WENDELSTEIN 7-X – Status of Construction and Prospects

H.-S. Bosch for the W7-X Team
Max-Planck-Institut für Plasmaphysik, Wendelsteinstraße 1, D-17491 Greifswald, Germany
corresponding author: bosch@ipp.mpg.de

The WENDELSTEIN 7-X stellarator, presently under construction in Greifswald, is “fully” optimised, based on the concept of quasi-isodynamicity. W7-X is consistently designed for a consistent operation of long-pulse (30min) reactor relevant plasmas. The advanced component design and the optimisation of the stellarator magnetic field configuration have been developed to ensure stable, high-beta steady state operation, thereby demonstrating the reactor potential of optimised stellarators.

The superconducting magnet system of W7-X consists of 50 non-planar coils (5 different geometry types), 20 planar coils for variation of the magnetic field configuration (2 different geometry types), a bus-bar system to electrically connect the coils, and a central support ring as well as a set of supporting elements to form a mechanically stable system. The cryostat that also provides the thermal insulation of the cold magnet system, consists of the plasma vessel, the outer vessel, the ports, and the thermal insulation.

Construction of Wendelstein 7-X has progressed considerably over the last years. Most of the large components of the device have been delivered. The manufacturing of the 70 super-conducting coils has been completed with the successful tests of all coils under cryogenic conditions. All large cryostat components (plasma vessel, ports, outer vessel) have been delivered. Fabrication of the bus-bars and of the cryo-pipes (for cooling the coils and their support structure) is on track, with the majority of these components already being finished and delivered. Also the manufacturing of the in-vessel components is according to plan.

Assembly of the stellarator has advanced very smoothly. Presently, the five identical modules assembled simultaneously (at different completion stages) on separate assembly rigs . When finally all modules are positioned on the machine base, they will be connected to form a torus and the peripheral components, (heating, diagnostics and peripheral installations) will be completed. At present, three modules are ready and being equipped with the ports, while on the two remaining modules, bus-bars, joints and cryo-pipes are being installed. The end of assembly is scheduled for the summer of 2014.

The paper will describe the main components of the device and give an overview of the construction progress. The physics approach to achieve high performance steady state operation will be described, based on the foreseen heating and diagnostic tools.