

Tolerance Evaluation of Poloidal Shear Keys for ITER TF Coil (P1-E-198)

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There are 18 ITER Toroidal Field (TF) Coils. Unlike the other ITER coils, these coils are structurally linked. These links consist of friction between the coil legs in the central vault formed by the inner straight legs of the coils, four outer inter-coil structures (OIS) and one inner inter-coil structure (IIS). The OIS consists essentially of bands around all 18 coils to provide shear support by forming shear panels with the coil case, and the IIS consists of poloidal circular keys placed directly between the coil cases. Global analysis of the 'perfect' coil shape has shown high stresses in the IIS, in the poloidal keyways. Optimization has successfully reduced these stresses to acceptable values as regards the expected fatigue resistance. However it is necessary to confirm that the stresses are still acceptable when realistic values of geometry variations are included (i.e. the effect of coil and case tolerances). Because of the extensive mechanical links between coils the poloidal key stresses can also be affected by tolerances elsewhere in the case. As the first step in assessment of the possible variations in stresses, a substructure technique is being used to develop a local model of the key region. The result of geometry variations between individual coils is a loss in the 18 fold symmetry used to simplify previous analyses. With the new and optimized model it should be possible to relax the 18-fold symmetry, but a full analysis of all 18 coils is still not possible. Systematic ways of representing the tolerance variation in the finite element model have been developed so that parametric studies can be undertaken without a full reconstruction of the model.