Mechanical Design and Fabrication of the Lower Divertor for DIII–D*

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The lower divertor of the DIII–D tokamak is being modified to provide improved density control of the tokamak plasma during operation in either a high triangularly single null with triangularly the same as ITER or a high triangularly balanced double-null configuration. This divertor replaces the much smaller Advanced Divertor installed in 1990 in which the pumping aperture for the lower divertor was located further outboard appropriate for a low triangularly configuration. The design and analysis of the lower divertor is nearly complete and hardware fabrication has started. 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 elevated 100 mm above the vessel floor. The space below the plate forms a pumping plenum connecting the floor strike point to the lower cryo-pump. Three rows of graphite tiles are mechanically attached to the plate to shield it from plasma impingement. Due to a concern about the excessive erosion caused by plasma impingement, the through bolt holes in the tile face have been eliminated in areas of high heat flux. The plate is water cooled for heat removal between shots and can be heated to 350°C with hot air and inductive current during vessel baking. The divertor plate is supported from the vacuum vessel floor by two rows of 24 supports that must react the vertical loads due to halo currents. These supports are radially flexible to allow for differential radial thermal expansion between the divertor ring and the vessel floor. Upgraded floor tiles in-board of the plate will be installed to improve the target for the plasma strike point for outer leg pumping.

The divertor plate is to be fabricated in four 90 deg sectors from type 316 stainless steel. Each sector consists of two plate halves with three machined coolant channels. The two halves are joined together by spot welds and perimeter seam TIG welds. The vacuum tight 90 deg plate sectors are welded together inside the vessel to form a toroidally continuous ring. The water cooling/air bake-out lines connect the four sectors into two 180 deg cooling circuits will be welded in place.

Several plasma diagnostics will require some modifications or relocation for integration into the divertor system.

Topical Category:
- 3) Plasma facing components

Preference:
- Poster

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