

EXPERIMENTAL RESEARCHES CONCERNING CERAMIC POST INSULATORS DAMAGE USED IN 110V HIGH VOLTAGE SWITCHES

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Abstract

Within the paper are presented the causes of 110V High Voltage Rotative Disconnecting Switches damage, during their exploitation in electric fields. Ceramic Cylindrical Post Insulators involved in their construction, often break, due to the following causes:

- freeze of condensed/rainfall water, slip between the Ceramic Insulator and its metallic parts (upper cup and the bottom support) during winter time;
- overpass of the nominal moment bending, due to frozen water which covers and increases weight of the connecting cables;
- incorrect armoured operation of the Ceramic Cylindrical Post Insulator, which presents „skid core” due to manual technology of production;
- incorrect operation of the mechanical systems which rotate High Voltage Disconnecting Switch, by the staff on duty.

1. 110KV High Voltage Switches Construction.

Ceramic Post Insulators which are studied in this scientific research, take part in the 110KV High Voltage Switches Construction. These Switches enable the horizontal blades opening, having a 110KV nominal Voltage and nominal currents of 1250 – 1600 – 2000 A

These Switches present only a monopole construction.

Engineering schema of such a Rotative Switch is presented in Fig.1.1 and its connecting pole is enclosed.

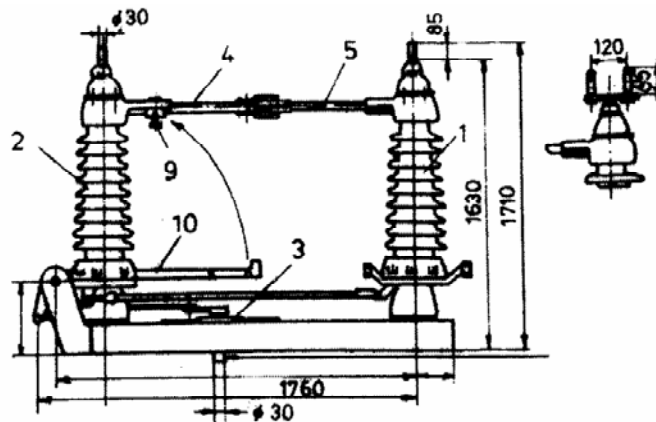


Fig. 1.1. - Schema of an 110 kV Rotative High Switch

Ceramic Insulators 1, 2 can swivel, turning round with 90° under the action of a mechanic or an electrical device 3. On the rods 4 and 5, are set electrical contacts 6, 7 and 8, as they are presented in fig. 1.2..

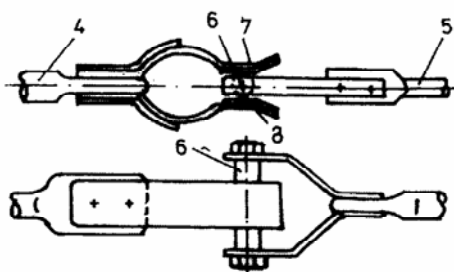


Fig. 1.2. – Electrical contacts of the switch.

They are mounted in a vertical position, on a metallic frame, on which are also set up all mechanic action devices.

Manufacturer „Electroputere S.A „ – provides all required needs concerning setting up, adjusting and probation. It also provides a 12 -18 months guarantee period.

2. Ceramic Materials used in Post Insulators Construction

Ceramic materials used in the Cylindric Post Insulators processing are presented in the state normativ, STAS 3471-85, table 2.1.

Table 2.1.

Group	Sub-group	Engineering process	Properties	Utilisation field
100 China type materials,	110	-lathing -extrusion -casting	Good electrical and mechanical properties	Ceramic Insulators for High and Low Voltage

The usual material is:

CER 110 - STAS 3471 – 85.

Chemical composition of this China type material is considered to be a „manufacturing secret”

3. Reported accidents to the beneficiary

. Electrical field events collected during a long period, 01.01.2005 – 01.06. 2006 showed that, some of these Ceramic Post Insulators have been broken in exploitation, both at the upper metallic cup and at the bottom metallic support of the ceramic rotating insulators. In fig. 3.1 is presented such an accident.

These accidents were traced out like follows:

- 4,3% through direct examination under electric voltage;
- 30,4 % direct examination without voltage ;
- 39,1% brakings with no other circuits damage;
- 26,1% brakings with other circuits damage.

The brakes were located at the upper metallic cup, most of them and also at the bottom metallic support.



Fig. 3.1. – Ceramic Insulator braked from the metalic bottom support

4. The main causes of Ceramic Post Insulators Breaking

According to electrical fields events, reported by the beneficiary, these kind of accidents happened to the old 110KV High Voltage Switches, having more then 10-15 years length of service.

Geographic areas into which these accidents have been located are: Harghita, Bihor, Salaj, Cluj, Baia Mare, Satu Mare.

Reported Breakings of the Ceramic Post Insulators, used in 110KV High Voltage Switches, are the action result of one or more of the following causes:

1. Metallic Parts craking during the winter time, when the protection coat of paint falls and the water is absorbed by the bounding cement. Freeze of the condensed/ rainfall water sliped between Ceramic Insulators and its metallic parts, the upper cup and the bottom support, or absorbed by the bounding cement, involves an important volume increasing of iced water. Consequently, microscopic cracks appears both into the metallic parts and to Ceramic Post Insulator. In time, these cracks become larger and larger . There were cases when such fissured metallic cups fell themself from the Ceramic Insulator.
2. During winter time, due to the hoar frost and water frost, the weight of electric bounding conductor , may increase very much, exceeding the maximum load of 4000 N, which may result in Bending Moment overtaking.
3. Rigid electric rod conductors, inadequate used in exploitation, may become stiff and lead to loads increasing;
4. Bounding paste of the metallic parts on the Ceramic Insulators (Sulph paste, and Portland cement now) was many times unsuitable, because of economic reasons.

5. Metallic parts of the Ceramic Insulators, the upper cup and the bottom support, were made of cast iron Fgn-250, thermic treated in 1970 -1980 years. Afterwards, their quality has been changed in cast iron Fc 200, which is less suitable;
6. Metallic Parts supplier „Armătura Cluj” during 1970-1989, has been changed afterwards with other less serious producers, so that, is to expect more damages in future.
7. Armed operation of the Ceramic Insulators with their metallic parts, were made unsuitable, sometimes. Bounding cement layer, in some cases, were not symmetrical distributed, and there were found important excentricities. This fault is called „running core”.
8. Getting stuck / blocking of the Mechanic Systems which rotate the High Voltage Switch, concerning following aspects:
 - blocking of the Levers System which rotate the Switch Cylindric Insulators;
 - unsuitable maintenance of the Switch Electric Contacts , which require a thoroughly half-yearly regulation,
 - axial bearings lubrication.
9. Accidental Switch Rods collision, in the Electric Contacts Junction , setting up by a Contact Cylinder and a Contact Muff.
10. Contact Pressure of the Slides Pack involved in Electric Contacts , adjustable by Spring Sets, is not properly checked out. Regulation and checking of Electric Contact Resistance should be done at least once a year.
11. Incorrect operation of the mechanical systems which rotate High Voltage Disconnecting Switch , by the staff on duty. They used to knock with a hammer the blocked levers of the mechanic system.

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