JT-60SA Newsletter
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Headline

TF coil casing production completed

Figure 1: TF coil casing components completed at the WTO workshop in Chieti, Italy

Figure 2: Curved leg being machined at the WTO workshop in Ortona, Italy

Figure 3: ENEA and Walter Tosto teams

All the toroidal field (TF) coil casings, an Italian in-kind contribution to the JT-60SA project, have now been successfully completed.

ENEA was responsible for providing the 18 production and 2 spare TF coil casings, and commissioned Walter Tosto S.p.A. (WTO) in Chieti, mid-Italy to manufacture them.

The preliminary design of the casing components was prepared under the coordination of F4E. Then, the detailed design was finalised by ENEA and WTO, involving the TF coil integrators, ASG Superconductors S.p.A. (Italy) and General Electric (formerly Alstom S.A., France), who together were responsible for the winding pack manufacturing and subsequent integration into the coil casing.

A single coil casing, with a height of 7.5 m and a width of 4.5 m, consists of a straight leg, a curved leg, and 3 inboard covers, assembled and joined by welding from forgings and rolled plates made of AISI 316L.

The TF coil casing contract between ENEA and WTO started in 2012 with the design and fabrication of mock-ups demonstrating the most important cross sections finished with the required chamfers. Detailed design of the casing components was completed in 2013, followed by the qualification of welding processes and definition of manufacturing procedures. Manufacturing activities, also started in 2013, were divided into several different production steps: composition of

the components (cutting, forming, rough machining, welding), final machining of the components to the final shape, and chamfering.

7 casings were manufactured in 2015, and another 7 in 2016. The last 4 casings were delivered to the coil integrators in the first quarter of 2017, completing the 18 production casing supply. All the TF coil casing procurement was then achieved with the completion of the last 2 spare casings in the summer of 2017.

Figure 1 shows a set of the TF coil casing components completed at the WTO workshop in Chieti, Italy, where most of the final machining activities were done.

The casings were manufactured with several milling machines at different locations. For instance, the final machining of the curved legs was performed at another WTO workshop in Ortona, Italy as shown in Figure 2.

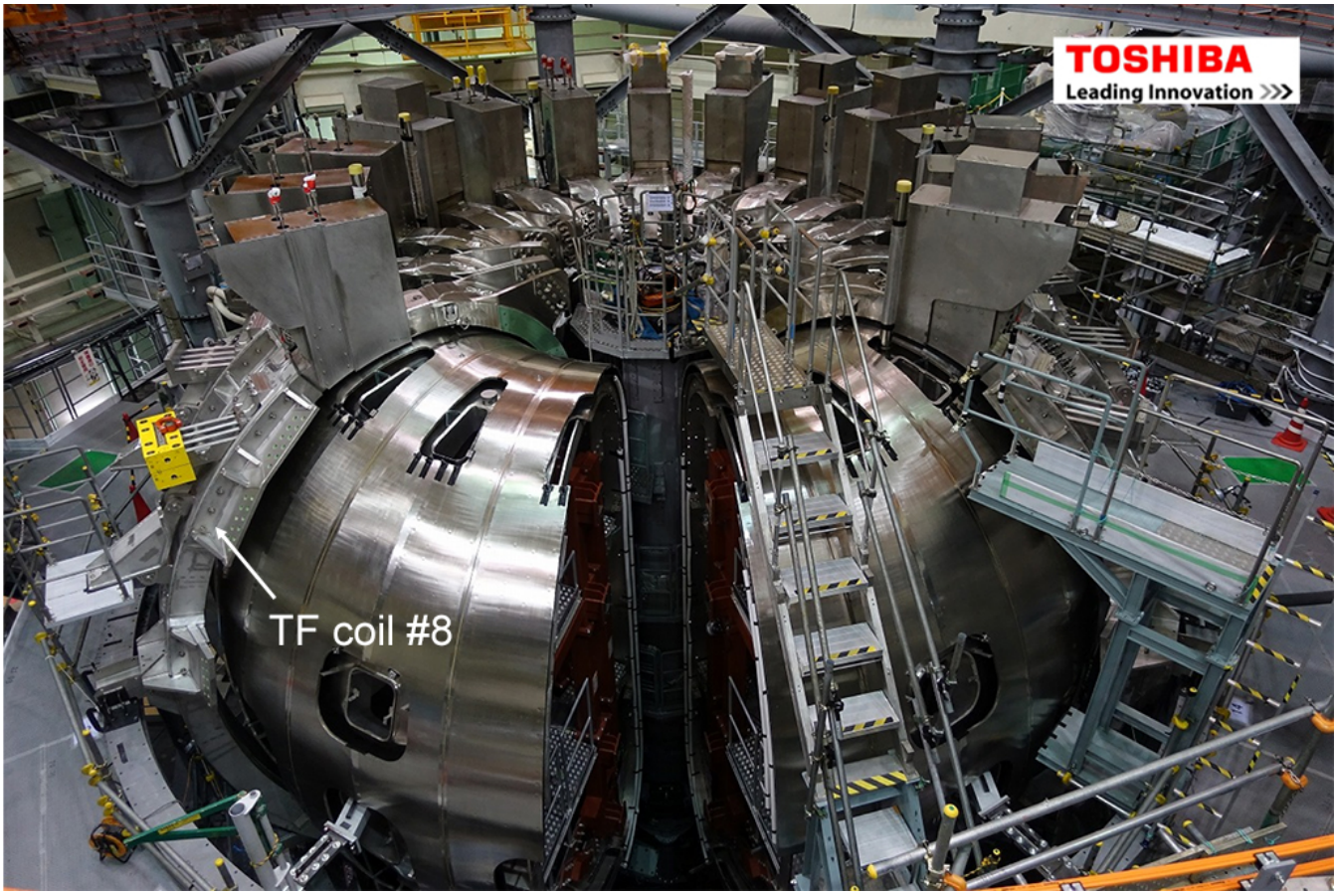
The contract was finally completed after 5 years. Starting from 500 t of stainless steel material, 200 t of finished casing components were produced (typically, 10 t for each casing set). The typical production cycle was 8 months for each casing set, and the average delivery rate was 1 casing set every 6 weeks.

Technical results of the overall supplies are satisfactory in terms of geometry, dimensions, surface finish, roughness, and documentation. Remarkably, all of the 20 casing component sets, delivered to the coil integrators, were assembled and integrated by welding by September 2017.

The successful completion of the TF coil casing production, allowing their smooth use at the TF coil integrators, demonstrated the positive application of innovative technologies and careful management of casing manufacturing by ENEA and WTO teams (Figure 3).

News

Tokamak assembly progressing steadily



JT-60SA torus with the newly mounted TF coil - “Sandra (coil #8)” - viewed from the final 20° sector position

The 13th toroidal field (TF) coil - “Sandra" (coil #8 in the overall TF coil numbering system in JT-60SA) - was mounted in place on 15 January 2018 (see figure). The assembly accuracy reached ±1mm in the same way as the other TF coils achieved previously.

In parallel, 5 lower port thermal shields and 3 vacuum vessel gravity supports were installed on the lower part of the JT-60SA torus.

News

1st Italian spare TF coil completed in record time

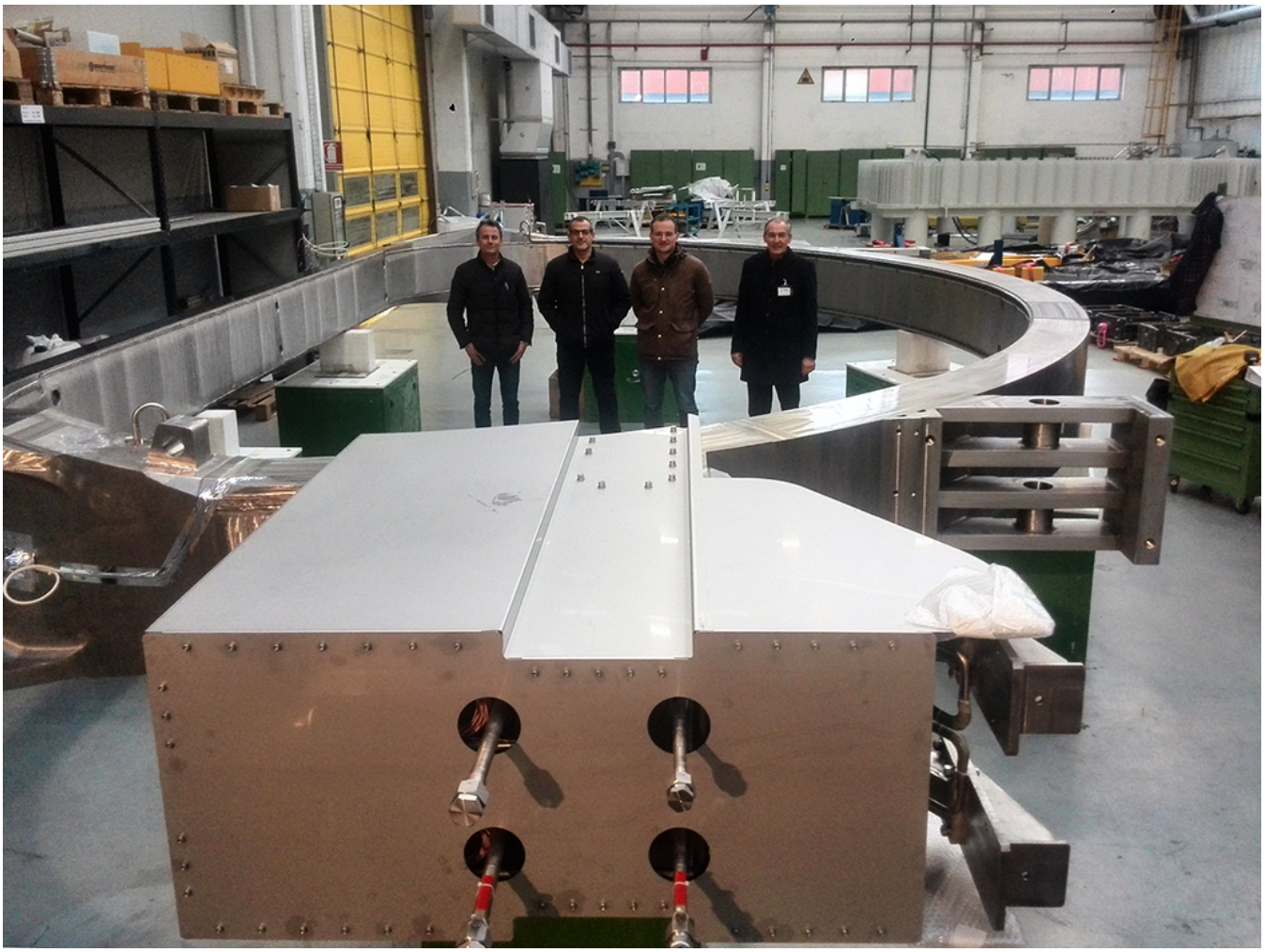


Figure 1: ENEA and F4E representatives inside the TF coil #19 at ASG on 22 December 2017

On 22 December 2017, the first spare toroidal field (TF) coil (coil #19 in the overall TF coil numbering system in JT-60SA) of the Italian in-kind contribution to the JT-60SA project was completed by ASG Superconductor S.p.A. (ASG) in Italy. It was visually inspected by ENEA and F4E representatives before its shipment to the TF coil cold test facility at CEA Saclay, France.

This coil is the ninth of 10 coils so far provided by ENEA for the JT-60SA project within the Broader Approach programme through a contract with ASG. It is the first coil intended for a spare for the 18 production coils composing the JT-60SA TF magnet system. Its winding pack (WP) was completed in December 2016, 8 months ahead of the corresponding TF coil casing delivery, subsequent to the previous 9 WP manufacturing[1]. This WP was integrated with its casing component set in a record time. Indeed, the casing set, provided by Walter Tosto S.p.A. under a contract with ENEA, was delivered to ASG on 31 August 2017, and the final acceptance test, followed by coil preparation for shipment, were completed on 22 December 2017. It took less than 4 months only (Figure 2).

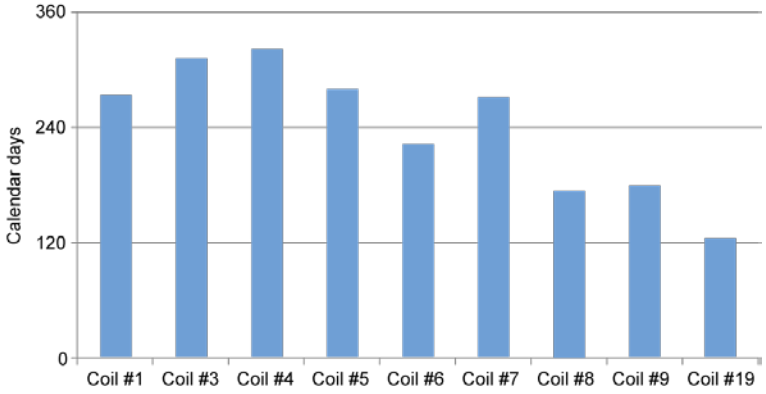


Figure 2: Time consumed for the WP integration at ASG (from the receipt of the coil casing components to the coil shipment

This significant achievement, the fastest integration among the other Italian coils, is the result of a great manufacturing effort provided by ASG and its sub-contractor, Officine C.L.P. S.r.l, for the final machining. In fact, it took only 2 months to insert the WP into the casing and seal the casing by welding, while the impregnation, final machining, and coil preparation for shipment consumed the remaining 2 months, as for the other coils. This coil also underwent and successfully passed all of the standard acceptance tests including a Paschen test at DC 3.8 kV.
Coil #19 is being prepared for the final acceptance tests under cryogenic conditions in Saclay. Then, it will be shipped to the QST Naka site in Japan where it will be stored as a spare coil.

[1] The 9 production WPs were manufactured in series at ASG. The manufacturing of the 19th WP for this spare coil significantly lagged the rest of the production. The WP-09 was completed in September 2015 whereas the first conductor for the WP-19 only arrived at ASG at the end of April 2016.

News

Cryostat vessel body cylindrical section arrives in Japan

Figure 1: Cargo ship and a CVBCS package at Hitachi port

Figure 2: Carefully unloading a package in a cold rain

Figure 3: All the CVBCS packages landed in Japan

Figure 4: Receiving the CVBCS packages at the Naka site

Ibaraki prefecture is very famous for its production of dried sweet potato in Japan. And the reason for such quality production is the dry winter climate with sea breeze for processing as well as the excellent soil for growing the sweet potato. Of course, there can be exceptions. This year, it happened right on time for unloading the cryostat vessel body cylindrical section (CVBCS), the Spanish in-kind contribution to the JT-60SA project procured by CIEMAT through a contract with Asturfeito S.A. (Aviles, Spain)). It was a cold and windy day with torrential rain! (Figure 1 and 2)

The huge shipment, composed of 38 packages/pallets including 10 big packages containing the 12 CVBCS sectors, with a total weight of more than 322 t, arrived in Hitachi, Japan at 11:00, 17 January 2018 after a ~40 day's journey with the ship "JAN St. John's" which left Aviles, Spain on 8 December 2017.

On the very same day, F4E and QST representatives attended the inspection for the first unloaded portion (placed on the middle deck of the ship). The remaining inspection had to be postponed to the next day since the other packages, placed on the lower deck, blocked the operation and the ship's crew had to remove the ceiling of the deck first. Luckily, the second day inspection could be done in better weather! (Figure 3)

All of the packages were inspected, and no damage was identified. Thus, the packages were immediately released for the road transportation to the QST Naka site about 11 km away. The transportation was started on the following days and was successfully completed in a few days (Figure 4).

News

Coil terminal box 04 and 05 delivered to Naka site

Delivered CT04 (4 HTS CLs for the EF5, 6 integrated)

Delivered CT05 (6 HTS CLs for the EF4 and CS3, 4 integrated)

The coil terminal boxes (CTBs) connect the superconducting coils and power supplies, across the cryostat boundary. The high temperature superconductor current leads (HTS CLs), which were manufactured by Karlsruhe Institute of Technology in Germany as the German in-kind contribution to the JT-60SA project, are installed to the CTBs in order to reduce heat flow from room temperature to cryogenic temperature. Such integration is performed by the CTB manufacturers.

The first CTB (CT01) was manufactured and completed by Mitsubishi Electric Corporation in February 2017. The 6 HTS CLs were installed and will carry a current of 25.7 kA to the 18 toroidal field coils.

Fuji Electric Co., Ltd. manufactures the CT02-05, feeding a current of 20.0 kA to the poloidal field coils. The CT04 with the 4 HTS CLs for the equilibrium field (EF) coils 5 and 6, and CT05 with the 6 HTS CLs for the EF4 and central solenoid (CS) 3 and 4 modules, were delivered to the QST Naka site in December 2017 (see figures). The remaining 2 CTBs (CT02 with the 4 HTS CLs for the EF1 and 2, and CT03 with the 6 HTS CLs for the EF3, CS1 and 2 modules) are still being manufactured. They will be delivered to the site in October 2018.

All of the CTBs will be installed on the tokamak in 2019.

Meeting

21st BA Steering Committee Meeting

Representatives from Europe and Japan participated in the BASC-21 meeting

On 13 December 2017, the 21st Broader Approach Steering Committee meeting (BASC-21) was held at the Belgian Nuclear Research Centre (SCK•CEN) in Mol, Belgium, with the attendance of representatives and experts from Europe and Japan. As one of the Voluntary Contributor designated institutions of the JT-60SA project, SCK•CEN procured the cryostat for the toroidal field (TF) coil test facility built in Saclay, France, which has been playing an essential role in confirming the performance specified for the JT-60SA TF coils.

At the BASC-21 meeting, the Work Programme 2018 for the 3 projects (IFMIF/EVEDA, IFERC and Satellite Tokamak Programme (STP)) were discussed and approved.

Concerning the STP Project, the Project Leader, H. Shirai, mentioned that the project had achieved steady progress in manufacturing, delivery, assembly, and commissioning activities by both Europe and Japan since the last BASC meeting, in

particular, the delivery of 13 TF coils, all of the 26 high temperature superconductor current leads, and components of the superconducting magnet power supply to the Naka site, completion of the cryostat vessel body cylindrical section, progress of the manufacturing of the resistive wall mode control coil power supply and electron cyclotron range of frequency power supply, central solenoid modules, cryostat top lid, and thermal shields, in parallel with the JT-60SA tokamak assembly steadily going on in the torus hall at the Naka site. The SC expressed satisfaction with the progress of the STP Project.

The next BASC meeting will be held in Naka, Japan on 26 April 2018.

Representatives from Europe and Japan participated in the BASC-21 meeting

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Local

One year after…

* This article was contributed by Dr. G. Frello of F4E.

When last year I decided to join the JT60-SA project, I already knew it was a life-changing moment for me, my job, and for my entire family too. Living in Japan is exciting, but it is also a challenge. And my family is of course in the front line with their daily life difficulties. I can never thank my family enough for accepting this new adventure in order to let me fulfil my desire to work for this exciting project.

The easiest part is that everyone at work has been great to me. It seems as if I have been working at Naka Institute for a long time, not just one year. Outside my work, both my family and I, although still with many difficulties, are excited and love Japanese people and culture. We are now learning Japanese, which is fundamental to survival, but nevertheless such a tough task that we might only accomplish it after 20-30 years :-(

I have had plenty of satisfaction at work and in my private life. I have had great moments: I ran my first marathon race in Japan, and the day before I was able to fulfil my dream to meet Satoru Sayama, the original Tiger Mask. Even more amazing, while I aimed for those goals, destiny gave me the opportunity to meet Professor Rostagni again, after 20 years in Naka! He is my university teacher and the one who let me discover the field of fusion energy.

「人生は素晴らしいです。(saying “Life is wonderful” in Japanese.)」

Figure left: Running the 37th Tsukuba marathon race on 26 November 2017

Calendar

7 March 2018
22nd Meeting of the STP Project Committee (PC-22)
Naka, Japan

26 April 2018
22nd Meeting of the BA Steering Committee (SC-22)
Naka, Japan

1 - 6 July 2018
45th European Physical Society Conference on Plasma Physics (EPS 2018)
Prague, Czech Republic

27 - 28 June 2018
30th Technical Coordination Meeting (TCM-30)
Naka, Japan

16 - 21 September 2018
30th Symposium on Fusion Technology (SOFT 2018)
Giardini Naxos, Italy

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/.