THE ITER REACTIVE POWER COMPENSATION AND HARMONIC FILTERING (RPC & HF) SYSTEM

A. Mankani[1], J. K. Goff [1], D.Jiao[2], J. Li[2], Y. Wu[2]

[1] *ITER Organization, CS 90 046, 13067 Saint-Paul-Lez-Durance CEDEX, France*
[2] *Rongxin Power Electric Company, 108 Keji Road, Gaoxin District, Anshan, Liaoning, 114051, China*

Corresponding author: Ashok.Mankani@ITER.org

ITER's 400 kV, 500 MW Pulse Power Electrical Network (PPEN) will be supplied directly from the French 400 kV power transmission grid via a double circuit line extension. PPEN will in turn supply many large AC/DC converters providing controlled current to the superconducting magnet coils, producing reactive power and harmonic currents at a higher level than acceptable to the transmission grid.

Due to large amplitude and short rise times of the pulsed power and for likely power step changes, rapid reactive power control is necessary for voltage stabilisation and compensation together with large inductor capacitor filters to eliminate harmonics generated by the power converters. Therefore, a Reactive Power Compensator and Harmonic Filtering (RPC & HF) system will be installed with an installed total power in the range of 750 - 900 Mvar.

Three RPC & HF units connected, one to each of three 66 kV busbars will be based on Static Var Compensation (SVC) technology. The scheme studied and reported in the paper will comprise a Thyristor Controlled Reactor (TCR) plus Harmonic Filter (HF).

The TCR will be directly connected to the 66 kV busbars, direct connection removing the need for TCR step down transformers. Such a solution is the optimum choice as it is now both industrially feasible and cost effective.

The 12-pulse four-quadrant AC/DC converters will generate harmonic currents or harmonic voltages, which are injected into the power system. The resulting distorted currents flowing through system impedance producing harmonic voltage distortion. Harmonic filters will reduce distortion by diverting harmonic currents into low impedance paths. Harmonic Filters, viz. 3rd, 5th, 7th, 11th and 13th order are designed to be capacitive at the fundamental frequency so that they are also used for producing reactive power required by the 12-pulse converters and 66 kV thyristor valves.

This paper describes in detail the ITER 66 kV RPC & HF system design and presents the results of the system steady state & transient stability studies.