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P2.109 EM analysis and thermal-mechanical dimensioning of First Plasma Protection Components

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The First Plasma Protection Components (FPPC) are a set of structures temporarily installed inside the vacuum vessel specifically for first plasma operation. In addition to aiding plasma generation, these components protect the unshielded vacuum vessel and ancillary systems from the plasma. Upon completion of first plasma operation, these components will be removed.

A significant design and analysis activity had been performed during the conceptual design phase.

For the final design phase, a revised design is being developed, from a combination of feedback from the conceptual design review, changes to interfacing requirements with other systems, and further investigation into detailed aspects of the design.

The feasibility of the final design concept of the four FPPC components (Temporary Limiter, Divertor Replacement Structure, ECRH mirror and dump) needs to be verified through an exhaustive set of thermal, electromagnetic (EM) and stress analyses before being presented to the Final Design Review.

The analysis includes evaluation of EM loads during reference plasma disruption events and of the temperature evolution due to the surface heat flux coming from the plasma.

The EM and thermal loads are used as input for the stress analysis of the FPPC, together with bolt preloads and seismic loads for the evaluation of static strength of the parts in accordance with the specified ITER design criteria (called SDC-IC).

The structural finite element analyses use static non-linear approaches, assuming the elastic or elastic-plastic behaviour of the materials. Further analyses make extensive use of the structural sub-modelling technique for detailed analysis of bolts connections.

This paper outlines the engineering aspects of the FPPC and focuses on the feasibility of the present design by structural assessment.

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