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Manufacturing Design and Progress of the First Sector for ITER Vacuum Vessel

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The ITER Vacuum Vessel (VV) is a torus shaped double wall structure and consists of nine sectors and several ports. Main functions of the VV are to provide high vacuum for plasma operation and to protect radioactive contamination as the first safety barrier. Korea Domestic Agency (KODA) has responsibility for procuring of two sectors including the first sector which will be delivered before others. KODA contracted with Hyundai Heavy Industries Co., LTD (HHI) to product the VV sectors and major ports.

The design and fabrication of the VV as nuclear equipment shall be complied with the RCC-MR code and regulations of nuclear pressure equipment in France (ESPN). The manufacturing design has been developed to fabricate the main vessel and port structures in accordance with the design requirements. All manufacturing sequences including welding methods are also established to meet the demanding tolerance and inspection requirement. The manufacturing design of Korean sectors has special design concepts to minimize welding distortion such as self-sustaining support ribs and cup-and-cone type segment joints. Several mock-ups have been constructed to verify and develop the manufacturing design and procedures. Qualifications for welding, forming and NDE have been conducted to verify related procedures according to the requirement.

For fabrication of the VV sectors and ports, 3,000 tons of plates and forgings had been produced by European steel companies and delivered to HHI. Four poloidal segments (PS) for the first sector are being fabricated simultaneously in HHI factory. All inner shells were cut, bended and machined for welding. Welding and NDE of inner shells for PS2 and PS4 are finished. To reduce schedule delay machining of forging blocks are on-going in parallel. Some of machined blocks are welded on the inner shell by TIG and electron beam welding.

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