



DC leakage test of water-cooled generator

Is it possible to measure DC leakage current of generator stator windings accurately with cooled-water inside?

Our answer it is possible to be proven by many cases of year's practice in China.

| Description

Compared with AC line frequency Hipot, due to price cheap, small size and less power rating required, some people prefer to perform their generator stator insulation assessment by DC test. However, the situation should be difference for those water-cooled generator stators.

| To dry stator bars is not easy thing

Most large generator stator are water-cooled units. Deionized water is passed through the conducting bars to keep them cool and not deteriorate the insulation.

Since DC tests shouldn't be applied without those cooled water thoroughly drying so that more real and reliable test values are available. However, to dry stator bars is not easy thing, high cost and long time, even impossible for those dead cooling water system of generator stators.

| IR & PI, DC leakage current and DC Hipot test

IR(Insulation Resistance)& PI(Polarization index) and DC leakage current are diagnostic tests, also are nondestructive test;

DC Hipot is destructive test. Theoretically, the insulation in a good machine should not suffer any detectable degradation during a hipot test.

The difference is, new windings and windings in service. There is a finite risk for a marginal winding, which would have hopefully operated for some more time, may be punctured in the Hipot test.

That is why IR&PI, DC leakage test is more important than its DC Hipot test.

| IR&PI, DC leakage test with cooled-water inside

The test data will be severely distorted and unreliable providing we performed diagnostic test of water-cooled generator with ordinary megohmmeter and DC Hipot;

Their insulation resistance is as small as less than $1\text{M}\Omega$, maybe dozens $\text{K}\Omega$;

And leakage current is as big as more than dozens of mA. Actually, the winding leakage current should be less than dozens of μA .

Here is one question, Is it possible to measure DC leakage current of generator stator windings accurately with cooled-water inside? The answer is yes.

Two circuit loops, one applies DC high voltage on stator winding to measure its leakage current by microammeter, and another loop applies DC high voltage on stator water cooler to measure its high current by milliammeter.

DC Hipot and Leakage is single phase test. Those two untested phases, should be shorted-circuit and earthed.

Fig.1 as below for reference.

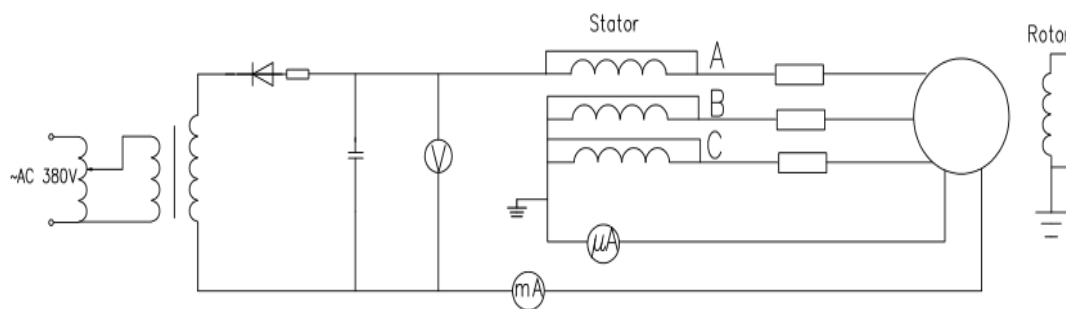


Fig.1. Stator DC leakage test with cooled-water inside

| Test Voltage, Step or Damp, threshold level

Test voltage of DC Hipot of generator stator is $(2U_n+1)\times 1.7\text{KV}$ and hold the voltage for 1 minute. U_n is the rated voltage of generator, Line-to-line.

DC leakage is a step by step test. And the test could be stopped if the leaking current is going too high (generally when $>35\mu\text{A}$).

Due to the high capacitive characteristic of the stator/rotor winding, the DC leakage current should be recorded after the values is stabilized. No matter step or damp test is carried out.

| Summary

To perform DC test of generator stators with cooled-water inside, it will make the test much easy, low cost and less time;

Based on threshold level $35\mu\text{A}$, DC leakage test could protect those windings in service from DC Hipot damage;

No taking any risks, less cost and preparatory works, the management make their decision easy from now on.

Besides DC Hipot and DC leakage test, RI and PI test also could be carried out when cooled-water inside of generator stators.

| Reference articles

Stator Winding Hipot (High Potential) Testing- AC Versus DC Hipot- A Comprehensive Discussion, written by Hafiz Shahzad Ahmad, Power Plant Electrical Maintenance Specialist