FACTS

Power quality improvement in hot rolling mill by means of SVC

A Static Var Compensator rated at 0-72 Mvar at 21 kV supplied by ABB has been in operation since1998 at the Swedish steel manufacturer SSAB´s heavy plate mill at Oxelösund. The SVC has the task of providing power quality within the plant just as well as for other consumers of power from the same grid.

By this means, not only does the electrical environment gain by the installation, but also more favourable conditions are provided for the rolling process itself in a situation of a relatively weak supply network, thereby ensuring improved availability of the rolling mill.

This, together with a more favourable power tariff and a decrease of power distribution losses in the plant due to a high and stable power factor brought about by the SVC, ensures improved economy of the rolling process, as well.

The rolling mill as a load on the network

The 3.7 m 4-high heavy plate mill is driven by two ABB 11.2 MW main cycloconverter drives. The mill is also equipped with an attached edger, driven by two 1.5 MW cycloconverter drives. These are significant loads on the supply network. Not only is the average load considerable, but also the dynamic load variation is large as the mill repeatedly runs through its process cycle.

Due to the limited fault level at the 135 kV point of common coupling, unless proper measures are taken, the running of the mill would result in unacceptable voltage variations, not only at the 21 kV mill bus, but also at the point of common coupling. Furthermore, the cycloconverter drives in themselves are a strong source of harmonics, the spectral content of which is variable not only in amplitude but also in frequency. These harmonics need to be confined as closely as possible to their source.

Task of the SVC

The task of the SVC is to act as a limiter of voltage fluctuations and harmonic distortion at the point of common coupling, and to ensure a high and constant power factor despite the strongly varying consumption of reactive power of the rolling mill.

Requirements fulfilled at the 135 kV point of common coupling by means of the SVC:	
Voltage variations	+/- 10%
Voltage flicker	Pst(95) < 1.0
	Plt(95) < 0.8
Harmonics	Total harmonic voltage distortion < 1.5%
	Total harmonic current distortion < 5%
Power factor	≥ 0,995

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Main SVC scheme

The SVC comprises a TCR (thyristor controlled reactor) rated at 72 Mvar at nominal voltage (21 kV), a 2nd harmonic filter rated at 16 Mvar, a 3rd harmonic filter rated at 22 Mvar, and a high-pass filter rated at 34 Mvar. The overall dynamic control range of the SVC is 0 – 72 Mvar (capacitive) at 21 kV.

When the TCR conducts 100% of its nominal current, the reactor absorbs all of the reactive power generated by the harmonic filters, and the output of the SVC is zero. This is the case when the mill does not consume any reactive power.

As soon as the rolling mill starts its operating cycle, the need for reactive power will change from one instant to the next. During this period the regulator of the SVC automatically decreases or increases the reactor current according to need, so that the reactor absorbs the reactive power generated by the filters but not needed by the drives at each single moment.

By varying the firing angle of the TCR extremely fast, adequate reactive power balance of the system is secured. A stable bus voltage and a high and constant power factor are thereby maintained at all times.

Control system

The control of the SVC is incorporating the following functions:

- Main control:
  Open-loop reactive power control;
- Secondary control:
  Closed-loop power factor control at 135 kV.

The SVC can be controlled both locally in the SVC building and from a station control system located elsewhere in the plant.

Technical data (SVC)	
Rated voltage	21 kV
Dynamic range	0 – 72 Mvar (capacitive)
Harmonic filters	2nd harmonic / 16 Mvar
	3rd harmonic / 22 Mvar
	High-pass / 34 Mvar
Control system	Open-loop reactive power control,
	plus closed-loop power factor control.

For more information please contact:

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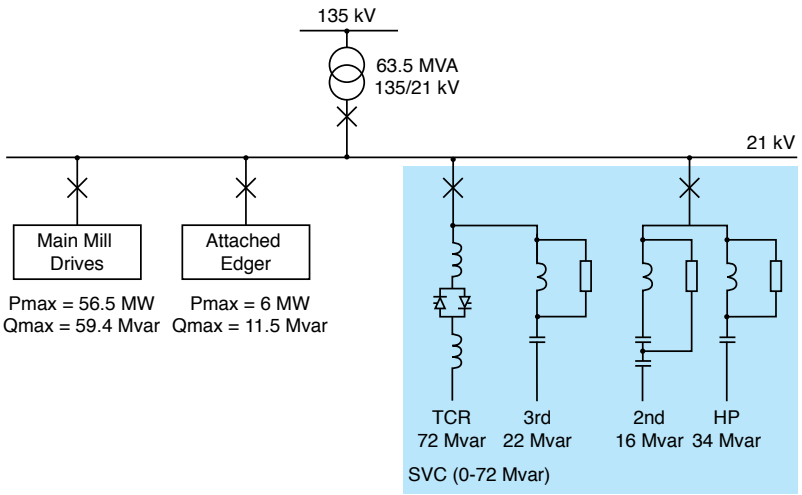
Single-line diagram



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