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Interference fit process development for the ITER vacuum vessel gravity support mock-up fabrication

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The ITER Vaccum Vessel (VV) is supported by the nine VV gravity supports (VVGS) located on the cryostat toroidal pedestal. The VVGS is dual hinge type that fastened by dowel on the hinge-block hole. The primary hinge restrains a vertical and toroidal movement of the VV system against fast displacements by the seismic events or fast transients. The secondary hinge restrains steady vertical load. However, the hinges allow radial thermal expansion during temperature increase for operation (100°C) and baking (200°C). This paper presents the technical approach and result of interference fitting process of the sleeves and MoS2 coated dowel to the full-scaled VVGS mock-up. Since the sleeve and hinge-block hole have tens of micrometers tolerance and around two meter long length, shrink fit method has been selected for the interference fitting of sleeves. To secure a sufficient time for process, liquid nitrogen was charged to the handling fixture capped sleeve hole's cavity. As a result, the required contraction time was secured as hundreds of seconds. Since the moisture which could be released from the VVGS in the vacuum evironment might be affect the operation of the VV or cryostat, defrosting treatment of sleeve is required. A local protection system was selected with charged nitrogen injection nozzles. As a result, the defrosted surface of shrinked sleeve was maintained during fitting process. A selected MoS2 coating solution was confirmed to satisfy the lubricating ability and durability of technical specification through the pin-on-disk test. The central heating bar was used to insure uniform thermal expansion of the sleeve hole. As a result, MoS2 coated dowel successfully inserted into the sleeve hole without surface contact. Consequently, the interference fitting was successfully done for VVGS mock-up fabrication, and the technical solutions will be applied to the VVGS manufacturing.

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