

LARGE SCIENTIFIC INSTRUMENTS

Continuing its collaboration with ITER Organization, CNIM is designing and manufacturing high-precision lifting equipment

With its expertise in designing and manufacturing extremely large equipment items of the greatest technical complexity, CNIM is proving to be an indispensable partner for the assembly of the ITER reactor.

Outsized tools to position parts weighing hundreds of metric tons

CNIM, a French equipment manufacturer and industrial contractor operating worldwide, has announced the launch of the **third phase of the Purpose Built Tools (PBT) framework agreement** signed with ITER Organization in December 2016. This agreement covers the engineering, manufacturing and installation of special tools for the installation of the Tokamak¹ on the Cadarache site, in Bouches-du-Rhône, France.

This third phase entails the **design and manufacture of extremely large lifting systems to handle parts weighing up to 4 metric tons**. These structures, comprising two 8-level towers (18 meters tall) weighing some 40 metric tons, will **equip the Sector Sub-Assembly Tools (SSAT)**. The SSATs will be used to assemble each sector² of the vacuum chamber of the fusion reactor

before its transfer to the reactor building where they will all be assembled. As the size of each sector increases at each stage of their assembly, all the lifting structures must be adaptable in order to constantly remain in step with the assembly process without causing any delay in the overall ITER schedule.



Figure 1: Lifting beam to install the cryostat base section (1,250 metric tons)

Under the same contract, CNIM has also been entrusted with defining **nine types of special, strategic tools for ITER**. These include the **handling systems** to be used to **position the cryostat base, which is the heaviest ITER component** (weighing 1,250 metric tons). The **Toroidal Field Coils Pairs in-pit Installation Tool** will be used to install the TFCs (superconductor magnets, 17 m tall and weighing some 700 metric tons). Fitted with 33 hydraulic rams, the TFC Pairs in-pit Installation Tool will move the TF coils a few millimeters in three axes, ensuring their precise positioning to within a millimeter. This **unique tool** will also perform the final adjustment of the Tokamak's nine sectors.

¹ The Tokamak is an experimental facility designed to demonstrate the scientific and technological feasibility of fusion power. (Source: ITER Org)

² Each Tokamak sector consists mainly of portions of vacuum chamber, heat shielding and two TF coils (superconductor magnets weighing about 400 metric tons).

Tools providing unparalleled adjustability performances

CNIM has also been entrusted with **installing the two SSAT** at the Cadarache site. This project is now well under way, with the first SSAT already at the functional test phase. Mechanical and electrical assembly of the second SSAT are being finalized prior to operating tests under load. CNIM teams will conduct these tests using two mockups, 14 meters tall and 8 meters wide with a weight of 390 metric tons, positioned on the SSATs to simulate the toroidal field coils (superconductor magnets that contribute to the confinement of the plasma inside the vacuum chamber). The SSAT tool must ensure high precision in moving, to within one millimeter, these two enormous loads with a volume close to that of three vertically positioned buses, on each of its arms. Delivery of this assembly is scheduled for the first half of 2019. CNIM has dispatched some 20 staff to work on site for this purpose.



Figure 2: Assembling SSAT No.2 © ITER Org

"ITER Organization had already chosen CNIM for the engineering and construction of the tools used to install the various internal components of the reactor's vacuum chamber (under the Mechanical Handling Equipment, or MHE contract)," points out Philippe Lazare, Chief Executive of CNIM's Industrial Systems Division and the Seyne-sur-Mer plant. "These new contracts testify our expertise as designers, manufacturers and installers of special, oversized handling tools."

For more information on Purpose Built Tools and SSAT on cnim.com

PBT : <https://cnim.com/en/positioning-parts-weighing-hundreds-metric-tons-accuracy-within-110th-millimeter>

SSAT: <https://cnim.com/en/extra-large-tool-site-assembly-millimetric-precision-9-iter-tokamak-sectors>

CNIM's Nuclear & Large Scientific Instruments businesses

CNIM has been a major player in the nuclear industry for 40 years. As a designer and integrator of high-performance, high added-value solutions, it covers the entire nuclear fuel cycle as well as commercial and research reactors. As an expert in systems classified as important for nuclear safety, CNIM notably offers safe, accurate, remotely-operated handling systems during the utilization and deep storage of radioactive packages.

In the field of large scientific instruments, CNIM demonstrated its expertise with the **manufacture of large-sized equipment** designed for experimental reactors and complying with the nuclear industry's strictest requirements. Examples include the complex manufacture of the Jules Horowitz (RJH) experimental reactor core in 2018, the construction of **remote-controlled handling systems in harsh environments** and very high-stability welded structures to hold high-performance optical assemblies for the Laser Mega Joule project (LMJ) since 2006. CNIM has also been awarded numerous contracts for the advanced design and manufacture of equipment for the Tokamak and handling solutions for ITER in the context of a collaboration spanning nearly 10 years.

About ITER

ITER is a first-of-a-kind international research program. 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) and pave the way for future industrial reactors. Fusion is the process that 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 aims to develop 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) contribute equally to the rest.

ITER is actually under construction in Cadarache, in the South of France.

<http://www.iter.org>

About CNIM Group

Founded in 1856, CNIM is a French equipment manufacturer and industrial contractor operating on a worldwide basis. The Group provides its products and services to major public and private sector organizations, local authorities and national governments in Environment, Energy, Defense, and High Technology markets. Technological innovation is at the core of equipment and services designed and manufactured by the Group. They contribute to produce cleaner and more competitive energy, to limit environmental impacts of industrial activities, to secure sensitive facilities and infrastructures, and to protect individuals and nation states. CNIM is listed on the Euronext exchange in Paris. It relies on a stable family-based majority shareholding structure committed to its development. The Group employs 2,613 people and had revenues of €689.8 million in 2017, 62.1% of which was from exports.

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