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P4.157 Improvement of manufacturing jigs design for reduction of welding distortion in Vacuum Vessel PS1 through finite element analysis

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One of the principal means of controlling welding distortion of metallic welded components is the use of assembly jigs. The knowledge about the effect of jigs on weld distortion is based in the qualitative, generally neither systematic nor documented experience of each manufacturer. Such knowledge needs to be complemented by specific research for components with the tight tolerances, intricate geometry, complex manufacturing sequence, size and wall thickness of the ITER Vacuum vessel. The vessel, of toroidal shape, will be constructed through the welding of nine 40° sectors, being each one formed by the welding of four poloidal segments. The influence of the assembly jigs, and the results of their design optimization process for the control of welding distortion in 'poloidal segment one' (PS1) have been investigated through finite element analysis. The result of the investigation is materialized in the jig design modification, obtained through iterative distortion analyses, identifying at each step the main distortion problems in the interaction between jig and segment. The conclusions of the research show that jig design is the main contributor to control weld distortion of PS1, when compared to welding sequence. Results and conclusions obtained provide highly valuable information to the manufacturer during the design phase, in terms of jig behavior, jig re-design and distortion control.

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