Technique of dry washing of the insulators of the electrical nets of distribution

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1. Introduction

Pollution and oxidation are phenomena that create aggressors and degrading agents of the electrical materials, mostly the insulators of the electrical nets.

The environmental pollution generates, mostly, the decreasing of the dielectric capacity of the insulators, reducing its isolating performance, consequently increasing the occurrence of the "flash over" discharges and reducing the mechanical resistance of the insulator and other materials [1].

To ensure the continuity of the electrical system the maintenance companies use specialized equipments and technical procedures where we can point out the washing services of the energized lines, nets and substations.

The convectional washing system, that uses treated water, it is not only a very expensive process but also an environmentally inadequate. The water, one of the most valuable patrimonies that human kind owns nowadays, after the washing process is totally disposed. At the northeast this problem occurs mostly in the coastal cities forcing the electrical companies to make the washing process only after the raining period.

Currently are used 8000 liters of treated water to wash the amount between 60 and 70 medium tension structures.

This article brings a new and environmentally correct technique of cleaning the insulators without the use of water, with an insulator dry washing procedure. This technique is being developed by a partnership between the department of electrical engineer of the Universidade Federal do Ceará and COELCE.

Key words: dry washing, insulators, pollution, flashover, water.

2. Simulation

For the definition of the pressure, distance and angle of attack of the cleanness nozzle was developed a three-dimensional computational model of the system insulator-nozzle. The system used the CFD (Computational Fluid Dynamics), package of programs of the ANSYS for a computational solution involving the fluids dynamics, being used the method of the finite volumes. The simulations have been made for nozzles with diameters: 0,5mm, 1,0mm, 2,0mm and 3,0mm. The used attack angle was 30° and a distance of 6 cm of the nozzle to a point in the insulator's surface. The insulator's dry washing technique was simulated for the following pressures: 2 bar, 5 bar, 10 bar, 15 bar, 20 bar, 30 bar, 40 bar and 50 bar, so with that is possible to obtain the dragging force.

For the validation of the results, laboratory tests were made with an industrial alternative compressor, which did not presented a good pressure control. With the

intention of obtaining better pressure control, a system with 6 nitrogen gas cylinders was used to make the cleanness of the insulators.

3. Methodology

The work in the first phase is based on emulate the environmental pollution that the insulator suffers in the net, by a process of artificial pollution, in which the porcelain insulators chain is placed in saline mist chamber for a period of six hours with a 5% salt solution. The insulators have also been submitted to other conditions of pollution. They have been polluted artificially in a saline mist chamber for a six hours period with a saline solution of 10% and three hours with saline solution of 30%. A manual method of pollution was also used, applying saline solution 35% and process of natural drying. The method of artificial pollution demonstrates to be more efficient and closer to the real condition.

The insulators have been cleaned with the use of a compressor of 12 bar, with an outflow low. Gas nitrogen was also used in the cleanness, due to the air composition being majorly of this gas. The system is composed of six cylinders with 10 cubical meters of gas each one. The cylinders are connected to a register that possess 6 entrances. The register possesses a valve for pressure control, a valve for control of the outflow and a manometer (measuring of pressure). The nitrogen is applied in the insulator through a flexible hose. The insulators chain is placed in a way that its fixation is as close as the way the chain is actually placed. With the use of this structure of cleanness in laboratory, some tests had been carried through and some procedures to be still standardized had been used in these tests.

On the following step the insulators chains are removed and placed on adequate structures for drying and transporting. The insulators chains are then submitted to an applied tension experiment to measure the leakage current. This will be the parameter to gauge the results. The experiment has three phases. The first one is made with the insulators totally cleaned, then the insulators are artificially polluted, and on the last phase a new analyze is made with the insulators cleaned with the dry washing technique.

4. Conclusion

The so far achieved results related to the artificial pollution show a good similarity of the leakage current of the insulators placed on the net and the ones artificially polluted. When comparing the dry washing technique with the conventional technique, for a 15bar pressure, a 50% reduction of the leakage current was obtained. The results obtained using the nitrogen gas system were not satisfactory. The pressures reached by the system as well as the gas outflow were not adequate to the cleaning process. This result leads to a belief that this new technique can be applied reducing costs and effectively contributing to the environment preservation.

References

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