

Consulting and Testing Services

Circuit Breaker Services Overview

- Expert consulting services
- Condition assessment services
- Mechanical tests (timing and motion)
- Contact resistance measurement
- Arcing contact condition assessment
- SF6 gas analysis and tightness test
- Insulation power factor and capacitance test
- Test results analysis and report creation



Description

DV Power provides comprehensive consulting and testing services, expert diagnosis and condition assessment of different circuit breakers types. Our ability to carry out all specific tests on the different types of circuit breakers will lead to preventive actions and problem avoidance.

DV-Power Consulting Packages offer:

- Expert consulting services
- Condition assessment services
- Field testing services
- Laboratory services
- Resource library of circuit breakers data and test results

DV Power has wide range of test instruments necessary to perform all required tests on circuit breaker.

Expert Consulting Services

Extensive DV-Power experience in power systems engineering applications ensure the highest level of consulting services and hands-on experience through specific workshops and customer defined training needs.

Independent test witnessing includes creating a fingerprint of new circuit breaker prior to and after installation. Each field service report is reviewed by a team of consulting engineers.

Condition Assessment Services

Valuable and comprehensive benchmark data, collected during the years of extensive field testing, will help evaluating test results on your equipment and making conclusion about circuit breaker condition.

As an initial step of a condition assessment service process is the overview of past operations, maintenance practices, loading history and abnormal event service records. This data will give an overview of circuit breaker condition and provide a basis for additional investigations.

The benefit to the customer is a comprehensive report indicating areas of concern and recommendations.

Testing Services

Circuit breakers are the executive body of the protection system. Their reliability is crucial for the reliability of the entire power system. Because that the circuit breaker is inspected and tested on different occasions during its life (factory, commissioning and maintenance tests).

DV Power offers all required tests of the circuit breaker: timing, motion (travel), contact resistance measurement, arcing contact condition assessment, SF6 gas tightness test and dew point measurement, insulation power factor test, capacitance test and more other specific tests.

Timing & Motion Test for Function Verification

Timing test is the basic and most important test. By definition, a circuit breaker timing test is the process of measuring the mechanical operating times with the goal of verifying, analyzing and validating the proper function of the circuit breaker.



Figure 1. Circuit Breaker Analyzer CAT65

Timing measurement offers precious information on the state of the circuit breaker and allows, in most cases, the precise verification of the presence or absence of anomalies. But this information does not reveal condition of all circuit breaker parts individually. Other important information remains hidden from view. For example, to assess the condition of the damper (shock absorber), motion (travel) curve has to be obtained and analyzed.

From the motion curve, along with time measurement, a velocity or acceleration curve can be calculated in order to reveal even marginal changes that may have taken place in the breaker mechanics.

Using analysis tools available with DV-Win software, it is possible to determine, with remarkable accuracy, the nature of the problems that affect circuit breaker performance even before disassembling the apparatus.



Figure 2. Linear transducer mounting example

Resistance Measurement for Main Circuit Condition Verification

The main circuit resistance should be as small as possible (mainly in the range from 30-100 $\mu\Omega$ or lower than 10 $\mu\Omega$ for generator CB). Increased resistance indicates poor and worn contacts.

For this purpose DV Power has wide selection; from simple RMO devices with resistance measurement as main function up to advanced CAT devices, with built-in Micro Ohmmeter, which provides resistance measurement.

Why to Assess Arcing Contact Condition?

The arcing contacts are the most important part of the high voltage circuit breaker. Since electrical arc, which forms on the arcing contacts during breaker operation, cause extremely high temperatures in the breaking chamber, a fraction of the arcing contact material burns away during each operation. One of the consequences of material lost is that arcing contacts get shorter. Also, the surface of the arcing contacts is changed and that changing shape will reduce the dielectric strength of space between the arcing contacts. Arcing contacts worn out excessively means unreliable circuit breaker.



Figure 3. Arcing contacts: new (left) and worn (right)

Only effective way to assess the condition of arcing contacts without disassembling circuit breaker is Dynamic Resistance Measurement (DRM). DRM method measures variations in contact resistance during the breaker operation. The DRM test is performed by injecting high current through the breaker contacts and simultaneously monitoring the voltage drop between breaker terminals, as well as current flow during the operation of the breaker.

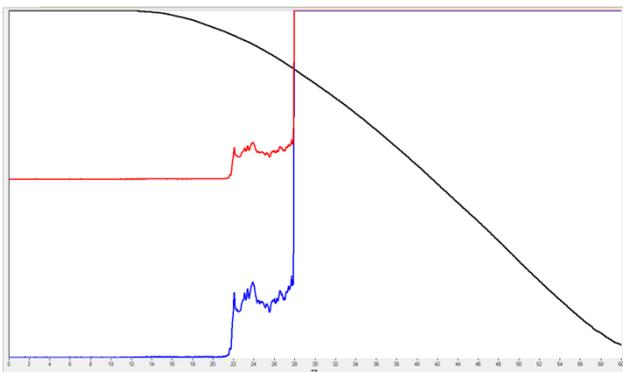


Figure 4. DRM graph: resistance and motion curve

Power Factor and Capacitance Test for Insulation Integrity Checking

Power factor (tan delta) and capacitance test provides means for verifying the integrity of the insulation for circuit breaker components.

High power factor readings on entrance bushings or grading capacitors (for circuit breakers having this) may be the result of deteriorated grading capacitors or, in some cases, surface leakage. If higher capacitance values occur, compared to prior tests, it could be the result of short-circuited sections of the grading capacitor. High losses on the column structure could be the result of moisture or surface leakage.

SF6 Gas Leakage Detection for Tightness Inspection

Using gas leak detectors (sniffers) or thermal imaging, SF6 leaks are searched. These may occur in any part of the breaker but are more commonly found where two parts are joined together such as valve fittings, bushings and flanges.

Dew Point Measurement for SF6 Gas Insulation Properties Analysis

A small amount of SF6 gas is vented from the breaker through a moisture/purity analyzer to determine the moisture and concentration of the gas. It is important that the moisture content inside an SF6 breaker is kept to a minimum as it can cause corrosion and flashovers inside the breaker. When there is arcing (i.e., faults or normal interruptions) inside of the circuit breaker, the SF6 combines with water to produce corrosive by-products. These weaken the insulation properties of SF6 and may cause rapid deterioration of a high-voltage circuit breaker.

DV Power cooperates with independent analytical laboratories and consulting firms specialized in diagnostic SF6 gas and other insulating materials used in power circuit breakers, that contributes to making detailed comprehensive conclusions about circuit breaker condition.

