

Measurements of the ECH Power and of the Transmission Line Losses on DIII-D

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ABSTRACT

The measurement of the power injected by the electron cyclotron heating (ECH) system in the DIII-D tokamak is a critical requirement for analysis of experiments, for tuning the gyrotrons for maximum power and efficiency, for tracking long-term operational trends and for providing a warning of problems with the system. The ECH system at General Atomics consists of six 110 GHz, 1 MW class gyrotrons. The rf power generated by each gyrotron is determined from calorimetry, using the relevant temperature and flow measurements from the cooling circuits of cavity, matching optics unit and dummy loads. The rf pulse length and time dependence are measured using an rf monitor at the first miter bend in the transmission line. The cavity power loading measured directly gives the generated rf power using a previously determined relationship between cavity loading and rf production. The direct measurement of the efficiencies of four of the transmission lines was performed using a high power dummy load placed alternately in 2 positions of each DIII-D waveguide line, at accessible points close the beginning and the end of each line. Total losses in the transmission lines range from 21.2% to 30.7%. Experimental results are compared to theoretical predictions of the performance of the components and waveguide lines.