Subject: Vacuum Interrupters

Vacuum Interrupters, have replaced minimum oil circuit breakers and the SF6 circuit breakers in MV distribution system. In vacuum circuit breakers, vacuum is used as the arc quenching medium. Vacuum offers the highest insulating strength. So it has far superior arc quenching properties than any other medium. For example, when contacts of a breaker are opened in vacuum, the interruption occurs at first current zero with dielectric strength between the contacts building up at a rate thousands of times higher than that obtained with other circuit breakers. The degree of vacuum is in the range from $10^{-7}$ to $10^{-5}$ torr. The technology is suitable for mainly medium voltage application. For higher voltage vacuum technology has been developed but not commercially viable.

The production of arc in a vacuum circuit breaker and its extinction can be explained as follows:

- When the contacts of the breaker are opened in vacuum ($10^{-7}$ to $10^{-5}$ torr), an arc is produced between the contacts by the ionization of metal vapors of contacts. However, the arc is quickly extinguished because the metallic vapors, electrons and ions produced during arc rapidly condense on the surfaces of the circuit breaker contacts, resulting in quick recovery of dielectric strength.
- The salient feature of vacuum as an arc quenching medium is that as soon as the arc is produced in vacuum, it is quickly extinguished due to the fast rate of recovery of dielectric strength in vacuum.

![MAC TS4 test equipment](image)

How do we Check the healthiness of Vacuum in the bottle?

Till now we had only Programma Vidar Vacuum interrupter test kit. VIDAR enables you to check the integrity of the vacuum interrupter quickly and conveniently by means of the known relationship between the flashover voltage and the vacuum interrupter. A suitable test voltage (DC) is applied to the vacuum bottle, and the result is known immediately. A lamp indicates GO/NO-GO condition.

Latest test equipment is testing with Magnetic Atmospheric Condition (MAC TS4) test set. This kit predicts the usable life of the vacuum interrupter. The instrument has Easy to use graphical user interface, Stores up to 500 test results & Built-in thermal printer & computer interface

Test Experience of Vacuum Bottle

The author had an opportunity to test 11KV Vacuum interrupters at Abu Dhabi Distribution Company during 2004. Over 1000 bottles tested which were 10 years old in service, only one bottle failed the Vidar test. This failed bottle was in service, after test was taken out and replaced. Surprisingly many manufacturers of MV circuit breakers have not heard about the Vidar kit, nor they have knowledge of how to test the Vacuum bottle. In their routine factory acceptance test there is no mention of testing of vacuum bottles. Facilities at ABB, or Siemens, or Schneider do not have a Vidar kit.

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