

A STRUCTURAL ANALYSIS OF THE SECTOR SUB-ASSEMBLY TOOLS FOR 40° SECTOR ASSEMBLY AT ASSEMBLY HALL

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The ITER Tokamak assembly tools are purpose-built tools to complete the ITER Tokamak machine which includes the cryostat and the components contained therein. Based on the basic design prepared by the ITER organization [1], Korea has carried out the conceptual design of assembly tools [2]. The Sector sub-assembly tools described in this paper are tools to assemble vacuum vessel, thermal shield and toroidal field coils into a complete 40° sector. In-pit assembly tools are the purpose-built assembly tools for the completion of final sector assembly at Tokamak hall. The 40° sector sub-assembly tools are composed of the upending tool, the sector sub-assembly tool, the sector lifting tool and the vacuum vessel support and bracing tools. The results of structural analysis to verify stabilities of the sector sub-assembly tools are described in this paper.

The structural stabilities of sector sub-assembly tools have been studied using ANSYS with an applied load that is 4/3 times the dead weight and the results of structural analyses for these tools are well within allowable limits. The structural analysis of the sector sub-assembly tool was carried out under applied load of dead weight x 4/3 using ANSYS v12.0 and compared with allowable stress. The main material is AISI 1050. Finite Element Analysis of the upending tool and lifting tool using ANSYS is carried out under applied load of dead weight x 4/3 as same process. As a result of this analysis, all stress intensities of the upending tool and lifting tool are below the allowable stress. In seismic analysis of the upending and sector sub-assembly tool, stabilities of these tools are verified under seismic load provided IO.

The conceptual designs of the sector sub-assembly tools including upending tool, sector sub-assembly tool and lifting tool have been developed. In the results of the analysis for assessing structural stabilities of the tools, all stress intensities of the upending tool are less than allowable stress in each case. The maximum stress intensity of the sector sub-assembly tool and associated parts was within allowable stress limit. The stress intensity and deflection of the lifting tool was also within limits. The design of the sector sub-assembly tools developed by KO DA satisfied ITER assembly plan and technical requirements. It was verified that the structural stabilities maintain sufficiently to secure assembly tolerance and geometrical requirements requested by IO.

[1] ITER Organization, Design Description Document; Assembly Tooling (DDD 22), 2004.

[2] K. H. Im, et al., The Structural Design of ITER Tokamak Sub-assembly Tools, APFA 2005, Jeju-city, Korea, August 29-31, 2005.