



# CENTRAL SOLENOID

The sixth and final module will be placed atop the central solenoid stack (back right in assembly hall) later this year.  
Photo: ITER Organization

## U.S. CONTRIBUTION

US ITER is responsible for the central solenoid, including the design, research and development, and fabrication of seven modules using supplied conductor, plus the associated structure, assembly tooling, bus extensions, and cooling connections.

## OVERVIEW

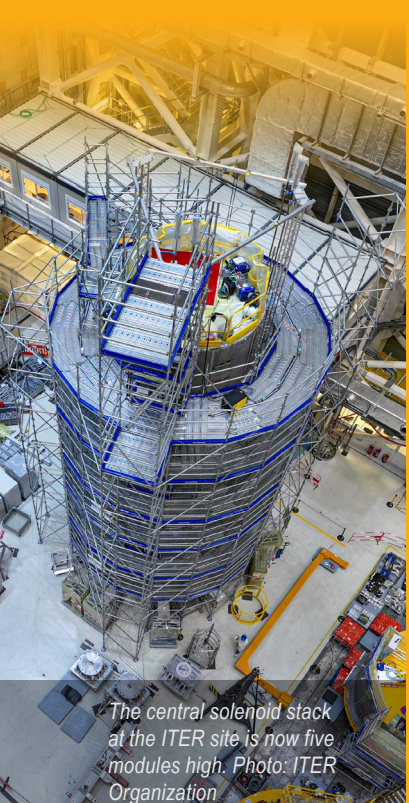
The central solenoid is the heart of the ITER tokamak and serves as a critical element in the ITER magnet system. The central solenoid induces the majority of the magnetic flux change needed to initiate the plasma, generate the plasma current, and maintain this current during the burn time. It is made of six independent modules, each wound from approximately 3.5 miles of niobium-tin ( $\text{Nb}_3\text{Sn}$ ) superconducting cable supplied by ITER Japan. The stacked modules will be held together by a vertical pre-compression support structure comprised of more than 9,000 parts.

US ITER is responsible for the six modules of the central solenoid, a spare module, the pre-compression support structure, and the tooling needed to assemble the central solenoid.

US ITER's scope includes all research and development, engineering, design, procurement, testing, and shipment of these components. In addition, design, fabrication, and testing of an insert coil was used to validate the manufacturing processes prior to starting module production. Upon completion, the central solenoid will be 60-feet tall, comprised of six modules each weighing 121 tons.

## STATUS

US ITER completed delivery of all seven central solenoid modules and final components to the ITER site in southern France in 2026. The tooling needed to assemble the central solenoid was delivered in 2021, and delivery of support structure components was completed in 2025. Assembly is underway at the ITER site, with five modules stacked on a dedicated assembly platform and the sixth module to be placed on top this year.



The central solenoid stack at the ITER site is now five modules high. Photo: ITER Organization



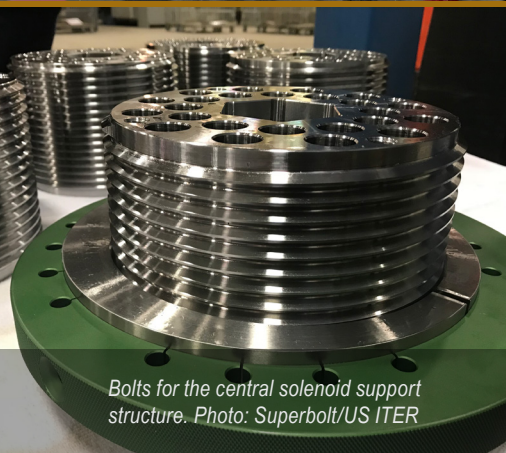
U.S. DEPARTMENT  
of ENERGY

OAK RIDGE  
National Laboratory

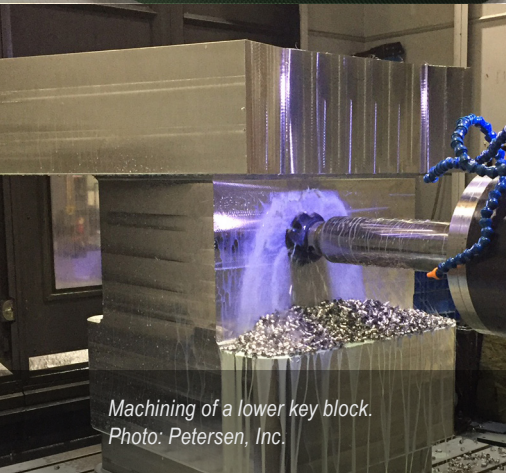




US ITER completed delivery of all central solenoid modules and other components in 2026. Photo: ITER Organization



Bolts for the central solenoid support structure. Photo: Superbolt/US ITER



Machining of a lower key block. Photo: Petersen, Inc.

## TECHNICAL DESCRIPTION

- Height:** 18 m
- Diameter:** 4.13 m
- Total weight:** 1,000 t
- Number of coil packs (modules):** 6 plus 1 spare
- Individual module weight:** 110 t
- Peak field strength:** 13.1 T
- Test Voltage:** 30 kV
- Operating voltage:** 14 kV
- Test current:** 40 kA (@ 4 K)
- Operating current:** 45 kA
- Stored energy capacity:** 5.5 GJ

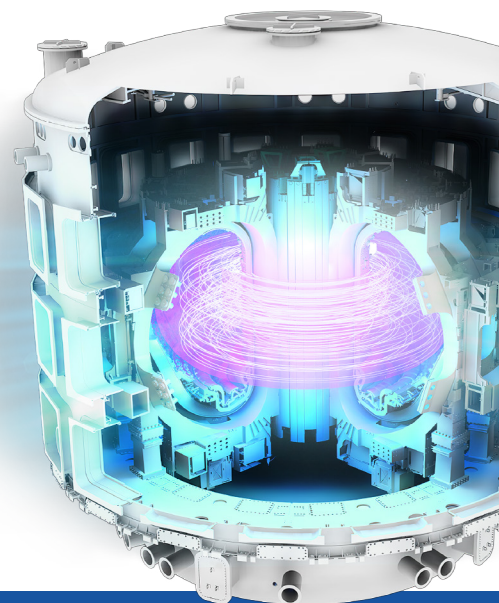
## CENTRAL SOLENOID SUPERCONDUCTING CABLE

Provided by ITER Japan (Japan Domestic Agency)

- Strand material:** Niobium-tin ( $Nb_3Sn$ )
- Strand diameter:** 0.83 mm (unreacted, after coating)
- Non-copper critical current density:**  $>1,000 A/mm^2$  (@ 12 T)
- Copper to non-copper ratio:** 1:1
- Cable design:** CICC (cable-in-conduit-conductor)

## CONTRIBUTORS INCLUDE

- General Atomics (San Diego, CA)
- ARMEC Corp (Knoxville, TN)
- Climax (Newberg, Oregon)
- Cryomagnetics (Oak Ridge, TN)
- Hamill Manufacturing Co. (Trafford, PA)
- Kamatix Corporation (Bloomfield, CT)
- Keller Technology Corporation (Buffalo, NY)
- Major Tool and Machine (Indianapolis, IN)
- National High Magnetic Field Laboratory, Florida State University (Tallahassee, FL)
- Petersen, Inc. (Ogden, UT)
- Precision Custom Components (York, PA)
- Rhinestahl (Cincinnati, OH)
- Robatel Technologies (Roanoke, VA)
- Superbolt, Inc. (Carnegie, PA)



## CONTACT

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US ITER is managed by Oak Ridge National Laboratory in Tennessee, with partner labs Princeton Plasma Physics Laboratory in New Jersey and Savannah River National Laboratory in South Carolina.