DESIGN AND ASSEMBLY TECHNOLOGY FOR THE THERMAL INSULATION OF THE W7-X CRYOSTAT

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The Max-Planck-Institut für Plasmaphysik in Greifswald is building up the stellarator fusion experiment Wendelstein 7-X (W7-X). To operate the superconducting magnet system the cryogenic vacuum is protected by a thermal insulated cryostat. The plasma vessel forms the inner cryostat wall, the outer wall is realised by a thermal insulated outer vessel. In addition 245 thermal insulated ports are feet through the cryogenic vacuum to allow the access to the plasma vessel for heating systems, supply lines or plasma diagnostics.

The thermal insulation is being manufactured and assembled by MAN Diesel & Turbo SE (Germany). It consists of a multi-layer insulation (MLI) made of aluminized Kapton with a silk like fiberglass spacer and a thermal shield covering the inner cryostat surfaces. The shield on the plasma vessel is made of fibreglass reinforced epoxy resin with integrated copper meshes. The outer vessel insulation is made of brass panels with an average size of 3.3 x 2.0 m². Cooling loops made of stainless steel are connected via copper strips to the brass panels. The thermal insulation of the ports is constructed by an offset of the as built port following the same design, a MLI is placed inside and a brass shield on the outer side is thermally connected by copper stripes to the actively cooled shields of the neighbouring vessel panels. Especially the complex 3 D shape of the plasma vessel, the restricted space inside the cryostat and the consideration of the operational component movements influenced the design work heavily. The manufacturing and the assembly has to fulfil stringent geometrical tolerances e.g. for the outer vessel panels +3/-2mm which will be checked by a 3D geometrical survey performed with a laser tracker.

The paper introduces the design of the thermal insulation especially of the outer wall and the ports. The assembly technology and recently reached assembly progress will be described.