

# *Voltage division over the interrupter units of a high voltage circuit breaker without grading capacitors*

Henryk Stürmer  
LS EVH, BTU Cottbus, Germany

## **Abstract**

In a modern high-voltage circuit breaker in lower voltage levels (up to 300kV) one interrupter unit is used per phase. In higher levels two, three or four switching lines in serial circuit are used.

Both in off-position and disconnection of the load or short circuit current the interrupter units are stressed by different voltages. In order to be able to stress a specified number of interrupter units by high voltage, the voltage is equally divided by grading capacitors to all interrupter units. The grading capacitors are connected in parallel to the interrupter units. For example for a quad breaking circuit breaker a voltage division of 25/25/25/25% is aspired and for a twice breaking circuit breaker a division of 50/50% is aspired. Using available grading capacitors the voltage division is 53/47% and 27/26/24/23%.

Because the grading capacitors are an important expense factor for high-voltage circuit breakers for several years it's tried to apply multiple breaking circuit breakers without grading capacitors. The voltage division is the most important factor. The result from the calculation of a twice breaking switch is 80/20%, for a quad breaking switch without grading capacitors it is 80/10/5/5%. In both cases one interrupter unit has 80% of the voltage; the other units have only a small voltage.

If you make a dielectric or switching capacity testing you can see, the switch is able to keep a higher voltage like the calculation showed.

The following facts could be the reasons:

- The calculation is too inexact.
- Only the capacities are considered; other effects could be the reason.

It's difficult to measure the voltage division between the interrupting units by common measurement equipment because the measurement equipment has a noticeable influence to the voltage division. A possibility could be the usage of measuring probes which have no or only a small effect to the voltage division because of the contact less measurement.

The following problems are to research:

- Development of a qualified measuring method: measurement of circuit breaker-capacities by measurement of capacitive current and with bridge, measurement of earth capacities by measurement of capacitive current, voltage measurement
- Simulation of circuit breaker and measurements: field an transient simulations
- Several High Voltage Tests: ac-tests and impulse tests
- Analysis of the effects, which determine the voltage division and which determine the several forms of the voltage stress
- Comparison of the findings and the test readings and declare, why the switch operates better than in the calculation
- Test problems: capacities between test object and measuring equipment/environment