

A QUICK GUIDE TO POWER FACTOR TESTING OF CABLES AND POTHEADS

By Dick Babcock

Power factor tests of cables can be helpful in detecting whether moisture or corona is present in the insulation. Power factor tests are typically performed on short lengths of cable found in substation and industrial power systems. Current limitations of the power factor test set can be increased by the use of a resonance inductor, thus allowing testing of longer lengths of cables.

Hot collar tests can be performed on potheads that are part of the cable system. On higher rated kV systems, the potheads may have test taps similar to that of bushings to allow testing the pothead in the UST mode.

TEST CONNECTIONS

Assure that the cables to be tested are de-energized, disconnected at both ends, and clearly identified.

- Ground the test set securely to the system or station ground.
- Connect the high voltage lead to the cable to be tested.
- The low voltage lead will be grounded in the GST mode.

When testing multi-conductor cable, the low voltage lead will be connected to another cable in the grouping and the test performed in the UST mode.

TEST PROCEDURES

Always observe safety rules when conducting tests. Power factor testing is extremely sensitive to weather conditions. Tests should be conducted in favorable conditions whenever possible. Test voltage should be at 10 kV. If 10 kV exceeds the rating of the cable, test at, or slightly below, the insulation rating.

- Single-conductor shielded cable is tested in the GST mode. Connect the high voltage cable to the conductor; the low voltage cable will be grounded. Testing single conductor unshielded cable will produce unreliable power factor results because there is no predictable ground return path.
- Multi-conductor individually shielded cable is tested in the GST mode; all other cables in the grouping not being tested should be shorted to ground. Multi-conductor cables can additionally be tested cable to cable in the UST mode. Repeat the tests until all cables in the grouping have had at least one test. Ground all cables not being tested.
- Multi-conductor unshielded cable installed in metal raceway can be tested in the same manner as the multi-conductor shielded cable. The metal raceway provides the return ground path.

POWER FACTOR TIP-UP TEST

When power factor results are unacceptable, a test known as a 'power factor tip-up test' can be performed to evaluate whether moisture or corona is present in the cable insulation. If the applied test voltage is varied and the power factor value does not change, moisture is suspected to be the probable cause. If the power factor increases as the voltage is increased, carbonization of the insulation or ionization of voids is the cause.

TEST RESULTS

For all power factor testing, the more information recorded at the time of testing ensures the best comparison of results at the next routine test. The following additional information should be recorded on the test form.

- Identify each set of readings with a cable or pothead number, or phase identification.
- Note any special or unusual test connections or conditions.
- Record actual test voltage, current, watts, power factor and capacitance.
- Record ambient temperature and relative humidity, and a general indication of weather conditions at the time of the test.

Compare test results with factory data if available. If factory data is not available, compare individual test results on cables in multi-conductor groups, or previous tests on the same cable. Comparisons can also be made from similar tests on similar cable.

A noticeable increase in millivolts and milliwatts on potheads using the hot-collar method may indicate the presence of moisture. Low readings may indicate a void in the compound or a low oil level.

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