

Stator Winding DC Hipot and Diagnosis Testing



1.Description:

Both AC and DC Hipot test are used for stator winding of water-cooled generator universally.

Besides DC Hipot, DC ramp or step test, IR/Insulation Resistance and PI/Polarization Index are effective diagnosis means to minimize marginal winding risk, it may fail a Hipot test.

2. Relative Merits of DC testing for Water-cooled Generator Stator Winding

It is mostly believed that AC Hipot test is better in detecting winding defects than DC Hipot test. However, compared to AC Hipot, DC Hipot also has its relative merits.

- DC Hipot is better in detecting defects in end-windings. For water-cooled generators, water and electricity joints of stator end-windings are locations of frequent failures;
- DC test is also sensitive for humidified insulation of stator end-windings as well as dirty;
- DC test sets are smaller and cheaper required than AC Hipot equipment for large rotating machines;
- Anyway, performing a DC hipot test is better than no test;
- DC ramp or step test is an effective and unique diagnosis means to minimize marginal winding risk, it may fail a Hipot test.

3. Why thoroughly drying is required for DC testing of Water-cooled Generator Stator Winding

Previous experiences, before DC Hipot test is performed for water-cooled generator, one pre-event must be done. Draining away cooling water of stator winding, its water pipes, then thoroughly drying. Why so trouble? The residual water will be discharged, even arced on the inwall of insulated water-pipes while DC High voltage is imposed. It will damage water-pipes.

However, water drained away and drying thoroughly is not a simple thing.

4. Performing DC Test of Water-cooled Generator with Innovative Solution and Proven Test Equipment

Since water drained away and drying thoroughly is trouble and costly. Then is it possible to do DC test of water-cooled generator without water drained away and drying thoroughly by innovative solution and test equipment? Very Lucky, it is possible and proven technical solutions and test machine are available in China.

4.1 Water-cooled Generator Insulation Tester

The best-known brand of water-cooled generator insulation tester which it is made in China is KD 2678 series. KD 2678 has the largest market share in China, and exported to many countries together with water-cooled generator exportation made in China.

If needed, please contact APT Power Technologies or Kangda Electrical directly.

4.2 Water-cooled Generator DC Hipot test sets

Water-cooled Generator DC Hipot test sets could perform DC Hipot and Leakage testing in the condition of water-cooled generator with cooling water inside.



4.2.1 The pre-conditions

The cooling water should be qualified while DC testing with cooling water inside performed.

- Cooling water should be transparent and pure, without mechanical impurities;
- Electrical conductivity required at water temperature 25°C, $\leq 5.0 \times 10^2 \mu\text{s}/\text{m}$ for open water system, and $\leq 1.5 \times 10^2 \mu\text{s}/\text{m}$ for circulating cooling water system;

Besides, stator winding IR & PI test should be qualified, A,B, C phase separately;

4.2.2 The following features are important for one set of qualified Water-cooled Generator DC Hipot test machine

- Water-pipe polarization potential compensation. Auto controlled by computer is better than manual adjustment;
- The rated current 200mA and the ripple factor $\leq 3\%$. Since decreasing ripple factor is contradictory to increasing output current, therefore, it is not easy to ensure the ripple factor $\leq 3\%$ at large output current;
- The test voltage stability should be $\leq \pm 1\%$ within 60 seconds;
- The power input is 380V,three-phase so as to restrain the third harmonic intruded from the power grid;
- Fully protections, the most important is over-voltage protection. The main power circuit should be cut off within 10us while protection is trapped;
- The DC ramp test gives diagnostic information and can be stopped before a failure occurs.

4.3.3 Recommended Specifications

60KV,200mA, meeting 600MW Turbine- Generator test.

The leakage 35uA is a significant value. Generally when the leakage current $> 35\mu\text{A}$ at test voltage, such as 40KV,50KV, you should consider to stop the test to avoid the margin winding failure.

5. APT Power Technologies Relevant Products

GENERATOR WINDING AC HIPOT TESTING & DIAGNOSIS

<https://www.xaapt.com/Solutions/Power-Generator-Test/Generator-Winding-Hipot-Testing-&-Diagnosis?id=19>