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On optimization of air cooling system of FDRs dissipating energy from ITER magnet coils

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The Fast Discharge Resistors (FDRs) under development at NIIEFA are intended together with switching equipment to dissipate energy released in case of a quench of the ITER superconducting coils, thereby protecting them against failure. FDRs are made of sections consisting of steel resistive elements enclosed in boxes. Two-four sections stacked vertically form a separate module. During energy release the resistive elements are heated to 250-300^{0}C practically adiabatically. The resistors should be cooled to their initial temperature within 3-4 hours. For this purpose, the authors have developed the air cooling system based on the forced air circulation produced by seventeen fans in a complex system of series-parallel channels formed by air supply and return pipes, vertical modules and chimneys. The numerical simulation of the cooling process revealed that distribution of the air flow in the parallel channels formed by the vertical modules is considerably non-uniform, which essentially increases the module cooling time. The study performed by the authors within the last few years has made it possible to propose measures on optimizing the air cooling system mitigating the negative effect of air flow non-uniformity in the FDR modules. The reported analysis continues the previously performed studies of the FDR cooling system. The idea to install diaphragms in each module to equalize the air flow in the cooled-in-parallel modules has made it possible to reduce the time for their cooling to the specified values without a considerable reconfiguration of the air cooling system.

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