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Europe signs its final contract for the ITER Toroidal Field coils

A landmark multimillion contract has been signed between Fusion for Energy (F4E), the organisation managing the European contribution to ITER, and SIMIC S.p.A, an Italian company specialised in high-tech engineering and manufacturing, marking the successful completion of Europe's strategy in the domain of the Toroidal Field (TF) coils, part of ITER's impressive magnet system.

The Director of F4E, Professor Henrik Bindslev, explained that "thanks to this contract the last and most decisive chapter of the TF coils manufacturing is about to be written. We will produce magnets of unprecedented size and power following extremely complex techniques. This final procurement is a clear demonstration of Europe's commitment to the project and its capacity to be competitive and meet high technical standards". For Marianna Ginola, Commercial Manager of SIMIC S.p.A this milestone "is an impressive achievement that enhances the proven track record of our company and associates Italian manufacturing amongst the most skilled in the world. ITER has given us the opportunity to build international collaborations. In this contract for instance, we will collaborate with Babcock Noell Gmbh. This project has given us the possibility to access new markets and grow both in size and expertise".

The contract is expected to run for approximately five years and its budget will exceed the amount of 100 million EUR. Through this contract, the TF coils will be tested at extremely low temperatures reaching nearly -200 degrees Celsius/80 Kelvin and subsequently will be inserted within their cases in order to be finally assembled in the ITER machine.

What is the role of TF coils and their specifications?

ITER will demonstrate the feasibility of fusion energy. The temperature of ITER's superhot plasma is expected to reach 150 million degrees Celsius. The challenge is to keep the plasma burning without touching the walls of the vessel of the reactor. The TF coils are "D" shaped gigantic superconducting magnets whose main task will be to create a magnetic cage where the plasma will be confined. Europe is responsible for the manufacturing of 10 out of the 18 TF coils of the machine.

Magnets of unprecedented size, weight, power and technique

The TF coils are composed of a winding pack and its stainless steel coil case. Each TF coil is 15m high, 9m wide and has a cross section of about $1m^2$. It weighs approximately 340 tonnes, which compares to six Boeing 737-800 planes! These will be the biggest Nb3Sn magnets ever manufactured, which once powered with 68000 A, they will generate a magnetic field that will reach 11.8 Tesla- about one million times stronger the magnetic fields of the earth.

The scope of this contract

First, the winding packs will be cold tested at -200 degrees Celsius/80 K using a combined cycle of nitrogen and helium. Next, they will be inserted into the TF coil cases, which will require sophisticated laser dimensional controlled technology and complex tooling in order to move and fit hundreds of tonnes with millimetric precision.

Then, the cases will be welded in compliance with the stringent ISO standard 5817 in order to close the metallic structure. Two important characteristics will add to the complexity: the thickness of the weld which will reach 130mm and the fact that welding will have to be carried out only from one side. For these reasons, ultrasonic technology will be deployed to inspect the quality of welding.

The gap between the winding pack and the TF coil case will have to be filled with reinforced resin to mechanically link the components. The high density of the resin makes this task particularly challenging. Try and imagine filling a tight gap of 4mm thick and 35m long gap with $1m^3$ of resin that has the thickness of honey.

ITER is a puzzle of many different interfaces that will need to be managed in a seamless way. Most TF coil components like the winding packs and the radial plates are manufactured in Europe. The TF coil cases however, are manufactured in Japan while the thermal shields of the Vacuum Vessel that will be ultimately welded on the TF coils, in Korea. In other words, the multiple interfaces and their careful management will be fundamentally important for the successful execution of this contract.

Background information

MEMO: Europe signs its final contract for the ITER Toroidal Field coils

F4E film clip: View the interview of Marianna Ginola, Commercial Manager of SIMIC S.p.A here

Fusion for Energy

Fusion for Energy (F4E) is the European Union's organisation for Europe's contribution to ITER.

One of the main tasks of F4E is to work together with European industry, SMEs and research organisations to develop and provide a wide range of high technology components together with engineering, maintenance and support services for the ITER project.

F4E supports fusion R&D initiatives through the Broader Approach Agreement signed with Japan and prepares for the construction of demonstration fusion reactors (DEMO).

F4E was created by a decision of the Council of the European Union as an independent legal entity and was established in April 2007 for a period of 35 years.

Its offices are in Barcelona, Spain.

http://www.fusionforenergy.europa.eu

http://www.youtube.com/user/fusionforenergy

http://twitter.com/fusionforenergy

http://www.flickr.com/photos/fusionforenergy

ITER

ITER is a first-of-a-kind global collaboration. It will be the world's largest experimental fusion facility and is designed to demonstrate the scientific and technological feasibility of fusion power. It is expected to produce a significant amount of fusion power (500 MW) for about seven minutes.

Fusion is the process which powers the sun and the stars. When light atomic nuclei fuse together to form heavier ones, a large amount of energy is released. Fusion research is aimed at developing a safe, limitless and environmentally responsible energy source.

Europe will contribute almost half of the costs of its construction, while the other six parties to this joint international venture (China, Japan, India, the Republic of Korea, the Russian Federation and the USA), will contribute equally to the rest.

The site of the ITER project is in Cadarache, in the South of France.

http://www.iter.org/

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