

PRELIMINARY STUDY FOR A JT-60SA TF COIL TEST FACILITY

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The 18 JT-60SA Toroidal Field (TF) superconducting coils, which are one of the European in-kind contributions to JT-60SA, are scheduled to be tested at CEA. A Technical Specification for the Cryogenic Acceptance Tests of the TF Coils of JT-60SA [1] has been approved. The test requirements of the JT-60SA TF coils include high voltage insulation tests up to 3800 V, a nominal current test at 25700 A corresponding to 20.5 MJ energy in the tested coil, and a temperature regulation between 5 and 7.5 K.

This paper presents cryo-magnetic and instrumentation technological solutions that comply with the test specification and are inspired from CEA Saclay test facilities operation, especially the experience gained on the 70 W7-X tests performed from 2003 to 2009. The purpose of the test facility preliminary study is to synthesize a simple and efficient solution so as to minimize operation and maintenance efforts and to reduce study, investment and operation costs [2].

The main technological options explored for the test facility design are the following:

- Direct connection from the helium refrigerator to the valve box,
- Use of liquid nitrogen for cold box extra power and cryostat thermal shields,
- Choice of either standard or HTS current leads,
- Fieldbus with cyclic deterministic and event-driven information,
- Web client interface to supervise, diagnose and maintain from any distant platform,
- Safety authentication and access control to the Programmable Logic Controllers.

This paper outlines working solutions for the cryogenic and control-command operation of a large superconducting coil test facility, and discusses the possibility to adopt other technological choices according to test and flexibility criteria. A solution for the cryogenic circuit is first proposed, along with its regulation principles. A discussion about options and alternatives is given. The architectures, requirements and functionalities of the magnet safety, control-command and acquisition systems are reviewed. Finally the main principles of a complying and practical systems solution are described.

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[1] M. Wanner "Technical Requirements for the Cryogenic Acceptance Tests of the TF Coils", annex of "Procurement Arrangement for the Setup of a Cryogenic Test Facility and the Performance of Tests of the TF coils for the Satellite Tokamak Programme", F4E doc. AST_D_223HQN

[2] L. Genini et al. "Phase A study of the JT-60SA coil test facility", dec. 2009, project doc. 5-JT60E R-0000 002DA