

LABORATORY SERVICES

FOR HIGH & MEDIUM-VOLTAGE ROTATING MACHINES



Design and manufacturing problems can cause premature equipment failure. To minimize that risk, Doble's high-voltage laboratory offers a wide range of qualification and acceptance tests for medium-voltage and high-voltage rotating machines.

Doble's team has more than 100 years combined experience testing and evaluating generator and motor insulation systems, including large rotating machine stator bars and coils. Our laboratories can perform over 200 laboratory tests on both solid and liquid insulation and have been serving satisfied customers for over 80 years.

In addition to laboratory testing, Doble specialists have extensive field testing experience in power factor, partial discharge, electromagnetic signature analysis, EL CID and AC/DC Hi-Pot testing as well as visual inspection, condition assessment and failure investigation of generators, motors, transformers, cables and other power apparatus.

QUALIFICATION & QUALITY CONTROL OF MANUFACTURED COILS

- Voltage endurance test as per IEEE-1043 & IEEE-1553
- Thermal cycling test as per IEEE-1310
- Dissipation factor and tip-up test
- Partial discharge test
- Turn-to-turn insulation test
- AC Hi-Pot test for groundwall insulation integrity
- Dissection & microscopic examination of coils
- Customer technical specification preparation
- Independent factory inspections, material verification & quality conformance

VOLTAGE ENDURANCE TESTS

The voltage endurance test is performed according to IEEE-1043 and IEEE-1553. An AC high voltage is applied to the coils for 400 hours. The heaters are set to 90°C -120°C and thermocouples are placed in the heater plates to monitor temperature. Several diagnostic tests such as polarization index, Hi-Pot, partial discharge, dissipation factor and tip-up are carried out. To pass the test, the coils should not fail in less than 400 hours (time length depending on voltage). Failing the voltage endurance test can indicate a manufacturing quality issue even if similar coils have previously passed the voltage endurance test.

HIGH-VOLTAGE LABORATORY TESTING SOLUTIONS INCLUDE:

- AC 300 kV, DC 400 kV, Impulse 1,200 kV
- Different waveforms including lightning & switching impulses, power frequency, etc.
- Wide range of rotating machine stator bar tests include voltage endurance testing & thermal cycling
- Wide range of cable test including accelerated aging & thermal cycling

THERMAL CYCLING TESTS

The thermal cycling test is intended to simulate the thermal-mechanical ageing that the stator insulation system can experience due to severe cyclical duty.

The coils are heated by passing high currents through to cause a temperature increase over a certain time period (e.g. 40 oC to 155 oC). The current will be removed and the test objects will be brought to initial temperature using a controlled cooling fan; then the cycle is repeated (e.g. 500 times). Thermocouples will be placed on coils under test to monitor temperature.

Diagnostic tests such as partial discharge, dissipation factor and tip-up are carried out prior to this test and at several number of cycles in order to monitor and assess the degradation of the insulation during thermal cycling test. Thermal cycling test can be followed by a voltage endurance test on the same coils.

DIAGNOSTIC TESTS

- Visual inspection of coils to check for any defects, impressions or damages
- Tap test to check for any delaminations
- Surface partial discharge test (lights-out test)
- Surface resistivity measurement
- Insulation resistance and polarization index test as per IEEE 43-2000
- Dissipation factor and tip-up test
- Partial discharge test

TURN-TO-TURN INSULATION TESTS

An impulse test can be performed per IEEE 522-2004 to evaluate turn-to-turn insulation in multi-turn coils.

AC BREAKDOWN TESTS

Doble can perform insulation breakdown tests on stator coils and bars. The failure site can be dissected.

COIL DISSECTIONS

Dissection locations are chosen by an experienced generator insulation specialist to discover the weakest insulation spots. If a coil fails voltage endurance testing, a dissection is required at the failure location. A Doble specialist will determine the cause of failure based on knowledge and experience of the generator insulation system.

Microscopic examination on dissected samples can be conducted to check any manufacturing quality issues.



About Doble Power Services

Doble has been a trusted name in electric power diagnostic solutions for over 90 years. Doble's unique business proposition combines three elements—diagnostic test instruments, expert consulting and testing services, and the world's largest resource library of related knowledge—into complete diagnostic solutions. Doble Power Services leverages the resources of Doble's extensive library and experienced team of engineers to deliver the highest level of consulting services and knowledge-based solutions.

Why Doble Power Services?

Extensive Global Experience

Doble has more than 40 consulting engineers each with extensive experience in power systems engineering applications.

Independent Expert Opinion

Trust Doble's expert consulting & testing services for unbiased diagnosis and assessment of critical assets.

Doble Peer Review Process

When you hire Doble, you are hiring the shared experience of our entire engineering team. Each Doble field service report is reviewed by at least one other consulting engineer.

Doble KnowledgeBase

Provides valuable benchmark data for use in evaluating test results on your equipment.



Doble Engineering Company
Worldwide Headquarters
85 Walnut Street, Watertown, MA 02472 USA
tel +1 617 926 4900 | fax +1 617 926 0528
www.doble.com

Specifications are subject to change without notice.
Doble is an ISO 9001:2008 Certified Company.
Doble is an ESCO Technologies Company.
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