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P4.168 Preliminary implementation of EU-DEMO primary heat transfer systems for HCPB breeding blanket option

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This work concerns the conceptual design of the pipework and the main equipment of the Primary Heat Transfer System (PHTS) of EU-DEMO fusion power plant. EU-DEMO is considered to be the nearest-term reactor design to follow ITER; it shall be capable of demonstrating production of electricity, operation with a closed fuel-cycle and to be a facilitating machine between ITER and a commercial fusion reactor.

In particular the systems related to the Helium-Cooled Pebble Bed (HCPB) Breeding Blanket (BB) option are considered here. During pulse operation, breeding blanket modules will be the main thermal power source; other In-Vessel components such as Divertor (DIV) and Vacuum Vessel (VV), generating thermal power at lower temperature, will join with BB in the definition of the total reactor power. BB, DIV and VV PHTS remove all the In-Vessel generated power and reject it to Power Conversion System (PCS) through a molten salt Intermediate Heat Transport System (IHTS), which is equipped with an Energy Storage System (ESS) to allow a continuous operation at nearly constant electric output in both pulse and dwell conditions, despite of the lack of the fusion power generation in this latter phase of the DEMO operation.

Given the current EU-DEMO plant schemes, the authors explored possible layout solutions and the main technological constraints. 3D CAD models helped estimating more precisely fluids inventory and pressure drops, also weight and length of the piping system, which have a significant impact on the plant cost estimation.

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