JT-60SA Newsletter

No. 44, 30 August 2013

Headline

First two HTS CL heat exchangers pass pressure test at KIT

Figure 1: Installation for pressure testing of the HTS CL

Figure 2: Check of the test documentation

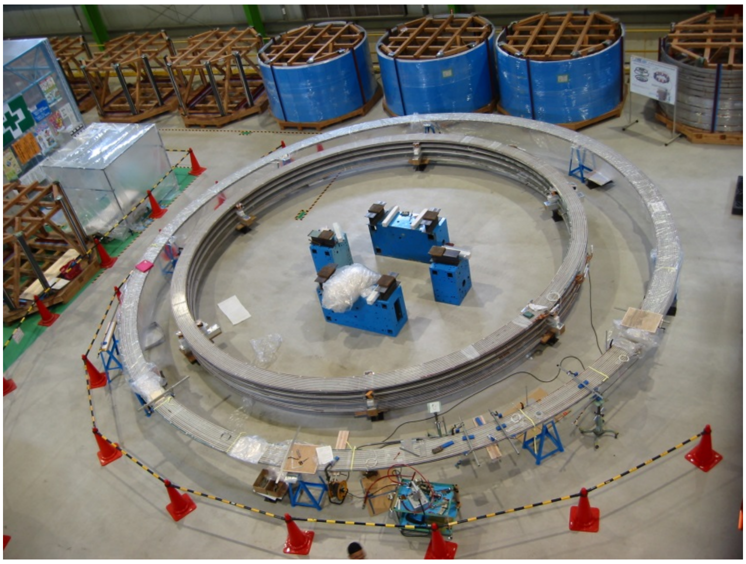
Karlsruhe Institute of Technology (KIT) is providing twenty-six high-temperature-superconducting current leads (HTS CL) for the toroidal and poloidal field coils of JT-60SA. The current leads conduct currents of up to 26 kA from the power supplies at room temperature to the superconducting coils at 4.4 K with a minimum of heat conduction to cryogenic temperatures. The high currents pass through a massive copper bar which is enclosed in a stainless steel shell and which is cooled by cold helium gas.

Being a pressure vessel designed for 1.9 MPa (g), this heat exchanger has to pass a pressure test at 2.4 MPa (g) witnessed by a third-party inspector, in this case from TÜV Süd. In addition to the pressure test a dimensional check, a leak test and a check of the manufacturing documentation have to be performed.

For the first two heat exchangers these important checks took place on 1st August 2013 in the cryogenic laboratory of KIT. As an independent inspector K. Kamiya from JAEA joined the third-party inspection and confirmed the proper execution of the pressure test and completeness of the documentation (see Figures 1 and 2). The leak test was performed by the appointed leak testing engineer of KIT confirming that the leak rate was well within the specified value of 10^{-8} Pa•m³/s. With this positive result, assembly of the HTS CL can continue, in order to have the two first current leads ready for testing by December 2013.

News

Manufacture of EF5 and EF6 coils progressing well



Pancakes of EF5 and EF6 being fabricated and stacked

Following the winding and curing of the equilibrium field coil No.5 (EF5) and No.6 (EF6), fabrication and stacking work was started on schedule with a view to completing the manufacture within this year.

For EF5, which consists of 7double pancakes (DP1 to DP7), the stacking of DP1 and DP2 has been started and the inlets and joints of DP5, DP6 and DP7 were completed. For EF6, which consists of 14 single pancakes (SP1 to SP14), the inlets and joints of SP5, SP6 to SP14 are now being fabricated.

EF5 and EF6, once completed at the Naka site, will be stored in the assembly hall, next year passing through the special delivery entrance which was recently constructed for these coils.

News

First Design Report of CS SNU approved

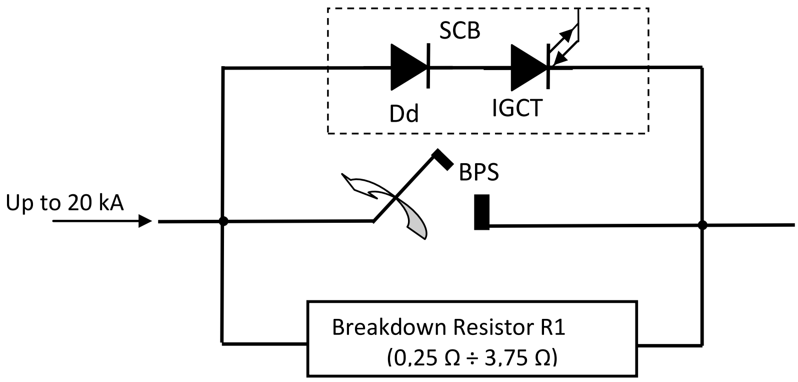


Figure 1: Functional scheme of the SNU hybrid switch

The four switching network units (SNUs) for the central solenoid (CS) of JT-60SA are being procured by ENEA through a contract signed in October 2012 with the industrial supplier OCEM Energy Technology (OCEM ET).

The SNU detailed design has recently been completed by OCEM ET under ENEA supervision, according to the expected schedule, and it has been described in the first design report (FDR). The draft of this document was discussed during the Design Review Meeting (DRM) held by videoconference on 25 June 2013, with the participation of OCEM ET, ENEA, F4E and JAEA representatives. The FDR has since been finalized by OCEM ET taking into account the results of the DRM, and the final version has been approved by the Project Leader on 24 July 2013, representing the achievement of the first important milestone of the SNU Procurement Arrangement.

Each SNU mainly consists of a dc circuit breaker connected in parallel to a couple of resistors. The function of the SNU is to produce high voltage for the plasma breakdown and current ramp-up. To perform this, the dc circuit breaker by-passes the breakdown resistor during the current charge phase of the CS coils. Once the current in the CS coils reaches the established value, the circuit breaker is operated inserting the break-down resistor in the coil circuit, and causing the required fast current derivative that enables plasma breakdown. After the plasma current break-down phase, the second resistor is inserted in parallel to the first, reducing the coil current derivative and so enabling a suitable plasma ramp-up phase. Finally both resistors are by-passed again by reclosing the dc circuit breaker. To allow maximum flexibility in the SNU operation, the value of the break-down resistor can be remotely and automatically preset to the desired value before each plasma discharge by means of motorised selectors.

The main features indicated in the conceptual design developed by ENEA, and included in the SNU Technical Specification as reference, have been endorsed by OCEM ET, including some improvements and optimization. The key part of the SNU is the 20 kA – 5 kV dc circuit breaker, whose design has been implemented by means of the parallel connection of an electro-mechanical by-pass switch (BPS) and an electronic static circuit breaker (SCB) based on IGCT components. Their coordinated operation takes advantage of the features of both components: low on-state losses of the BPS and fast and precise current interruption of the SCB. The thermal design of the resistors has been performed according to specifications significantly larger than the required ones, assuring a large thermal margin even in the case of a fault.

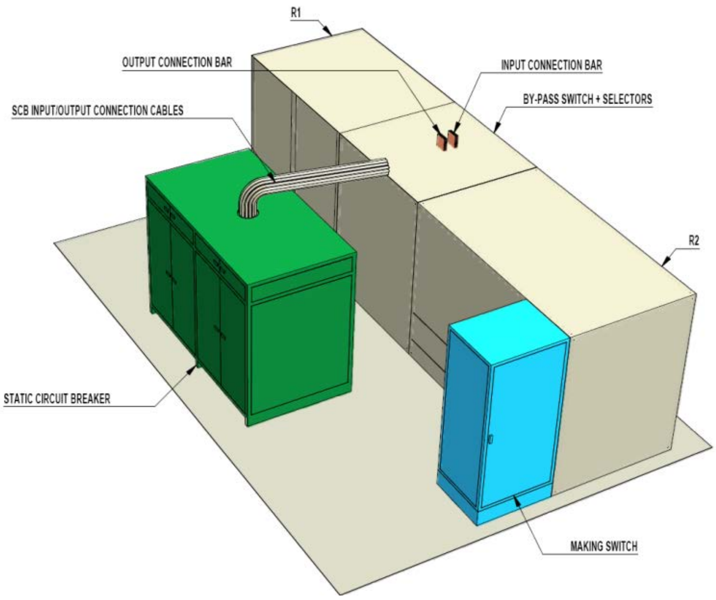


Figure 2: General layout of a SNU as presented in the first design report

The next steps include the development of a first SNU so as to be able to perform the required type tests, whose successful result is a pre-condition to proceed with the manufacturing of the remaining three units, which are expected to be delivered to Japan in 2016.

News

ENEA contract awarded for SCMPS

Figure 1: Attendees at the kick-off meeting

The contract for the procurement of the superconducting magnet power supplies (SCMPS), consisting of eight power supplies (PSs) and six transformers for part of the JT-60SA poloidal field coil (PFC) PSs (including the central solenoid (CS) 1, CS2, CS3, CS4, equilibrium field (EF) coil 1 and EF6 PSs and the fast plasma position control (FPPC) PSs) was awarded by ENEA to the industrial joint venture supplier POSEICO – JEMA on 1 August 2013.

Figure 2: Introduction to the kick-off meeting

Both POSEICO and JEMA have great experience in the fields of power electronics and of PSs. The former focusses its experience on semiconductor devices (diode, thyristor gate turn off (GTO), and insulated gate bipolar transistor (IGBT) cooling systems (innovative and integrated heatsink) and static converters (rectifier and inverters mainly for railway systems and electric traction). The latter focusses its experience on high precision and high current PSs for nuclear physics and nuclear fusion and is already involved in several international projects, such as: MAST, JET, JT-60SA (CEA Contract) and STELLERATOR.

Figure 3: Screenshot of the kick-off meeting in videoconference

The procurement technical and management activities started immediately after the award of the contract. The kick-off meeting was held at the ENEA Research Centre in Frascati, Italy, on 1 August 2013. The meeting was attended (in person or by videoconference) by the representatives of ENEA (A. Pizzuto, A. Cucchiaro, A. Lampasi, P. Zito, F. Starace, C. Cristofani, G. Ginoulhiac, P. Costa), POSEICO (M. Portesine, F. Fasce), JEMA (B. Eikelboom, C. Viniegra, A. Dorronsoro), F4E (L. Novello) and JAEA (K. Yamauchi, T. Terakado).

The procurement is based on technical specifications developed by ENEA with the close collaboration of F4E and JAEA. During the kick-off meeting, the system characteristics and the technical and quality management specification documents were thoroughly analyzed and discussed. POSEICO - JEMA presented the main management and quality plans. Also a complete organisation chart was presented identifying the technical responsible officer and the quality responsible officer. Furthermore, POSEICO - JEMA presented how the contractual phases and sub-phases of the project were split between POSEICO and JEMA, and a preliminary schedule for implementation of the project was shown, identifying main deadlines and milestones (in autumn 2013 the transformers and first design report will be issued, in 2014 the FPPC PSs will be ready, in 2016 CS and EF PSs, and the final delivery to Japan is expected in 2017).

The POSEICO - JEMA PS design will be based on criteria of conformity to requirements, modularity, reliability, maintainability, risk mitigation and fault analysis. The specific aspects of the project will be defined during the detailed design phase that will be discussed in depth at the first progress meeting scheduled on 13 September 2013 at the ENEA Research Centre of Frascati.

Meetings

23rd Magnet Technology Conference

Figure 1: The JT-60SA oral presentation underway

Figure 2: Gathering round a JT-60SA poster

The 23rd Magnet Technology Conference (MT-23) was held at the Westin Copley Place in Boston from 14-19 July 2013. MT-23 is an international forum for all aspects of magnet technology research and development including permanent, resistive, superconducting, and hybrid magnets. The program consisted of plenary sessions, special sessions, and oral and poster presentations. About 700 presentations in total were given at the conference.

A number of contributions from the JT-60SA EU and JA Home Teams were presented as follows (only presenters shown):

- Invited presentations (1)

- K. Yoshida from JAEA Naka, on the mass production of superconducting magnet components for JT-60SA.

- Poster presentations (9)

- T. Takao from Sophia University, Tokyo, on the influence of temperature rise on butt joints for the JT-60SA central solenoid;
- C. Fiamozzi Zignani from ENEA Frascati, on the electrical measurements of the JT-60SA interpancake joint manufactured by ASG;
- P. Decool from CEA Cadarache, on the JT-60SA TF magnet industrial manufacturing preparation and qualifications;
- S. Davis from F4E Garching, on the manufacturing status of JT-60SA toroidal field coils;
- H. Murakami from JAEA Naka, on the development and test of JT-60SA central solenoid model coil;
- L. Zani from F4E Garching, on the completion of TF strand production and progress of TF conductor manufacture for the JT-60SA project;
- F. Nunio from CEA Saclay, on the qualification of the fastening components of the outer intercoil structures of the JT-60 SA tokamak;
- G. De Marzi from ENEA Frascati, on the JT-60SA NbTi strand characterization after thermal shock due to He inlet welding;
- A. Maistrello from Consorzio-RFX Padova, on the experimental qualification of the hybrid circuit breaker developed for JT-60SA quench protection circuit.

Meetings

5th cryogenic system Design Review Meeting

The 5th cryogenic system Design Review Meeting (DRM) was held by videoconference on 23 July 2013 with attendance of 17 experts from Germany (F4E Garching), France (CEA Grenoble and Air Liquide Advanced Technologies (ALAT)) and Japan (JAEA Naka).

The focus of the DRM was to agree on the configuration model of the cryogenic system which was formed by a 3D-model and 2D drawings as well as detailed descriptions/representations of the relevant interfaces.

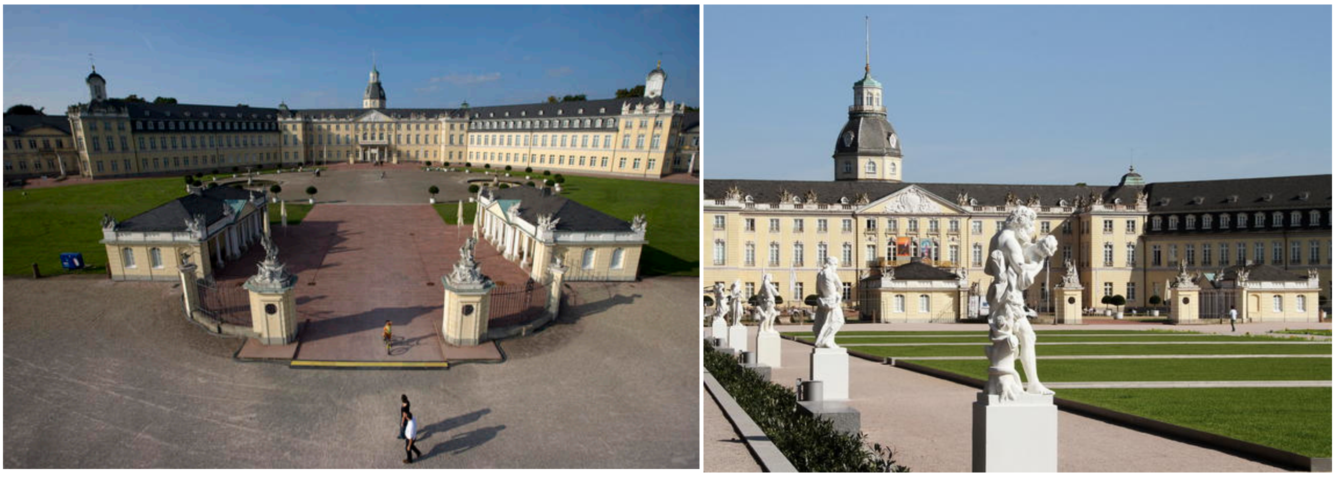
The updated 2D drawings of the installation site and in particular of the Compressor Building were explained by JAEA. It was agreed that a unique origin would be used on drawings with coordinates and elevations referenced to this point, in particular identifying each working area. It was agreed that the configuration model should preferably be formed by a 3D model of the complete installation site.

ALAT explained the modifications on the layout plan. CEA explained how they would manage the interfaces showing all external interfaces of the cryogenic system and indicating the reference documents for each interface. F4E explained the interface between the GHe storage vessels and the foundations and the input for the design of these foundations.

It was agreed to create a configuration model in DMS based on the existing 2D drawings of JAEA (building) and on a 3D model and 2D drawings by ALAT (layout and installation) together with supplementary documents (drawings, descriptions, sketches) as necessary to describe the interfaces in detail.

Local

Karlsruhe Palace



Views of the Karlsruhe Palace

Karlsruhe Palace was built between 1715 and 1718. For almost 200 years it served as the residence and seat of the government of the Margraves, the electoral princes and grand dukes of Baden. The palace was given its present baroque appearance in the second half of the 18th century after conversion work and extensions. These can be traced back to the plans of Balthasar Neumann, realized by the architect Albrecht Friedrich von Kesslau, who at that time was building director for the Baden royal court.

Karlsruhe Palace is at the hub of 32 avenues radiating outwards to form Karlsruhe's iconic layout, the so-called "Fächer", or fan. The history of the city and its architecture is concentrated along the "via Triumphalis", the central axis of the "rays" emanating from the residence.

Today the Karlsruhe Palace houses a cultural historical museum, the “Badische Landesmuseum”, one of the most prominent museums in the country.

Calendar

September 16-20, 2013
11th International Symposium on Fusion Nuclear Technology (ISFNT-11)
Barcelona, Spain

October 9, 2013
13th Meeting of the STP Project Committee (PC-13)
Naka, Japan

October 23-24, 2013
18th Technical Coordination Meeting (TCM-18)
Naka, Japan

November 5-8, 2013
9th Asia Plasma and Fusion Association Conference (APFA-9)
Gyeongju City, Korea

December 17, 2013
13th Meeting of the BA Steering Committee (SC-13)
Saclay, France

Contact Us

The JT-60SA Newsletter is released monthly by the JT-60SA Project Team.
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For more information please visit the website: http://www.jt60sa.org/