

Structural Analysis of the NCSX Vacuum Vessel

Fred Dahlgren¹, Art Brooks², Peter Titus³, Paul Goranson⁴

¹ *Princeton Plasma Physics Laboratory, Princeton, NJ, fdahlgren@pppl.gov*

² *Princeton Plasma Physics Laboratory, Princeton, NJ, abrooks@pppl.gov*

³ *MIT Plasma Science and Fusion Center, Cambridge Ma, titus@psfc.mit.edu*

⁴ *Oakridge National Laboratory, Oakridge, TN, goransonpl@ornl.gov*

The NCSX vacuum vessel has a rather unique shape being very closely coupled topologically to the three-fold stellarator symmetry of the plasma it contains. This shape does not permit the use of the common forms of pressure vessel analysis and necessitates the reliance on finite element analysis. The current paper describes the NCSX vacuum vessel stress analysis including external pressure, thermal, and electro-magnetic loading from internal plasma disruptions and bake-out temperatures of up to 400 degrees centigrade. Buckling and dynamic loading conditions are also considered.