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The Design Improvement of the Superconducting Magnet of the KATRIN Cryogenic Pumping Section

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The Karlsruhe Tritium Neutrino experiment (KATRIN) operates a series of superconducting solenoid magnets for guiding beta-electrons from the source to the detector. KATRIN has changed the superconducting magnet systems with respect to operation mode and by-pass diodes, in order to have a more reliable operation of the complex magnet systems for a designed long operation lifetime of more than 10 years. The key components of the superconducting magnets like persistent-current switch and by-pass diodes can degrade due to quenches at a higher current and be finally damaged. Moreover, the components can be hardly repaired with an expansive cost and time, once one of them fails inside a welded complex magnet chamber. Therefore, we improved the design of the superconducting magnets according to the operation mode change from persistent-current mode to driven-mode with a stable power supply. A more sophisticated quench protection system is under design for the driven-mode including power supply and external energy dumping circuit. The design of the diodes stacks has been updated and qualified by cryogenic cold tests. Two cold diodes vessels are added for the accessibility to the by-pass diodes from outside of the cryostat. This paper describes the design improvement of the superconducting magnets of the Cryogenic Pumping Section (CPS) of KATRIN.

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