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Servo valve endurance test for Water-Hydraulic systems in ITER-relevant conditions

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ITER Divertor maintenance equipment work under considerable ambient temperature and radiation load. The heavy components are moved with equipment powered with water hydraulics, with demineralised water as a pressure medium. None of this has yet been tested in ITER-relevant environmental conditions and over projected duty cycles and loading. Hence, a project was undertaken to ascertain the component compatibility with the environment and pressure medium, and their robustness over the required operational period. No irradiation, however, was included. This would be done later on if this test was successful. A heated chamber was constructed to emulate the 50°C ambient temperature of the divertor area. All the tested components were located within this chamber.

Test trajectories and loads were derived from the Divertor Test Platform 2 (DTP2) at Tampere, Finland, at which the Cassette Multifunctional Mover (CMM) operations and equipment are prototyped. The prototyped operations are along the operations projected for the ITER Divertor area maintenance operations with active-to-idle ratio similar to what was projected for ITER operations. The most important component to be tested was the servovalve. As the hydraulic medium is rather aggressive and the selected servovalve was not originally designed to be used with water, the 2000-hour operational time was considered to be a potential issue. Hence, test routines and measurements were specifically tailored to measure the operational parameters of the servovalve.

As a result, after the 2000-hour test the servovalve parameters remained within the limits promised by the supplier (Moog hydraulics). Null-point leakage increased by 45% (from 0.45lpm to 0.65lpm which is still quite low) and tare leakage did not change significantly. Pressure gain and hysteresis increased significantly but remained within the allowable limits. Cylinder tracking error remained more or less constant over the test, although it decreased an insignificant amount over the last testing week.

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