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P4.142 Heat Management for Water-Hydraulic Systems at ITER Remote Handling

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The full exchange of the ITER divertor is performed with the Divertor Remote Handling System during ITER long-term maintenance campaigns. Access to the vessel is possible through the lower maintenance port. The size of the port is highly constrained, therefore, high power density actuation systems are required to lift and transport the 10-tonne cassette assemblies in and out the vessel. It has been found that water-hydraulics can deliver the required power and tracking accuracy.
The ambient temperature within the divertor area is around 50℃, which tends to be at the upper limit of allowed temperature range for water hydraulic components. Cooling hydraulic fluid below this with traditional methods is practically impossible. In this study, heat management of two water-hydraulic powered systems were considered, namely Cassette Toroidal Mover (CTM) and Cassette Multifunctional Mover (CMM). Hydraulic power for the CTM cannot be externally supplied as the umbilical connecting CTM to the outer world is packed with electric wires for motors and control as is. Therefore, the Hydraulic Power Unit (HPU) needs to be situated within the CTM chassis. Power for the CMM hydraulics is supplied from the transfer cask used for transporting plant components and maintenance equipment between divertor area and the hot cell. It is practically the only place the HPU can be housed in. Hence, a project to develop and analyse heat management methods for the Movers was undertaken.
Multiple heat management methods were devised and analysed. Their pros and cons were weighed against each other and the best solutions for these particular cases were selected after trade-off analyses. As a result, rather a traditional fluid/air heat management solution was selected for the CMM and a solution which includes no dedicated cooling was selected for the CTM. Whether the solutions suggested herein are applicable to other ITER systems is discussed.

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