

ABSTRACT

The maximum operational high beta in single-null divertor (SND) long-pulse tokamak discharges in DIII-D with a cross-sectional shape similar to the proposed ITER device, is found to be limited by the onset of resistive instabilities which have the characteristics of neoclassically destabilized tearing modes. There is a soft limit due to the onset of an $m/n = 3/2$ rotating tearing mode which saturates at low amplitude and a hard limit at slightly higher beta due to the onset of an $m/n = 2/1$ rotating tearing mode which grows, slows down and locks. By operating at higher density and thus collisionality, the practical beta limit due to resistive tearing modes approaches the ideal MHD limit.