SYSTEM INTEGRATION OF THE ITER SWITCHING NETWORKS, FAST DISCHARGE UNITS AND BUSBARS

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The ITER Switching Networks (SN) and Fast Discharge Units (FDU) consist of large resistor banks which are inserted in the Toroidal Field (TF), Central Solenoid (CS) and Poloidal Field (PF) circuits by means of appropriate circuit breakers. These breakers are connected by water-cooled busbars to the AC/DC thyristor converters on one side and to the superconducting coils on the other side.

The SN are used at every pulse for plasma initiation in each of the CS, PF1 and PF6 circuits; the current is interrupted and then transferred into a resistor bank, giving rise to a maximum voltage of 8.5kV across the coils; thanks to the coupling between the coils and the torus, a loop voltage is induced in the gas, thus leading to the breakdown and to the start-up of the plasma current. After a few seconds (the exact time depending on the pulse set-up), the voltage can be reduced by inserting a second bank in parallel to the first one; finally, the whole unit is short-circuited, once the start-up phase is completed.

As for the FDU, these are used to protect the superconducting coils in case of quench; in such event, large resistor banks are inserted in the circuits to dissipate the energy stored in the coils, with a time constant varying from 7.5 s to 14 s, depending on the coil (CS, TF or PF).

This paper, after providing a description of the SN, FDU and busbars systems, will focus on system integration aspects: this subject has become more and more important as a consequence of the necessity to define the requirements for the ITER buildings, and therefore many details concerning the realisation and the installation of the equipment had to be defined.

One of the most critical aspects was the definition of the layout of the TF circuit busbars in the Tokamak building; in particular, since these are Safety Important Components, seismic analyses have been carried out on the busbar supports, to assure their capability of withstanding the worst event foreseen for the site; the outcome of these analyses, which resulted remarkably challenging in such a packed environment, will be given and discussed.

Critical topics regarding the new Resistor building will also be illustrated: the latest development in the resistors design led to a substantial rearrangement of the building layout, with a non-negligible consequence on the design of the resistor cooling system.

Issues associated to the routing of the cables connecting the resistors to the switches located in the Diagnostic building will also be discussed: this proved to be a non-trivial topic, due to the number (more than 200), size (from 50 mm to 65 mm diameter), length (above 200 m) and tortuous path of the cables.