

TOPIC: E - Magnets and Power Supplies
(P1-E-43)

Structural evaluation of the bus bar system of Wendelstein 7-X stellarator

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The superconducting magnet system of the Wendelstein 7-X stellarator produces a magnetic field up to 3 Tesla at the magnetic axis. The system consists of 5 identical modules each including 10 non-planar and 4 planar coils as well as a 72 degree sector of the central supporting ring. This modular system allows to design and to study the bus bars for each module independently. The present study deals with the bus bar supporting system for the module No.5.

To minimize the stray field in the plasma area the bus routing is basically arranged in a way that bus lines fed with the opposite current run in parallel and close to each other. The electromagnetic forces occurring in the bus lines are a result of interaction of the bus current (up to 18 kA) with the external fields produced by magnet system and also with the fields of neighboring buses.

Main requirements to bus supporting system:

- It has to provide acceptable levels of stresses in the conductor jacket (aluminum alloy) and conductor insulation.
- It has to tolerate relative movements of the coils and central ring for different regimes.
- It has to allow relative shift of the neighboring bus lines due to their temperature difference up to 50 K during cooling down process.

Main elements of the bus supporting system:

- Supports fixing the buses to the coils and to the central ring. They represent adjustable structures allowing buses' movement in the longitudinal direction.
- Neighboring bus lines are interconnected with special clamps every 250 mm.

The global beam/shell/3D finite element (FE) model of the insulated buses and their supports has been developed for the module No.5.

The paper describes design and test strategy as well as the main analysis results.