THERMAL STUDY OF THE DIII-D MACHINE HEAT REMOVAL CAPACITY*

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The DIII-D Tokamak machine dissipates 0.5 to 1.0 GJ of energy every 10 minutes in firing plasma shots. Cooling water must cool many heat generating sources including the DIII-D power supplies, coils, vacuum vessel, motor/generator, RF current drives, neutral beam power supplies, etc. The Tokamak heat removal system recirculates a few thousand gallons per minute of cooling de-ionized water to cool the critical components. As the DIII-D machine plans to go for longer and longer shots beyond the current experimental plans, we need to re-assess the machine's overall heat removal systems capacity and its performance efficiency. It is also planned to operate further into the summer which may affect cooling water temperature. A programmable logic controller (PLC) collects thermal and flow sensors data. The heat generating sources, the heat transfer rate to intermediate heat exchangers, and the ultimate heat rejection to the environment via the cooling towers are analyzed. A comparison of the DIII-D machine original design versus the actual performance result can determine the margin for heat removal capacity. Projections of heat removal rate at various longer plasma shots in the machine will be made. The ultimate limit will be the ability of the cooling towers to reject the heat load to the environment. Necessary design or operation procedural improvement will be proposed to attain the desired pulse duration. These changes may include cooling tower upgrade, heat exchanger cleaning and/or heat transfer surface addition, and /or modifying operational procedure to limit peak heat load.

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