QUALITY ASSURANCE DURING ASSEMBLY OF WENDELSTEIN 7-X

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At the Max-Planck-Institut für Plasmaphysik (IPP) in Greifswald (Germany) the stellarator experiment W7-X is presently being assembled. The assembly is a very complicate and long lasting process (> 8 years) which must be carefully documented in order to ensure that all steps are carried out as planned, that the envisaged quality is met, and that later on all actions are traceable. To control all the work and test steps for each major assembly task Quality Assurance and Assembly Plans (QAAP) are used as the central managing instrument. They contain all essential work and test steps with the input documents to be used (work- and test-procedures, technical guidelines etc.), the responsibilities, and the output documentation (test protocols, non conformity reports etc.) to be made. These plans regulate also the interaction of the parties involved in the assembly, namely the executing organization, the responsible department and QA. Each step must be signed by the responsible persons and the continuation of the assembly is only allowed after the successful execution of the steps before. For major substeps hold points for final QA are included.

The confirmation of a successful work is done by tests and measurement. For each test special instructions were prepared to secure, that reproducible, correct, meaningful and comparable results are obtained. The tests are either carried out by the certified QA inspectors of the project or by specially qualified internal inspectors.

The main tests carried out during assembly are:

- nondestructive tests (visual, dye penetration, ultrasonic, radiographic) for almost all weld seams as well as leak tests (at hot- room and LN₂-temperature), pressure tests and magnetic permeability test.
- geometry checks of threads, fits, surfaces and distances between components.
- collision investigations (for RT, cool down and several load scenarios) on the basic of 3-D laser scanning or photogrammetry.
- electrical tests of insulation like HV-tests and Paschen tests.
- frequent tests of all sensors (for temperature measurement, Rogowski- and saddlecoils, strain gauges, contact sensors, quench detection cables, etc.) to confirm their function and to be able to repair them if necessary.
- flow measurement of the superconductors and the case cooling to look for blocked channels.
- frequent tests of the tightening of various bolts using an ultrasonic method.
- cleanness examinations with UV light shall secure surfaces with a high vacuum suitability.

The paper will describe all these tests in more details and will summarize the experience especially with emphasis on those topics which may require special attention to ensure that W7-X which will work later properly.