

Headline

Cryogenic system compressors tested



Figure 1: Warm compression station with oil removal system (left) and 4 compressor skids holding 2 screw compressors each (right)

In contrast to all other large capacity helium plants, the JT-60SA cryogenic system uses 8 standard screw compressors in parallel. Four out of the eight compressors are equipped with frequency drivers. The 8 units are grouped in 4 compressor skids enclosed by a sound protecting cabin (Figure 1), and deliver about 700 g/s of helium at 1.5 MPa(g), thereby consuming about 2.4 MW of electrical power. The full mass flow of all compressors is purified in a common oil removal system.

In order to demonstrate the smooth interaction of all 8 screw compressors for a long period of operation, the commissioning team of Air Liquide Advanced Technologies (AL-AT, France) had to demonstrate a 48 hour capacity test in a closed loop without intervention. In preparation of this essential test, all compressors were operated, independently and in groups, for several hours to check their capacities, efficiencies and various control parameters.

Before the capacity test started, a safety plan had to be issued and submitted to JAEA for approval. This safety plan indicated all steps of the test, the expected operating parameters, potential failure modes and necessary recovery actions. As the capacity test was performed over 2 nights, shift work had to be agreed among AL-AT, CEA, F4E and JAEA representatives.

On 25 November 2015, all checks were finished and the compressors were started one after the other. Once the suction, discharge pressures and the total mass flow stabilized, they remained well within the narrow boundaries required by the technical specification (Figure 2). The dissipated electrical power for the compressors was absorbed by JAEA's new powerful water cooling system, running at 200 m³/h with very good temperature stability. After 48 hours, the different compressor units were stopped by actively interrupting the main supply voltage, triggering an emergency shutdown.

The successful result of the capacity test marked another important milestone for the pre-commissioning of the cryogenic system. During the coming months, the refrigeration cold box and the auxiliary cold box will be prepared for commissioning and for cool down in March 2016.

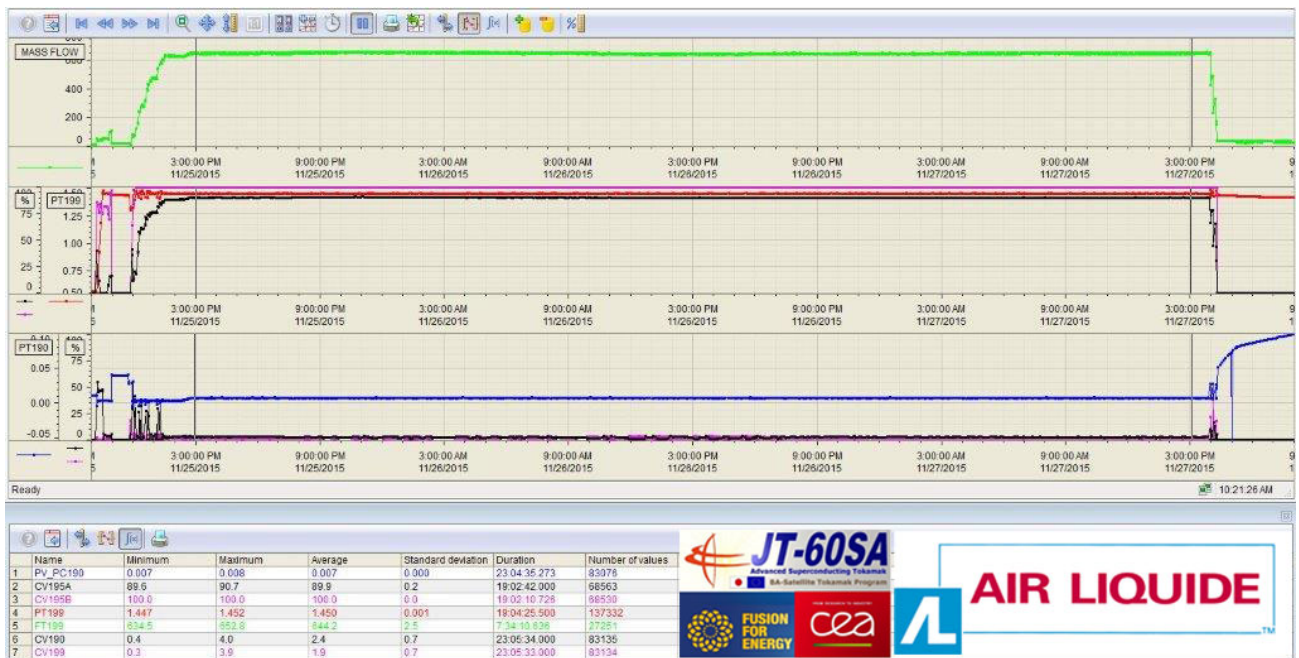


Figure 2: Stability of the mass flow (green), discharge (red) and suction pressures (blue) of the warm compression station during 48 hour capacity test

News

All HTS CLs for TF coils delivered



JAEA and F4E representatives in front of delivered HTS-CLs with a visitor, Mr. Stefan Kaufmann, Member of German Parliament (6th person from left)

On 21 October 2015, two remaining pairs of high temperature superconductor current leads (HTS CLs) for the toroidal field (TF) coils were delivered by Karlsruhe Institute of Technology in Germany to the JAEA Naka site. Together with the delivery of the first pair of HTS CLs, which arrived already on 27 March 2015, all 6 HTS CLs for the TF coils have now been delivered (see figure).

The 6 HTS CLs will now be provided for installation to the manufacturer for the TF coil terminal boxes. Furthermore, 10 HTS CLs for the poloidal field (PF) coils will be shipped to Naka around October 2016, while the delivery of the remaining 10 HTS CLs is scheduled in 2017.

News

VV assembly status

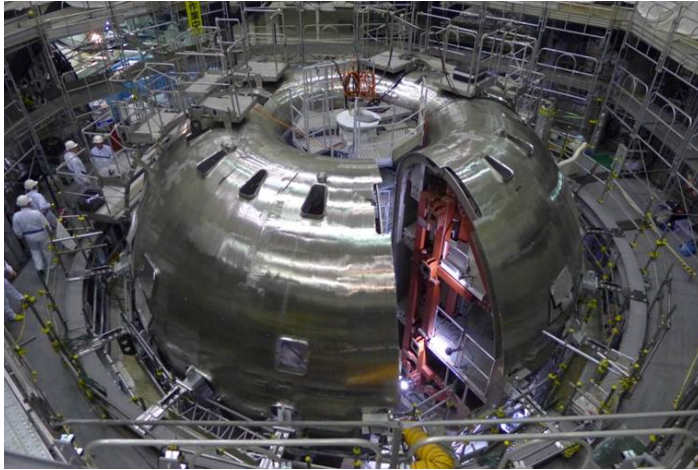


Figure 1: 340° VV torus after repositioning



Figure 2: Performing visual checks of the rotary crane

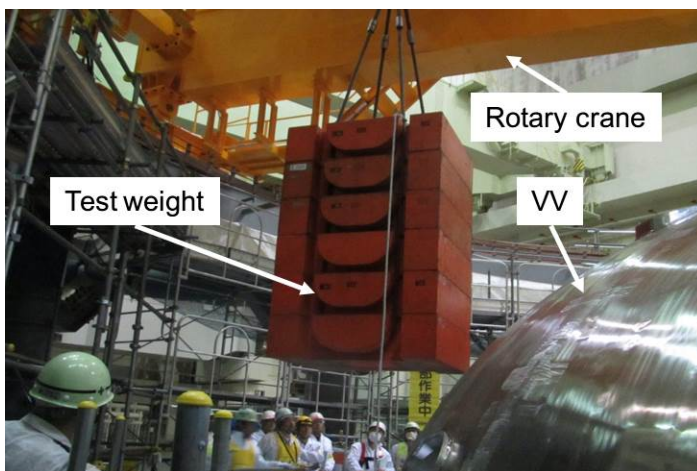


Figure 3: Performing the load test of the rotary crane

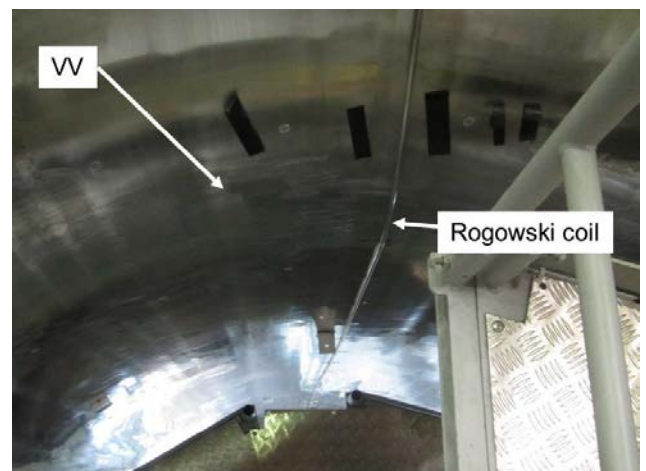


Figure 4: Rogowski coils mounted outside the VV

Non-destructive tests (NDTs) of the vacuum vessel (VV) – including a radiographic test, an ultrasonic test, and a liquid dye penetrant test – began on 1 September and ended on 5 October 2015. The tests were performed to confirm the vacuum tightness of the VV after completion of the welding with splice plates between 1 set of 110° and 2 sets of 120° sectors. Weld defects were found at 3 points after grinding. Such points were repaired, and passed a 2nd round of NDTs.

It was found that the 110° and 120° sectors had shifted 3 to 5 mm from their designated positions toward the device centre due to heat contraction after the welding with splice plates. Therefore, the position of each sector was measured by laser tracker, and the sectors were moved again to the designated positions (Figure 1).

A rotary crane (30/50 t) was mounted on the surrounding support structure to use for assembly of the VV thermal shield and TF coils. The installation of the crane started at the end of September, and finished in the beginning of October 2015 after the performance tests and so forth. The crane passed a completion test supervised by the local Labour Standards Inspection Office. The completion test included document inspection, visual checks, and a load test against a weight, which was 1.25 times heavier than the rated load (Figure 2 and 3).

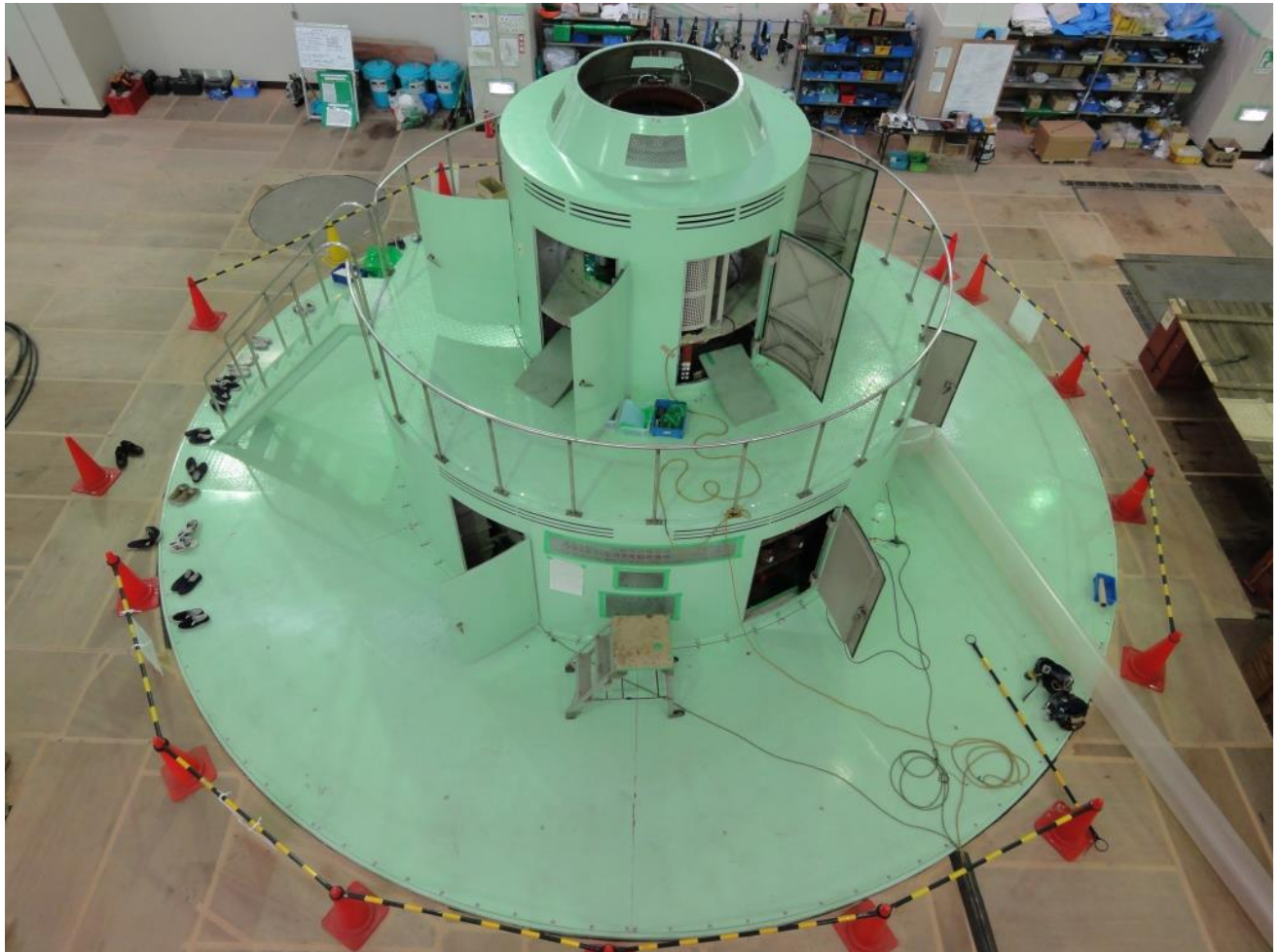
Currently, 4 Rogowski coils for plasma current measurement and 22 thermocouples are being mounted on the VV outer surface, while the constraint jigs are disassembled and removed from the VV (Figure 4).

News

H-MG overhaul and inspection completed

The heating motor generator (H-MG), with rated capacity of 400 MVA and available discharge energy of 2.6 GJ, is one of three motor generators, installed at the JAEA Naka site, which were formerly used for JT-60U operation. For JT-60SA it will mainly provide electricity for the poloidal field (PF) coil power supplies.

Since the European power supplies require the H-MG to be operational for their on-site test in 2016, an overhaul and minute inspection was performed in accordance with the safety regulations for electric facilities of the Naka Fusion Institute. The work included the inspection, maintenance and upgrade of the generator main body, driving motor, thrust bearings, thrust lifting device, guide bearings (top, middle and bottom), lubricant circulation pump, oil coolers, air coolers, fans, liquid resistor, collector rings and sensors. The inspection began in July 2015 and was almost finished, including re-assembly, at the end of November 2015, as scheduled. The inspection and maintenance of the peripheral equipment is currently being conducted.



News

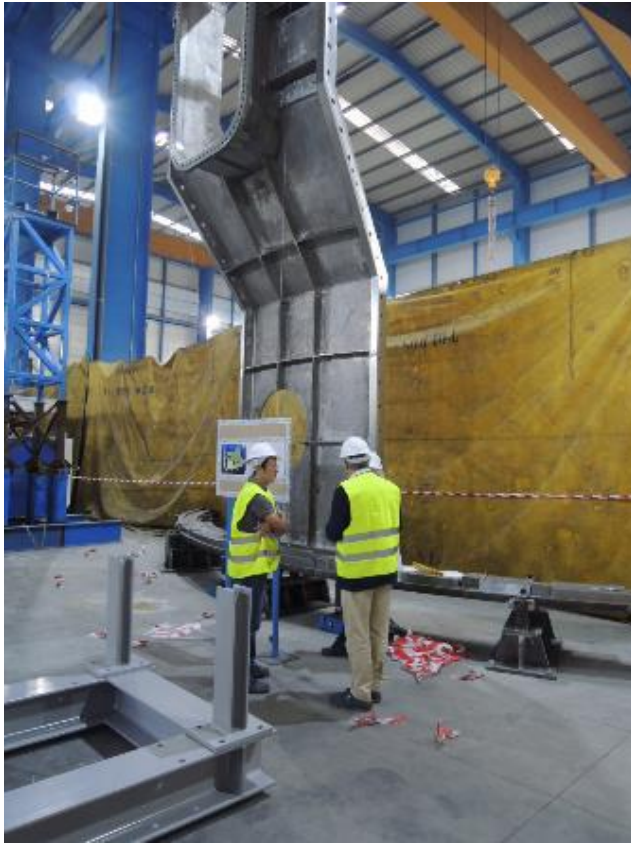
CVBCS manufacturing progress

Asturfeito S.A. (AF), located in Spain, is the company responsible for the manufacturing of the cryostat vessel body cylindrical section (CVBCS), which is a CIEMAT contribution to the JT-60SA project. A progress meeting was held on 5 October 2015 with attendance of experts from JAEA, F4E, CIEMAT and AF.

The CVBCS consists of 4 sectors (2-3, 4-5, 6-7 and 8-1), split in the toroidal direction. Each sector is composed of 3 sub-sectors. The status of the production of each sector was as follows:

- Sector 2-3
All 3 sub-sectors had been welded and machined, and were under dimensional inspection. It was difficult to perform the metrology precisely and consistently, since they were so flexible mechanically, so strongly dependent on the accuracy of their positioning. The initial dimensional inspection, which had not been valid, was repeated again after positioning the sectors precisely on a rigid and accurate platform.
- Sector 4-5
The main parts of the sub-sectors had been assembled and welded. The ports and ribs were being joined by welding to the sub-sectors.
- Sector 6-7
All the pieces of the sub-sectors had been cut out from the base material. Bevelling and forming of pieces were in progress.
- Sector 8-1
The pieces of the sub-sectors were being cut out from the base material.

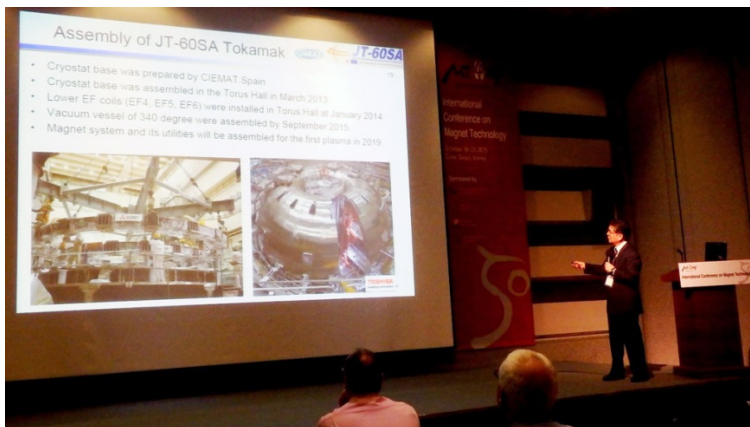
All 4 sectors will be preliminarily assembled at the factory before delivery to the JAEA Naka site in 2017.



Preparation for dimensional inspection of the lower sector 2-3 A

Meeting

International Conference on Magnet Technology 24 (MT-24)



The International Conference on Magnet Technology 24 (MT-24) was held in Seoul, Korea from 18 to 23 October 2015. There were more than 1,000 participants and about 1,200 presentations from 29 countries. JT-60SA, ITER and other fusion devices were presented in the sessions on "Fusion Magnet", "Conductors for Fusion", "Low Tc Wires/Cables", "Cryogenics/Current leads" and "Test/Measurement/Designs".

11 contributions on JT-60SA were presented as follows (only representatives shown):

- Invited oral presentations (2)
 - W. A. Maksoud from CEA, on "Commissioning of the Cold Test Facility for the JT-60SA Tokamak Toroidal Field Coils";
 - K. Yoshida from JAEA, on "Construction Status of Superconducting Magnet System for the JT-60SA";
- Poster presentations (9)
 - P. Decool from CEA, on "JT60SA TF coils production status at Alstom";
 - K. Tsuchiya from JAEA, on "Progress of manufacturing CS and EF coils for the JT-60SA tokamak";
 - K. Kizu from JAEA, on "Mass production of NbTi conductors for EF coil and feeder of JT-60SA";
 - P. Rossi from ENEA, on "Manufacturing of the casing components for the first JT-60SA toroidal field coils";

- L. Zani from CEA, on "Influence of JT-60SA TF conductor strands trajectories on hydraulic and electromagnetic properties in both operation and cold tests configurations";
- K. Nakamura from Sophia University, Tokyo, on "Thermal Stability of Conductor Joint for JT-60SA Poloidal Field Coils";
- P. Decool from CEA, on "JT-60SA TF Coils hydraulic operating conditions";
- H. Murakami from JAEA, on "Conceptual Design of Error Field Correction Coil for JT-60SA";
- P. Decool from CEA, on "JT60SA TF coils production status at Alstom".

Meeting

17th STP Project Committee Meeting



On 26 October 2015, the 17th Meeting of the Satellite Tokamak Programme (STP) Project Committee (PC-17) was held at the JAEA Naka site between Europe and Japan. A total of 27 participants joined the meeting also by videoconference. There were 6 members from the Project Committee, the Project Leader (PL), 4 experts from the Project Team, and 16 experts from the EU and JA Home Teams.

At the meeting, the PL overviewed the project status, and presented the Work Programme 2016 and a proposal for the establishment of an STP Common Fund, subsequently submitted to the 17th Broader Approach Steering Committee held on 11 December 2015. The latest status of procurement and assembly was also reported in detail by the Project Managers of the EU and JA Home Teams.

The STP-PC expressed satisfaction at the achievements and the progress in both EU and JA procurements as well as the assembly activities. The progress included activities such as TF coil winding, impregnation and incorporation of the winding packs with the coil casing, commissioning of the TF coils cold test facility, fabrication of the HTS CLs for the TF and PF coils, delivery and installation of the cryogenic system, installation and commissioning of the QPC components, fabrication of the CVBCS, winding of conductors for the equilibrium field (EF) coils (EF1, EF2 and EF3) and the central solenoid (CS) modules (CS1 and CS2), completion of the magnet power supply water cooling system (MPS-WCS), and completion of welding of 9 VV sectors forming 340° of the torus on the cryostat base. The STP-PC appreciated the completion of the VV Procurement Arrangement (PA), QPC PA and MPS-WCS PA as scheduled. The STP-PC also recognised that acceleration of the fabrication of the TF coils had started by the efforts of the European Implementing Agency, Voluntary Contributors and related European manufacturers.

The STP-PC decided that the next STP-PC meeting (PC-18) would be held on 16 March 2016.

Calendar

24 - 25 Feb 2016

24th Technical Coordination Meeting (TCM-24)

Naka, Japan

16 Mar 2016

The 18th Meeting of STP Project Committee (PC-18)

Naka, Japan

22 April 2016

18th Meeting of the BA Steering Committee (SC-18)

Rokkasho, Japan

4 – 8 July 2016

43rd European Physics Society Conference on Plasma Physics (EPS 2016)

Leuven, Belgium

6 - 7 July 2016

25th Technical Coordination Meeting (TCM-25)

Spain

Contact Us

The JT-60 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/>.