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Wed-Mo-Po3.01-07 [7]: Design and analysis of DEMO PF coils

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The design of DEMO PF coils is proposed and analysed based on the requirements defined by the EUROfusion 2019 DEMO baseline. Two types of forced flow cable-in-conduit conductors are used: NbTi with high void fraction and Nb3Sn with a dedicated cooling channel. The design addresses the dimensioning of the winding pack, the electromagnetic field calculations, stress analysis and thermal hydraulic and quench propagation analysis. The amount of structural material depends mainly on the hoop load. This is verified by fatigue stress analysis. The amount of superconductor, copper and cable void fraction (or cross-section of cooling channel) are determined by the temperature margin and quench analysis. The AC loss is modelled with conservative assumptions. The new design fulfils the design criteria set by the 2019 DEMO baseline. For some coils, the comparison of NbTi and Nb3Sn design options suggest more efficient allocation of structural and superconducting material in the latter case. It is also verified that temperature margin is always above 1.5 K.

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