JT-60SA Newsletter
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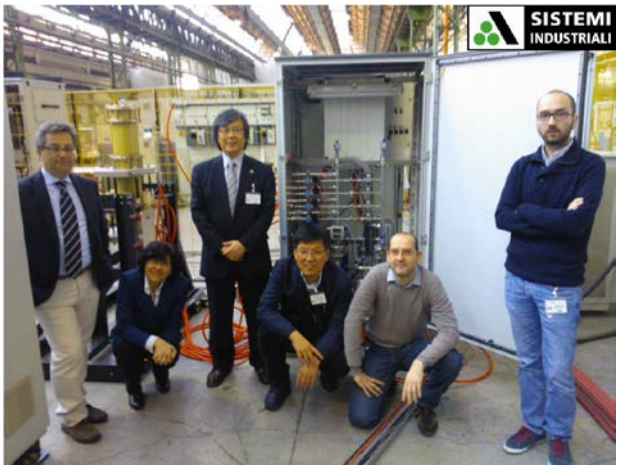
Headline

Final stage of quench protection circuit manufacturing

In front of the QPC static circuit breaker cubicles in the Nidec ASI workshop



Visiting the QPC test facility in the Nidec ASI workshop during the routine tests of the last QPC unit

The quench protection circuits (QPC) of JT-60SA are procured by the Italian National Research Council acting through Consorzio RFX. The supply of the 13 QPC units required for the protection of the poloidal and toroidal field superconducting magnets of JT-60SA is provided by a contract awarded by Consorzio RFX to the company Nidec ASI (formerly Ansaldo Sistemi Industriali) in December 2010.

The protection of the toroidal field (TF) coils is assured by 3 QPC units, each one rated for a current interruption of 25.7 kA and a reapplied voltage of about 2 kV, while 10 QPC units are needed for the protection of the poloidal field (PF) coils, with a current interruption capability of ±20 kA and a reapplied voltage of ± 3.8kV. Each QPC unit is composed of a by-pass switch for carrying the current during normal operation, a static circuit breaker performing the current interruption, a dump resistor discharging the magnet stored energy, and a pyrobreaker for back-up protection.

After the completion of the detailed design in Summer 2011, two full scale prototypes were developed by Nidec ASI at the beginning of 2012, one for the TF and one for the PF QPC, to verify the performances of the innovative design solution based on a hybrid mechanical-static circuit breaker. The positive outcome of the intensive type tests performed on the prototypes, during two test campaigns in April-May and August-September 2012 at Consorzio RFX, allowed the manufacture of two QPC pre-series units that were completed in middle 2013. These two QPC units (one TF and one PF QPC) have been subjected to a complete set of routine tests, whose successful results in June 2013 represented the green light for the manufacturing of the remaining QPC units.

S. Ishida, the JT-60SA Project Leader (PL), visited the premises of Nidec ASI in Milan (Italy) on 24 February 2014 to verify the progress of QPC procurement activities.

During his visit, the PL, together with Consorzio RFX, F4E and JAEA representatives, had the possibility to verify the well advanced status of manufacturing of the components of the remaining QPC units. In particular he visited the dedicated storage area where all by-pass switches, dump resistors and cooling systems for the pyrobreakers, now completely manufactured and tested, are being stored before being prepared to be shipped to Japan. During his tour of the Nidec ASI workshop, the PL had a look inside 12 cubicles of the static circuit breakers already manufactured and tested, and he had the chance to visit the test facility where the thirteenth static circuit breaker was actually undergoing the final routine tests. Two pyrobreakers, manufactured and tested by the sub-supplier Efremov Institute, were available at Nidec ASI premises at the time of the PL's visit, four have been shipped and the remaining seven are expected to be manufactured and tested by May 2014.

During the presentation illustrating Nidec ASI activities

After the arrival in Nidec ASI premises of the last pyrobreaker units, all components will be packed and finally shipped to Japan, where the installation and commissioning phase is expected to start in September 2014, representing the first occasion of activities directly performed by European personnel at the Naka Site for JT-60SA.

News

Upgrade of safety interlocking system for the SCSDAS

Figure 1: SCSDAS used for JT-60U

Figure 2: Newly upgraded SCSDAS

The supervisory control system and data acquisition system (SCSDAS), which has been renamed from “ZENKEI” as it was known in JT-60U, has the following functions: a) plant monitoring, b) discharge sequence management, c) plasma real-time control, d) device protection, and e) discharge result data archive, storage, and database management. Each item of plant is equipped with its own safety interlock system to avoid inappropriate access or use. In addition, signals of events from each item of plant that may harm other items are monitored by the global protection system (GPS) of SCSDAS so that appropriate actions can be taken when necessary.

The existing JT-60U ZENKEI has been upgraded to the SCSDAS for JT-60SA so that various kinds of advanced tokamak experiments can be performed more flexibly and efficiently. The major upgrade is a change from the existing interlock function shown in Figure 1. Due to the complicated wiring of the relay circuit, the logic had to be added by connecting the plugs manually. To enhance the expandability and improve the operation efficiency in the new system, a programmable logic controller (PLC) has been applied to the interlock function instead to automatically control all the operation process (Figure 2).

News

Delivery and installation of cooling towers for second cooling system underway

Secondary water cooling system in the middle of construction

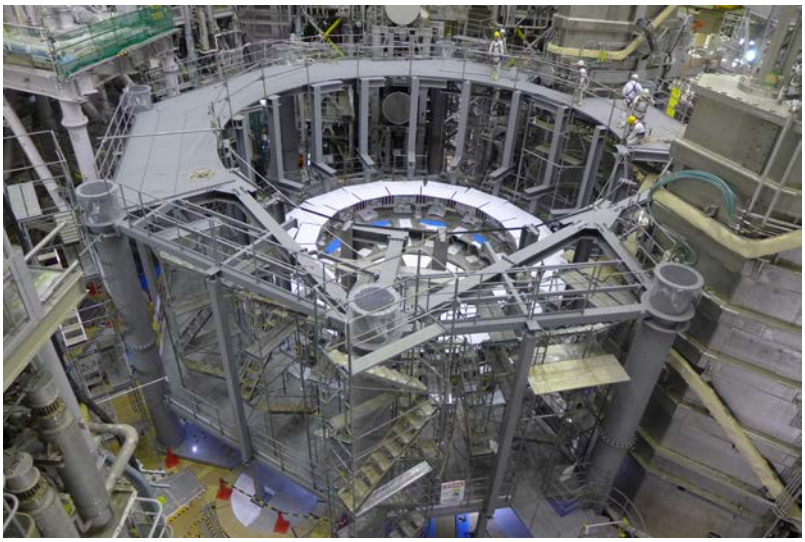
The secondary water cooling system used for JT-60U served all primary cooling circuits of heat sources throughout the plant, including the vessel, magnets, heating and diagnostic systems, and all peripheral major heat sources that were not cooled by the building HVAC (heating ventilation and air conditioning) systems.

As a part of the construction work for JT-60SA, the secondary water cooling system is being modified and replaced. The base frame of the cooling tower, and the cooling tower connection to the base frame, are being modified, and the water treatment equipment to maintain the water quality, and the 12 pumps, are being replaced.

Now that the base frame has been modified by installing new steel frames, the cooling towers are beginning to be installed on the steel frames. For the water treatment equipment replacement work, the existing filtration tank and plumbing pipes have been removed and for the pump replacement work, the existing pumps have also been removed. Recently the installation of all the bases for the new pumps has been completed and the piping work is now proceeding.

News

Assembly frame being built



Current status of achievement

An assembly frame is needed to give additional support during the assembly of 340° of the vacuum vessel (VV), the VV thermal shield (VVTS) and the toroidal field (TF) coils. After completion of the temporary installation of the three lower equilibrium field (EF) coils in January this year, the assembly frame can now be constructed.

Base plates have been mounted around the cryostat base (CB) using the existing anchor bolts, and eight main posts have been assembled on the base plates. After that, horizontal beams were bridged between the posts to assemble the stages on them. The upper stage has now been assembled on the posts at the second level.

In further steps, three kinds of guide rails will be put in place to allow the VV, the VVTS and TF coils to rotate on the CB. The posts of the frame will also be assembled to the third level and the centre pole will be put in place. The frame structure as a whole is fixed by eight structural support beams (star-shaped torus) bracing it against the existing building walls in order to withstand earthquakes. Furthermore, two spiral staircases will be set up to allow worker access.

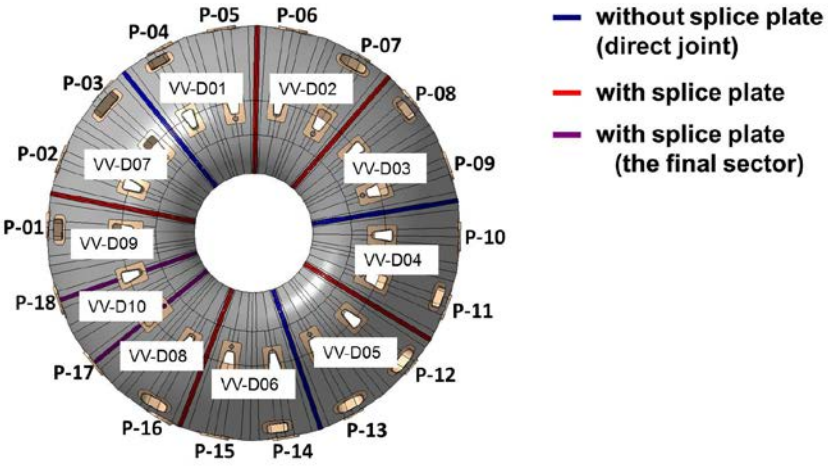
The frame is expected to be ready for use by April.

News

VV 30°sectors manufactured

Outboard leg of the ninth 30°sector unloading from the truck

Dimensional measurement after the welding



Welding connection and port numbers of the vacuum vessel

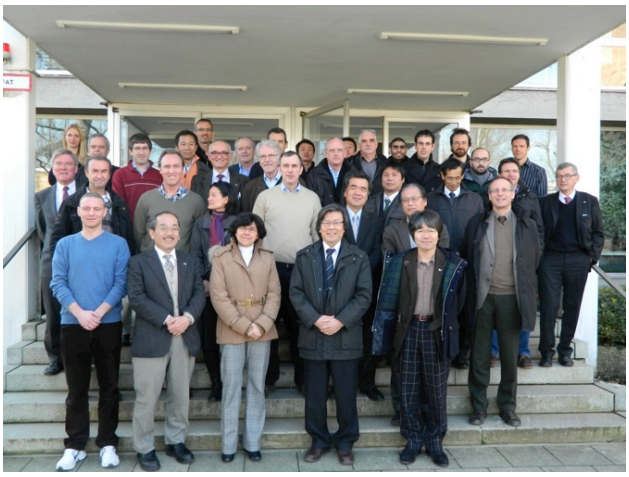
The inboard and outboard legs of the ninth 30° sector were welded and completed as scheduled at the Naka site following the completion of the eighth vacuum vessel (VV) 30° sector last November. The inspections and tests after the welding have all passed without any problems.

In the VV assembly process, the ninth VV 30° sector, the very last sector, the tenth 20° sector, and the port stub, positioned in the centre section, are welded and assembled together. The ninth 30° sector consists of port 01 (P-01) and port 18 (P-18), divided in the middle (see figure above). Unlike the other sectors that have been manufactured so far, the P-18 side has no port stub yet but it has the reinforcement structure in order to install the 20° sector whose manufacturing will be completed in April 2014.

The ninth 30° sector has been already transported to the torus hall to be ready for the assembly and there is now only one more sector left.

Meetings

TCM-19 held in Garching



Participants group photo

Special session on Research Plan

The 19th Technical Coordination Meeting (TCM) took place on 26/27 February 2014 at the Max Planck Institut für Plasmaphysik in Garching, hosted by Fusion for Energy. This was something of an anniversary for Europe, as all voluntary contributors had hosted a meeting of the TCM since last it had been held in Garching. That was TCM-4 in 2009, just after the approval of the Rebaselining Report, which had been the stimulus for JT-60SA procurement to start.

TCM-19 was attended in person by 42 members of the Integrated Project Team, including 11 who had travelled from Japan, as well as a further 20 or so who attended various meeting sessions by video-conference, sometimes late into the night at their location. Plenary sessions focussed mainly on interfaces between the magnets, magnet shared components and thermal shield and the progress on component manufacture, developments in the design of the cryostat vessel body and lid, progress made with the cryoplant manufacture and layout, status of power supply related procurements, and development of the assembly procedures, in particular for pre-assembly of the toroidal field coils. There were also parallel sessions on power supplies and magnets, as well as pre- and post-TCM meetings on magnets, power supplies, and the cryogenic system. A unique open TCM session was devoted to explaining the JT-60SA Research Plan, recently revised, and a large contingent of scientists and engineers from IPP attended and actively engaged in the discussion.

On the intermediate evening the TCM attendees enjoyed in some traditional Bavarian entertainment and cuisine in the Wappensaal at the famous Munich Hofbräuhaus, a place whose beer Lenin once referred to while sojourning in Munich as quickly breaking down all the barriers between cultures and classes. The TCM participants would certainly agree with that.

Local

Nidec ASI and Milan

Figure 1: Duomo

Figure 2: “The Last Supper” by Leonardo da Vinci

Nidec ASI, the industrial supplier of the JT-60SA quench protection circuit, was founded in 1853 in Genoa (Italy) as Giò Ansaldo & Co and over the decades the company evolved into three business areas: Transportation, Energy and Industry. In 1899 Ansaldo established its electro-technical plant in Genoa, giving birth to Ansaldo Sistemi Industriali (ASI). After being a partially state-owned company in 1950 and having being privatised in 2000 changing the name into ASI Robicon, in 2012 it was acquired by the Japanese company Nidec and became Nidec ASI S.p.A, headquartered in Milan (Italy).

Milan is the second largest Italian city, having a population of about 1.3 million people, but if the suburban area is included, it becomes the largest and most populated area of Italy. During the second industrial revolution (from 1856 to 1900) Milan led the Italian industrialisation process, being at the very heart of the economic, social and political debate of the country, and today it is considered the main economic, financial and industrial centre of Italy.

Milan is home to many cultural institutions, museums and art galleries. The most striking of the monuments is the cathedral, or “Duomo” (Figure 1), a triumph of Gothic architecture that took nearly six centuries to complete. It is one of the largest churches of contemporary Europe, holding more than 20,000 people. Another highlight is “Santa Maria delle Grazie”, a church that has been included in the UNESCO World Heritage sites list. The church contains the famous mural of “The Last Supper” by Leonardo da Vinci (Figure 2), which is in the refectory of the convent.

“Teatro alla Scala” (Figure 3), constructed in 1776 in the centre of Milan, is one of the most famous opera houses in the world. Most of greatest conductors (Toscanini, von Karajan, Abbado, Muti, Barenboim, …) and many of the finest singers (Callas, Tebaldi, Pavarotti, Domingo, …) have appeared at La Scala during the past 200 years, and the theatre is commonly known as the “Temple of the Opera”.

Figure 3: Teatro alla Scala

Figure 4: Panettone

The city of Milan is recognised internationally as one of the world's most important fashion capitals, along with Paris, New York and London, hosting each year two fashion weeks, one in Spring and another in Autumn, and many of the most famous Italian fashion brands, such as Valentino, Gucci, Versace, Prada, Armani and Dolce & Gabbana, are headquartered in the city.

Like most cities in Italy, Milan has its own regional cuisine, which includes “Risotto alla Milanese” (rice with saffron and beef marrow), “Cotoletta alla Milanese” (a breaded veal cutlet pan-fried in butter) and “Panettone” (Figure 4) (a type of sweet bread loaf usually prepared and enjoyed for Christmas and New Year).

Calendar

April 10, 2014
14th Meeting of the BA Steering Committee (SC-14)
Rokkasho, Japan

May 26-30, 2014
21st International Conference on Plasma Surface Interactions (PSI-21)
Kanazawa, Japan

June 4-5, 2014
20th Technical Coordination Meeting (TCM-20)
Naka, Japan

June 23-27, 2014
41st European Physical Society Conference on Plasma Physics (EPS-CPP-41)
Berlin, Germany

September 26 - October 3, 2014
28th Symposium on Fusion Technology (SOFT-28)
San Sebastian, Spain

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 hisato.kawashima@jt60sa.org.

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