electrical transformers naturally degrade as they age, and the extent of degradation increases when operating at high temperatures. Environmentally, climate change typically results in elevated operating temperatures, and in conjunction with higher experienced loads, greater in-service temperatures are an unavoidable reality.

Consequently, there is significant interest in developing materials and components capable of withstanding higher in-service temperatures.

Simulation of Thermal Aging

Typical industry standard thermal aging tests involve heating containers of sealed materials in an oven for extended periods of time (sealed tube test, IEEE C57.100). This method does not take into account many of the critical phenomena that are present in an in-service transformer, e.g., interactions between dissimilar materials, type and nature of headspace, pressure, and thermal cycling due to varying electrical loads, induced localized hot spots.

The new High Temperature Power Transformer Models (McNutt *et al.*) provides realistic in-service thermal aging without full-scale tests. A scaled-down power transformer core is placed in a tank and injected with high currents, simulating typical/expected operation. The transformer can maintain hot-spot temperatures up to 210°C, allowing for significant acceleration of thermal

aging. Novel or alternative insulating fluids, additives, sealing materials, and solid insulation can all be tested.

This system can provide insight regarding material or component degradation within weeks or months, instead of years in the field.

Additional features of the testing equipment include:

- Automatic temperature control to induce thermal cycling and simulate varying daily electrical loads.
- Variable headspace type: bladder, nitrogen blanket, open, or sealed system.
- Circulation of insulating fluid to simulate convection in the transformer tank.
- Optional simulated faults (thermal, partial discharge, arcing).

Thermoelectrical testing is supported by our world-class in-house chemistry laboratories which will provide more comprehensive information into the degradation and aging phenomenon via:

- Dissolved Gas Analysis (DGA)
- Paper Strength (Degree of Polymerization, Tensile)
- Volatile Compound Analysis
- Furanic and Phenolic Compound Analysis
- Moisture in Oil and Paper (offline) Analysis
- Flash Point and Fire Point
- Oil Quality (color, viscosity, etc.)

ABOUT POWERTECH LABS:

Powertech Labs Inc. is one of the largest testing and research laboratories in North America, situated in beautiful British Columbia, Canada. Our 11-acre facility offers 15 different testing labs for a one-stop-shop approach to managing electrical utilities, and testing gas components, pressure vessels and systems.

Outside of the utilities industry, Powertech provides routine testing capabilities, product development, research and consulting services to support an array of industrial-type operations, electrical equipment manufacturers and automotive original equipment manufacturers.

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