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P2.098 Protection system for Wendelstein 7-X superconducting magnets

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The Wendelstein 7-X stellarator (W7-X), one of the largest stellarator fusion experiments, will start the third plasma operation campaign mid of 2018 at the Max Planck Institute for Plasma Physics in Greifswald, Germany. The main objective of the experiment is to prove the reactor relevance of the stellarator design.

The W7-X experiment has a superconducting magnet system with 50 non-planar and 20 planar coils grouped in five equal modules and electrically connected in seven circuits with 10 coils each. Seven power supplies provide individual coil currents in the seven circuits. A quench detection system checks permanently the superconducting system regarding the onset of a quench. In case of a quench or a severe failure, the magnet protection system will be activated and leads the current into dump resistors. The magnet protection system consists of a set of switches and breakers and a dump resistor, made of pure nickel. The system was original designed for currents up to 20 kA and voltages up to 8 kV with a total energy of about 1 GJ. Based on new requirements and operation experiences, updates and improvements of several components were implemented in the last 12 month.

The paper will present the design and function of the magnet protection system and describes the motivation, the studies as well as the implementation and tests of updated components and procedures in detail.

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