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Convective Baking Test of the ITER Lower Port for Factory Acceptance

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The ITER lower port is designed to support divertor remote handling and vacum pumping. To meet the purpose, it will be assembling to each main vessel on the vacuum vessel manufacturing site. Before delivering to the sector shop, a series of fuctional and mechanical test, which is so-called factory acceptance test (FAT) should be performed by the manufacturer. The ITER FAT should be complying with the RCC-MR 2007 code and French regulations of neclear pressure equipment (ESPN) to assure quality of nuclear pressure equipment. The precedure of lower port FAT has been set to that visual test, pressure test, baking, vacuum leak test, and final dimensional inspection. Especially, the baking is critical cleaning method to satisfy required vacuum condition. The baking condition is challengeable to satify both the given ramp-up/down condition, which is 5 ℃/hr, and the temperature difference of the object within 40 ℃, simultaneously. The air heating and circulating furnace has been specially designed to apply convective heating and cooling method. This is because the lower port is large complex double wall box structures, convevtive heating and cooling is relatively proper method to satify the given condition with time. In this study, using the mock-up of the lower port, convective baking test is perfomred with maximum holding temperature is set to 220 ℃ during 12 hours. As a result, the maximmum temperature difference of the mock-up is apperaed 15 ℃, which is appeared at the ramp-down condition. In addition, applying the measured result, thransient thermal-structural analysis is performed. The maximum stress of 85.5 MPa is occured, and this is reasonable stress intensity compare to the allowable stress 187.5 MPa. It is a proven that the convective baking method is quite feasible as the FAT baking for the ITER lower port.

Co-authors: Dr MOON, Hokyu (Tokamak Engineering Department, ITER Korea, National Fusion Research Institute); Dr KIM, HakKun (ITER Organization); Dr KIM, Hyun-Soo (Tokamak Engineering Department, ITER Korea, National Fusion Research Institute); Dr KIM, Yu-Gyeong (Tokamak Engineering Department, ITER Korea, National Fusion Research Institute); Dr PARK, Chulkyu (Tokamak Engineering Department, ITER Korea, National Fusion Research Institute); Dr CHEON, Jason (ITER Korea(KODA), National Fusion Research Institute); Dr KIM, Gwang-Ho (Tokamak Engineering Department, ITER Korea, National Fusion Research Institute); Dr CHUNG, Woo-Ho (Tokamak Engineering Department, ITER Korea, National Fusion Research Institute); Dr SA , Jeong-Woo (ITER Organization)

Presenter: Dr MOON, Hokyu (Tokamak Engineering Department, ITER Korea, National Fusion Research Institute)

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