

SVC for increased power transmission capacity in subtransmission network



A static Var Compensator (SVC) rated at 46 Mvar inductive to 135 Mvar capacitive at 115 kV supplied by ABB has been in operation since 1997 at Los Alamos National Laboratory in New Mexico, USA. The Purposes of the SVC installation are to achieve dynamic voltage stabilization in the Los Alamos and Northern New Mexico area, thus minimizing power outages caused by voltage dips coming from outside sources, as well as to increase the active power import capability of the existing regional sub-transmission system.

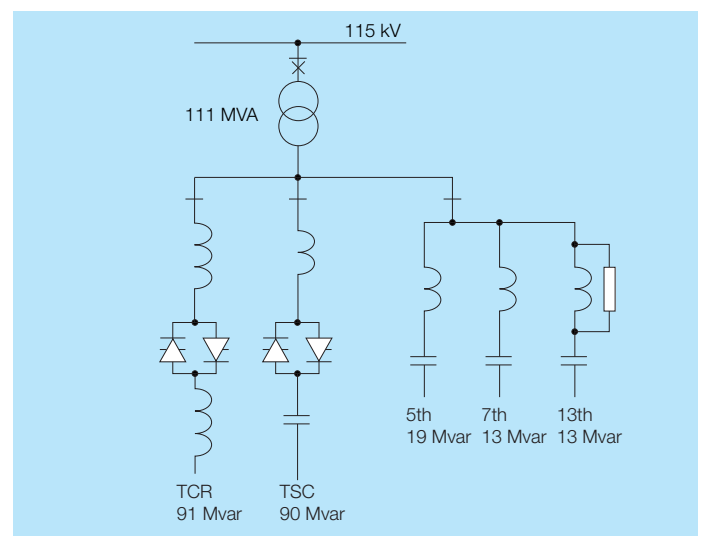
The SVC improves the dynamic performance of the system and provides critical voltage support to the LANL loads during transmission system disturbances.

Damping of voltage oscillations following disturbances in the overriding 345 kV system is likewise improved by the SVC. A benefit and purpose of the application of the SVC is the enhancement of power delivery capability of the sub-transmission system due to the “stiffening” of the system by the SVC.

The SVC is located at the Laboratory’s 115 kV ETA substation. Electric power wheeled by the Public Service Company of New Mexico and other utilities is delivered to Los Alamos via two 115 kV sub-transmission lines.

Main building blocks

The SVC consists of a TCR (Thyristor-controlled reactor) rated at 91 Mvar at 115 kV, a TSC (Thyristor-switched capacitor) rated at 90 Mvar at 115 kV, and an array of Harmonic filters with a total capacitive rating of 45 Mvar, tuned to the 5th, 7th and 13th harmonics. The nominal overall rating of the SVC is 50 Mvar (inductive) to 100 Mvar (capacitive), defined at 1,03 p.u. primary voltage (inductive part) and 0,85 p.u. primary voltage (capacitive part).



Single-line diagram

The SVC has been prepared to accommodate a planned future extension of the dynamic rating with the provisional addition of a supplemental 50 Mvar TSC.

Control system

The SVC control system is built up around micro-processor based computer functions continuously monitoring the status of the power system and the SVC. Communication with the operator is via an OWS (Operator work station) and an EWS (Engineer work station), either locally in the SVC building, or remotely from the LANL dispatch centre.

In the latter case, communication is routed via fibre optics from an RTU (Remote terminal unit) located in the SVC building. The control system is fully redundant, where one channel is acting as master and the other as stand by. Both systems are identical, and either one can act as master.

In the normal, automatic control mode, the 115 kV bus voltage is controlled through a voltage feedback. The desired voltage level can be set manually from the OWS. The setting can be selected between 0,8 and 1,1 p.u. on a 115 kV base. The slope can also be set manually between 0 and 10% on a 100 Mvar base.

With the SVC in automatic control mode, a susceptance control can be activated from the OWS. This function will slowly bring the compensator back to a selected steady state Mvar output. This enables the SVC to quickly and fully respond to subsequent sudden system contingencies.

An undervoltage strategy will force the SVC to fully capacitive output in case of primary voltage sags. For severe sags, below 0,5 p.u. and lasting up to one second, a strategy can be selected to force the SVC to zero output. If the voltage returns to normal within one second, the SVC will return to normal. If the low voltage persists, the SVC will trip out.

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Monitoring system

To facilitate operating and maintenance of the SVC, systems for monitoring and recording are provided. These will continuously keep the operator informed about the status of the SVC and record all events that have occurred during operation. As the SVC is normally unmanned, control measures and other important information are transmitted to the Laboratory dispatch centre.

A sequence of events recorder will record and time tag all alarms, status and important control changes. By this record, the sequence of a series of events can be determined as well as the operating status before and after a disturbance.

A digital fault recorder monitors continuously all relevant currents and voltages in the power system.

In case of a contingency, the recorder will store the information in its memory until a printout is called for.

Technical data

Controlled voltage	115 kV
SVC rating	50 Mvar (inductive) to 100 Mvar (capacitive) at 1,03 p.u. and 0,85 p.u. respectively. 46 Mvar (inductive) to 135 Mvar (capacitive) on a 115 kV base (1,00 p.u.).
Control system	Three-phase voltage control by means of redundant voltage regulators. Regulator functions include strategy selection and gain supervision/ optimization.
Thyristor valves	Water-cooled three-phase valves with indirect light triggering.