Phase I

Overview

This phases's purpose was to study the factors which determine the development of switching overvoltages in an electric power system.

The switchgear and electric motors (the main consumers) designed for mines with danger of firedamp are made with the type of protection flameproof enclosure. Even if this type of protection is safe enough, the enclosures exposure to switching overvoltages can cause destructions of motor windings and even of the switchgear enclosure. So, the switching overvoltages study is very important to establish possibilities to measure, limit, and if possible, prevent undesired effects.

The nominal voltage for a three phase system represents the effective value of the voltage between phases. To establish the stresses to which the system is being subjected it is very important to know the maximum service voltage U_m, representing the highest effective voltage value between phases, which appear in a certain moment, in a certain point of the system in normal operating conditions.

The overvoltage can be defined like any voltage variable in time, with the peak value exceeding the peak value of the maximum working voltage. The overvoltage can occur between the phase and ground, the exceeding referring to value $U_m \frac{\sqrt{2}}{\sqrt{3}}$ or between phases, when the reference is $U_m \sqrt{2}$.

Overvoltages are transient phenomena and can be characterized by three essential parameters: amplitude, shape and occurrence frequency. When the cause which produces them doesn't belong to the network or system elements, the overvoltages are external. When the cause belongs to network, the overvoltages are internal.

International regulations classifies overvoltages in two categories: strongly damped and short term overvoltages; and underdamped and long term voltages. In the short term overvoltages category are included atmospheric (produced by atmospheric discharges) and operating overvoltages. Underdamped overvoltages are produced by some manoeuvres or failures.

To improve, respectively limit the switching overvoltages, the transient phenomena which occur when connecting or disconnecting the switchgear must be study.

In the first part of the paper were presented the component parts for a circuit closer with vacuum extinguishing.

From the experience accumulated in the previous researches it can be concluded that the switchgear with vacuum power contacts creates the highest switching overvoltages. Consequently, especially low voltage power switchgear with circuit closer with vacuum switch on or off was studied.

In the next part were presented the transient phenomena that occur in switching on or off the circuit closers and implicit the factors that involve the occurrence of switching overvoltages.

The last part of the study included the conclusions of this phase and proposals for continuing the researches for the next phases provided in the approved research schedule.