NOKIAN CAPACITORS

SVC Configuration Optimisation

Optimising the SVC configuration is about deciding the number and scale of different components and also the voltage level at the SVC main bus. Reactive power can be generated either with Thyristor Swiched Capacitors (TSC) or filters. Filters can be located either at the primary or the secondary side of the main step-down transformer. Moreover, the amount of reactive power generated by an individual filter or TSC is freely decided by the designer. The essential thing is that the SVC is capable of operating at its full operation range, not how it is composed.

In the year 2005, Nokian Capacitors developed a computer program for optimising the configuration of an SVC. The optimisation process focuses on finding the configuration that produces minimal loss at specified operation points. A non-optimised configuration can generate up to hundreds of kilowatts more losses than an optimised configuration, though these two configurations have the same operation range and performance. Additional losses cause additional heating, which means a shorter lifetime for the components.

From experience, there are usually 5 to 10 bidders, globally, who receive an invitation to make a bid. Spite strictly specified characteristics, all bidders base their SVC on different configurations. Bidders are using different components, which change the optimum configuration between the bidders´. This means that universal optimising rules cannot be created.

Example of calculation methodology and loss curve

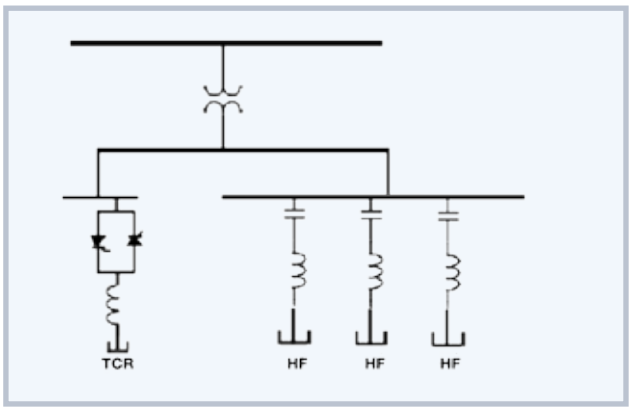
The following example demonstrates two different SVC configurations with similar operation range and performance. The customer has defined the loss calculation methodology as follows:

The first SVC configuration is composed of one Thyristor Controlled Reactor (TCR) and three single-tuned filters. These four components are generating and absorbing the needed reactive power for the whole operation range.

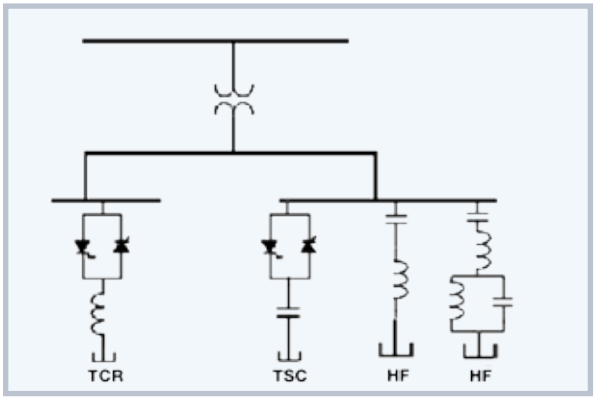
The second SVC configuration is composed of one TCR, one TSC, one single-tuned filter and one double-tuned filter. In this configuration, the filters are generating 60 Mvars reactive power and the TSC is switched on at higher capacitive outputs.

Loss curves for both SVC configurations are demonstrated below:

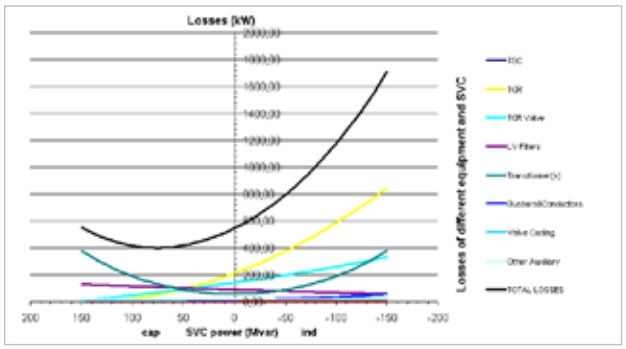
Configuration 1



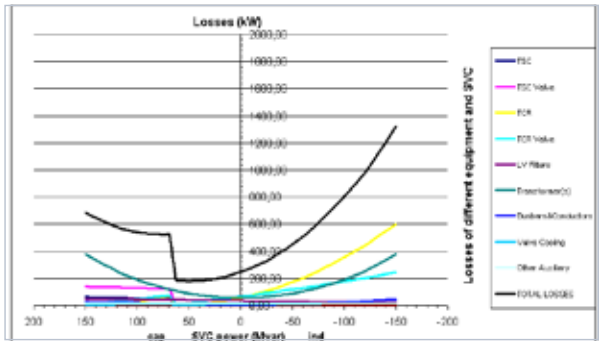
Configuration 2



Configuration 1



Configuration 2



Calculation explanations:

- Total system losses at full capacitive output 150 Mvar. Value: 100 €/kW
- Average of total system losses at 50 Mvar capacitive, 10 MVar capacitive and 50 Mvar inductive output. Value: 3100 €/kW
- Total system losses at full inductive ouput are 150 Mvar. Value: 100 €/kW

Using the given calculation methodology and loss curves, the evaluated losses for the first SVC configuration are worth (523kW*100 €/kW) + (579kW*3100 €/kW) + (1755kW*100€/kW) = 2.022.700,00 €.

Using the same calculation methodology for the second SVC configuration, evaluated losses are worth(680kW*100 €/kW) + (294kW*3100 €/kW) + (1412kW*100€/kW) = 1.120.600,00 €.

The customer can save up to 45% in loss based costs by using the second SVC configuration.

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