

WATER COOLING SYSTEM UPGRADE OF DIII-D FACILITY FOR LONG PULSE OPERATION*

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In order to operate the DIII-D tokamak at higher auxiliary power levels and longer pulse lengths, the water cooling systems, which ultimately remove all of the heat loads generated by various current drives, neutral beams, compressors and power supplies, were recently re-evaluated. Thermal data from the current heat removal circuits were assessed during the past two years to establish thermal performance baseline. Heat load estimates for the next ten years of anticipated experiments were collected from all users of the facility. Material and energy balances, based on present and future operating scenarios were calculated. Required flows and temperatures for each of the users' components were addressed.

Based on this analysis and new requirements, a series of DIII-D facility cooling system improvements are planned. New energy-efficient cooling towers and pumps, with variable frequency drive, were proposed to allow for closer heat load matching. To take advantage of an energy conservation incentive program, offered by San Diego Gas and Electric to reduce power consumption, variable frequency drives and efficient computer control systems will be added, yielding financial savings and better flow distribution. A more efficient cleaning method for fouled heat exchangers was developed and verified to provide effective heat rejection to the users' equipment required for physics operations. Water treatment methods were planned to chemically slow fouling and physically remove precipitates and dust from the cooling water before they can settle. Filtration and chemical injection will be monitored by computer control system.

In addition, flow modeling of the cooling tower water-piping network, to distribute to the key equipment components, revealed flow deficiencies and a potential restriction in the facility. By using system modeling and ultrasonic flow measurements, the cooling tower water was redistributed through a more optimized (tuned) flow network lineup. The flow deficiencies will be corrected during the upcoming maintenance shutdown.

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