JT-60SA Newsletter

No. 61, 30 January 2015

Headline

On-site installation of QPC units


Safety training for EU workers

After delivery to Japan at the end of September 2014, the quench protection circuits (QPCs) for JT-60SA are now being installed at the Naka site.

The installation and commissioning of the 13 QPC units, procured by the Italian National Research Council acting through Consorzio RFX, are being carried out under a contract awarded to Nidec ASI S.p.A.

The QPC installation is the first occasion of activities directly performed by European personnel at the Naka Site for JT-60SA, and it involves the definition of a number of unprecedented issues ranging from logistics to safety.

A special visa dedicated to the Broader Approach activities has been issued by the Japanese government for the European personnel involved in the QPC installation.

The definition of safety-relevant procedures complying both with European and Japanese requirements has been another important task in the preparation of on-site activities. To reduce the risk of incompatibility between European and Japanese operating procedures and standards, Nidec ASI has sub-contracted the actual installation activities to a Japanese supplier, Nippon Advanced Technology (NAT), having previous experience of installation activities in Naka.

The QPC on-site installation activities formally started on 1 December 2014: after a safety training of workers, the boxes containing the QPC units were opened, and the QPC components were taken out and positioned in their final installation locations.

After the installation activities, which are planned to carry on through January 2015 under the continuous supervision of personnel from F4E, Consorzio RFX and Nidec ASI, the QPC commissioning phase is expected to start in February 2015, leading to the final acceptance tests planned in April 2015.


QPC on-site installation activities start in earnest

News

340° VV sector installed

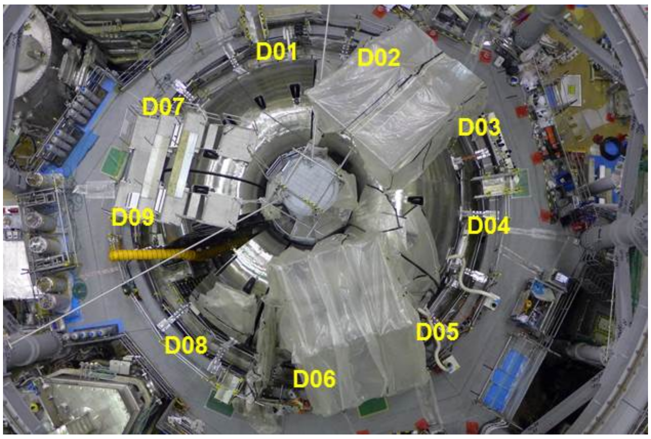


Figure 1: 340° structure of VV sectors installed on the cryostat base

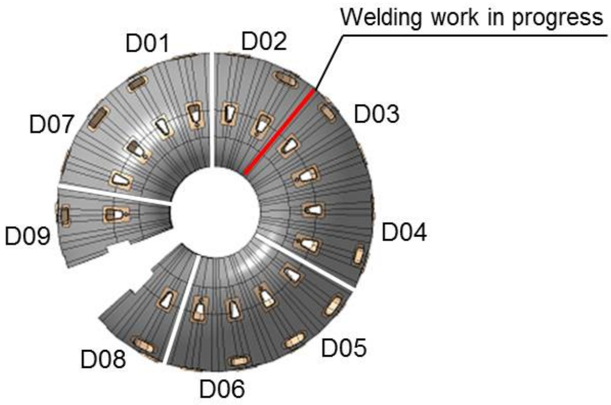


Figure 2: Current progress status of VV assembly

The eighth and ninth vacuum vessel (VV) sectors (D08 and D09), both of which are 30° sectors, were installed on the cryostat base on 9 and 26 January 2015, respectively. Now the installation of the 340° structure, which is one of the most important milestones for the project, is taking place (Figure 1). After the completion of the joint welding of the VV sectors, the assembly work will move on to the next step: the VV thermal shield assembly, and then the toroidal field coil assembly.

The direct joint welding of the three pairs of VV 40° (D03 and D04, D01 and D07, D05 and D06) has already been completed and the first joint welding with splice plate between D02 and D03 (red line) started at the end of January (Figure 2). All the joint welding will be completed by autumn 2015.

News

Advances in TF coil manufacturing in Italy

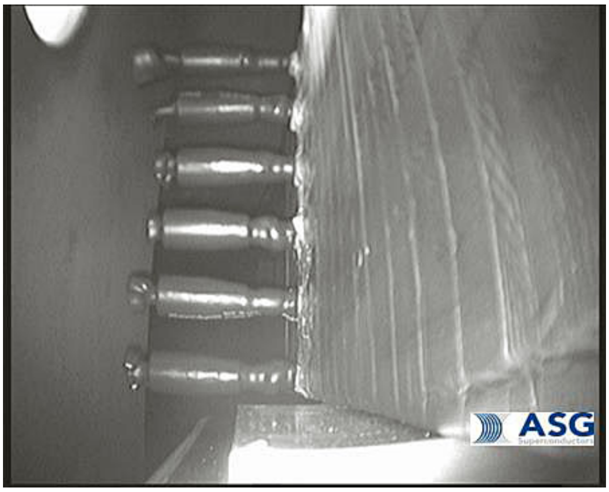
The PL, and JAEA, ENEA and ASG representatives, in front of the WP-02 before dimensional tests

The supply of 9 toroidal field (TF) coils for JT-60SA, part of the ENEA contribution to the Broader Approach activities, is currently progressing at ASG Superconductors in Genoa with the completion of the first three winding packs (WP) and the preparation of the first WP for the subsequent insertion in the TF coil casing components. The status of the fabrication was inspected on 10 November 2014 by H. Shirai, the JT-60SA Project Leader (PL), who visited ASG premises together with JAEA and ENEA representatives. In the course of 2014, ASG Superconductors, ENEA industrial supplier for this activity, completed the design and provided all the tooling needed for the manufacturing steps that will be put in place during 2015 after the reception of the first casing components. Also the qualification activities have been defined and the commissioning of the relevant tooling has been completed.

The PL had an opportunity to see WP-01 under preparation for the insertion into the coil case, WP-02 under dimensional survey at the completion of the Paschen test, and WP-03 in the final phase of the impregnation.

Currently, WP-03 has completed the impregnation cycle and is about to start the final acceptance tests, while WP-01 has been placed on the structure that will be used for the case insertion.

WP-01 placed on the tooling for case insertion



Helium inlet area of WP-02 under Paschen test

WP-02 during final dimensional tests

WP-03 after impregnation

The above pictures show the present status of first three WPs completed. WP-04 has been inserted in the impregnation mould, where the impregnation cycle took place at the end of 2014, while WP-05 is in the winding phase, with the first 4 double pancakes already completed.

News

HTS current leads: Germany's contribution to JT-60SA

TF current lead for JT-60SA (26 kA nominal current)

During the visit of H. Shirai, the JT-60SA Project Leader (PL), on 4 November 2014 at Karlsruhe Institute of Technology (KIT), the first two toroidal field (TF) coil current leads were successfully tested under operating conditions in the Current Lead Test Facility Karlsruhe (CuLTKa). All specified values have been achieved.

Current leads are needed to transfer the electrical current from the power supplies at room temperature to the superconducting coils at low temperature (-269 °C). KIT is in charge of the development, construction and testing of the high temperature superconductor (HTS) current leads for the JT-60SA project. Funded by the German Ministry for Education and Research it is Germany's contribution to JT-60SA within the Broader Approach activities.

The design of the current leads for JT-60SA is similar to that for Wendelstein 7-X, a superconducting stellarator in Germany. To form the joint to the superconducting busbar that connects the current lead to the coil, a clamp contact is foreseen at a temperature of approximately 4.5 K. To reduce losses at low temperature, HTS material is integrated in the current leads, which produces no losses below a temperature of approx. 60 K. One side of this HTS module is cooled down by heat conduction only through the connection to the superconducting coil actively cooled at 4.5 K, and the other side is connected to a copper heat exchanger cooled with 50 K helium. The copper heat exchanger is optimised to cover the temperature gradient from 60 K to room temperature.

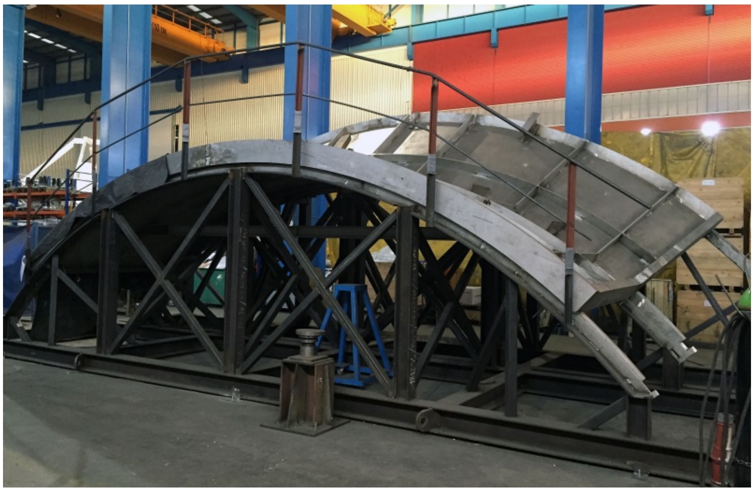
Two TF coil current leads installed in the test facility CuLTKa at KIT

In 2014 all six TF coil current leads were completed, pending testing. In addition, almost all the half pieces needed for the twenty poloidal field (PF) coil current leads have been manufactured, and six heat exchangers were already ready, by the end of 2014. The manufacturing of the first pair of PF coil current leads has started.

News

CVBCS fabrication progress meeting at Asturfeito

Representatives from CIEMAT, F4E and JAEA



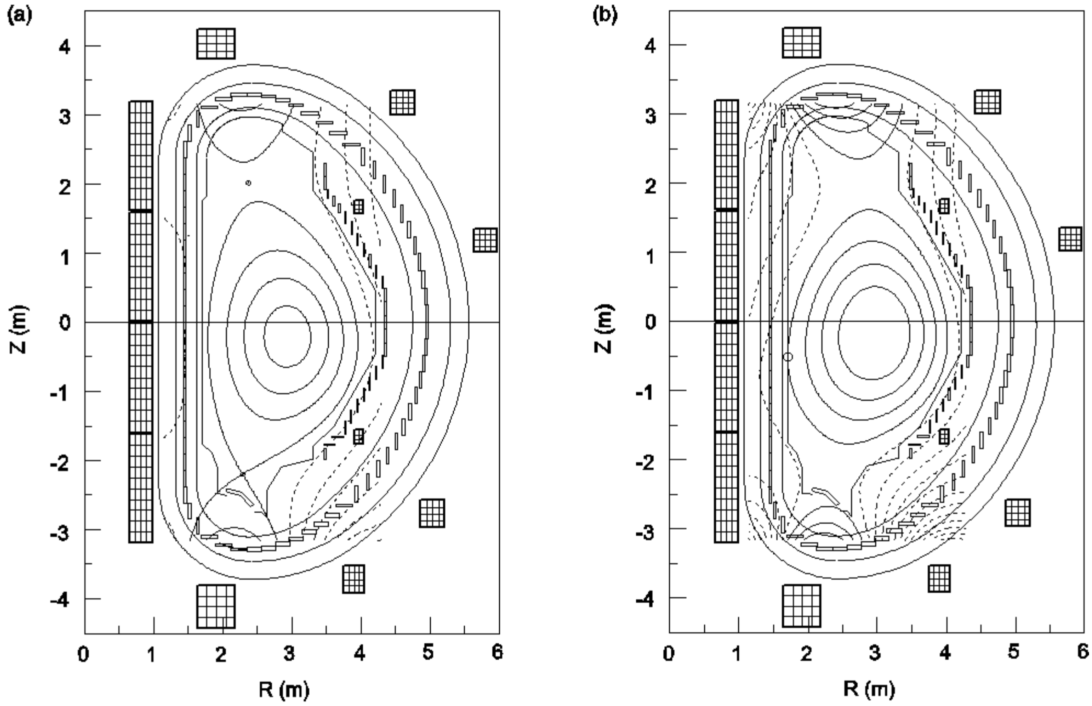
Upper part of sector 2-3 on the welding frames

The 5th progress meeting of the cryostat vessel body cylindrical section (CVBCS) fabrication was held on 17 November 2014 at Asturfeito in Spain. Representatives from CIEMAT, F4E and JAEA attended the meeting to see the progress of the fabrication.

The fabrication (machining, dimensional tolerance and surface finishing, etc.) and assembly issues were also discussed. Forming of the conical parts and rolling of the vertical parts for the sector 2-3, which is composed of three parts, had been completed. Subsequently, welding of the parts started on each welding frame, monitoring the welding distortion step by step. This experience will be incorporated into the welding sequence for the subsequent sectors to improve the fabrication process.

News

Conditions for formation of divertor configuration



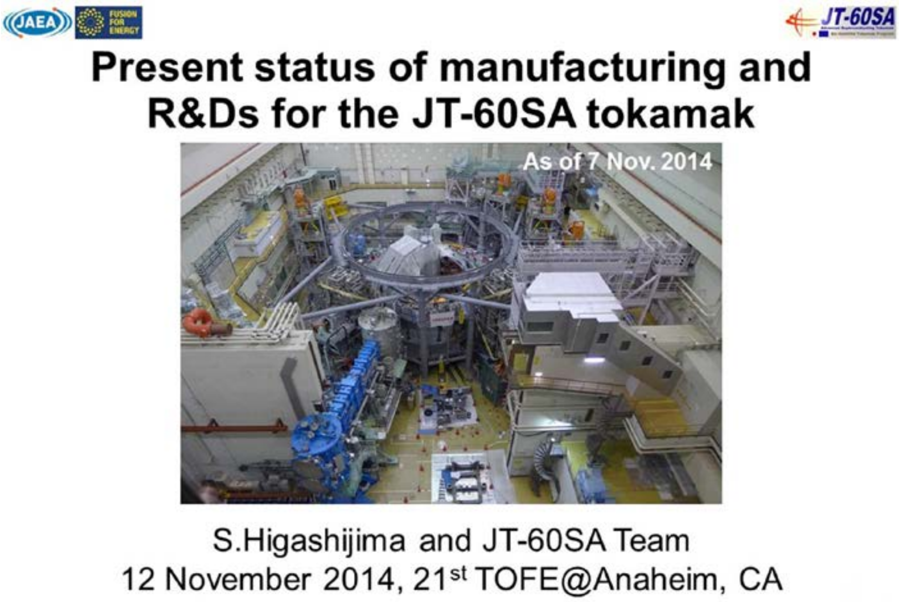
Examples of simulations where the plasma current and the magnetic flux are varied to identify how the lower single-null configuration can be formed for a specific reference plasma position: (a) I_p = 1.5MA, Ψ = 8Wb, (b) I_p = 1.0MA, Ψ = 16Wb

In the development of operation scenarios for the plasma current ramp-up phases of a tokamak, it is necessary to make a smooth transition from the 'limiter' configuration, where the plasma surface is attached at a point on the in-vessel material, to the 'divertor' configuration, where the plasma is completely separated from the plasma-facing component materials by two legs of the magnetic field lines. This transition changes depending on the starting time of the heating, plasma-wall interaction, plasma current penetration, and the flux consumption of the central solenoid (CS) which determines the duration of the plasma discharge. This also strongly influences the following plasma performance and thus is a crucial issue for JT-60SA, ITER, and DEMO.

The optimisation of CS currents, magnetic flux, and plasma current is indispensable for a good transition to the divertor configuration. The operation range in which the lower single-null divertor configuration can be formed in JT-60SA has been examined in simulation. The plasma current and the magnetic flux were varied over a specific range of values while the reference points of plasma position were kept fixed. It was found that, for small plasma current (I_p), the magnetic flux (Ψ) must be lowered to form the divertor configuration. As shown in the examples above, a lower single-null divertor configuration is successfully formed at I_p = 1.5MA and Ψ = 8Wb, whereas the formation of a divertor configuration is not achieved at I_p = 1.0MA and Ψ = 16Wb. In practical operation, the plasma current and magnetic flux vary together with the flux consumption for the plasma current ramp-up. Accordingly, a large pre-magnetisation current in the CS will require a large plasma current for the formation of the divertor configuration, and this must be programmed into the tokamak pulse control systems.

Meetings

21st Topical Meeting on the Technology of Fusion Energy



The 21st Topical Meeting on the Technology of Fusion Energy (TOFE-21) was held in Anaheim, California, USA, from 10 to 13 November 2014 as an embedded meeting of the American Nuclear Society winter conference. More than 100 participants joined together to present and discuss the latest progress on fusion engineering and the technology of various devices in the United States and elsewhere, including Europe and Japan.

S. Higashijima, on behalf of the JT-60SA team, orally presented the current status of JT-60SA procurements and R&D for the major components, including JT-60U torus disassembly, the superconducting poloidal and toroidal field coils, the vacuum vessel, cryostat, cryogenic systems, power supplies, in-vessel components, and heating systems, and JT-60SA torus assembly. In the JT-60SA assembly, where welding between the vacuum vessel sectors is currently in progress, he described in detail the procedure to suppress the welding deformation, indicating its importance as a reference for ITER construction.

In the meeting, the current state of steady operation of LHD, the construction status of Wendelstein 7-X, the upgrade plan of NSTX, plasma wall interaction studies in JET, and the ignition plan of NIF, etc. were also reported.

Calendar

March 17, 2015
16th Meeting of the STP Project Committee (PC-16)
Naka, Japan

April 21, 2015
16th Meeting of the BA Steering Committee (SC-16)
Naka, Japan

April 22 – 23, 2015
22nd Technical Coordination Meeting (TCM-22)
Naka, Japan

May 17 – 21, 2015
23rd International Conference on Nuclear Engineering (ICONE-23)
Chiba, Japan

May 31 – June 4, 2015
26th Symposium on Fusion Engineering (SOFE-26)
Austin, USA

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 newsletter@jt60sa.org.

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