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P4.094 Mechanical analysis of the European DEMO central solenoid pre-load structure and coils

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The pre-conceptual design of the European DEMO fusion tokamak is currently being developed under the coordination of the EUROfusion Consortium. This paper reports the mechanical analysis of the central solenoid (CS), which comes right after the phase of definition of the winding pack proposed by the CEA. An analytical model is firstly developed in order to approximate the required axial preload level, considering the electromagnetic forces and the cool-down thermal shrinkage of the coils. This first step allows to define the tie-plates pre-compression structure. Then a global FEA of the CS, considering a sector-symmetry model and smeared winding pack properties is built-up in order to check the pre-load structure, and to identify the most critical loading scenario for the conductor. Finally, an axisymmetric local FEA of the CS winding pack is performed in order to study in detail the stress level in the conductor jacket and in the insulations layers. This procedure allowed to assess the acceptability of stress for the CEA winding pack proposal, and will be will be operated during the future magnetic system design iterations.

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