STRUCTURAL RESPONSE OF THE DIII-D TOROIDAL FIELD COIL TO INCREASED LATERAL LOADS*

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Recent calibration shots with full toroidal field (TF) coil current crossing the magnetic field from maximum current in the outer poloidal field coils have produced increased lateral loads on the outer sections of the TF coil. The increased lateral loads have resulted in deflections that have been sufficient to cause the TF coil to contact adjacent equipment and produce a transient short to ground within the coil. The upper and lower sections of the outer turns of the TF coil are clamped together by insulated preloaded studs to provide increased bending stiffness. These sections of the outer bundles depend on friction to react the lateral loads as a bundle rather than six individual turns. A major concern is that the increased loads will produce slip between turns resulting in excessive lateral deflections and possible damage to the insulating sleeve on the preloaded studs.

A finite element structural model of the B-coil was developed for the calculation of deflections and the shear load distribution throughout the coil for the applied lateral loads from a full current calibration shot. The purpose of the updated structural model is to correlate the applied lateral loads to the total shear force between the unbonded sections of the outer turns. An allowable integrated lateral load applied to the outer turns is established based on the maximum shear force that can be reacted by friction. A program that calculates the magnetic fields and integrated lateral load along the outer turns is to be incorporated into the plasma control system. The integrated load will be compared to the calculated allowable value prior to execution of certain calibration shots. Calibration shots with a calculated total lateral load greater than the allowable value will be prevented.

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