

## **STRUCTURAL ANALYSIS OF THE LOWER DIVERTOR PLATE FOR DIII-D\***

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The lower divertor of the DIII-D tokamak is being modified to provide better density control of the plasma in a balanced double-null configuration. The design and analysis of the lower divertor is complete and hardware is being fabricated. Installation of the new divertor is scheduled to be completed by the end of this year.

The primary component of the lower divertor is a toroidally continuous flat plate. The plate is water cooled for heat removal between discharges from three rows of graphite tiles attached to the plate. The plate is heated to 350°C with hot air and inductive current during baking. The plate is attached to the vacuum vessel floor by staggered supports which allow for differential radial thermal expansion and still react the large vertical loads due to halo currents. In addition, two rows of upgraded floor tiles in-board of the plate will be installed to provide diverted plasma strike points. The divertor plate is to be fabricated in four sectors from 316 stainless steel. Each sector consists of two plate halves with three machined coolant channels and are joined together by spot welds and perimeter seam welds. The 90 deg plate sectors are welded together inside the vessel to form a toroidally continuous ring. The divertor plate is subjected to large vertical halo current loads and simultaneous hoop loads. The asymmetric halo current loads are based on 30% of a 3.0 MA plasma current with a 2:1 peaking factor in the toroidal direction. Static stress analyses of the divertor plate and the welded joints show that the maximum stresses are less than the allowable stress values for annealed 316 stainless steel. A 2D stress analysis of the plate tile indicates that the maximum deflection of the plate due to halo currents will not produce cracks in the graphite tiles. Sizing calculations show that Inconel 718 supports are required to react the differential thermal expansion and halo current loads. The results from the structural analyses demonstrate that the new lower divertor satisfy the stress and deflection criteria.

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