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THERMAL ANALYSIS OF DIII–D COILS FOR LONG PULSE OPERATION*

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DIII-D tokamak will be operated at higher magnetic flux and longer pulse lengths starting in 2006. Hence, the water-cooled copper coils will be subjected to higher currents for longer pulse length. In order to insure that the coils do not overheat during such an operating condition, a systematic program of analysis and experiments is being implemented.

The F8A coil consists of 58 turns. The coil is cooled by two parallel water circuits. Each set of 29 windings is arranged such a way that there is conduction heat transfer between adjacent windings through the electrically insulating epoxy.

This geometry was modeled which accounted for the forced convective heat transfer to the coolant, conduction heat transfer between the windings, heat loss to the atmosphere and change in coolant temperature as a function of distance. The analysis took into consideration the transient energy equations and axial conduction in the conductor. The effect of electrical leads on the coolant outlet temperature was also accounted for. The model was verified by comparison to the measurements done during operation. Additional experiments were performed with hot water flowing through the coil.

The model was used to determine the flow rate required and time to cool down the coil for higher currents and longer pulse operation without exceeding the safe temperature limits.

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