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P4.143 Water quality and cleanliness effects on water hydraulic components in ITER remote handling maintenance systems

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Remote Handling (RH) equipment are deployed to exchange the ITER Divertor, segmented in 54 cassettes. The RH equipment are powered and controlled with water hydraulics, using self-supplied demineralised water as a pressure medium. Water hydraulics servo control technology has been successfully proven at Divertor Test Platform 2 (DTP2) with a full-scale prototype, namely Cassette Multifunctional Mover (CMM). However, the tests at the DTP2 have been carried out at 20°C ambient temperature while the maximum in-vessel ambient temperature during long-term maintenance operations can reach up to 50°C. Demineralised water at high temperature is known to be chemically aggressive, leading to potential problems such as corrosion and seal material degradation. This could result in accelerated hydraulic component degradation and in water particle contamination. The latter is especially worrying as water hydraulic servo valves require high levels of water cleanliness in order to function correctly.

A test was commenced to ascertain the impact of demineralized water at high temperature on the selected water hydraulic technology in terms of performance and component deterioration. A heated chamber was constructed to emulate the 50°C ambient temperature of the divertor area. The water hydraulic system test bed inside the heated chamber was a loaded single-joint system with the hydraulic components of the CMM design. The test system ran for 2000 hours. Water impurities were monitored regularly over the testing period.

The test results showed that the filtration system could keep the water cleanliness up to the required level. Deterioration and corrosion was found in the post-test disassembly of the components, even though the component materials were specified as stainless steel and other non-corroding materials. A discussion on component material compatibility and effect of heat treatments, water quality and cleanliness, and management thereof, based on the results and observations on the test period is included in this paper.

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