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Thu-Mo-Po4.03-11 [22]: Implementation and first operational experiences with the high voltage In-Service-Tests on the superconducting magnet system of Wendelstein 7-X

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A hypothetical ground fault in the superconducting (sc) magnet system of Wendelstein 7-X would shift the midpoint of the grounding system and therefore increase the voltage to ground during a fast discharge of the sc magnet system. As this voltage could endanger the high voltage integrity of the sc magnet system, an In-Service-Test system has been developed to monitor the insulation of the sc magnet system during operation especially after changing the loads of the magnets. The system, that is associated to the power supply system, is designed to lift the electrical potential of non-planar coil system with respect to ground by 1.5 kV and to measure the resulting leak current while the magnets are operated. The leak current is used to evaluate any changes in the insulation resistance and to decide whether a fast discharge can still be done without endangering the sc magnet system. The design of the In-Service-Test was evaluated with computer simulations of the power supply and the magnet system, and a prototype that was tested at one coil group together with the corresponding power supply. In 2014, the system was finally installed for all five non-planar coil groups and commissioning took place for the first experiment campaign in 2015. Operated during the first experimental campaigns of Wendelstein 7-X from 2015 to 2017 the experiences gained led to modifications that already have been implemented and tested during the operation campaigns in 2018 and 2019.

The paper describes the implementation of the In-Serve-Test system and the associated tests for the commissioning as well as the first operational results and corresponding modifications.

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