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DEMO Divertor - Cassette Design and Integration

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The divertor is one of the key components of the EU-DEMO reactor. The development of a reliable solution for the power and impurity particle exhaust is recognized as a major challenge towards the realization of DEMO. The pre-conceptual design activities for the EU-DEMO divertor are carried on considering two project areas: the 'Target development', focusing on the design of the vertical targets directly facing the plasma, and the 'Cassette design and integration', dealing with the design of the cassette structure and the integration of sub-components. The essential aim of the project is to develop in both project areas advanced design concepts for a divertor system being capable of meeting the physical and system requirements defined for the EU-DEMO reactor.

In this work a general overview of the EU-DEMO divertor cassette design is presented, considering systems & functional requirements, structural assessments and interfacing systems. The design solutions adopted for the integration of the main divertor sub-components are discussed, in terms of layout and attachment to the cassette body (CB) of the Plasma Facing Components (PFCs), the liner, the reflector plates and the cassette-to-vacuum vessel fixation system (nose at the inboard and wishbone at the outboard).

Different materials are integrated on the divertor cassette, requiring different cooling temperatures and leading to different behaviors to consider. In particular, Eurofer97 ferritic-martensitic steel has been selected for the cassette structure in order to meet the activation and radwaste requirements. As a consequence of this choice, two different cooling circuits have been introduced on the divertor cassette, one working at 180℃ at 3.5 MPa as operating conditions of the Eurofer CB, the other providing coolant water for the PFCs (CuCrZr pipes) at 130℃ at 5 MPa.

The main issues driving to the divertor design are tackled, mainly in terms of material damage for different materials present in the divertor assembly, VV shielding function of the divertor, optimization of both Vertical targets and Cassette body cooling circuits, dimension and position of opening on the divertor assembly necessary for pumping deuterium and helium from the lower port.

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