THE ITER AC/DC COIL POWER CONVERTERS

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The ITER AC/DC coil power converter plant is powered directly from the French 400 kV transmission grid and will provide controlled direct current in the superconducting magnet coils for Toroidal Field (TF), for plasma initiation, current and shape as well as position control and error field correction.

The magnet coil circuits comprise of TF, Central Solenoid (CS), Poloidal Field (PF), Vertical Stabilisation (VS) and Correction Coils (CC). In total, the installed power of the conversion plant will be between 1.6 and 2.0 GVA.

The highest reliability, availability, maintainability and safety are the key design drivers for this huge installation and due to the high current rating and DC voltage and current characteristics, thyristor based technology has been selected, with four-quadrant operation and circulating current capability introduced as a basic design feature.

In order to maintain the design requirements, the AC/DC converter units must meet a strict fault withstand capability against both internal and external events. In some very extreme but rare fault conditions a design compromise must be made such that there may be fuse intervention.

A modular approach is adopted for the AC/DC converter units, with higher output voltage requirements being met by series connection of converters. This also increases ease of maintainability and facilitates future enhancement.

The reactive power absorbed by the transmission grid becomes a major issue for large thyristor converters. However, the series modular approach to the design makes it possible to apply sequential voltage control and thus reactive power reduction without introducing non-characteristic harmonics.

The ITER AC/DC power converters will be controlled as an integral part of a real-time Plasma Control System (PCS); therefore, the fast response of the converter needs to be demonstrated. A transfer function model of has been developed that takes into account the required evolution of DC current output and the sequential voltage control.

The paper outlines the conceptual design considerations of the ITER AC/DC power converters, fault simulation and fast response analyses, together with reliability, availability, maintainability and safety requirements. The final detailed design will be performed under the responsibility of ITER Domestic Agencies as part of the ITER procurement arrangements