

POWER FACTOR TESTING

Educational Series: Why Test?



Why Perform Power Factor Testing?

Most failures of electrical equipment are the result of a breakdown in the insulation system. Power factor testing is an effective way to detect defective electrical equipment insulation. Power factor is the ratio of the capacitive or 'charging' current (measured in volt-amperes) to resistive or 'leakage' current (measured in watts). It is a means of measuring insulation integrity since the smaller the power factor, the better the insulator.

Insulation may be deteriorating, however, the equipment may not fail for some time. Although this condition represents a serious hazard, if deteriorated insulation is detected before failure, it can often be reconditioned rather than being replaced. This allows corrective action to be taken during a planned outage before extensive equipment damage results from insulation failure.

Power factor testing also makes it possible to detect equipment insulation problems without making an internal visual inspection. The result is a significant decrease in maintenance cost and downtime. Power factor testing is one of the best testing techniques for predictive and preventive maintenance.

What are the Test Procedures?

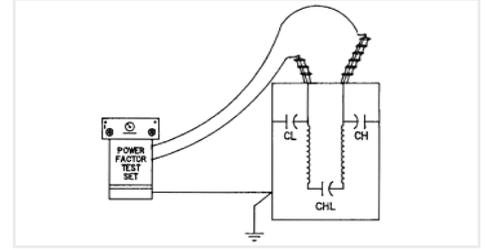
Once the equipment is taken out of service, an AC voltage at or below the normal rating is placed on the equipment conductors. At the same time, the dielectric losses to ground are measured. After correcting the field measurements to standard conditions, the test results are then compared to guides which list proper values for specific types of equipment and insulations. These guides are contained in an extensive data library compiled by testing thousands of similar types of equipment in the field and at the factory.

If an abnormal condition is indicated, a number of special tests may be used to localize the problem. These include hot guard tests, hot collar tests, ungrounded specimen tests, cross check tests, oil tests, and dielectric loss tests on wood members.

What Types of Equipment are Tested?

The most frequent applications of power factor testing include medium and high voltage transformers and circuit breakers. Other equipment such as bushings, reclosers, switches, cables, capacitors, lightning arrestors, liquid insulation, potheads, rotating machinery, and voltage regulators may also be power factor tested.

Power factor testing is used as a factory test and in the field for acceptance testing, preventive maintenance, and emergency diagnostic testing.



What are the Advantages?

Power factor tests can detect the presence of "poor" insulation even if there is a layer of "good" insulation in series. However, DC tests usually show a high insulation resistance under this condition.

At a given voltage, the charging current and the dielectric loss increase as the quantity of insulation increases. However, the power factor ratio remains the same no matter how much insulation is present. This makes it possible to establish simplified test values for particular types of insulation.

Power factor testing provides a measure and evaluation of the overall condition of medium and high voltage AC apparatus insulation under simulated normal-frequency operating conditions. This is independent of the duration of the test. DC tests not only require more time, they also do not simulate normal insulation operating conditions. Furthermore, the results are affected by the duration of the test.

Power factor tests provide a benchmark which may be compared over periods of time in an organized manner and are used to identify any trends on apparatus insulation. It provides a more complete picture of overall insulation conditions.

Used in conjunction with capacitance and AC resistance, it provides comprehensive data on the condition of the insulation.