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Profile Tolerances influence on Cryostat Base Section

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The ITER cryostat—the largest stainless steel vacuum pressure chamber ever built which provides the vacuum environment for components operating in the range from 4.5 k to 80 k like ITER vacuum vessel and the superconducting magnets. The Cryostat is divided into four section, of which, Base section is most complex because of its web shaped structure sandwiched between two 60mm thick plates with stringent requirements in manufacturing tolerances.

The required profile tolerance is $30(+10/-20)$ mm at weld locations and $20(+/-10)$ mm at other locations but during manufacturing, the tolerances are observed to be $60\text{mm}(+10/-50)$ mm at weld location and $50\text{mm}(+10/-40)$ at other locations. This increased profile tolerances are expected to affect the structural behavior of Cryostat. The present paper discusses assessment of these tolerances on Cryostat Base Section using FEM software, Ansys. The increased profile tolerances on Base Section are applied using two different methods [2]. Maximum tolerance value was considered and five cases were identified to the complete effect of increased profile tolerances on Base section. Limit Load method [1] is used to analyze structural impact of these increased tolerances cases on Cryostat Base Section. The impacts of critical results were discussed in the end.

References

- [1] Limit Load Analysis Method, ASME Sec VIII, Div 2
- [2] ANSYS Theory of Reference v15
- [3] Instructional Material Complementing FEMA 451, Design Examples, Seismic Isolation 15-7- 53

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