

DESIGN AND FABRICATION OF THE SUPERCONDUCTING BUSSYSTEM FOR THE STELLARATOR W7-X

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In the framework of cooperation with the Max-Planck-Institute for plasma physics (IPP) essential work packages of the superconducting stellarator Wendelstein 7-X (which is presently under construction at Greifswald, Germany) have been taken over by the Forschungszentrum Jülich (FZJ). One of these packages is the design, construction, qualification, manufacturing and assembly of the superconducting three-dimensional bussystem and its appropriate supports. An overall concept of the project was elaborated with the goal to optimize manufacturing steps, to simplify the system assembly and to provide easy transportation.

In order to compensate the magnetic stray fields generated by the bus currents and to facilitate the bus assembly, a suitable bus topology was developed. For checking the geometry of the bent buses and to examine the buses assembly a 1:1 model of one W7-X section (72°) has been built. An insulation set up was developed and different samples have been fabricated. For qualification the insulation was examined as follows:

- high voltage insulation checks including measurements of the Paschen firmness,
- thermal tests and mechanical bending under cryo-temperatures at 77 K,
- leakage and high pressure tests to simulate quench situations and
- vacuum compatibilities of the materials and methods used.

The design will be shown, calculation of magnetic fields and forces are presented. For series production of the 121 buses a production line has been installed. The fabrication process and its main appropriate steps will be presented:

1. Straightening of the superconductor on a rolling machine
2. Rounding on a special turning lathe, required to facilitate 3-dimensional bending
3. Bending on a 3-D-bending machine
4. Checking of geometry on the 1:1 model
5. Electrical insulation and conductive lacquer coat applied by hand
6. Vacuum and high voltage test at several pressure steps (Paschen test) inside bellow tube
7. Transportation in bundle of 6 buses to Greifswald