Medium voltage products

ABB's new diode-based transient-free capacitor switch provides New York City with reliable power

ABB successfully delivered its unique medium voltage diode-based capacitor switch to a Consolidated Edison Company of New York, Inc. substation in Manhattan.

Consolidated Edison is a regulated utility providing electric, gas, and steam service to New York City and Westchester County, in one of the most power demanding cities in the world.
ABB delivered DS1 to one of Con Edison's substation - A unique, medium voltage diode-based capacitor switch. In that substation, each capacitor is equipped with current-limiting reactors and operated by a vacuum capacitor switch with zero voltage crossing control on a daily basis (Figure 1).

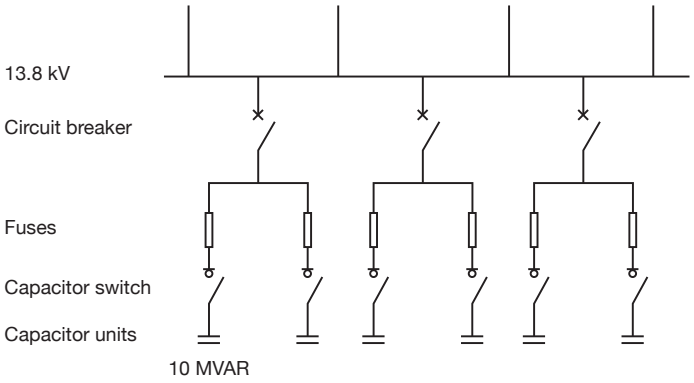

Figure 1 – Simplified single line diagram.

Despite the switching control of these apparatuses, the previous technical limitations of vacuum technology did not allow smooth switching. This resulted in transient phenomena, such as inrush current and switching overvoltage (Figure 2).

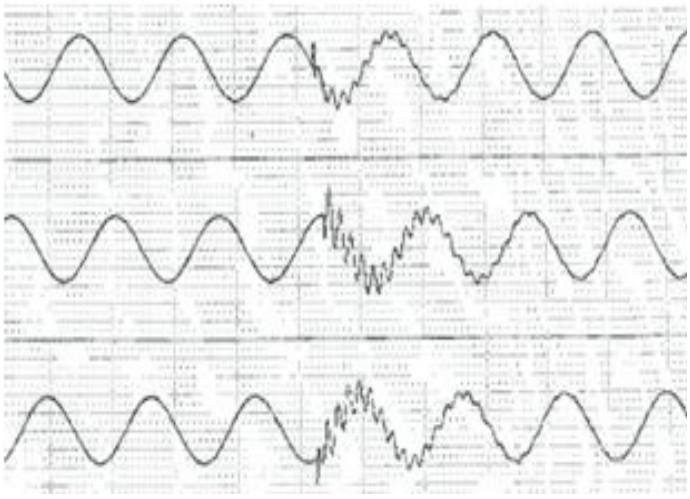

Figure 2 - Busbar overvoltage during vacuum switch close operation on capacitors.

Shaping a stable and more reliable customer's network

Con Edison decided to look for a solution to these challenges. This allowed ABB the opportunity to perform a pilot installation of the first synchronous capacitor switch in the world based on diode technology and insulated with dry air. After studying the customer's equipment layout, schemes and logics with Controllix Corporation's engineers, the new diode-based switch was installed in 2009. Over the years, the ABB switch has undergone significant technical improvements and refinement, culminating in the final product: DS1, the first diode-based transient-free capacitor switch.

The pilot installation of DS1 occurred in May 2014 and is fully functional (Figure 3). By the end of the first quarter 2015, DS1 performed about 200 operations on capacitor banks.

Figure 3 - 10 MVAR capacitor bank with DS1 inside.

Switch performance requirements fulfilled

In order to achieve objective evidence of DS1's excellent switching performance, an instrumentation system was installed to monitor and evaluate the performance of the switch. The phase currents are measured with Rogowski coil sensors, while voltages upstream and downstream of the switch are measured with ABB KEVA resistive voltage dividers. Every operation has been, and still is, captured with a data acquisition board connected to a laptop.

Busbar voltage (Figure 4) and capacitor current (Figure 5) during a back-to-back close operation of DS1 on a capacitor bank are shown below.

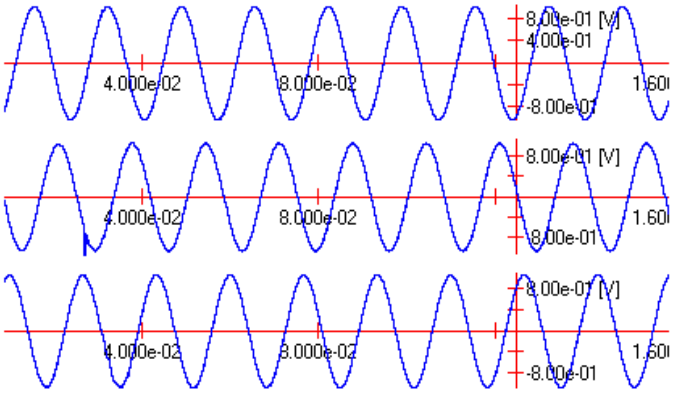

Figure 4 - Busbar voltage during DS1 back-to-back close operation at Astor Substation. No overvoltage is in place.

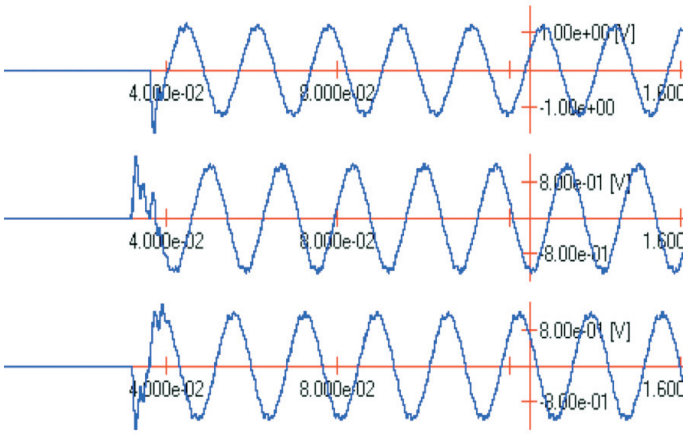

Figure 5 - Capacitor current during DS1 back-to-back close operation. Inrush is limited to rated current peak.

As shown in Figure 4, the voltage waveform at busbar is not affected by capacitor switching overvoltage. The illustration shows that the network does not even feel that the 10 MVAR capacitor bank has been connected to it. Additionally, Figure 5 shows that the inrush during a back-to-back closing is limited to the peak of the rated current.

Using DS1 provides a big step forward in guaranteeing reliable and stable networks.

Find out more about ABB DS1 capacitor switch

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