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Study of the Hotspot Temperature during Quench in the Non-Planar Coils of W7-X

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The quench protection system of the non-planar coils of the Wendelstein 7-X stellarator was laid out over fifteen years ago. At that time, the assessment of the hot spot temperature by a basic adiabatic model was done using design values for material and operation parameters. After the operating experience in 2016, the hot spot temperature is re-assessed with the thermal-hydraulic program THEA, using the actual values for delay and dump time. The electrical resistivity of the conduit alloy is measured over the whole range of temperature and in magnetic field on relevant samples of conductor, exposed to the hardening heat treatment after winding. The results are fed into Thea. Parametric variations are studied in the calculations, e.g. testing the effect of the operation current, quench initiation zone and dump resistor. The results suggest that the hot spot temperature of the conduit in case of quench is safely within the allowable values even in case the dump voltage is reduced compared to the initial design value.

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