JT-60SA Newsletter
No.38, 28 February 2013

Headline

Approaching the manufacturing of the TF magnet

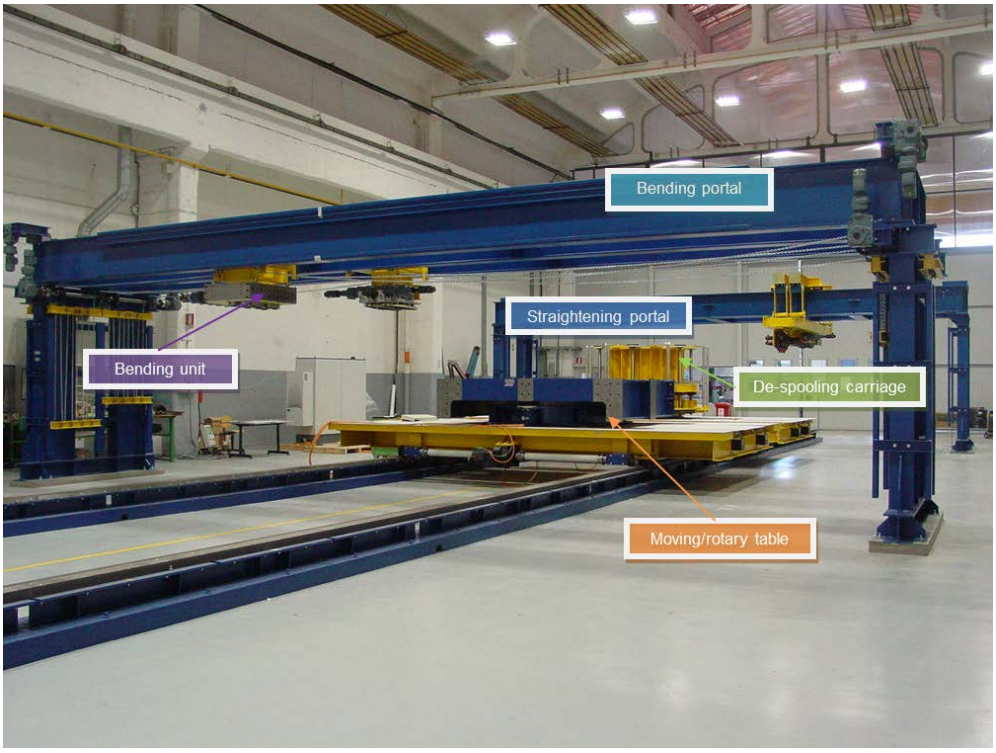


Figure 1: ASG winding line with main components highlighted

ENEA contributes to the Broader Approach activities by, amongst others, manufacturing 9 JT-60SA toroidal field (TF) coils. The supply is provided by a contract between ENEA and ASG Superconductor. The validation programme related to special processes for construction has recently been finished, and the installation of the winding line for the manufacture of the double pancakes (DP) of the JT-60SA TF coil in ASG Superconductor's premises, in Genoa, Italy, is about to be completed.

The winding line designed by ASG envisages the use of a reserve spool - the conductor will be subdivided in two sub-spools and the winding will start from the mid-point.

Once the first half of the conductor has been transferred onto the reserve spool and the mid-point has been made accessible, the layer jump and the He-inlet welding will be made. Then the first layer of the DP will be wound anticlockwise using the remaining half conductor on the de-spooling carriage. After having completed the first layer, the reserve spool will be positioned on the de-spooling carriage and the second layer of the DP will be wound in a clockwise direction.

The winding line, shown in Figure 1, is composed of two rail-mounted carriages that host the de-spooling and the moving/rotary winding table. The tooling for conductor handling is suspended on two portal structures. On the first portal the straightening unit is installed: it is composed of straightening motorized driving units, for fine horizontal and vertical straightening. On the second portal the bending and conductor insulation machines are installed. Conductor cleaning equipment is installed on a mobile support between the two portals and consists of a washing machine equipped with ultrasonic, rinsing and drying modules.

Having already constructed and set up all the remaining associated tools for the winding and impregnation (insulation and stacking bench, impregnation mould and D-shape vacuum chamber), ASG is confident they will complete the first winding pack (WP) by the end of 2013 in line with the schedule. Figure 2 and 3 show the impregnation mould equipped with the resistors needed for the impregnation, and the vacuum chamber that will be used for pressure, leak and electrical tests before insertion into the casing. The vacuum chamber is equipped with a set of glass windows, in the electrical joint and He-inlet areas, to check for the occurrence of current discharge during the Paschen tests.

The equipment procured so far makes ENEA confident that manufacturing of the toroidal field coils will proceed as scheduled.

Figure 2: Impregnation mould with resistors already installed

Figure 3: Vacuum chamber for final pressure and electrical tests

News

Mock-ups of TF coil casing delivered to TF coil manufacturers

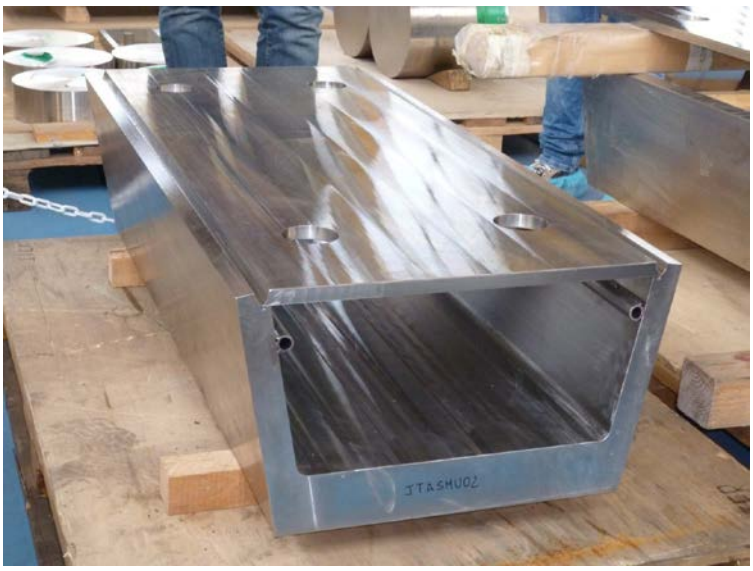


Figure 1: Overview of straight leg mock-up (holes for markers in the cover and cooling channels are shown)

ENEA is constructing two different sets of 9 toroidal field (TF) coil casings and related mock-ups through a contract with Walter Tosto (WT). Casing mock-ups have recently been completed, allowing WT to successfully complete the qualification programme for manufacturing.

The casing mock-ups have been delivered to Alstom and ASG to enable them to qualify their welding procedures for both the transverse weld and the cover weld of the closure plates. The straight leg mock-up has a trapezoidal shape, since the coils must be wedged together in operation, while the curved leg mock-ups have a rectangular shape. The mock-ups are composed of two wings welded by EBW (Electron Beam Welding) to a central plate. This welding process has been developed and qualified for the purpose. The mock-ups, including the covers, have been manufactured with preliminary transverse and longitudinal chamfers. The covers are equipped with inspection holes required to identify the locations of the coil through markers attached to the surface of the winding pack. Cooling channels are welded on the inner surface of the mock-up with a throat 3 mm thick as required for adequate heat transfer.

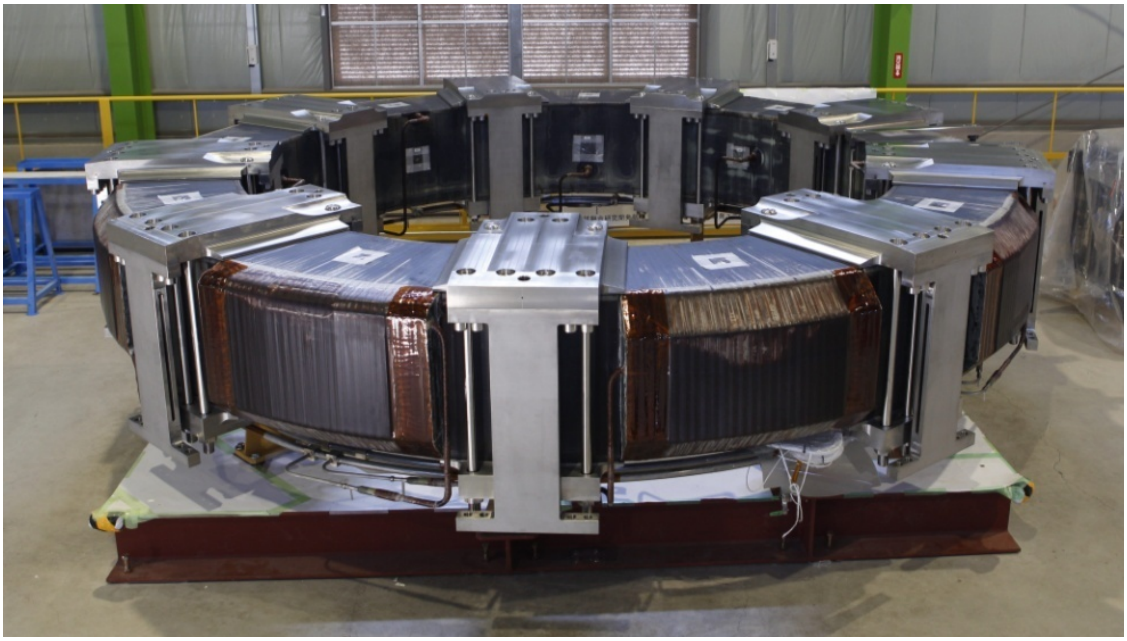
All the components are being provided with a manufacturing record book complete with material certificates, welding qualification, non-destructive examinations (NDE), dimensional reports, and laser tracker survey.

Figure 2: Curved leg mock-up during dimensional survey

Figure 3: All sets of mock-ups ready for shipping

News

Manufacturing of PF magnet progressing - completion of equilibrium field coil No. 4



Completed equilibrium field coil No. 4

In January, the equilibrium field coil No. 4 (EF4), which had been already delivered to Naka in April 2012, was completed at the poloidal field (PF) coil manufacturing building with the additional installation of supplied clamps and low-temperature pipes to the EF4. The EF4, with about 4.4 m diameter, will be situated at the bottom of the vacuum vessel (VV) to produce a lower single null divertor configuration in the JT-60SA plasma. Therefore, it needs to be ready for its temporary assembly location on the cryostat base at the beginning of the tokamak assembly.

As for the EF5 and EF6 coils to be situated below the equatorial plan of the VV, their manufacturing is also progressing on schedule, with about 70 % of the total winding work currently being complete.

As for the central solenoid (CS), the winding of the first real pancake, called CS1QP (4-layer pancake), has been prepared. Heat treatment of a sample has also been started to allow adjustment of the process, and to verify the soundness of the weld.

News

PAs signed for thermal shield procurement and assembly

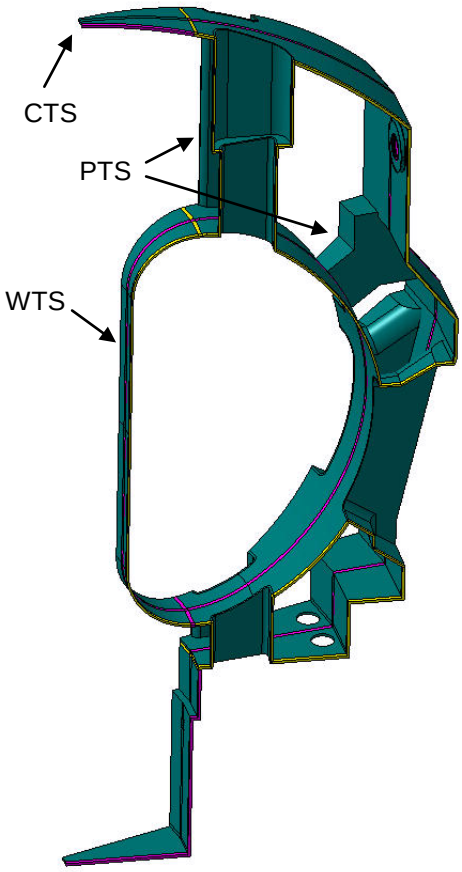


Figure 1: One segment of thermal shield

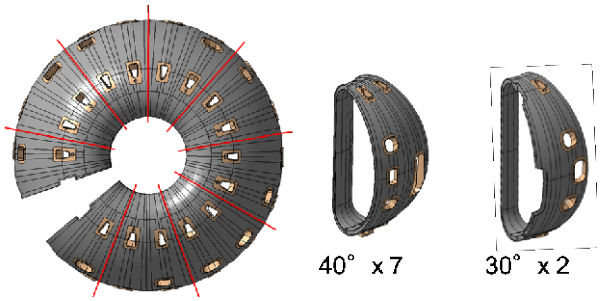


Figure 2: VV components to be assembled

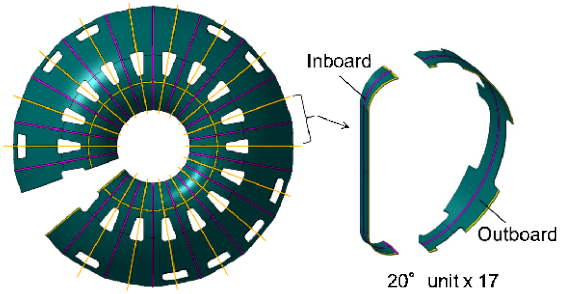


Figure 3: VVTS components to be assembled

After a protracted discussion on the technical specifications between JA and EU Home Teams, in order to consider its many interfaces and assembly procedures, the two Procurement Arrangements (PAs) for the supply of the thermal shield (TS) and for the assembly of the vacuum vessel (VV) and vacuum vessel thermal shield (VVTS), for which JAEA was responsible, were signed together in January 2013. This brings to twenty-one the number of PAs already placed for construction between F4E and JAEA, covering about 90% of the total procurement.

The structure of the TS consists of a VVTS, port thermal shield (PTS), and cryostat thermal shield (CTS). These TSs are necessary to efficiently screen the superconducting magnets from heat input, in particular due to radiation from the cryostat and the VV. The VVTS consists of 18 segments insulated from each other to prevent excessive electromagnetic forces during disruptions (Figure 1). The detailed assembly of the 340° VV and VVTS after the completion of the cryostat base assembly is specified in the assembly PA. The 340° VV is fabricated by uniting 7 sectors of 40° and 2 sectors of 30° (Figure 2). The VVTS consists of gaseous (80K) He cooling pipes and two panels reinforced by edge frames , fitting snugly in the gap between toroidal field coil and vacuum vessel, and the 17 inboard and outboard sectors of 20° are connected together (Figure 3). The CTS is single-walled with multilayer super-insulation.

These components are assembled by using an assembly frame installed in the torus hall in accordance with the assembly procedure. The assembly will start in 2013 to enable its completion by 2016.

Meetings

Design Review Meeting on power supply

The 14th Design Review Meeting (DRM) on the superconducting magnet power supplies (SCMPS) of JT-60SA was held by videoconference on 6 February 2013 with attendance of 19 experts from Germany (Fusion for Energy Garching), Italy (ENEA Frascati), France (CEA Caradache) and Japan (JAEA Naka).

Some modifications of the technical specification for the SCMPS proposed by ENEA were discussed in preparation for the call for tender for the SCMPS contract. The quality and management specification for the industrial supplier was also presented.

Visits

PL sees final stage of divertor monoblock target manufacturing

On 12 February, S. Ishida, the JT-60SA Project leader (PL) visited the factory in Osaka prefecture with JA Home Team member S. Sakurai, to inspect the final testing of the divertor monoblock target.

The factory, which is carrying out the main parts machining and the final testing process, engages in specimen processing, prototype manufacturing, testing apparatus design, and manufacturing for research and development for universities and companies, as well as plant manufacture for the food industries.

Three-dimensional measuring instrument

The PL confirmed the progress of the precise dimensional inspection using 3D measuring equipment, and the pressure-drop measurement for 76 divertor monoblock targets, which had already passed an infrared image test performed at the Naka site to confirm the thermal performance. He also observed the processing machine used for the parts machining, and discussed the future prospects and issues. The results of the inspection at the factory gave confidence that the manufacturing of the divertor monoblock targets will be completed as scheduled.

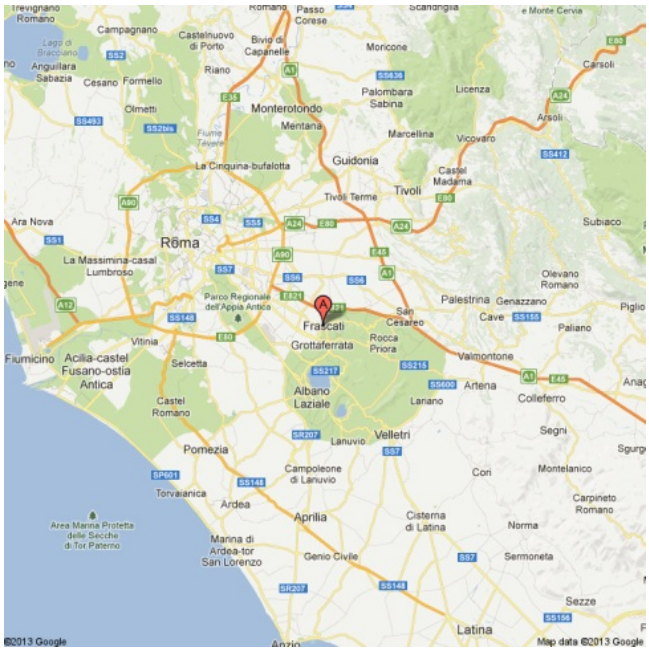
After the completion of the final testing process for 100 divertor monoblock targets, including those still under test at the Naka site, they were delivered to the Naka site at the end of February.

Pressure-drop measurement

Local

Frascati, Italy

Coat of arms of Frascati



Google map pointing Frascati

Frascati, a town of over 20,000 people, is part of the province of Rome in the Lazio region of central Italy. It is located 20 kilometres south-east of Rome, in the area of Roman Castles (“Castelli Romani”) about 320 m above sea-level, close to the ancient Roman city of Tusculum. The area of the Castelli occupies an ancient, fertile volcanic area which has enjoyed flourishing agriculture since ancient times. The former crater is now occupied by two lakes, Lake Nemi and Lake Albano. Frascati is considered the “Pearl” of the Roman Castles both for its marvelous geographical location and for its archeological, historical-artistic and environmentally distinctive features.

The climate in Frascati is mild throughout the year, and as such is one of the favorite destinations for tourists to spend a few days in a place with stunning natural beauty and clean air and to escape the heat and crowds of Rome, while only being a short distance away.

The economy of the town is mainly based on the production of the wine Frascati Doc, known and appreciated all around the world. Archeological discoveries from the ancient town of Tusculum have shown that the cultivation of grapes for wine has been going on in this area since the 5th century B.C.

The origins of Frascati are rooted mostly in the ancient Roman times, but it is only since 1191 that there was a sharp increase in population, caused by the destruction of the nearby ancient Roman city of Tusculum.

From the 16th century Frascati has become a place for noble Roman families, as well as some of the most important members of the Apostolic Chamber, who chose to build their residences outside the city of Rome as a "status symbol" of Roman aristocracy. The villas, known as “Tuscolane Villas”, are still among the most beautiful and impressive of the period. These gorgeous houses, beautified by the masterpieces of the best architects and artists of that period, were erected to show their owner’s power. The villas are substantially well preserved, or have been carefully and authentically restored following damage during World War II, among them villas Aldobrandini, Tuscolana (La Rufinella), Lancellotti and Falconieri.

Villa Aldobrandini

The Baroque cathedral of Frascati

Thanks to its beauty Frascati became one of the stops for the Grand Tour travellers during the 18th century and until the first half of the 19th century. The writings of Goethe, Stendhal, Ibsen and Zola, amongst others, account for the attraction the city of Frascati had for its famous visitors.

The civic archaeological museum of Frascati, hosted in the Aldobrandini Stables ("Scuderie Aldobrandini"), exhibits archaeological findings from the ancient city of Tusculum and the nearby area, and it has scale models of the Tuscolane Villas.

Frascati is closely associated with science, being the location of several international scientific laboratories, among which are ENEA, INFN, and ESA.

Links:
www.comune.frascati.rm.it
www.parcocastelliromani.it
www.prontocastelli.it/frascati

Calendar

March 25, 2013
Celebration of the delivery of the first component from EU and start of assembly of the JT-60SA tokamak
Naka, Japan

March 26, 2013
12th Meeting of the STP Project Committee (PC-12)
Naka, Japan

April 23, 2013
12th Meeting of the BA Steering Committee (SC-12)
Rokkasho, Japan

May 28-29, 2013
17th Technical Coordination Meeting (TCM-17)
Grenoble, France

June 10-14, 2013
25th Symposium on Fusion Engineering (SOFE-25)
San Francisco, USA

July 14-19, 2013
23th International Conference on Magnet Technology (MT-23)
Boston, 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 masayasu.sato@jt60sa.org.

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