Anomalies in the Applied Magnetic Fields on DIII-D and their Implications for the Understanding of Stability Experiments

J.L. Luxon,[1] M.J. Schaffer,[1] G.L. Jackson,[1] J.A. Leuer,[1] A. Nagy,[2] J.T. Scoville,[1] and E.J. Strait[1]

[1]*General Atomics, P.O. Box 85608, San Diego, California 92186-5608*

[2]*Princeton Plasma Physics Laboratory, Princeton, New Jersey 08543*

Abstract. Small non-axisymmetric magnetic fields are known to cause serious loss of stability in tokamaks leading to loss of confinement and abrupt termination of plasma current (disruptions). The best known examples are the locked mode and the resistive wall mode. Understanding of the underlying field anomalies (departures in the hardware-related fields from ideal toroidal and poloidal fields on a single axis) and the interaction of the plasma with them is crucial to tokamak development. Results of both locked mode experiments[1] and resistive wall mode experiments[2] done in DIII-D tokamak plasmas have been interpreted to indicate the presence of a significant anomalous field. New measurements of the magnetic field anomalies of the hardware systems have been made on DIII-D. The measured field anomalies due to the plasma shaping coils in DIII-D are smaller than previously reported[3]. Additional evaluations of systematic errors have been made. New measurements of the anomalous fields of the ohmic heating and toroidal coils have been added. Such detailed in situ measurements of the fields of a tokamak are unique. The anomalous fields from all of the coils are one third of the values indicated from the stability experiments[1,2]. These results indicate limitations in the understanding of the interaction of the plasma with the external

field. They indicate that it may not be possible to deduce the anomalous fields in a tokamak from plasma experiments and that we may not have the basis needed to project the error field requirements of future tokamaks.

PACS Nos. 52.30.Cv, 52.55.-s, 52.55.Fa, 52.55.Tn, 52.70.Ds.