JT-60SA Newsletter



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Headline

Procurement of the JT-60SA Quench Protection Circuits: First milestone achieved on time



Fig. 1 Scheme of PF QPC



Fig. 2 Static CB and voltage clamp circuit cubicle



Fig. 3 Bypass Switch



Fig. 4 Picture of the pyrobreaker

<u>The Quench Protection Circuit (QPC)</u> for the JT-60SA Poloidal and Toroidal Field Coils is being procured by the Italian National Research Council (CNR), acting through Consorzio RFX, in the frame of an Agreement of Collaboration between the CNR and F4E for the joint implementation of a Procurement Arrangement signed by F4E and JAEA. The contract activities were entrusted to the company Ansaldo Sistemi Industriali (ASI) on 20 December 2010.

The detailed design phase was expected to last six months, culminating in the approval of the First Design Report (FDR) scheduled for mid-July 2011. The FDR was delivered in time, at the beginning of July, and the Design Review Meeting was held on 13 July at Consorzio RFX in Padua Italy, with the participation of the ASI and Consorzio RFX teams, F4E and JAEA Technical Responsible Officers (TROs) and other members of the JT-60SA Integrated Project Team.

The FDR is the first deliverable of the supply of this system, and its approval represents the first milestone of the Procurement Arrangement.

The QPC design is based on an innovative solution: a Hybrid Circuit Breaker (HCB) composed of a mechanical ByPass Switch (BPS) to conduct the continuous current, in parallel to a Static Circuit Breaker (SCB) for current interruption, with a Pyrobreaker assuring back-up protection (Fig. 1). The nominal currents to be interrupted and the maximum reapplied

voltages are 25.7 kA and 2.8 kV for the TF QPCs and ±20 kA and ±5 kV for the PF QPCs. Although the ratings of TF and PF QPCs are rather different, the supplier has proposed the same components for both. This choice improves the modularity level and gives advantages in terms of maintenance and spare part management. Specific provisions were adopted to improve the system reliability, assuming significant safety margin even in the worst operating conditions and basing the internal fault detection on redundant transducers. The main components are shown in figures 2-4; the BPS and Pyrobreaker designs derive from those developed for the Fast Discharge Units of ITER.

Improvements were achieved in terms of intervention time of the HCB, which can be faster than specified, thus allow to reduce the resistance value and the corresponding voltage across the magnets, while keeping the maximum I²t on the magnets well within the limits. Dedicated clamp circuits, minimization of the stray inductance and optimization of the resistor design also allow reducing the transient overvoltage in the magnets during QPC operation.

The FDR was first revised and approved by Consorzio RFX and then delivered to F4E and JAEA. The TROs expressed a very positive opinion of the high quality of the design, emphasizing the fulfilling of the required specifications with considerable safety margins and provisions to assure high reliability even in anomalous conditions. F4E and JAEA management expressed their satisfaction at the achievement of this milestone.



Design Review Meeting held at Consorzio RFX in Padua, Italy

News

CS conductor series production launched and EF coil manufacturing progressing well



A Nb₃Sn conductor 238 m long was fabricated for the CS1 module of <u>the Central Solenoid (CS)</u>. After this conductor successfully passed the pressure test and airtightness test, series production of the CS conductor was launched.

Five out of ten double pancakes required for the Equilibrium Field coil No.4 (EF4) were fabricated, and it was confirmed that there were no defects in their coolant channels.



Three double pancakes for EF4

News

Assembly of iron frame completed for N-NBI upgraded inverter building

Assembly of the iron frame was completed for the upgraded inverter building for the negative-ion-based neutral beam injector (N-NBI) at the JAEA Naka site in Japan, and its exterior walls will be constructed next. Design work for an upgraded inverter board is also progressing well.

<u>News</u>

Disassembly: half the upper support structure removed

Half the upper support structure, 300 t in total, was disassembled and removed from JT-60 as shown in the above picture, and almost five welded lower parts of the Toroidal Field Coils out of nine were cut. As for the Vacuum Vessel (VV), the lower vertical ports were cut and the divertor baffles were taken out, and special cutting tools were set to disassemble and cut some sections of the VV to allow removal of the Toroidal Field Coils. Five upper units out of ten positive-ion-based neutral beam injector (P-NBI) units were taken out, and stored in the JT-60 Storage Building at the JAEA Naka site.

Meetings

Kick-off meeting held for TF Coils in Belfort, France

Meeting participants in front of a brand new TGV train just leaving its plant

France and Italy, as European Voluntary Contributors, are sharing the supply of the 18 superconducting toroidal field coils, along with the corresponding mechanical structures and supports. A major step was reached on 12 July 2011 with the signature of the contract for manufacture of the nine TF Coils to be produced by France, between CEA (Commissariat à l'Energie Atomique) and Alstom. With a weight of more than 15 t, each coil will be produced at the French Alstom site of Belfort in France.

The contract kick-off meeting took place at the Alstom workshop in Belfort on 28 July. Apart from the Alstom staff involved in the project, participants from F4E (E. Di Pietro and S. Davis) and CEA (R. Gondé, P. Decool, A. Torre, S. Nicollet, N. Berton, J.L. Jourd'heuil, B. Peluso and J.C. Vallet) joined the meeting. In his welcome, the general manager C. Koch-Mathian, on behalf of Turbogenerators Management, emphasized the important involvement of B. Armstrong, Vice President of Alstom Power Steam Turbogenerators, in the finalization of this contract. Magnet activity officially joined Turbogenerators in April 2011, and will benefit from the whole Turbogenerators organizational support. Many people from Belfort site have worked for magnet and superconductor manufacture in the past.

Presentations by Alstom, CEA and F4E were made to introduce the teams, initiate and review rules, and describe project overall coordination and organization, and to initiate and implement the first project actions. The technical baseline and management requirements were clarified and a first technical meeting was planned for September to comply with the coil delivery planning, which is foreseen to be completed in the second half of 2015.

Meetings

26th Project Leaders Meeting

On 20 July, the 26th Project Leaders Meeting was held in Tokyo, Japan with the IFMIF interim Project Leader, H. Matsumoto, appointed as a successor to P. Garin by the Steering Committee in July. At the meeting, common issues were discussed including the future direction of collaboration of the three Broader Approach Projects.

A draft of the collaboration plan of the STP and IFMIF-DDA was prepared and later discussed at the first collaboration meeting for the STP and IFERC-DDA (see below), and both Project Leaders agreed on the draft in August. The Project Leaders will report the plan at the respective Project Committees to be held in September.

Meetings

First collaboration meeting held between STP and IFERC-DDA

On 26 July, the first collaboration meeting between IFERC-DDA and STP (DSM-1) was held by video conference, with attendance of both Project Leaders and Project Managers, organized by the DDA-unit Leader, K. Okano, in order to make a plan of the DDA-STP collaboration. The participants discussed the framework of the collaboration, the scope and schedule, including the JT-60SA Research Plan, and the roadmap towards DEMO.

Calendar

September 11-16, 2011 <u>10th International Symposium on Fusion Nuclear Technology (ISFNT-10)</u> Portland, USA

September 12-16, 2011 22nd International Conference on Magnet Technology (MT-22) Marseille, France

September 26-27, 2011 12th Technical Coordination Meeting (TCM-12) Naka, Japan

September 28, 2011 9th Meeting of <u>the STP Project Committee</u> (PC-9) Naka, Japan

October 25, 2011 9th Meeting of <u>the BA Steering Committee</u> (SC-9) Europe

December 6-7, 2011 13th Technical Coordination Meeting (TCM-13) Karlsruhe, Germany

Contact Us

The JT-60SA Newsletter is released monthly by the JT-60SA Project Team. Suggestions and comments are welcome and can be sent to <u>masayasu.sato@jt60sa.org</u>.

For more information please visit the website: http://www.jt60sa.org/